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Functions of the Pointing Gesture in Mothers and their 12 to 36-Month-Old Children during Everyday Activities

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This study longitudinally examined the production of pointing in four Spanish 1-year-old and four Spanish 2-year-old children in interactive situations with their mothers at home over the course of one year. Three aspects were analyzed: a) the functions of the pointing gesture, their accurate comprehension by the interlocutor (mother or child), and their order of emergence in the child; b) whether or not there were differences in the production of pointing according to who initiated the interaction; and c) whether maternal and child speech were related to maternal and child pointing production. The results showed that the pointing function of showing is the most frequent for both children and mothers from groups 1 and 2, and the first to emerge followed by the informing, requesting object, requesting action, and requesting cooperation functions. The accuracy with which these intentions were comprehended was found to be very high for both mother and child. Pointing production was greater when the speaker initiated the interaction than when the other person did, indicating that gestures follow the turn-taking system. Finally, the production of pointing to showing in children and mothers was found to be related to maternal and child speech, while pointing to request cooperation triggered the process of joint activity between mother and child.
Keywords: pointing gesture, mother-child interactions, longitudinal study.

Se examinó longitudinalmente durante un año la producción de gestos de señalamiento de 8 niños (4 de 1 años y 4 de 2 años) en situaciones interactivas con sus madres en el hogar. Se analizaron tres aspectos: a) las funciones del señalamiento, su uso y comprensión por parte de la madre y del niño y su edad de emergencia; b) si existían cambios en la producción de señalamientos de la madre y del niño en función de quién inicia la interacción; y c) si había relación entre las funciones del señalamiento y la producción verbal de la madre y del niño. Los resultados sugieren que el señalamiento de mostrar tiene una mayor producción tanto en la madre como en el niño y a nivel evolutivo emerge primero, seguido del de informar, pedir objeto, pedir acción y cooperación. La madre y el niño interpretan con precisión las diferentes funciones de los gestos de señalamiento. Iniciar la interacción verbal incrementa la probabilidad de producir señalamientos lo que indica que los gestos también se articulan según el sistema de turnos. Por último, la función de mostrar está más relacionado con el desarrollo lingüístico, mientras que la de cooperar dispara el proceso de colaboración entre madre e hijo.
Palabras clave: gesto de señalamiento, interacción madre-hijo, estudio longitudinal.

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Children tend to communicate through a variety of gestures, one of which is pointing; this consists of extending the index finger with a raised arm to indicate something (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Pettito, 1993; Rodrigo et al., 2005). Various studies have shown the importance of this gesture during the child's early phases of linguistic development, and its omnipresence in the acts of communication that take place between them and their mothers during day-to-day activities (Baldwin, 1991; Camaioni, Castelli, Longobardi, & Volterra, 1991; Fenson et al., 1994; Rodrigo et al., 2004). The authors of this study were particularly interested in exploring in detail the plurality of functions of the pointing gesture used by mothers and children, which can be inferred by analyzing each person's communicative intention. In order to do so, not only the two functions of the pointing gesture (imperative and declarative) described in the pioneering work of Bates, Camaioni, and Volterra (1975) were explored. Other possible functions suggested in more recent research were studied, too (e.g., Liszkowski, Carpenter, Striano, & Tomasello, 2006; Tomasello, Carpenter, & Liszkowski, 2007). In addition, we analyzed the relationship between said functions and language. Thus, we studied the influence of conversational turn-taking on the production of pointing that serves a variety of functions, in order to determine how it is inserted into the flow of verbal, mother-child interactions. We also explored the role played by these functions in the child's linguistic development and in the mother's verbal production during everyday episodes. With all these factors in mind, we can determine whether or not the communicative character of this gesture and its crucial role in linguistic development apply to all of its functions.

Functions of the Pointing Gesture in the Process of Mother-child Communication

There is consensus within the scientific community that children's pointing gestures emerge quite regularly at the end of their first year, and remain throughout their second and third years (Bates et al., 1975; Butterworth & Morisette, 1996; Carpenter, Nagell, & Tomasello, 1998; Muñetón, Ramírez, & Rodrigo, 2005; Rodrigo et al., 2005).

Traditionally, two functions of children's pointing have been described: declarative and imperative (Bates et al., 1975). The former refers to pointing with the intention of drawing someone's attention to something in order to share and promote an attitude about the given object (interest, surprise, pleasure, etc.). The latter refers to pointing whose intention is to claim the object being pointed to, in which they use the other person as a tool to bring them closer to the desired object. Bates et al. (1975) based their classification on the theory of speech acts proposed by Austin (1962), who suggested that a speech act consists of a locutionary act (what is said), an illocutionary act (the intention behind what is said), and a perlocutionary act (the effect of what is said). Bates et al. (1975) considered pointing gestures to fall under the category of illocutionary or intentional acts. In other words, when producing pointing, children have a communicative intention, and are conscious that their pointing will elicit an effect in the other person.

Subsequently, Camaioni (1993) proposed that only declarative pointing necessarily reveals a communicative intention, which implies representing the other person as an individual capable of having intentional states and understanding those of others. By contrast, in the case of imperative pointing, the child assumes the adult is an efficient tool to serve their purposes, but does not consider them to have a mind of their own. Camaioni, Perucchini, Bellagamba, and Colonnesi (2004) conducted a study of 12-month-old children to examine whether or not the declarative pointing gesture emerges later than the imperative, and if the ability to use declarative pointing is tied to comprehending the other person's intentions. The results indicated that children produce and comprehend declarative pointing later than imperative. Also, among children who had begun to point, imperative pointing was more frequent than declarative. Furthermore, only the production of declarative pointing was found to be related to comprehending other people's intentions. Therefore, it seems that children's imperative pointing considers others as causal agents, yet not as mental agents.

It is widely agreed that children's referential intentions, starting with their first pointing acts, are centered on directing other people's attention to some entity within a joint attentional framework (Baldwin, 1995), which establishes that both interlocutors focus their attention on the same reference. The point of view of Camaioni (1993) and Camaioni et al. (2004) has been labeled the *lean* perspective, while its counterpart, suggested by Tomasello et al. (2007), is known as the *rich* perspective. According to the latter, a child not only tries to get the adult's attention, but also tries to influence his or her mental state (Liszkowski et al., 2006). It would follow, then, that children's pointing typically be guided by human abilities and motivations centered on cooperation and joint intention. Communicative cooperation with a significant adult is an important aspect of human communication, and one that children seem to understand from a very early age. Hence, Tomasello et al. (2007) posited that children are capable of creating, together with adults, the attentional frameworks necessary to comprehending and producing cooperative, communicative acts that involve important inferences about the other person's intentions.

In a recent study, Liszkowski et al. (2006) demonstrated that children use the pointing gesture declaratively to inform, that is to say, to help an adult find something for which he or she is looking. 32 children participated in this study, 16 12-month-olds and 16 18-month-olds. Two experimenters participated as well; while one left the place the experiment was being held, the other changed the location of two objects

or hid them (one the target, the other the distractor). When the first experimenter returned and began to look for the target object, children more frequently pointed to the object for which the experimenter was searching than the one included as a distractor. Far from desiring the object (imperative), or simply wishing to show it to the to the person and share an attitude about it (declarative-expressive), what the children were trying to do was help the adult find the object for which he or she was looking. They considered it to be of interest to the interlocutor, so they pointed to where the object was located (declarative-informative). Furthermore, Tomasello et al. (2007) explained that children use imperative pointing not only to obtain objects but also to solicit an action or even collaboration. In fact, these authors established three human motives for pointing: a) wanting the other person to "feel, enjoy" with them the object to which they are pointing; b) wanting the other person to "know something" they do not yet know about the object; and c) wanting the other person to "do things" either individually or cooperatively. They established nothing with regards to the functions of pointing gestures in adults and their possible coordination with the children's functions. Along that vein, we will analyze the different functions of the pointing gesture in children and their mothers according to Bates et al. (1975), Liszkowski et al. (2006) and Tomasello, et al. (2007).

Production of the Pointing Gesture in Mothers and Their Children as a Function of Who Initiates the Interaction

We have already seen how joint attention is relevant to the production of pointing gestures among children. We also know that the production of pointing gestures in children is mediated by the interlocutor's attention paid to the child as well as the referent during episodes of joint attention (Liszkowski, Carpenter, Henning, Striano, & Tomasello, 2004). It follows, then, that the production of pointing occurs within the framework of adult-child joint attention. However, is this gesture emphasized and does it have many functions within the framework of conversational turn-taking in speech? To test these notions, one must take into consideration pointing on the part of both mother and child, and analyze it over the course of interactive exchanges. In one of the few studies that has longitudinally tracked the production of mother-child pointing, it was observed that this production is quite similar in mother and child, suggesting that both parties adapt their pointing production in everyday interactions (Rodrigo et al., 2005).

On another note, we know that mothers and children organize their verbal interactions very early on through the use of speech turn-taking, which regulates their exchanges of speech sequences during conversation (Bruner, 1975; Sacks, Schegloff, & Jefferson, 1974). Interactions between children and their care-takers exhibit a well-defined sequence that is structured through a series of vocal exchanges even before the child is capable of saying a word (Mueller & Lucas, 1975). 12 to 24-month-old children and their mothers take turns while interacting (Bloom, Rocissano, & Hood, 1976; Schaffer, Collis & Parson, 1977). Turn-taking in speech marks the beginning of dialogue and is a prerequisite to the later emergence of the more complex communicative roles involved in routine interactions (Bruner, 1977). Presumably, in light of the communicative nature of pointing gestures, their use in mother-child interactions should follow a turn-taking structure.

To evaluate turn-taking, we followed the indications of Sacks et al. (1974). Those authors proposed a two-component system to organize conversational turn-taking. The first component creates the unit of production to be used during the speech turn-taking (words, phrases or clauses). The other assigns turn-taking, which operates according to a set of rules and determines who will speak next. The second component acts only at transitional points of the transmission, in other words, when the end of a production occurs that may either be followed by the same speaker, or another. The most common technique to select the next speaker is to see who starts to speak first. The "adjacent pairs" technique consists of identifying productions that require a reply from someone. It is very useful because it allows one to clearly deduce the turn-taking structure; the mother usually replies to the child and vice versa.

Relationship between the Functions of Pointing Gestures and Mother-child Verbal Production

Numerous research studies have elucidated the importance of the pointing gesture in the early phases of a child's linguistic development (Butterworth & Morisette, 1996; Pettito, 1993; Rodrigo et al., 2004; Rodrigo et al., 2005). Meanwhile, the use of pointing gestures has been found to relate to episodes of joint attention between mothers and their children (Franco & Butterworth, 1996) and both have been found to relate to a child's early lexical comprehension (Fenson et al., 1994) and the production of his or her first words (Butterworth & Morisette, 1996; Pettito, 1993). In a study of 18-month-old children, the pointing gesture was classified as the best predictor of linguistic development (Bates et al., 1975) compared to all other gestures. Rodrigo et al. (2005) yielded similar results in a naturalistic study of children 12 to 36-months-old. The results showed that mother-child pointing gestures, as opposed to instrumental gestures, were the most frequent and the most highly correlated with a verbal production from the other person, whether mother or child.

That being said, far fewer studies have compared the functions of the pointing gesture with verbal production (Liebal & Tomasello, 2009). Regarding declarative and imperative pointing, some authors maintain that only the former is connected to linguistic development, since it involves

the child sharing an attitude about an object with an adult, while that is not the case for imperative pointing (Baron-Cohen, 1989; Camaioni, 1993). This has led many researchers to suggest that these two pointing gestures are, in fact, not associated with one another (Baron-Cohen, 1989; Camaioni, 1993). Specifically, this non-association is supported by empirical data from studies of gorillas (Gómez, 1991) and autistic children (Baron-Cohen, 1989). Gómez's (1991) study presented data about an infant gorilla developing patterns of eye contact while interacting with adults in problem-solving situations over the course of six months. The results indicated the gorilla was capable of producing imperative, but not declarative, pointing. Along those lines, Baron-Cohen's (1989) data showed that autistic children understand and produce proto-imperatives, but can neither understand nor produce proto-declaratives. There seem to be no relationship between the informative and declarative functions, according to Aureli, Perucchini, and Genco (2009). They analyzed whether or not the production of informative and declarative pointing during laboratory tasks were correlated in a group of 40 children aged 16 to 20-months-old. Although the children adequately performed the tasks set before them, there was no correlation observed between the two functions.

The present study had three objectives. The first was to longitudinally explore the different functions of the pointing gesture over the course of one year in 12 to 36-month-old children and their mothers during their daily interactions. To do so, we assessed the interlocutor's (mother's and child's) accurate level of comprehension of the pointing functions, and tried to determine which of these functions emerges first in the child's repertory. We expected to find, first of all, that the pointing gesture most often produced would be showing, followed by the imperative, informing and others further down the road. Second, we expected to observe a high percentage of accurate comprehension of the gestures' functions on the part of both mother and child.

The second objective was to observe changes in the mother and child's production of the diverse functions of pointing, taking into account who initiates the interaction. We expected to find that when the child initiates the interaction and begins to take his or her turn, he or she would point more than when it is not his or her turn, given that the interlocutor's attention and interest may have a motivating influence on the child's production of the pointing gesture. Alternately, the same would occur when the turn is initiated by the mother.

The third objective was to analyze the relationship between the different functions of pointing and the mother and child's verbal production. We anticipated that the showing and informing functions would be the ones most closely tied to language, because both relate to the declarative-expressive function, which is characteristic of language. The categories of requesting an object, requesting action, and requesting cooperation are more instrumental, and should therefore not be directly related to language, but rather, more probably, with action.

So as to analyze the production of pointing gestures in real communicative spaces, and without restricting its variability in terms of the different functions that these gestures can take on, we opted for naturalistic observation and longitudinal data. The observations were collected in natural, interactive contexts while the mother and child took part in everyday routines such as eating lunch, playing and bathing. The advantage of naturalistic observation is that it registers spontaneous use of pointing gestures in its variety of functions in a rich, complex environment where the child has many options for indexical reference.

Method

Participants and Procedure

Over the course of 12 months, with an interval of 3 months (5 sessions), the activity sequences of four 1-year-old children and their mothers (Group 1) and four 2-year-old children and their mothers (Group 2) were recorded. All children were firstborns and all mothers had attended college (average age of 29 years old, ranging from 26-34 for both groups). Their socioeconomic status ranged from middle to upper class. Four of the children's mothers worked outside the home and the other four worked at home.

The children and their mothers were recorded in their homes during routine, everyday sequences beginning with free play, followed by bathing, and finally eating lunch. Mothers were instructed to interact and play with their children like they normally do; meanwhile, the observer avoided interfering with mother-child interactions. Observations were completed every three months with an interval of one week (five sessions per dyad). The same observer recorded all sessions for each dyad and before the study began, the observer visited the home three times so the child could get acclimated to her.

Classification

First, all verbal materials in the scenes of mother-child speech sequences were transcribed and speech turn-taking was established according to the criteria suggested by Sacks et al. (1974). The verbal units emitted by each interlocutor could be vocalizations, words, phrases or clauses to account for the participants' wide variety of linguistic levels. The transition from one turn to the next marked the end of the current speaker's production, and the beginning of the next person's. If the speaker was the same in the following production, it did not count as a turn.

Subsequently, verbal productions were divided into clauses where applicable, based on a more pragmatic view than on the perspective of traditional grammar. In this way,

the internal coherence of each unit of meaning was more relevant than its structure in terms of subject, verb and object (Halliday, 1990; Mora, Martínez, & Domínguez, 2009). Later, all pointing produced during the exchange of clauses was registered, independently of whose turn it was to speak. Last, functions were assigned to the pointing according to whether or not it exhibited the following characteristics:

Showing: The speaker produces pointing with the intention of showing someone something. By listening to and observing the addressee, we determined this was the intention because addressees usually make comments such as "yes, it is pretty," "there, yes, a doll," etc., or without making a verbal comment, look at the object and smile.

Informing about an Object: The speaker points to an object that the addressee is looking for, and he or she does not know where it is located. In this case, the addressee continues looking at the object and usually makes some comment consistent with the information received. Example: the mother is looking for her keys, the child points to them and the mother looks at them.

Requesting an Object: The speaker produces pointing with the intention that the addressee will either give him or her an object, or bring it near to him or her. This intention is observed when the addressee passes the object to the speaker, and the latter seems satisfied. Also, we can deduce the speaker's intention if the addressee makes a comment, usually the mother saying something like: "would you like me to give you the notebook?"

Requesting Action: The speaker uses pointing toward the aim of asking the addressee to perform some action; for example, the child points to the door so the mother will open it. Once again, the addressee is observed to see if she completes some action that leaves the child satisfied with the request. For example, the child points to the telephone and the mother puts it up to his or her ear and says "who is it?"

Requesting Cooperation: The speaker produces pointing with the intention that the addressee will complete some action in cooperation with him or her, such that they will both achieve a certain goal. For example, a boy is trying to wind up his or her toy car unsuccessfully, so he or she points to the car to draw the mother's attention to it, so that she will cooperate and ultimately, they will wind up the toy car together.

In classifying the functions of pointing, we also took into account whether the message was understood or not by the addressee. We later calculated the percentage of correct interpretations of the gesture relative to the absolute frequency of gesture production.

Finally, we counted and recorded mother-child verbal productions and classified them into two categories: open-class (nouns, derivative adverbs, adjectives and verbs) and closed-class (determiners, temporal and modal adverbs, prepositions, pronouns, conjunctions and auxiliary verbs).

Results

Development and Accuracy of Pointing Functions for Mother and Child

Table 1 displays descriptive data for each mother and child including their sex, age range, number of sessions, total number of minutes they were recorded, total number of pointing gestures, number of open-class productions, and total number of words. The total number of pointing productions was 1,475: 604 in Group 1 (child: 356, mother: 248) and 871 in Group 2 (child: 415, mother: 456). Production was quite similar between children and mothers in both groups. The total observation time was 14.3 hours for Group 1 and 14.2 hours for Group 2.

Figures 1 and 2 describe the development of pointing production according to its various functions, month by month, for both children and mothers. Table 2 presents the percentage corresponding to the interlocutor's accuracy of interpreting gestures, relative to the absolute frequency of pointing. The percentage of correct interpretations was found to be high for both mother and child. This implies that, overall, when the speaker produces pointing, the addressee understands it.

Table 1
Comparative data on the children and the mothers

					Child			Mother		
Child	Age period	Sex	No. of sessions	Total time	No. of pointings	Open-class words	Total words	No. of pointings	Open-class words	Total words
PA	12 to 24	F	5	220'	128	551	979	58	3769	7794
LA	12 to 24	F	5	186'	119	157	271	70	4595	8769
JP	12 to 24	M	5	185'	52	94	275	28	3055	6399
CA	12 to 24	M	5	271'	57	221	388	92	6290	12437
CR	24 to 36	F	5	141'	98	1609	3459	102	8119	1850
PC	24 to 36	M	5	271'	95	922	1940	68	2161	1008
PB	24 to 36	M	5	196'	93	1158	3116	131	6768	1684
CE	24 to 36	M	5	244'	129	2432	5406	155	7143	3535

Table 2
Absolute frequency and percentage of the interlocutor's accuracy at interpreting the function of the pointing gesture

	Total	Showing	Informative	Ask for an object	Ask for an action	Ask for cooperation
Child						
Group 1						
Absolute frequency	356	259	56	29	11	1
% of accuracy	91.5	95.7	91	72.4	100	100
Group 2	415	375	17	8	12	3
Absolute frequency						
% of accuracy	96.6	96.8	100	100	83.3	100
Mother						
Group 1						
Absolute frequency	248	161	7	3	77	0
% of accuracy	96.4	98	85.7	100	93.5	—
Group 2	456	384	4	0	56	12
Absolute frequency						
% of accuracy	95.6	97	75	—	89	91.6

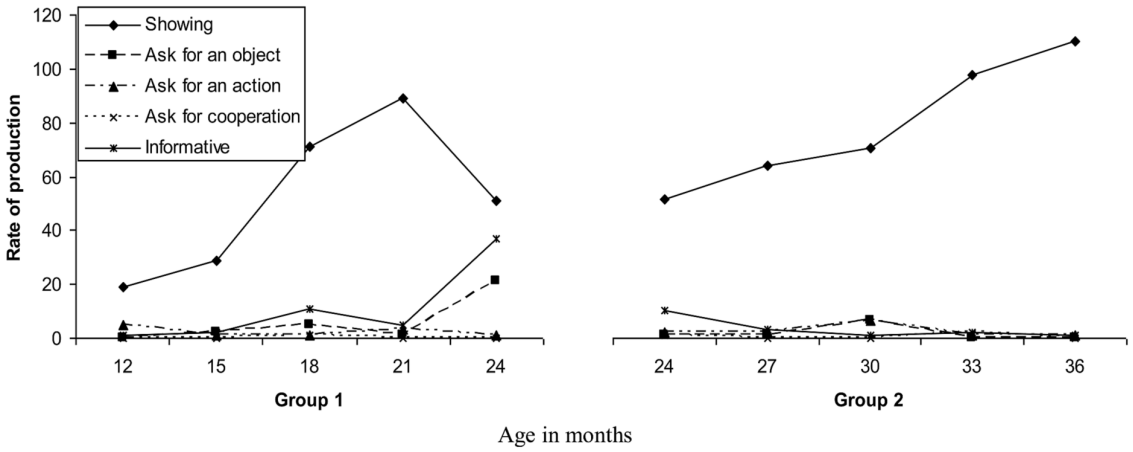

Figure 1. Development by sessions of the pointing functions for children.

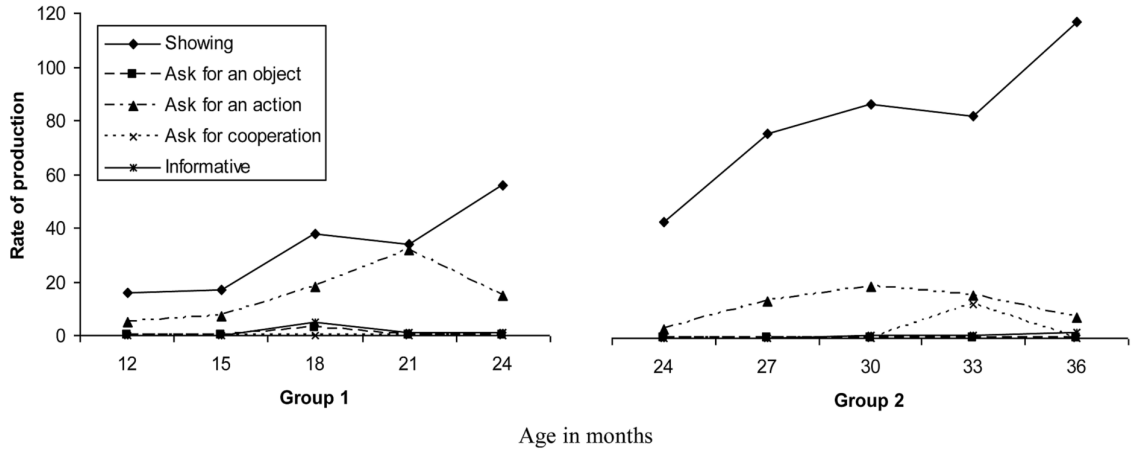

Figure 2. Development by sessions of the pointing functions for mothers.

According to Table 2, the showing function was the most frequent for all participants. In second place were informing for children, and requesting action for mothers. Third place went to requesting an object for children in Group 1, requesting action for children in Group 2, informing for mothers in Group 1, and requesting cooperation for mothers in Group 2. Requesting cooperation fell in last place for both groups of children and mothers in Group 1, and requesting an object fell in last place for mothers in Group 2.

We compared the distribution of each pointing function's use for each mother-child pair in both age groups, and found no significant differences, indicating that similar behaviors were observed within each mother-child pair.

To compare the functions of pointing, a series of t-tests was performed. The results revealed that independent of group, children and mothers both use the showing gesture significantly more than the others. The showing function exhibited significant differences, for children in Group 1, from requesting an object ($t(4) = 3.472$; $p \leq .026$), requesting action ($t(4) = 3.763$; $p \leq .020$), requesting cooperation ($t(4) = 4.010$; $p \leq .016$) and informing ($t(4) = 3.000$; $p \leq .040$); and among mothers, from requesting an object ($t(4) = 4.322$; $p \leq .012$), requesting cooperation ($t(4) = 4.348$; $p \leq .012$), and informing ($t(4) = 4.345$; $p \leq .012$). In addition, the frequency of requesting an object was significantly higher than requesting action ($t(4) = –3.110$; $p \leq .036$), and the frequency of requesting action was significantly higher than requesting cooperation ($t(4) = 3.207$; $p \leq .033$) and informing ($t(4) = 3.055$; $p \leq .038$).

For children in Group 2, the production of showing gestures was significantly greater than that of requesting an object ($t(4) = 6.755$; $p \leq .003$), requesting action ($t(4) = 6.716$; $p \leq .003$), requesting cooperation ($t(4) = 7.187$; $p \leq .002$), and informing ($t(4) = 6.156$; $p \leq .004$). In addition, the frequency of requesting an object was significantly greater than that of requesting action ($t(4) = –4.000$; $p \leq .016$). Among mothers, we found a similar pattern as in Group 1; in other words, the frequency of showing gestures was significantly higher than that of requesting an object ($t(4) = 6.865$; $p \leq .002$), requesting action ($t(4) = 6.132$; $p \leq .004$), requesting cooperation ($t(4) = 6.539$; $p \leq .003$), and informing ($t(4) = 7.002$; $p \leq .002$). We also found that the frequency of the requesting action function was significantly higher than that of requesting an object ($t(4) = –4.106$; $p \leq .015$). Meanwhile, the frequency of requesting action was significantly higher than that of requesting cooperation ($t(4) = 2.994$; $p \leq .040$) and informing ($t(4) = 3.833$; $p \leq .019$). Furthermore, mothers in Group 2 used the showing gesture more than those in Group 1 ($t(8) = –3.324$; $p \leq .010$).

Concerning the order of emergence of these functions, for children, the first pointing to emerge had the function of showing and it continued to be produced quite a lot throughout all months of the study. In months 12 and 15, informing and requesting action were each utilized by one child. During month 18, informing was employed by two children and requesting action by one. In month 21, informing continued to be used by two children along with requesting action. In light of these findings, we suggest that the second pointing gesture to emerge is informing, followed in third place by requesting action. The fourth pointing function to emerge was requesting an object, whose use began during month 15 and was solidified in month 18. Last, requesting cooperation was employed by children in months 24, 27 and 33.

Production of the Pointing Functions in Mother and Child According to Who Initiates the Interaction.

The children and their mothers took turns a total of 18,400 times throughout highly reciprocal conversations. In Group 1, this occurred 5,739 times (2,794 children, 2,945 mothers). In Group 2, 12,661 turns were taken (children 6,089, mothers 6,572). To analyze the production of mother-child pointing as a function of who initiated the interaction (child or mother), we performed ANOVAs corresponding to each function. Generally speaking, initiating the verbal interaction increased the probability that the speaker would produce pointing. In Group 1, when the child initiated the interaction, he or she pointed more than the mother in the case of showing $F(1,12408) = 154.718$; $p \leq .000$ and requesting an object $F(1,12408) = 24.792$; $p \leq .000$. When the mother initiated the interaction, on the other hand, she pointed more than her child in the case of showing $F(1,12408) = 28.333$; $p \leq .000$ and requesting action $F(1,12408) = 16.164$; $p \leq .000$.

In Group 2, when the child initiated the interaction, he or she pointed more than the mother in the case of showing $F(1,22732) = 522.772$; $p \leq .000$, requesting an object $F(1,22729) = 16.812$; $p \leq .000$, and requesting action $F(1,22734) = 10.033$; $p \leq .002$. Similarly, when the mother initiated the interaction, she produced more pointing than the child in the case of showing $F(1,22734) = 161.137$; $p \leq .000$, requesting action $F(1,22734) = 23.892$; $p \leq .000$, and requesting cooperation $F(1,22734) = 6.199$; $p \leq .013$.

Relationship between the Functions of Pointing and Verbal Production on the Part of Mother and Child.

The children's total verbal production was greater in Group 2 than in Group 1 ($t(7) = 8.1$, $p \leq .001$). The children's open-class production was greater in Group 2 than in Group 1 ($t(7) = 8.8$, $p \leq .001$) as well. The mothers' total verbal production in Group 2 was greater than in Group 1 ($t(7) = 3.5$, $p \leq .005$) and the same was true for closed-class production ($t(7) = 3.8$, $p \leq .005$).

In order to explore the correlation between the verbal production (total words and open-class productions) of mother and child, and the production of the different functions of pointing (showing, requesting an object, requesting action, requesting cooperation, informing), the Pearson correlation was utilized. There were a total of 10 observation points corresponding to averages for each of the months in the study (the dyads' data were averaged during the two years of observation) (see Table 3).

Table 3
Pearson correlation between mothers and children taking into account the verbal production and the different functions of the pointing

	Child						
	Total Words	Open-class words	Showing	Information	Ask for an action	Ask for cooperation	Ask for an object
Total Words	0.91**	0.93**	0.80**	– 0.07	– 0.14	0.24	– 0.03
Open-class words	0.88**	0.90**	0.83**	– 0.08	– 0.13	0.20	– 0.04
Showing	0.95**	0.95**	0.73*	– 0.09	– 0.14	0.08	– .01
Information	0.02	– 0.16	0.44	0.14	– 0.29	0.27	0.13
Ask for an object	– 0.30	– 0.30	0.09	0.11	– 0.10	0.30	0.07
Ask for an action	– 0.15	– 0.12	0.48	0.10	0.12	– 0.04	0.16
Ask for cooperation	0.40	0.37	0.37	– 0.16	– 0.25	0.80**	– 0.20

* $p < 0.005$, ** $p < 0.001$

First, the different functions were correlated with the child's verbal production and subsequently, the mother's. Showing was found to be correlated with verbal production in both children (showing –total words: $r = 0.69$ $p \leq .026$; showing –open-class: $r = 0.68$ $p \leq .028$) and mothers (showing-total words: $r = 0.99$ $p \leq .000$; showing-open-class: $r = 0$ .91 $p \leq .000$). That is, the showing function is related to verbal production in both child and mother.

Second, the different functions were correlated between each mother and child revealing that, in the first place, the categories of verbal production for mother and child were correlated significantly with one another. Next, the mother and child's verbal production was significantly correlated with showing. Hence, the mother's total word production was significantly correlated with the child's use of the showing function of pointing. The same pattern was observed in the child's total word production and the mother's use of the showing function of pointing. Mothers' and children's open-class verbal production exhibited the same pattern, a reciprocal relationship with the showing variable. Finally, requesting cooperation on the part of mothers was significantly correlated with that of their children.

Discussion

Our first objective was to explore the different functions of the pointing gestures used by 12 to 36-month-old children and their mothers during their daily interactions, whether or not these functions were understood by the other (mother or child), and finally, which function emerges earliest. Similar to the findings of Tomasello et al. (2007), we have found that pointing gestures can serve a variety functions including showing, informing, requesting an object, requesting action, and requesting cooperation. In neither of the two different age groups studied were mother-child differences observed in the distribution of the functions of these gestures. In light of this finding, we suggest that a joint adaptation occurs between mother and child when articulating gestural communication with several intentions.

The showing function was used more often than the others in both age groups and among mothers and children alike. In mother-child interactions, the two jointly attend to reference objects; this concept was termed joint attention by Clark (1996). This implies that both people perceptually attend to something, and that both recognize they are paying attention to this thing. This show of interest and attention allows for the possibility of comprehending the function being transmitted through gesture. It also explains the high percentage of correct comprehension of all the pointing functions by both interlocutors.

Even though the frequency with which the informing pointing function was produced in children indicates it falls in second place, comparing it to other functions yielded no significant differences. This is due to the fact that the bulk of the production came from one child in Group 1, so although this gesture indeed occurs, it is not as frequent or generalized among the children selected to participate in this study as it might at first appear. That being said, these results are along the lines of what several different theories have proposed, that children's intentional communication begins in the first months of life with gesture. Bates et al. (1975) suggested that the transition from using the pointing gesture in an exploratory manner to using it with reference to an adult's attention is evidence of their pre-verbal, intentional communication, which usually begins around 12 months of age. In this way, a child first consolidates his or her use of declarative gestures, gestures that emphasize intentional communication such as showing and informing. Similarly, Tomasello et al. (2007) and Liszkowski et al. (2006) proposed that when children point, they are trying to influence the adult's mental state in some way. The fact that we did not find as many informative pointing gestures may be due to the fact that, in the research cited about pointing, they were directly elicited by experimenters in a laboratory setting, while in our study, gestural production was purely spontaneous by virtue of our naturalistic design.

The results do not support the notion suggested by Camaioni et al. (2004) that the most frequent function of pointing in the first years of life, and the first to emerge, is imperative (requesting an object). This difference may, too, be due to the method of data collection employed. In the present study, all observations were made in naturally occurring, interactive contexts where the mother and child took part in everyday routines such as eating lunch, playing and bathing and our objective was to register spontaneous use of pointing in a rich, complex environment where the child has a wealth of options for reference. In contrast, Camaioni collected her data in a laboratory setting by directly eliciting the child to point, surrounded by objects yet without structured routines of actions to execute.

Among mothers in both groups, in addition to the intentionality of showing the child something, stimulating the child to perform some action by means of the pointing gesture predominated and later, in Group 2, it was used to solicit coordinated actions requiring cooperation. This suggests that the mothers also used gestures to stimulate the child to cooperate, which is key to their intellectual development (Rogoff, 1989). In other words, what Rogoff (1989) called guided participation occurred, in which adults do activities jointly with their children and guide them in the process of learning so that they will advance from an inferior level of comprehension and ability to a more advanced one. Several studies (e.g., Rogoff, Malkin, & Gilbride, 1984) have demonstrated that after six months of age, babies exhibit very clear intentions to communicate how to participate in specific actions. They have a very active disposition and try to influence adults to initiate or stop doing things, as well as to obtain objects they desire.

The second objective of this study was to observe whether or not there were changes in the pointing production of mother or child as a function of who initiated the interaction. The results are in line with our expectations; that is, both mother and child produce more pointing when they initiate the turn-taking interaction. In Group 1, when it was the child's turn, they pointed more than their mothers with the function of showing and requesting an object. In Group 2, this was also true of pointing gestures with the requesting action function. When it was the mother's turn, on the other hand, the showing, requesting action, and soliciting cooperation functions were produced more often than in children. This is consistent with the mother's interest in making the child's activities more dynamic and in collaborating in actions that push him or her ahead to a more advanced level, as mentioned above.

The results indicate that pointing gestures form part of the linguistic system, whose primordial intention is to communicate. We posit that the exchange of attention and experience between mother and child, which is one basis of communication and language acquisition (Baldwin, 1995; Tomasello, 1995), also regulates the production of pointing gestures. From this perspective, gestures as well as language are organized according to turn-taking, which gives discourse an integrated structure. Pointing is not merely an action but a communicative gesture. Along those lines, we posit that pointing is not originally an element of reaction, but rather an element of production. In other words, pointing is not limited to being a mere reaction to someone else's message, but it serves as a vehicle for one's own message.

The third objective was to analyze the relationship between the different pointing functions and verbal production of mother and child. The results confirmed our expectations to some extent, although not entirely. The only pointing function found to be associated with verbal development was showing. This result is of particular relevance because the results of various studies have indicated that pointing supports word acquisition, or that mother and child's verbal production were significantly correlated with pointing (Butterworth & Morissette, 1996; Pettito, 1993; Rodrigo et al., 2004). No one, however, had provided results about which function was most highly correlated with language development. However, our expectation that there would be a relationship between the informative function and language was not met.

The results convey that there is no correlation between the declarative and imperative functions for mother, child or both. This would seem to support a hypothesis of disassociation of these two pointing functions. Baron-Cohen's (1989) data were similar in that he found that autistic children could understand and produce protoimperatives, but not protodeclaratives. This suggests that producing one does not necessarily imply producing the other. No correlations between showing and informing were found either, which supports Aureli´s et al. (2009) findings.

The requesting an object, requesting action, and requesting cooperation functions were more instrumental and not found to be directly related to language. Similarly, a naturalistic observation study by Rodrigo et al. (2005) compared the production in mothers and children (1 and 2-year-olds) of deictic (pointing and instrumental) and representational gestures (symbolic and social) and found that mother-child pointing gestures were the most frequent, and also most highly correlated with a verbal production from the other person, in the case of both mother and child. Nevertheless, that is not to say that the imperative functions are not useful. The correlation between the requesting cooperation pointing gesture between mother and child, for example, was an interesting result, because it highlights the fact that this function can effectively potentiate mother-child joint activities.

In conclusion, the present study shows that children and their mothers use pointing gestures to serve a variety of functions in naturalistic contexts, congruent with what Liszkowski et al. (2006) and Tomasello et al. (2007) concluded from research in laboratory settings. The aforementioned functions are practiced quite similarly between mother and child, are correctly interpreted by the interlocutor, and are integrated into the system of turn-taking that is characteristic

of verbal interactions. Furthermore, the gesture of showing serves the function of language potentiation while gestures that request action or cooperation help to promote joint activities between mother and child. With respect to the controversy between Camaioini's (1993) *lean* perspective and the *rich* perspective described by Tomasello et al. (2007) about pointing (Elgier & Mustaca, 2009), the present results reinforce Tomasello's *rich* theory. First, a very rich panorama of pointing functions was unearthed and, second, the declarative function emerged before the imperative one. However, in support of Camaioni, the results reveal that only the declarative function is related to linguistic development.

References

Aureli, T., Perucchini, P., & Genco, M. (2009). Children's understanding of communicative intentions in the middle of the second year of life. *Cognitive Development, 24*, 1-12. doi:10.1016/j.cogdev.2008.07.003

Austin, J. L. (1962). *How to do things with words*. Oxford: Oxford University Press.

Baldwin, D. A. (1991). Infant contributions to the achievement of joint reference. *Child Development, 62,* 875-890. doi:10.2307/1131140

Baldwin, D. (1995) Understanding the link between joint attention and language. In C. Moore & P. J. Dunham (Eds.), *Joint Attention: Its origins and role in development* (pp. 131-154) Hillsdale, NJ: Erlbaum.

Baron-Cohen, S. (1989). Perceptual role-taking and protodeclarative pointing in autism. *British Journal of Child Psychology and Psychiatry, 30*, 285-298.

Bates, E., Camaioni, L., & Volterra, V. (1975). The acquisition of preformatives prior to speech. *Merrill-Palmer Quarterly, 21*, 205-226

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

Bloom, L., Rocissano, L., & Hood, L. (1976). Adult-child discourse: Developmental interaction between information processing and linguistic knowledge. *Cognitive Psychology, 8,* 521-552. doi:10.1016/0010-0285(76)90017-7

Bruner, S. J. (1975) Child development: play is serious business. *Psychology Today*, *8*, 80-83.

Bruner, S. J. (1977). Early social Interaction and Language Acquisition. In H. R. Schaffer (Ed.), *Studies in Mother-Infant Interaction* (pp. 271-289). London, UK: Academic Press.

Butterworth, G., & Morissette, P. (1996). Onset of pointing and the acquisition of language in infancy. *Journal of Reproductive and Infant Psychology, 14*, 219-231. doi:10.1080/02646839608404519

Camaioni, L. (1993). The development of intentional communication: A re-analysis. In J. Nadel & L. Camaioni (Eds.), *New perspectives in early communicative development* (pp. 82-96). London, UK: Routledge.

Camaioni, L., Castelli, M. C., Longobardi, E., & Volterra, V. (1991). A parent report instrument for early language assessment. *First Language, 11,* 345-358. doi:10.1177/014272379101103303

Camaioni, L., Perucchini, P., Bellagamba, F., & Colonnesi, C. (2004).The role of declarative pointing in developing a theory of mind. *Infancy*, *5*, 291-308. doi:10.1207/s15327078in0503_3

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). doi:10.2307/1166214

Clark, H. (1996). *Uses of language*. Cambridge, UK: Cambridge University Press.

Elgier, A. M., & Mustaca, A. E. (2009). Perspectivas teóricas contemporáneas sobre el gesto de señalar infantil [Contemporary theoretical perspectives on the infant pointing gesture]. *Avances en Psicología Latinoamericana*, *27*, 281-296.

Fenson, L., Dale, P. S., Reznick, J. S., Bates, E., Thal, D. J., & Pethick, S. J. (1994). Variability in early communicative development. *Monographs of the Society for Research in Child Development*, *59*(5). doi:10.2307/1166093

Franco, F., & Butterworth, G. (1996). Pointing and social awareness: declaring and requesting in the second year. *Journal of Child Language, 23,* 307-336. doi:10.1017/S0305000900008813

Gomez, J. (1991). Visual behavior as a window for reading the mind of others in primates. In A. Whiten (Ed.), *Natural Theories of Mind* (pp. 195-207). Oxford, UK: Basil Blackwell.

Halliday, M. (1990). *Language, context and text: aspects of language in a social-semiotic perspective*. Oxford: Oxford University Press.

Liebal, K., & Tomasello, M. (2009). Infants appreciate the social intention behind a pointing gesture: Commentary on "Children's understanding of communicative intentions in the middle of the second year of life" by T. Aureli, P. Perucchini, and M. Genco. *Cognitive Development, 24*, 13-15. doi:10.1016/j.cogdev.2008.09.004

Liszkowski, U., Carpenter, M., Henning, A., Striano, T., & Tomasello, M. (2004). Twelve-month-olds point to share attention and interest. *Developmental Science*, *7*, 297-307. doi:10.1111/j.1467-7687.2004.00349.x

Liszkowski U., Carpenter, M., Striano T., & Tomasello, M. (2006). 12- and 18-month-olds point to provide information for others. *Journal of Social Cognition and Development, 7*, 173-187. doi:10.1207/s15327647jcd0702_2

Mora, E., Martínez, H., & Domínguez, C., (2009). Análisis audio-perceptivo y acústico de la prosodia de las cláusulas del español venezolano [Audio-perceptive and acoustic analyses of the prosody of clauses in Venezuelan Spanish]. *Opción*, *25*, 54-69.

Muñetón, M., Ramírez, G., & Rodrigo M. J., (2005). Estudio longitudinal de la producción de deícticos en castellano en niños de 12 a 36 meses durante las actividades cotidianas [Longitudial study of the production of diectics in spanish 1- and 2-year-old children in everyday activities]. *Anuario de Psicología, 36*, 315-338.

Mueller, E., & Lucas, T. (1975). A developmental analysis of peer interaction among toddlers. In M. Lewis & L. A. Rosenblum (Eds.), *Friendship and Peer Relations* (pp. 223-257). New York, NY: John Wiley.

Pettito, L. A. (1993). Modularity and constraints in early lexical acquisition. In P. Bloom (Ed.), *Language Acquisition* (pp. 25-59). New York, NY: Harvester Wheatsheaf.

Rodrigo, M. J., González, A., de Vega, M., Muñeton-Ayala, & Rodríguez, G. (2004). From gestural to verbal deixis: A longitudinal study with Spanish infants and toddlers. *First Language, 24*, 71-90. doi:10.1177/0142723704041040

Rodrigo, M. J., González, A., Ato, M., Rodríguez, G., de Vega, M., & Muñeton-Ayala, M. (2005). Co-development of child–mother gestures over the second and the third years. *Infant and Child Development*, *14*, 1-17. doi:10.1002/icd.412

Rogoff, B. (1989). The joint socialization of development by young children and adults. In A. Gellatly, D. Rogers, & J.A. Sloboda (Eds.), *Cognition and Social Worlds*. Oxford: Clarendon Press.

Rogoff, B., Malkin, C., & Gilbride, K. (1984). Interaction with babies as guidance for development. In B. Rogoff & J. Wertsch (Eds.), *Children learning in the zone of proximal development* (pp. 65-76). San Francisco, CA: Jossey Bass.

Sacks, H., Schegloff, E.A., & Jefferson, G. (1974). A simplest systematics for the organization of turn-taking for conversation. *Language, 50*, 696-735. doi:10.2307/412243

Schaffer, H. R., Collis, G. M., & Parsons, G. (1977). Vocal interchange and visual regard in verbal and pre-verbal children. In H. R. Schaffer (Ed.), *Studies in Mother-Infant Interaction* (pp. 291-324). London, UK: Academic Press.

Tomasello, M. (1995). Joint attention as social cognition. In C. Moore & P. J. Dunham (Eds.), *Joint Attention: Its origins and role in development* (pp. 103-130). Hillsdale, NJ: Erlbaum.

Tomasello, M., Carpenter, M., & Liszkowski, U. (2007). A new look at infant pointing. *Child Development*, *78*(3), 705-722. doi:10.1111/j.1467-8624.2007.01025.x

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