

The Rhythmic, Sonorous and Melodic Components of Adult-Child-Object Interactions Between 2 and 6 Months Old

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Abstract Adults mediate the relationship between material reality and children, according to functional units of cultural relevance. This paper explores early development of semiotic systems in infants, analyzing rhythmic, sonorous and melodic components, which enable adult-child interaction *with* and *about* objects. The triads (with sonorous and non-sonorous objects) was studied longitudinally at age 2, 4 and 6 months. We propose that rhythmic, sonorous and melodic components conformed one of the basic semiotic systems upon the adult's action relies (through gestures and uses of objects) in order to segment and organize objects in the world. Likewise, children actively respond to these presentations and seek sounds for themselves when they are able to interact with the object more autonomously.

Keywords Triadic interactions · Gestures · Semiotics · Early development · Rhythm

Highlights: We explore how early development of semiotic systems enable triadic interactions. We propose that early triadic interactions have a communicative/educational nature. Rhythm could be one of the first semiotic systems, and an instrument of communication. Children easily respond to the adult's rhythmic-sonorous proposals. Adults favor rhythmic, sonorous and melodic components to interact with babies from 2 to 6 months.

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Theoretical Foundations

There is a large consensus among psychologists regarding the definition of “triadic interaction” that involves, among others, joint attention, social reference and communicative gestures (Bates et al. 1975; Tomasello 2004, 2008). For them, triadic interaction appears at the end of infant’s first year of life, when the child is able to intentionally communicate with others about something in the world.

Colwyn Trevarthen thoroughly investigated this subject in his well-known distinction between primary intersubjectivity, which refers to the coordination of the self and the other, and secondary intersubjectivity, which includes an object (Malloch and Trevarthen 2009; Trevarthen 1999, 2003). Prior to the secondary intersubjectivity, the child is assumed to relate only in dyads, either with objects or others, but not both. According to Trevarthen, coordination between the self, the other and an object develops between 9 and 12 months old and is based on the cooperative exchange of referential gestures. In fact, a critical change is produced from playing situations to a growing initiative that leads to the systematic combination of intentions with the other and the object.

The idea that triadic interactions occur only at the end of the infant’s first year of life remains relatively unchanged. Recently conducted studies (Liszkowski et al. 2006; Liszkowski and Tomasello 2007; Tomasello 2004, 2008) have shown that 12-month-olds not only interpret other social partners but also take the initiative in communicating with intention, finding themselves “in tune” with adult attention and behavior. From this time onwards, a child communicates something to the adult about something in the world: for example, giving or showing the object intentionally (Andrén 2010; Reddy 2008) or, later, pointing a desired object that is out of reach (Csibra 2010; Futó et al. 2010; Leavens et al. 2008; Southgate et al. 2007).

However, the concept of “triadic interaction” has other meanings. Vygotsky and the classic development theorists (Bühler 2009; Vygotski 1984/1996; Wallon 1972) postulated the existence of triadic interactions in infant’s first months of life, but these ideas were not sufficiently measured and therefore did not survive. However, Piaget did provide empirical data (Piaget 2007), although neither communication nor the adult’s role as a guide was analyzed, despite the fact that the adult was present during almost all observations (Bronckart 2012).

The common denominator in the specialized literature nowadays is that the role of adult as a guide in the origin of triadic interactions, at the end of the first year, has been ignored. The function of concrete objects in producing gestures is not very often specified, relegating them to a secondary position and paying few attention to their functional nature. Not several studies have emphasized the existence of early triadic interaction or the role of the object in the communicative space between adults and infants under 9 months old. Triadic interactions in infant’s first months of life, thanks to the communicative intention of the adult, might help explain, understand and analyze the nature of the transformations that allow a later entry into the “classic” triad discussed in the literature.

The semiotic and pragmatic perspective of objects (Moro and Rodríguez 2005; Rodríguez and Moro 1999) extends the pragmatic tradition of Bruner regarding language use to object use in communicative settings (Rodríguez and Palacios 2007). According to this perspective, triadic interactions do not begin when the child intentionally initiates communication with the other but when the adult, who is also an

interaction partner, guides the child and combines their relationship with the material world through communication. This guiding role occurs through different semiotic systems, such as the rhythmic-sonorous, gestures, uses of objects, symbols, language and so on.

Objects are part of tradition, are subject to public-use rules, possess social properties approved/shared by the community, involve forms of life and activity and are part of communication (Rodríguez 2012a; Sinha and Rodríguez 2008).

Throughout their first year, children erect the public and cultural functions of objects as they begin to use them as class members. There is a form of *functional permanence* in objects that is public and socially agreed upon, as well as being necessary for communication and intersubjective understanding (Rodríguez 2012a, 2012b). The child alone cannot decode the complexity of the artifact object's meaning, but he/she needs the mediation/guidance of another person through systems of signs. Furthermore, objects are part of communication because adult and child build together a shared reference to them. Communicative niches are set up in triadic interactions, from which tremendously rich and varied meanings emerge during the first 2 years of the infant's life.

Objects play an important role in everyday adult-child interactions, where adults provide children with instruments and their conditions of use, and children access them via interaction with the adults. Later, the child uses objects by him/herself. Semiotic systems are tools to communicate and become tools for thought later in development. Therefore, analyzing how developmental communicative processes are produced is relevant due to these processes enable the transfer of cultural knowledge, regarding the objects that an adult gives to a child in his/her first months of life.

From the pragmatic of the object perspective, several studies have been conducted on triadic interactions adult-child-object throughout the first and second year, regarding children's first conventional uses of objects (Rodríguez and More 1999), how and when they begin to perform symbolic actions (Cárdenas et al. 2014; Palacios and Rodríguez 2015; Rodríguez et al. 2014), how and when children use private gestures with a self-regulation function (Basilio and Rodríguez 2011; Rodríguez and Palacios 2007), the early interactions through music (Del Olmo et al. 2010), and the use of number between 2 and 3 years (Cavalcante and Rodríguez 2015). In all these studies, adults assume an educative role, segmenting and selecting portions of the world to share with the infant in his/her first months of life by relying on different semiotic systems, which include rhythm and sound.

In this sense, there is a general agreement in the literature about the importance of rhythm as an early form of child-adult interaction (Perinat 1993; Díaz 2004; Hargreaves 2002; Jaffe et al. 2001; Rodríguez 2006; Trehub 2003). However, we did not find studies about rhythm including objects in these early interactions.

In this study, we seek to identify the place of rhythm and sound as a basic semiotic system that is crucial to understand early child-adult interaction. There is a need to analyze the basic semiotic systems upon adult's action relies, in order to segment and organize objects in the world and how to present them to the child in the best possible way. In this study, we explore the rhythmic components of adult-child interaction, including those in objects, and defining these components as one of the first forms of shared reference.

We want to analyze how the first agreements between adult and child are built related to objects, hypothesizing that ostensive gestures are one of the main tools to reach them. Rhythmic, sonorous and melodic components are assumed to play important roles in the presentation of objects used by the adult *in front of* and *for* the infant, in these first months of life.

Material and Methods

Participants

Two boys (henceforth, Child1 and Child2) and one girl (Child3) were filmed at age 2, 4 and 6 months with a parent. Child2 was filmed with his father and Child1 and Child3 with their mothers. Participants are volunteers for the study.

Procedures and Materials

Each child was systematically recorded at home at three observational and longitudinal 5-minute sessions. Adults were provided with the object¹ (see Fig. 1). Parents were asked to be free to place the child in a comfortable position, where both could interact, and were instructed to “Play with your child as you normally would.”

The object in this study was chosen because it favors triadic interactions: (1) for adults to produce gestures as demonstrations of uses of objects and ostensive gestures with rhythmic, sonorous and melodic components and (2) for productions of the child also related to rhythm and sound.

A formal authorization was required to parents in order to register the sessions and to spread and publish the results of the study. Parents also signed an informed acquiescence where the terms of their participation on the study were made explicit and the anonymity of the participants was guaranteed.

Microgenetic and qualitative analyses of frequencies and proportion comparison were conducted. Although the object can be used in multiple ways, parents of 2-, 4- and 6-month-olds discard the more complex uses (even when they are more socially rooted) and merely places the rings on the pole (Rodríguez and Palacios 2007). The adult favors “easier” uses of objects, that is, their rhythmic, sonorous and melodic components, which presumably allows him/her to create a shared meaning with the child.

Data Analyses

For transcription was used ELAN (EUDICO linguistic annotator - Elan (Version 4.1.1) [Software computation] 2011), based on the transcription protocol of Rodríguez and Moro (1999).

Sequences were selected using the following criteria: gestures, actions, or both with (1) rhythmic –with or without sound–, (2) sonorous –changes in sound intensity–, or (3) melodic components.

¹ The same object was used in a case study of self-regulation function in private gestures on a 18 months old girl with Down Syndrome (Rodríguez and Palacios 2007).

Ring Pyramid

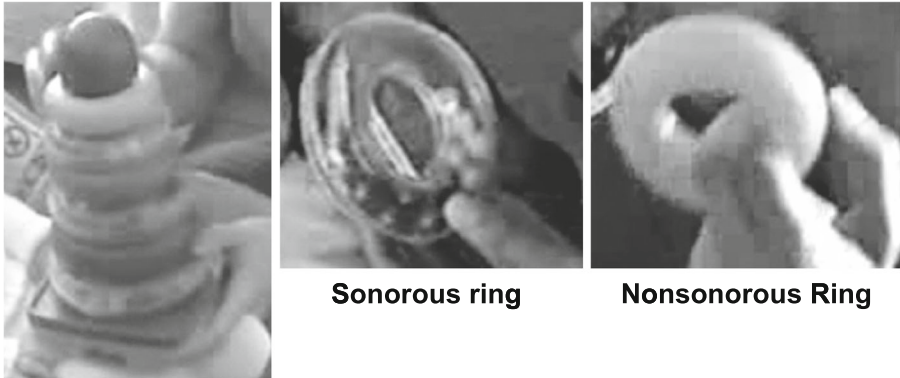


Fig. 1 Object description. The object consisted of: (1) six rings of different diameters that could be placed on (2) a narrow supporting pole. Three rings were transparent and filled with small plastic balls, so that they sounded like a rattle when shaken (sonorous ring). The other three rings were colored, hollow and did not produce a sound (nonsonorous ring)

A series of adult-child interactions were categorized on the basis of previous semiotic categories (Rodríguez and Moro 1999) and other emergent ones, where rhythmic, sonorous and melodic components of adult's actions and rhythmic and sonorous components of child's actions were added (Table 1).

Coding reliability was analyzed by three independent coders. Inter-coder agreement index (Freelon 2010) of Krippendorff's Alpha was 0.921, which denotes an excellent level of reliability (Cicchetti 1994).

We also used SPSS to perform Chi-square test to assess differences among frequencies distribution into a variable, and a proportion comparison among frequencies of uses of objects through the different variables studied.

Results

Adult's Communicative Mediators

Over time, adult used different semiotic systems to communicate with his/her child about, and through the object. Especially at 2 and 4 months old, the primary action responsibility and initiative comes from the adult, as 2-month-olds are unable to manipulate objects by themselves and still do so with difficulties at 4 months old. This situation changes at age 6 months, when children have no longer difficulty to manipulate objects.

Importantly, different uses of objects and social forms of action can be organized. However, the rhythmicity of action is not only found in objects designed to be sonorous, but it can also be found in any object when a rhythm is applied (e.g., striking an object against another in an organized manner). We consider the conventional use of these particular objects to shake it in different manners, which involves a rhythmic organization, either with sonorous or non-sonorous rings.

Table 1 Observation Categories

Children	Adults
<p>Attention¹</p> <p>Child's visual activity toward:</p> <p>The object</p> <p>The adult</p> <p>The adult's action</p> <p>Uses of objects</p> <p>Non conventional Uses: Child uses the object in a non conventional way such as sucking rings or shaking the non-sonorous ring.</p> <p>Precursors to Conventional Uses: Child includes him/herself in the joint action initiated and directed by adult. For example, before the ostensive action of adult, child takes or attempt to grasp the object.</p> <p>Conventional uses: Child performs or attempts to perform the rhythmic-sonorous use of the object. For example, shaking the sonorous ring or striking the non-sonorous ring against something to make a sound.</p> <p>Ostensive gestures</p> <p>Self-Ostensive gesture with the rings: Child "shows" the object to him or herself in an exploratory mode.</p> <p>Vocalizations</p> <p>Vocal sounds emitted by the child that can vary in tone or intensity (e.g., screams, tweets, or chirps).</p>	<p>Communicative mediators of adults</p> <p>Demonstrations: Performing the conventional sonorous use of the object in an organized manner. These ostensive gestures have rhythmic and sonorous characters. Types:</p> <p>Distant: When adult performed a complete or incomplete conventional use of the sonorous ring (i.e., using it as a rattle) or percuting the non-sonorous ring with another object to child.</p> <p>Immediate: When adult directed or introduced the use to child through his body to perform a joint action (e.g., when adult inserted the sonorous ring onto child's wrist and shook her arm, or when adult struck the sonorous ring against the chest of the child)².</p> <p>Ostensive gestures</p> <p>Ostensive gesture: Gestures with the object itself to draw the attention of the other (e.g., holding the sonorous or non-sonorous ring in front of the child).</p> <p>Rhythmic ostensive gesture: When the ostensive gesture is also rhythmic (i.e., with organized movement) using the non-sonorous ring. Or when the sonorous ring is presented rhythmically and slowly, focusing on the visual aspect of balls inside, which produces the non-sonorous behavior of them.</p> <p>Language, Verbalizations and Vocalizations³:</p> <p>Musical components using one's voice to add a melodic character, tone, or intensity. Usually accompanied by rhythm and the sound of the object being acted upon.</p>

¹ The attention category was solely based on the child because the adult always looks at the child or the object during the session

² No immediate demonstrations with the non-sonorous ring were observed

³ Adult's vocalizations are imitations of child babbling

T1/ 2 Months: Adult favors Rhythmic and Sonorous Components, Especially Through Distant Demonstrations

At 2 months old, three aspects draw attention about the adult's action (Table 2): (1) they favored sonorous rings compared with non-sonorous ones, presenting proportions that differ statistically ($p < .05$), (2) they preferred to produce *distant demonstrations* by shaking the rings, presenting a higher proportion than other actions –immediate

Table 2 Frequencies of adult's uses of the sonorous and non sonorous rings with the baby (by participants)

	2 months			4 months			6 months		
	Child1	Child2	Child3	Child1	Child2	Child3	Child1	Child2	Child3
Sonorous ring	Distant Demonstration	12	46	88	3	23	27	1	4
	Immediate Demonstration	1	1	13	-	2	7	-	-
	Ostensive Gestures	2	6	12	3	12	18	1	-
	Rhythmic Ost. Gestures	11	3	15	1	10	2	-	1
Non sonorous ring	Distant Demonstration	1	27	-	-	8	6	1	5
	Immediate Demonstration	-	-	-	-	-	3	-	-
	Ostensive Gestures	3	4	7	-	1	1	-	1
	Rhythmic Ost. Gestures	2	2	3	2	1	-	-	2

demonstrations, and basic and rhythmic ostensive gestures— ($p < .05$), and (3) they also used some *ostensive gestures* to present the rings.

The Adult Used the Sonorous Ring More than the Non-Sonorous Ring The adult used the sonorous rings preferably compared to non-sonorous ones with their 2-month-old babies. This object selection was striking in the case of Child1 and Child3 and the trend remained for Child2 but with minor differences. Importantly, the adult used the non-sonorous rings in a sonorous way by percussing them against another object.

The rings were not arbitrarily presented to the children, but in an organized manner preferably via rhythmic and sonorous components.

The Adult Favors Distant Demonstrations with Sound Through demonstrations, the adult introduced uses of the objects to the child. The sonorous rings were shaken like rattles and the non-sonorous ones were struck. Thus, the rings became for the child something to hear, to watch, and eventually to use together, becoming objects of joint attention and, to some degree, of joint action. The adult produced less ostensive gestures to the child than demonstrations at age 2 months.

They placed the object between him/herself and the infant in a convergence of multimodal semiotic networks (e.g., by making ascending or descending *glissandos*,² waving the object, using it, or talking to the child). The adult used the object to communicate with the child, organizing the first communication spaces between them, by introducing something external (i.e., the earliest forms of triadic interactions adult-child-object).

The Adult Produces Ostensive Gestures with and Without Rhythm In addition to the aforementioned sonorous uses, the adult also displayed ostensive “silent” gestures when presented the rings to the child. However, a significant portion of these ostensive gestures was made through rhythmic movements. These actions maintain the rhythm although these objects do not produce any sounds.

Classic ostensive gestures (statically made between adults) are differentiated from the rhythmic ones that we have found. The presentation of the rings was performed in a static manner in the former and in a rhythmic (redundant) way in the latter.

Observation 1 illustrates what happened at 2 months old when the uses of the adult organized the interaction through rhythm and sound.

Observation 1. Child3 0; 1, 16 [duration 54 s] The adult makes a distant demonstration of the sonorous ring between herself and the child

Child3 is reclined on the sofa while the adult holds her by the arm. Child3 constantly looks at the adult’s face, smiling at times. The adult speaks with a melodic intonation: “Look how beautiful this iiis...,” placing a non-sonorous ring between herself and Child3, moving it rhythmically. “Loook... Oh, how beautiful this iiis...!” intonating the words as descending *glissandos* and stroking her index finger down Child3’s cheek in the same direction. Child3 looks at the

² *Glissandos* are cascades of sounds produced by the adult in an ascending or descending manner.

object and then smiles at, and babbles the adult back. The adult continues showing her the object, accompanying this action with descending *glissandos* (“Aaaaaah...”), according to the girl’s babble. Child3 becomes a bit restless, so the adult releases the non-sonorous ring and *picks up the sonorous one, shaking it in Child3’s face and recovering her attention*. After a few repetitions, she accompanies the *glissandos* with *rhythmic uses of the ring, shaking it to the rhythm of the vocalizations emitted by the child*.

In Observation 1, different components of the action of the adult are identified, such as (1) the rhythm in the movement of the ostensive gestures, (2) the rhythm made by the sound of the sonorous ring, in order to recover the child’s attention, and (3) the rhythm and melody in the adult’s verbalizations.

T2/ 4 Months: the Adult Continues to Favor Rhythmic and Sonorous Uses Via Distant Demonstrations

The adult at T2 (Table 2) still preferred to use the sonorous rings versus the non-sonorous ones ($p < .05$), primarily as a rattle, as in T1. The adult organized the rings following rhythmic and sonorous criteria and highlighted the sound they made (see example in Observation 2).

Observation 2. Child1 0; 4, 3 [duration 50 s] The adult segments her action through distant demonstrations of two sonorous rings

The adult held the large sonorous ring over Child1’s head and shook it constantly. Child1 *observed the action of the adult and vocalized* until the adult, without altering her action, moved it closer to the child’s face. When the adult withdrew, Child1 was distracted and looked away. Then, the adult shook the small sonorous ring, this time in front of Child1’s face, who paid attention to the object again. The adult *used both sonorous rings* the large and the smaller one. During these actions, *Child1 waved his arms and legs and smiled*, watching the adult. Child1 occasionally vocalized to accompany the adult’s language: “Looook at how many baaalls! And here’s anooooother [ring]”. By waving his arms, Child1 *accidentally* placed his arm in the ring that the adult was using to make sound. Then the adult said: “Oops! Did you get it?”

In Observation 2, the adult tried to capture child’s attention and, once achieved, the dyad converged into the same action holding the object together, although this use was only intentional by the adult. A big difference with T1 is that 4-month-olds grasp objects and 2-month-olds do not.

Given the clear choice that adults consistently makes regarding the sonority of the object, children get easily involved in adult’s action, when he/she shows or gives the rings rhythmically (Observation 3). This implies a categorization according to the sonorous possibilities of the object.

Observation 3. Child3 0; 4, 1 [duration 30 s] The adult categorizes the rings according to their sonorous versus non-sonorous characteristics

The adult took two rings off the pole (one sonorous and one non-sonorous) and shook both rings for Child3, *comparing the rings that produce sound with those that do not*: “This one makes sounds, see? This one makes noise, and this one does not. This one has nothing, and this one has balls”. *Child3 was constantly looking at the sonorous ring while waving her arms and legs and ignoring the non-sonorous one.*

At T2, as in T1, the adults preferred distant demonstrations versus immediate demonstrations and gestures when using the rings. The adults show the object to the child but they do not give it to him or her.

The adult’s demonstrations and gestures tend to decrease in Child3 and less strikingly in Child2. However, immediate demonstrations and rhythmic ostensive gestures increased. These data are contrary to those for the adult with Child1, who shows an increase in demonstrations and gestures at T2.

T3/ 6 Months: Adult keeps favoring Rhythmic and Sonorous Uses. However, the Frequency of Demonstrations and Ostensive Gestures Decreases

As at T1 and T2, at T3 the adult preferably used sonorous rings versus non-sonorous ones, except in the case of Child3’s mother. In general, preferences were maintained for organized rhythmic and sonorous ring presentations. Furthermore, all T3 ostensive gestures by the adult were to *give*, not merely to *show* the object to the child ($p < .05$). This trend opposes the findings at T1.

Nevertheless, adult’s uses of objects and gestures decrease, accompanied with an increase in children’s participation. They practically limited his/her action in terms of providing children with the support they need to explore the object. Ostensive gestures toward the child with the rings decreased, which allowed the child to perform different uses. Whereas 4-month-olds remain involved in the uses performed by the adult most of the time, 6-month-olds are able to use and choose objects autonomously (Observation 4).

Observation 4. Child2 0; 5, 29 [duration 56 s] The adult limits his action and supports the child’s action

Child2 sat on a table with the three-ring pole in front of him; his father crouched on the floor directly behind him. *The boy held a sonorous ring and used it to hit the table*, waving both arms. Then, with his other hand, he hit the pole and moved it. *His father held the pole at the base to keep it from sliding while Child2 continued hitting it with his free hand. This action caused the sonorous rings on the pole to produce sound.* When Child2 stopped, he held the ring in front of him and moved it slowly to show it to himself (i.e., self-ostensive gesture).

In Observation 4, the adult did not take the initiative, limiting himself to give the object to the child when it was out of reach. The child had more space for action than at

T1 and T2 and was able to explore objects' sonorous possibilities by shaking and striking the rings against other objects that do not produce sounds by themselves.

The Rhythmic, Sonorous and Melodic Actions of the Adult

This section highlights two key points: (1) that adult very often adds rhythmic, sonorous and melodic components to his/her demonstrations and gestures; (2) and that although adult's uses tend to decrease as the child grows, the remaining uses have rhythmic, sonorous and melodic components.

Quite often, adult's actions have rhythmic components when presented to the child. We classified these uses whether they are (1) *only rhythmic* without sound (e.g., a rhythmic ostensive gesture with the non-sonorous ring or slowly with the sonorous one), (2) *rhythmic and sonorous* (e.g., use conventionally the sonorous ring, struck it against the child's chest, or percuss the non-sonorous one), or (3) *rhythmic, sonorous and melodic* (e.g., when adult incorporates melodic components using his/her voice³). Again, adults used more rhythmic presentations of the sonorous rings than with the non-sonorous ones in the three sessions. The *rhythmic and sonorous* uses prevailed over the *rhythmic* and the *rhythmic, sonorous and melodic* uses ($\chi^2(3, N=476)=198.27, p<.05$) (Table 3).

The rhythmic and sonorous components predominated in all the adults, but not the melody. Melodic components were added to those that were already rhythmic and sonorous. The demonstrations accompanied by all rhythmic, sonorous and melodic components clearly predominated over pure ostensive gestures ($p<.05$).

In addition, a *rhythmic structure of the first uses of objects* was identified in adult's actions (Fig. 2), which was characterized by four fast pulses, a long pulse accented at the end and a silent pause.

This structure formed a series of continuous, rhythmic sequences in the adult's actions. Figure 3 shows how the adult simultaneously applies the same predominant rhythmic structure in her action with the object and how she melodically speaks to the child. Adults create a multimodal, coherent stimulating context that helps children to be included in the action.

Patterns of Children's Activity in Response to the Rhythmic, Sonorous and Melodic Actions of the Adults

As we presented, adults constantly engaged with children throughout this type of actions. This section presents the patterns of children's activity prompted by the rhythmic, sonorous and melodic actions of adults.

Children are incorporated into the categories of joint action proposed by adults. Changes in children's gazes and its duration towards the object,⁴ the adult and the adult's actions have been observed (Graph 1).

³ Ostensive gestures, as happens between adults, were eliminated from this classification because they are produced in a static manner and, therefore, they do not involve either rhythm, nor sound.

⁴ Only the sequences of action with the sonorous rings were noted because the adult preferably used them.

Table 3 Frequencies of adult's rhythmic, sonorous and melodic uses with the baby (by participants)

		2 months			4 months			6 months		
		Child1	Child2	Child3	Child1	Child2	Child3	Child1	Child2	Child3
Sonorous ring	Rhythmic Uses	11	–	3	15	1	10	2	–	1
	Rhythmic and Sonorous Uses	49	13	34	72	3	20	24	–	–
	Rhythmic, Sonorous and Melodic Uses	15	–	13	10	–	5	8	1	4
Non sonorous ring	Rhythmic Uses	1	2	3	2	1	3	2	–	2
	Rhythmic and Sonorous Uses	1	–	19	–	–	8	2	1	4
	Rhythmic, Sonorous and Melodic Uses	1	–	8	–	–	–	5	–	1






Basic Pattern	
	 Two pulses at one time
	 One pulse at one time
	 Accent
	 Silence

Fig. 2 Representation of the adults' rhythmic structure of the first uses of objects. *Note:* This structure only represents the rhythmic component of the object presentations by adults, regardless of whether sonorous and melodic components were present

Children looked at the sonorous object's movements over time. In fact, Child2 looked at all the occurrences at T2 and all three children looked at all the occurrences at T3.

T1/ 2 Months: the Child Pays Attention to the Adult's Rhythmic, Sonorous and Melodic Actions

The response patterns of 2-month-olds are characterized by: (1) the child pays attention to the adult's actions when he/she presents the object in the "cutting" line that joins both of their gazes; (2) the child cannot use the objects without the help of the adult.

The adult places the rings between their previously connected gazes. In this way, the adult captures the child's attention via rhythmic, sonorous and melodic actions (Graph 1). Moreover, the child stirs, vocalizes and smiles at the adult's actions. In these cases, the adult often adapts his/her own language using *glissandos*, humming, or both.

At age 2 months, the child is not yet able to grasp the object. However, Child1's and Child2's adults placed the sonorous ring on their wrists, causing a sound when the children waved their arms. This was considered as a canonical use of the object because the sound was produced directly by shaking their arms, even when nothing indicates intention on the child's part (Table 4).





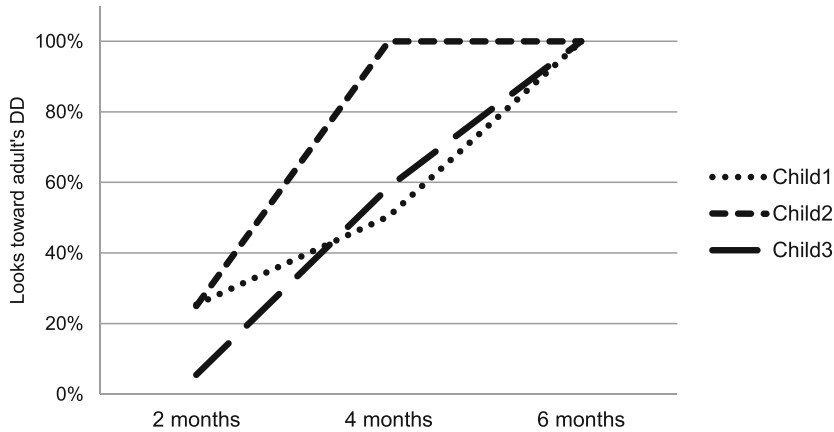
Voice of adult (with rhythmic content)	¿Qué	te	pa-	-sa a	-ti?	---
Use of the sonorous ring	Turns the ring left	Turns the ring right	Turns the ring left	Turns the ring right	Turns the ring left	Offers the ring to child
Rhythmic structure						

Fig. 3 Example of the predominant rhythmic structure in the action of adults. *Note:* "¿Qué te pasa a ti?" can be translated as "What is happening to you?". In this case, it was not translated in text because the meaning of the figure may be lost



Graph 1 Percentage of looks by the child toward the distant demonstrations (DD) of the sonorous rings made by adults

T2/ 4 Months: the Child Participates in the Adult's Proposed Action

At 4 months old children: (1) are able to grasp the rings, which facilitates their entry into uses of objects; (2) performed their first self-ostensive gestures using the rings.

Four-month-olds clearly show an active response to adult's performances, and increase in their uses of objects compared to T1 ($p < .05$). Unlike at 2 months old, the adult was able to involve 4-month-olds by using the rings and children are now able to hold the object, so they can use it themselves. However, these uses are basic and the child still needs the adult to place the ring in his/her hand (i.e., to shake it or make a noise with it). 4-month-olds easily understand that the adult's ostensive gestures are at least an invitation to take the ring.

First ostensive gestures appeared in Child1, directed to himself as a way to explore the objects. Although these self-ostensive gestures were infrequent (only twice at this age), they occur with the sonorous ring.

T3/ 6 Months: the Child Explores Objects' Sonority

At age 6 months, we observed that: (1) the first conventional uses of sonority-related objects appeared; (2) children used the sonorous rings to strike other objects, obtaining different sounds; and (3) the frequency of self-ostensive gestures increased ($p < .05$).

Children's first conventional uses are to shake the sonorous ring, which are linked to rhythm and sonority. Importantly, 6-month-olds shook and struck the rings and selected the sonorous rings by themselves. This suggests that rhythmic and sonorous uses are one of the first conventional ones that children are able to perform.

By T3, children used objects rhythmically, obtaining two types of sound with the rings by shaking them or striking them against other objects (e.g., against the table). Self-ostensive gestures of Child1 increased in frequency and Child2 started to display the rings to himself, but not the non-sonorous ones (see Observation 4 above). Child3 did not perform any gesture.

Table 4 Frequencies of children's uses of the sonorous and non sonorous rings (by participants)

	2 months			4 months			6 months		
	Child1	Child2	Child3	Child1	Child2	Child3	Child1	Child2	Child3
Sonorous ring	Non conventional Uses	–	–	–	–	–	1	2	–
	Precursor to Conventional Uses	9	3	–	–	–	3	17	2
	Conventional Uses	–	–	–	–	–	1	13	2
	Self Ostensive Gestures	–	–	–	–	–	12	1	–
Non sonorous ring	Non conventional Uses	–	–	–	–	–	–	9	23
	Precursor to Conventional Uses	–	–	–	–	–	–	11	4
	Conventional Uses	–	–	–	–	–	–	–	–
	Self Ostensive Gestures	–	–	–	–	–	1	–	–

Discussion

This study explored the rhythmic, sonorous and melodic components used by the adult and the child with objects in triadic situations (e.g., when incorporating an object into their interactions). These interactions are less studied in this field compared to exclusively dyadic child-adult interactions (Malloch and Trevarthen 2009; Trehub 2003; Trevarthen 1999, 2003).

The results of this study show that the rhythmic, sonorous (and melodic in case of adult) components compose a semiotic system allowing adult-child communication around/with an object. This semiotic system appears prior to more complex systems related to conventional, symbolic or private uses of also more complex objects made by the children from the end of their first year (Basilio and Rodríguez 2011; Dimitrova 2012; Rodríguez 2012a; Rodríguez and Moro 1999; Rodríguez and Palacios 2007). Between age 2 and 6 months, children are not just in a world of dyadic interactions with adults or with objects (the latter emerges around age 4 or 5 months). Rather, they are sometimes in triadic interactions when the adults mediate the relationship between them and the material world.

Early Triadic Interactions of a Communicative/Educational Nature

One of the major results of this study is that triadic interactions are strongly supported by the ostensive and intentional actions of the adult, taking place at the second month of the infant's life. These interactions differ from the "classic" triadic interactions that occur at the end of the infant's first year when he/she initiates the interaction (Liszkowski et al. 2006; Liszkowski and Tomasello 2007; Tomasello 2004, 2008; Tomasello and Carpenter 2007; Tomasello and Hamann 2012). The current study examined interactions whose communicative intentionality stems from the adult. However, children interject themselves at different levels: (1) by paying attention, and (2) by responding to the adult's proposals, which depend on the possible actions (joint or individual) that increase beginning at 4 months old.

The adult plays an educational-communicative role with the child, characterizing the triadic interactions. When an object is placed between both of them, it can play an important role establishing a shared reference. Adults only produce ostensive gestures (we did not observe any pointing), which is remarkable considering that pointing is seen as the ultimate gesture of shared reference in the literature (Rodríguez and Moro 2008; Rodríguez et al. *in revision*).

Parents did not behave in the same way across all three sessions and neither did the children. Adults progressively relinquished responsibility to the child and they seized control. At 2 months old, the adult maintained the responsibility of the triadic interaction; however, at 6 months old, the child often initiated certain rhythmic and sonorous uses of objects, although their use was not as organized as the adult's. Rhythmic and sonorous uses could be one of the first conventional ones that children are able to perform. More research is needed in this issue.

Rhythm as an Instrument of Communication: One of the First Semiotic Systems

Rhythm is the common denominator of adults' behavior in triadic interactions with 2-month-olds. In fact, if the rhythm of the interaction was removed, then the interaction

would lose its structure and organization (Español 2004; Perinat 1993; Trehub 2003; Trevarthen 1999, 2003). The objects presented to the child by the adult are performed with a rhythmic nature. Rhythm is among the first semiotic systems of human communication that references the outside world. This conclusion agrees with the findings of Trehub (2003), which concluded that rhythmic skills are most likely the first to emerge and develop in children.

This study also highlights the formation of the adult's basic *rhythmic structure of the first uses of objects*. This rhythmic scheme or pattern organizes adult's action, which attracts the child's attention. One possible explanation for this homogeneity—even when there are some individual differences in terms of frequency of productions in adults' rhythmic actions with the object—is that this scheme is binary, simple, short and easy to follow for 2-month-olds and up. Adults seemed to notice it, and kept presenting the objects in this way in the different sessions, discarding other unrhythmic actions, becoming in a progressive increase of children's percentage of looks to the share action.

Rhythm does not often occur alone; rather, sonorous components accompany it. In fact, when given a choice between sonorous or non-sonorous objects, the adult preferred the sonorous object at all three ages most of the time.

In addition, melody accompanies adult's language and vocalizations. This finding corresponds to the observations made by Del Olmo (2009), when the adult responds to the child with a rhythm that is consistent with the child's movement. The child is stimulated by rhythm, sound and body contact (Santiago 2011; Wallon 1972) and by the adult's voice as well.

The Child Easily Responds to the Adult's Rhythmic-Sonorous Proposals

From 2 months old, the child attends to adult's ostensive actions regarding the object as long as these actions occur between the participants. From 4 months old, the child is not only able to attend to the displayed object but he/she can also hold it: objects that were initially "things to look at" become "things to grasp". This ability probably creates the first joint action niches where the child plays an active role.

From the moment that children are able to manipulate objects independently (in this study, at 4 months old) they look for sounds that are often presented in a structured, rhythmic manner. This structure becomes a more organized rhythm at 6 months old than at age 4 months.

Possible future lines of research will be directed at analyzing the rhythmic, sonorous and melodic components as well as the rhythmic patterns identified in the majority of the uses of objects performed by the adult in more detail. These uses of objects can be considered cognitive and semiotic precursors to the triadic interactions characteristic of the end of the first year, when the children initiate and demonstrate intentional communicative abilities.

Further research on this area, extending both participants and sessions, are needed to: (1) explore how this rhythmic, sonorous and melodic components work; (2) what its role in the early development is; and (3) how this relates to other semiotic systems.

Conclusions

Adults play an essential role in 2-, 4- and 6-month-olds, as regards the presentation of the world to children. As previously discussed, adults follow the rhythmic-sonorous-

melodic criterion to (1) apply different semiotic systems and ensure that the child is included in the action, (2) select certain uses of objects and discard others, and (3) adjust the way in which he/she organizes action(s).

Rhythm plays a key role in actions with objects that mediates the adult-child interaction. At 2 months old, children show great interest in objects, primarily because they are used by the adult. It is through rhythm that interests converge in the triadic interaction. This is also an important medium through which the child-adult interaction, including the object, takes place. Based on the transversality of rhythm that marks all interactions, adults (with or without sound, melody, or both) provide children with objects and educative intention as well as share parts of the world. The object focuses the child's attention and both the adult and child learn to share the meaning of the object (e.g., *if the ring is sonorous, then grasp it and produce rhythm*).

The adult provides space for the child to interact with the object. They adjust themselves to the child's action, which implies a certain interpretation of the other's capabilities. In turn, this behavior eventually stops the regulation of all activity and provides the child with space to control the action through the object. Children's development level allows 6-month-old infants to explore and produce different types of rhythm and sounds by themselves using the objects.

In conclusion, the first semiotic systems are characterized by rhythmic, sonorous and melodic components, and these components are relative to the action with the object. These components are most likely organized on the basis of new semiotic systems throughout the first and second year of the infant's life (including conventional, symbolic, private and other types of uses).

The results of this study suggest that the entry into triadic interaction occurs when the adult promotes this interaction by introducing the child to his/her own course of intentional action. This introduction does not occur at the end of the first year, when the child understands the intentions of the other as is often claimed in the literature (Bates et al. 1975; Tomasello 2004, 2008; Tomasello and Carpenter 2007; Tomasello and Hamann 2012). For this triadic interaction to occur, the presence of rhythm is required. Rhythm is most likely one of the first systems of meaning that allows the establishment of a shared reference.

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