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Object Pragmatics: Culture and communication, the bases for early cognitive development

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Abstract:

The idea of objects having social status is gaining momentum in the Sociocultural Paradigm.

To assert that children “explore” or “play with” objects is imprecise and absolutely banal. Children use objects and instruments in everyday life according to different degrees of complexity: *non-canonical, rhythmic-sonorous, proto-canonical, canonical or functional, symbolic, meta-canonical, uses with a self-regulatory function, and numerical uses*. Their development during the first years of life is spectacular. Their presence, as a cascade, follows a developmental “ordered” path.

When children use objects canonically, it is because they have acquired a type of *functional permanence*, shared with the community. This functional permanence has a pivotal status and may be a pragmatic link in the origin of concepts. Adults play an important role in this cultural development, as objects are often part of communicative-educative acts since the beginning.

In *Doctor Brodie's Report*, the Argentinian writer and literature Nobel Prize winner, Jorge Luis Borges, talks about the Yahoos, a very remote tribe situated in a faraway place. He says that only a very few individuals have names, and that to address one another they fling mud. Because “they lack the capacity to fashion the simplest object”, they believe ornaments like gold pins are natural.

To the tribe my hut was a tree, despite the fact that many of them saw me construct it and even lent me their aid. Among a number of other items, I had in my possession a watch, a cork helmet, a mariner's compass, and a Bible. The Yahoos stared at them, weighed them in their hands, and wanted to know where I had found them. They customarily reached for my cutlass not by the hilt but by the blade, seeing it, undoubtedly, in their own way, which causes me to wonder to what degree they would be able to perceive a chair (Borges, 1970/1972, p. 114, translated by Norman Thomas di Giovanni in collaboration with the author)

Beyond the beautiful fiction by Borges, it would be chaotic for humans to relate to one another disregarding the *functional* attributes of objects. Objects are defined by *what they are for* in everyday life. Communicating in a meaningful and functional way implies a regard for their pragmatic aspects, that is, their practical purposes (Groupe μ , 1992). The functional attributes of objects, obvious to adults, are not so to children in their first months of life. For them, things have no names. They do not see chairs, or everyday objects, for what they are. This has evident consequences for psychological development. Observing children shows that the *same* object can be *used* to do very *different* things. The first thing children usually do with objects is sucking, banging, or throwing them, irrespective of the object. Only gradually do they abandon these undifferentiated

noncanonical uses, to acquire the cultural uses of the community. *Object* and *use* do not coincide. One thing is the object and another is the use of it.

Because children are not born knowing the functions of objects (as evidenced by how they use them), these functions have to be learned. Here, the *adult guide the educational action* – done by parents and teachers, for instance-, intervenes through different semiotic systems (language, gestures, intonation, rhythm, uses of objects, and so on). This idea is in tune with one of the most deeply rooted sociocultural maxims: the child does not discover meaning or signifies the world on his/her own. It is evident that to “learn to write, add or use a map, help is needed from other more competent persons who know how to interpret writing, numbers and maps” (Martí, 2003, p. 21). Schooling and educational intervention provide the necessary guidance (Vergnaud, 2013; Saada-Robert, 2012). There is no reason not to apply these maxims to babies, who are in greatest need of the presence of others. The observation unit to understand the emergence of meaning-making is *adult-child-object triadic (educational) interaction*, which occurs right from the beginning of life. The popular idea that triadic interaction begins at the end of the first year, when children can communicate intentionally with others (Tomasello, 2014), is therefore subject to question. Before then, someone has communicated intentionally with children, providing them significant clues to functionally understand the world. Adults *offer their intentions* by involving children in their own action (Rodríguez, 2006) while cleaning, caring, feeding or interacting freely (Rodríguez, Benassi, et al., *in press*). Indeed, adults promote the first triadic interactions in the most diverse scenarios and children take part in them long before they know it. During these early triadic interactions, adults communicate *with* and *about* objects. Language alone does not suffice to generate shared meaning because it is too complex. Objects are not mere external referents, but instruments for communication (see Fig. 1) that children understand and use before they can speak.

In the first edition of this Handbook, Rodríguez (2007) referred to Bruner’s (1975) pragmatics of speech position, opposing Chomsky’s formalism and claiming that children learn to

speak by *using* language in everyday life. Our objection back then was that applying this pragmatic approach to language alone does not suffice and that objects, too, should be analysed regarding their range of uses in everyday communicative situations. When objects are used, they “come to life” (see with adults in Clark, 2003).

Fortunately the sociocultural paradigm no longer banishes objects from culture or relegates them to “physical reality”. The idea of objects having social status is gaining momentum (Kontopodis & Perret-Clermont, 2016; Moro, 2016; Rosa, in this volume; Sinha, 2014; Valsiner, 2016; Zittoun, 2010), resembling, thus, to semiotic systems traditionally considered *cultural*, whether language (Nelson, 2015), images (Sonesson & Lenninger, 2015), calendars for understanding social time (Tartas, 2008), maps (Brizuela & Cayton-Hodges, 2013), or graphic representations of number (Martí, Scheuer & de la Cruz, 2013).

To assert that children “explore” or “play with” objects during their first years of life is imprecise and absolutely banal. It is necessary to analyze what they do in everyday life with objects and instruments, how and what for they use them, and with what degree of semiotic complexity. In this chapter we will deal with the diversity and development of first uses of objects (and instruments) from a pragmatic perspective. The role of the adult is also addressed.

We will begin with *functional, canonical uses*. If objects and instruments are used with specific functions (the bottle to drink, the spoon to eat, the cradle to sleep, etc.), we must ask: How do children appropriate them? How do they get to canonical uses of objects? Using objects by their function means they become *permanent*. This permanence is *functional*, pragmatic, and shared with others. This does not coincide with the “physical” object permanence proposed by Piaget, and the competent baby paradigm (see discussion in Rodríguez, 2012). We will conclude this section by suggesting a possible relation between the functional permanence and the origin of concepts.

Rhythmic-sonorous uses occur when children produce sound with objects. They are the most basic uses along with undifferentiated *noncanonical uses* (such as sucking or throwing any object). Even though developmental psychology has reserved an important place for rhythm in studies on early dyadic intersubjective interactions, few studies have investigated the rhythmic-sonorous characteristics of adult-baby-object triadic interactions.

When children know social uses of objects, they share with the adult a common ground that becomes a base for more complex uses (linked to new forms of communication). That is the case of *symbolic uses*. They are “traveling uses” referring to momentarily absent situations performed out of context that are neither effective nor efficient. There is a debate about the origin of symbols. Here, we argue that the root of symbolic uses is found in the functional uses of objects. Without that socially shared base, it would be impossible to comprehend children (and adults!) when they use an object as another, or when they change their attributes.

We will also mention *metacanical uses*. They are uses that, as symbols, are rooted in functional or canonical uses. Here, the object is momentarily used in an efficiency way to do something functional for which it was not conceived. Thus, the object “breaks in” a function that does not belong to it. For example, using a chair, instead of a stair, to reach a book on a very high shelf. They are very creative uses. They corroborate that *object* and *use* do not coincide. *Metacanical uses* confirm that it would be very strange that every specific use could only be realized with a unique object.

Another consequence of knowing functional uses is that children become able to *self-regulate* and correct themselves when they have difficulties with *these uses*. This fact has important consequences. The first is that language cannot continue to be considered the first nor the unique instrument of self-regulation. Although within the “semiotic approach” of sociocultural psychology language is *the* privileged semiotic system (Vygotski, 1934/1985; Rivière, 1985; Bronckart, 2002) while gestures and uses are now recognized for their self-regulation utility. This confirms that

executive functions are functional from the end of the first year of life, before language occupies the hegemonic place.

We will end with *numerical uses*. There is an important debate between advocates of the competent baby paradigm, which consider that children are born with the concept of number (core knowledge), and who defend more constructivist and sociocultural approaches that state number is the result of a complex process of construction. In this process, the communicative and educative influence of the adult cannot be ignored.

How do children learn to use objects according to their function?

This is the first question that needs to be answered.

To do that it is important to distinguish between *object* and *uses* of the object. Adults, who no longer remember how they learned to relate functionally to objects, consider both things equivalent. Adults automatically see objects according to their practical purposes. Upon seeing a chair they think: “I can sit on it”; a cup: “I can drink from it”; a spoon: “I can eat with it”. If they sit on chairs or drink from cups, it is not because they make an individual decision, or randomly discover their function, but because it is what their ancestors have done for ages. These are ancient objects, manufactured with a clear purpose (Tilley et al., 2006), they are part of the cultural practices that transcend individual decisions, that is, socially conveyed knowledge. During ontogenesis, children have to acquire this knowledge, internalize the objects’ social rules of use. Our first step was to study this process.

In the first edition (Rodríguez, 2007), we described the longitudinal study in which six Spanish children (Rodríguez & Moro, 1998) and six Swiss children (Moro & Rodríguez, 2005)

were observed in their homes at 7, 10, and 13 months of age, interacting with their mothers, a replica telephone and a shape sorter truck¹.

Children performed three types of uses: (1) *non canonical* (2) *protocanonical*, and (3) *functional* or *canonical*. Despite the various efforts by their mothers, children at seven months never used *those* objects according to their function, that is, canonically. They did not interpret their mothers' intentions when pointed at and touched the hole through which the blocks were meant to fit in the shape sorter. The children also performed *protocanonical* uses when "riding" on the adult's functional action as a consequence of the *magnet effect*: the adult's action on the object was like a "powerful magnet" to the child, who stretched his/her hands toward it. Some *canonical*, or *functional*, uses were performed at 10 months and increased at 13 months, by which time the children also understood the mothers' intentions when they used gestures (see Dimitrova & Moro, 2013 on the relationship between understanding adult gestures and object function).

Adults did not behave as though children learned by "direct" imitation (if they had done so, they would have repeated the canonical use over and over). Their actions were diverse and adjusted to the children's actions, first stressing ostensive interventions² (with gestures or uses in which the objects were always *part of the communicative act*) and subsequently, invitations. Adults also performed many gestures of varying degrees of semiotic complexity, of which the most efficacious were *ostensive gestures* (*sign* and *referent* coincide) such as *showing*, *giving*, or *placing* objects to children (Rodríguez et al., 2015). Adults also realized pointing gestures, either touching or keeping a distance to the referent.

¹ Other common denominators among the studies addressed in this chapter are: (1) longitudinal design, (2) naturalistic settings (participants' homes or room at nursery school), (3) all interactions observed were triadic: adult-child-object (or sometimes child-object-child); the instructions were "play with your child as you usually do", and (4) they all used microgenetic analyses.

² Adults performed distant demonstrations (i.e. using the object itself to communicate about the object), immediate demonstrations (involving children directly in the uses), and preparations and adjustments (to facilitate use). This resulted in episodes of *joint action* as from 7 months of age.

An important insight derived from these studies is that when children use objects canonically, it is because they have acquired a type of *functional permanence*, shared with the community. This permanence is not the same as Piaget's (physical) permanence of the object, or as the permanence recently proposed by supporters of the "competent baby" (Rochat, 2012; Karmiloff-Smith, 2012). Functional permanence allows objects to be considered not as unique specimens, but as members of classes. Knowing the canonical use of cups and telephones implies using *any* cup as a cup, *any* telephone as a telephone (see discussion in Rodríguez, 2012). This does not seem farfetched if we consider that objects in daily life are functionally permanent to adults, who relate to children on the basis of this assumption.

Functional permanence may be a pragmatic link in the origin of concepts³. If first concepts, relative to the function of objects, are rooted in socially shared everyday meanings, they may arise as a product of educative interactions, and functional uses may play a major role in their development.

Rhythmic-sonorous uses of objects

Rhythm is ubiquitous in children's lives from the moment of birth. Piaget (1936/1977) referred to rhythm in the movements of his newborn children. Rhythm is such an essential feature of baby-adult interaction (Papoušek, 1996; Trevarthen, 2003; Reddy, 2008, 2012; Trehub, 2003) that if it was stripped away not much would be left (Perinat, 1993; Español, in this volume). A classic example is the way mothers rock their children making use of babies' pauses while nursing (Kaye, 1982/1986). Considering biological rhythms, such as breathing tempo, heart rate, or intensity of body movements, and consistently acting according to them, improves adult-child

³ Rosch, known for her theory of prototypes, recently proposed an "ecological" theory for the ordinary use of concepts: "concepts, categories and other conceptualisations are participating parts in life games" (2009, p. 202, quoted by Duque y Packer, 2014).

interaction (Foster & Kreitzman, 2004). All that is very helpful with hospitalized infants in music therapy sessions (Del Olmo, Rodríguez, & Ruza, 2010).

However, “triadic rhythms”, when there is an object between the adult and the child, have gone unnoticed. Adults do not present objects to children “anyhow”, but in an organized, rhythmic manner, often adding sonority (Rodríguez & Moro, 2008)⁴. The rhythmic-sonorous components facilitate making the objects shared referents. Triadic rhythmic interactions start very early (sometimes even as early as age one or two months⁵), when the adult communicates intentionally by presenting and using objects *for* the child, sharing the same referent (see Fig. 1) and introducing the child in “his own finalized action”. These joint actions clearly illustrate how the adult introduces the child to the functional use of the object long before the child takes any initiative him/herself. Before knowing it, the child is already a “user according to function” when the adult “lends his/her intentions”.

PLEASE INSERT FIGURE 1

⁴ In a longitudinal study on three parents and their children at ages 2, 4 and 6 months, at home, parents and children were given 3 rings containing beads (which rattled when shaken) and 3 hollow rings (which did not rattle). Adults preferred the rattling rings and performed many *rhythmic-sonorous uses* which helped segment and organise their own action *for* the child. At 4 and 6 months, children paid close attention both to the adult and to their own actions. The *magnet effect* occurred when children stretched their arms out towards the adult’s action, triggering episodes of *joint action*. By 6 months, children were active agents, seeking and producing sounds themselves (Moreno-Núñez, Rodríguez & del Olmo, 2015).

⁵ In another study (Moreno-Núñez, Rodríguez & del Olmo, *submitted*), children at 2, 3 and 4 months old were offered a very light rattle (see Fig. 1), of which the functional use is sonorous. Mothers *showed* the rattle (ostensive gestures are the simplest, as sign and referent are the same) often at all three ages. They *gave* it to their children more often as age increased from 2 to 4 months, inviting the children to be agents. Adult rhythmic-sonorous structured uses (with pauses) were more frequent than non-structured (without pauses). Structured uses enabled children to become involved and pay more attention. Non-structured uses occurred more frequently at 2 months, when children have greater difficulty in becoming involved in the adult’s action. At 2 months, parents tapped the rattle directly on the child’s body (Immediate demonstrations). They did less often at 3 and 4 months. However, they placed the rattle in the child’s hand and performed *joint rhythmic-sonorous uses* at 2 months, increasing at 3 and 4 months. The children were very active, and nearly all of them held the rattle given to them by the adult as from 2 months. Some of them did so on their own initiative at 3 months.

Rhythmic-sonorous uses (along with non-canonical uses) are the first uses of objects that children perform without the help of others. As shown in Fig. 1, by four months, children start using rattles according to its function, by shaking them and producing sound. These are the first instances, however rudimentary, of an instrument being used according to its social function. By six months, children are active agents, seeking and producing sounds with any object. And 7-month-olds produce sounds by banging objects together. At 10 months children are “skillful percussionists” (Rodríguez & Moro, 1999).

Rhythmic-sonorous uses deserve special attention for two other reasons: (1) because very little is known about musical development during the first years of life, and (2) because rhythm may be a basic ingredient for cultural (canonical, symbolic, self-regulatory, metacultural or numerical) uses of objects in general.

Symbolic uses of objects: what is their relationship to functional uses?

Another milestone in early development is when children produce symbols, representing absent objects or situations with differentiated signifiers (Bronckart, 2012; Español, 2004; Martí, 2012; Rivière 1990). There is plenty of literature on symbols, nevertheless, several questions remain, such as in what previous meanings are they rooted. For instance, according to Leslie (1987) and Baron-Cohen and Swettenham (1996) previous meanings are literal. Piaget claims that there is no need for previous conventions. Symbols are solitary products, although he does not explain how he managed to understand his children (Piaget, 1945/1976; Belsky & Most, 1981; McCune, 1995). Another position that is gaining ground is that the child requires meanings agreed on with others regarding objects as the basis for symbolic uses (Barthélémy-Musso, Tartas & Guidetti, 2013; Rodríguez, 2006; Vygotski 1931/1995a; Wallon, 1942/1970; Zittoun, 2010).

Another unresolved issue is that of similarity between symbol and referent. The dominant position (explicit or implicit) is Piaget's (1945/1976), which claims that similarity exists between objects (signifier and signified). However, according to Vygotski (1931/1995b) similarity is not perceptual (related to how objects look) but *functional* (related to *how objects are used*). This is a key point because canonical – functional – uses of objects may be the root of symbolic uses⁶. Similarity should be found between *uses* (canonical and symbolic), not between objects (Rodríguez et al., 2014).

Developmental psychology is not conclusive regarding the emergence of first symbols. What are the minimum requirements for a given behavior to be considered symbolic? According to the prevailing position, there needs to be substitution of one object by another (El'Konin, 1966; Leslie, 1987; Lillard *et al.*, 2013; Piaget, 1945/1976; Tomasello, 1999), for instance, when pretending to “eat with a pencil” (where the pencil represents the spoon). However, it seems difficult to claim that “eating” with an empty spoon is not symbolic because it is the same spoon with which eating is effectively performed.

Following Vygotski, the functional uses of objects seem good candidates as anchor points for symbols. To pretend one is eating with an empty spoon, or one is talking on a replica mobile telephone, one needs to know that spoons are used for eating and mobile telephones for talking. The conventional rules of use arise from “genuine” objects, from where they “transfer” and are applied to (1) situations different from the everyday, such as “eating” with an empty spoon out of context (level 1); (2) to different objects, by substitution, such as “eating” with a pencil (level 2); (3) without an object, with the empty hand representing the spoon (level 3); and (4) narratives of symbols in action, when several symbols are linked (level 4) (Palacios et al., 2016).

Symbolic and canonical uses differ in that canonical uses must be *efficacious* (if one eats with a spoon, the contents must reach the mouth without spilling), and *efficient* (if possible, without

⁶ At another level, according to Alessandrini (2016), the emergence of metaphorical thought does not proceed from a transparent world, but it is an emergent result from prelinguistic cultural semiotic systems.

dirtying oneself), whereas symbolic uses need not be – no one gets dirty while *pretending* to eat. How does this “functional knowledge” affect the origin of symbols? The adult as a guide plays an important role in this process. But we do not know of any studies on how children construct their first symbols in triadic interaction with adults, even though the need to study this topic has been widely recognised (Adamson, Bakeman, & Deckner, 2004; Carpendale & Lewis, 2004, Göncü & Gaskins, 2011).

In various triadic interaction studies with children with typical⁷ and atypical development, adults communicate using objects symbolically long before children do. And that works! Children pay attention and include themselves in the adults’ symbolic scenarios. The first symbols (the more frequent ones) occur with the same object with which canonical use is made (level 1). Although they are “very close” to canonical uses, they are still symbols because they are abbreviated and lack the efficacy of the missing elements. Nevertheless, symbols by substitution (level 2) or without material support (level 3) are not usual. Sometimes adults correct “inadequate” children symbols, such as “drinking” from a plastic replica horse (see observations in Palacios et al., 2016).

Children also perform the first and most frequent symbolic uses with the same object of the canonical use (level 1). A very interesting example happens with the instrument spoon. The symbolic use (Palacios et al., 2016) is very different from the functional one when they effectively eat with it (Ishiguro, 2016; Rodríguez, Estrada, et al., 2017).

The low percentage of symbols by substitution and *in absentia* shows the complexity of transferring the rule of use to other objects or without material support, suggesting that rules for

⁷ In two longitudinal studies on Spanish children at ages 9, 12 and 15 months (Palacios & Rodríguez, 2015) and Mexican children at ages 9, 12, 15 and 18 months (Palacios, Rodríguez, Méndez-Sánchez, Hermsillo-de la Torre, Sahagún & Cárdenas, 2016), dyads were allowed to interact freely with 10 everyday objects: *replica objects* – rag doll, plastic horse and mobile telephone; *artefact objects* – empty pot of skin cream, lighter, toothbrush, rag, empty cardboard box with a string attached to one end, and wooden spoon; and natural object – a rock. Adults performed symbols to communicate with 9-month-olds. They created scenarios, delimiting structure, content and objects involved. Most of the symbols were level 1: using the *same* object involved in functional use.

canonical uses disengage gradually from the niche where they first arose, in order to be “transferred” (to other objects or to no object).

PLEASE INSERT FIG. 2

Knowing whether or not a child produces symbols (their first manifestations should be identified) is important in typical development, and even more so in children with *different developmental paths*, for example, autism or Down syndrome. This information may help to guide the actions of child educators and early childcare professionals. Since children with Down syndrome tend to have delayed language development, nonverbal communication works as a strategy to compensate their linguistic deficits (Jackson-Maldonado, Badillo, & Aguilar, 2010). It is thus highly relevant to understand prelinguistic semiotic systems, including symbols.

In general, more variability was observed in the symbolic uses of children with Down syndrome⁸ than in typically developing children. In triadic situations with their mothers, they performed their first symbolic uses between 12 and 21 months’ chronological age (Cárdenas, Rodríguez, & Palacios, 2014), much earlier than usually mentioned in the literature (mental age is considered to enable comparison with typically developing children).

The diversity and complexity of symbols performed may be influenced by the greater or lesser complexity of the proposals from adults. It is important for the adult to know what the child is able to do, to promote increasingly complex uses (see Fig. 2). Knowledge of each individual should prevail over any stereotypical belief about “what children with Down syndrome can or cannot do” at early ages (Cárdenas, 2012, p. 232).

⁸ In two longitudinal studies using the same objects, a similar pattern was observed in children with Down syndrome -chronological ages 12 to 21 months (Cárdenas, 2012; Cárdenas, Rodríguez & Palacios, 2014; Cárdenas, Rodríguez, Miranda-Zapata & Palacios, *in prep.*). The first symbolic uses were performed with the referent object e.g. “eating” with an empty spoon or “talking” on the telephone (see Fig. 2). It is confirmed the similarity exists between uses – a symbolic use present to the observer and another conventional use which is absent, represented by the symbol. Object substitution and symbolic narratives in action were also observed, as occurred in 18-month-old typically developing children.

It is well known that peer interaction provides an important source of learning at nursery school (Amorim, dos Anjos, & Rossetti-Ferreira, 2012; Li, 2012). It could be thought that the specific object is irrelevant in the production of symbols, however, this is not true. In a study carried out at the nursery school about peer interaction⁹, it became apparent that with replica objects, children aged 11 months already produced symbols with the same object of the functional use (level 1). What is noteworthy here is that the observed symbolic level remained simple. Children aged 15-24 months did not perform more complex symbols by substitution or without material! Replica objects did not reflect children's more advanced symbolic ability. One possible explanation is that replica objects facilitate the first symbols at 11 or 12 months, but may limit higher symbolic levels later on. These objects are "strongly marked" and it is difficult to turn them into something else.

In an ongoing study on 20 children, aged 11 to 21 months, everyday artifacts were added (Yuste, Rodríguez, y de los Reyes, *forthcoming*). Preliminary results show that 11-month-olds with an expert peer perform symbolic uses (level 1) with replica objects. At 13, 15, 17, 18, and 21 months, they produce more complex symbols (level 2 by substitution and level 3 in absentia), but *only with artifacts*. These first results seem to confirm the "ceiling effect" of replica objects. The type of object seems to influence the symbolic level achieved by children who do not yet talk. This important finding needs to be explored further on.

We will finish the section by referring to *metacanonical uses*.

⁹ In a study on symbols in peer interaction, ages 9 months to 24 months, at nursery school (Yuste, 2012), we used replica objects included in the supplies received at nursery schools, with which the children were familiar. These replicas were (1) set of dishes and cutlery, including plates, forks, spoons, cups and glasses; (2) hair styling set, including dolls with hair, brushes, combs and dryers, and (3) telephone set, including complete telephones, mobile telephone and headset. It was confirmed that the production of symbols is a gradual process. Nine-month-olds did not produce symbols, but 12-month-olds did, even when interacting with young peers rather than adults. Symbols were level 1: they "eat", "drink" or "push the food around the plate"; they "comb" their own or companion's hair. They "talk" on the telephone. At 15, 18, 21 and 24 months, children produced symbols during longer times and symbolic narratives in action (Palacios et al. 2016), always at level 1, with the object of functional use. At 24 months they set plates on the mat (on the ground) to "set the table", "eat" and "clear the table".

Halfway between canonical and symbolic uses are the *metacanonial uses*, which are efficacious and efficient, like canonical uses, but performed with objects or instruments which were not designed for that purpose. They are “creative uses” very frequent in everyday life. Children begin to perform them during the second year of life when they apply, through generalization, the rule of canonical use to any object which enables an efficacious result. One example was observed with a 13-month-old child (Rodríguez & Moro, 1999). During the recording session he used the shape sorter effectively and a few minutes later went to the kitchen and showed the hollow plastic block to the mother, asking her to fill it with water, thus *doubling the use* of the plastic block as a *cup*. This was not a symbol since the child was not pretending to drink from the shape, but rather wanted to use it as a functional cup to hold real water.

Functional uses of objects and Executive Functions before language

In the sociocultural tradition, language is *the* instrument of self-regulation (see Winsler, 2009, for a review). Vygotski dedicated much attention to private speech due to its “transitional” status between *communication* with others, and self-regulation or *communication* with *oneself*. Katherine Nelson (2015) recently studied the “crib speech” of children alone in their cot before sleeping. She considers it “private in a double sense (1) being addressed to the self (2) with no one else present” (p. 172). Self-regulation comes from the internalization of semiotic tools employed previously with others (Wertsch, 1979; Wood, Bruner, & Ross, 1976; Tartas, Perret-Clermont, & Baucal, 2016). Luria (1979) develops this tradition in neuropsychology: the prefrontal cortex and other neurological systems form interactive – not modular – functional systems, which enables conscious regulation of one’s own behavior.

Now, is language the first and unique instrument for cognitive self-regulation? Can other previous semiotic systems serve that purpose? If the answer to the second question is “yes”, we must say *which* and *from when* they are functional.

There is increasing support within the sociocultural paradigm for the idea that private gestures are used for self-regulation and may be precursors for self-regulation through language (Delgado, Gómez & Sarriá, 2009, 2011). Children direct pointing gestures toward themselves with a private, contemplative function (Bates, Camaioni & Volterra, 1975) before pointing to others (Carpendale & Carpendale, 2010). Symbolic and aesthetic self-directed gestures (Español, 2006), such as shaking the head to forbid (Pea, 1980) and signs taught in nurseries as part of the Baby Signs Program (Vallotton, 2008), may also serve for self-regulation.

Besides, if children already know the functional uses of some objects of their everyday life, we should ask what place do this knowledge has within the first forms of cognitive self-regulation when, for instance, they have difficulties with the functional use to which they hope to arrive. The timing of the first manifestations of executive functions (end of the first year of live) (Zelazo & Müller, 2004) fits very well with the idea that gestures and objects can serve a function for self-regulation before language.

In a longitudinal case study with N., a child with Down syndrome, on the last day of recording, when N. was 18 months old, an interesting situation took place. As N. could not insert a ring on a vertical pivot, she began producing self-directed gestures *before* attempting the complex use, without asking her parents for help. We published a paper dealing exclusively with this observation session (Rodríguez & Palacios, 2007). In a detailed analysis we identified these behaviors as *private gestures* (ostensive gestures and immediate pointing gestures) with a self-regulatory purpose. As she was unable to achieve her aim – placing ring on the stick – she corrected again and again. And although she did not say anything during the session, there was no doubt that she was attempting to use the object according to its function. There was also no doubt that she

knew what the function was, but had difficulties regarding *how* to do it. It had become a cognitive challenge, which is why she sought various solutions with private gestures *before* attempting it repeated times¹⁰. Language, therefore, is neither the first nor the only instrument for cognitive self-regulation.

Instruments can also be used for self-regulation. Two recent studies on children 11 to 18 months old (Basilio & Rodríguez, 2011; 2016) showed once again that triadic interactions with complex objects and instruments¹¹ provide scenarios that are highly appropriate for triggering self-regulatory behavior with preverbal signs. In both studies, we observed children's use of *private gestures* (ostensive gestures, indexical, and symbolic gestures), supporting previous preliminary evidence suggesting that these gestures may be the early precursors of private speech.

Moreover, the conventional uses of these objects allow researcher to interpret children's semiotic productions reliably in relation to the regulation of their actions when using the objects conventionally. For example, if a child is attempting to put a ball through a hole with a hammer, tries several times but fails, and at that moment the child extends her arm to *show* the hammer to her father, one can interpret such *ostensive gesture* as a *request for help* (Basilio & Rodríguez, 2011; see also Moreno-Núñez, Rodríguez, & Miranda-Zapata, *forthcoming*). It is the precise circumstance of the performance of the gesture in relation to the use of the object (Rodríguez, 2009) which gives an observer the grounds for interpreting the cognitive function of this communicative behavior.

¹⁰ This findings are consistent with what happened with a 13-month-old Swiss child (Moro & Rodríguez, 2005; see also Moro, Dupertuis, Fardel & Piquet, 2015) who, upon being unable to insert a block through a hole, instead of persevering, performed an ostensive gesture by showing himself the block *before* attempting to perform the conventional use again.

¹¹ We chose objects with a clear but challenging goal: a shape sorter and a hammer toy to push balls into a box, and a set of houses with keys. They all involve different objects and instruments than need to be coordinated in unified conventional uses. The children received guidance by their parents through gestures and demonstrations. Children older than 12 months all understood the aim or function of the objects, but had difficulties regarding *how* to do it. The conventional uses of the aforementioned complex objects impose cognitive challenges once children understand and internalise their goals: putting shapes through the right holes, hammering balls until they fall into the box, positioning and turning keys to unlock doors. These challenges present the need for self-regulation. This is of paramount importance when eliciting children's self-regulatory behaviours, because without a cognitive challenge, self-regulation is not necessary (think of the difficulties of a rattle compared to these complex objects).

Asking for help is a widely accepted behavior interpreted as a self-regulatory control strategy. It implies knowledge of how (a) the goal has not been achieved, (b) the current strategy is not working therefore a different one is needed, (c) that someone knows how to achieve the goal, and (d) how to communicate this request. Not only did children self-regulate with private gestures, but they could also do so in communicative situations such as this.

We shall conclude this section with a case study of a child (I.) aged 11 months and 9 days, regarding the first manifestations of executive functions at mealtime at the nursery school¹² (Rodríguez, Estrada, et al., 2017). I. manages to eat with the spoon after a laborious process of self-regulation. He knows that spoons are for eating, but at the beginning of the session, he does not know *how* to do it himself. After asking his teacher with gestures (symbolic, pointing, emotional) to feed him (as usual) and faced by her refusal (she challenges him by *placing* the plate of puree and the spoon within his reach, “How about it?”), I. begins a series of increasingly successful approaches to the goal he is given: to eat alone, without help, using the spoon (see Fig. 3). The first obstacle is how to hold the spoon *to* eat, anticipating its future use (11-month-olds do not have problems with holding objects), and he performs successive *attempts at holding*. He tells himself that “he is hungry” with private symbolic gestures of “eating”. After much hesitation and attempts at holding, he manages to pick up the spoon. The next obstacle is how to fill it with puree. He self-regulates with *private ostensive gestures* (changes the hand holding the spoon repeatedly, looking at it carefully, in order to find the best position), with *private pointing gestures* and *protocanonical* uses with the spoon – dragging it horizontally left to right, right to left, inside and outside the dish, constantly approaching the goal. Finally, and without seeking any help (rejecting it when the teacher tries to guide his hand to his mouth), he manages to eat dessert with the spoon.

PLEASE INSERT FIGURE 3

¹² *La Cigüeña María*, in Madrid.

This case illustrates that executive functions begin at the end of the first year of life (Zelazo & Müller, 2004), and material objects (here, an instrument) are protagonists in this process through self-directed gestures and uses. We join the voices claiming the need to study self-regulation and executive functions in their sociocultural contexts (Moro, 2012; Müller & Kerns, 2015).

From the uses of objects in interaction with an adult to numerical uses

There is an open debate since the 1980s regarding whether babies possess or not early numerical abilities. According to the advocators of the competent baby paradigm (Spelke, 2000), the baby would come equipped with the concept of number as a core knowledge. However, children aged 3 or 4 have many difficulties to functionally use numbers (Martí, Scheuer, & de la Cruz, 2013). There is, therefore, the following paradox. If children are so competent at birth and already have the concept of numbers: Why are they such slow learners and such clumsy users of numbers (even with small quantities) in everyday life situations, between two and four years of age? (see discussion in Rodríguez & Scheuer, 2015).

Part of the debate on the use of numbers is related with the fact that only what is segmented can be counted (what is continuous cannot be counted). It also relates to *what* to count and *for what* to count. This seems trivial, but without practical and pragmatic aims, why would children want to use numbers?

It is very striking what we found in a study. At 24 months, the children could not have comprehended the aim of the game - a “pony” (replica) was “hungry” (see Fig. 4) and had to reach “food” (represented by a bottle top) at the end of a “road” (represented by a strip of rubber) -

without some conventional-symbolic understanding enabling them to accept all that (Cavalcante and Rodríguez, 2015)¹³.

The aim was to “feed” the “hungry” pony by (1) rolling the dice, (2) counting the dots, and (3) moving the pony forward along the road by the number of squares indicated by the dice, until it reached the “food”. At 24 months of age, children had serious difficulties *with the numerical part* of the task, despite the enormous help of their mothers. Children used the dice as a “projectile” to knock the pony down, as a “seat” for the pony, or took the pony directly to the “food”, without ever resorting to numbers either to count the dots on the dice or the squares on the road.

They also had difficulties counting the dots of the die. And when they achieved that, they had problems in *using* the numerical information to count the squares of the road where the pony was meant to advance. There was a misalignment between both things.

Nevertheless, in the last session, at 36 months of age, they used the dice conventionally, or counted the dots, to regulate the pony’s progress along the squares. Between the first and last sessions, the children gradually understood the rules of the game and the conventional – numerical – uses of the objects.

In most studies on this subject, children resolve tasks alone (Martí, Scheuer, & de la Cruz, 2013). In our study¹⁴ children received help from their mothers. We analyzed the use of objects and gestures performed by the children at ages 24, 27, 30, 33, and 36 months and their mothers. We do not know of any other longitudinal studies on number in triadic interaction (Cavalcante, 2016; Cavalcante & Rodríguez, 2015).

PLEASE INSERT FIGURE 4

¹³ At age 12 months, they made a replica pony “gallop”, or “galloped” themselves, or the parents made a doll gallop on the pony (Palacios & Rodríguez, 2015; Palacios *et al.*, 2016).

¹⁴ Mothers were to play with their children, following the rules as far as possible. Two boys and one girl, at ages 24, 27, 30, 33 and 36 months, were filmed at home with their mothers. They had never played with dice before.

Particularly interesting was the *new function of pointing gestures*¹⁵ as a support for counting (Graham, 1999; Schaeffer, Eggleston, & Scott, 1974). The mothers and children pointed at (usually by touching) and accompanied by a numerical word, the dots on the dice and the squares on the road to count (see Fig. 4). This new use of the pointing gesture highlights the fact that any entity, which is counted, must be treated as a *single*, segmented, item (Fuson, 1988), with one-to-one correspondence (Gelman & Gallistel, 1978).

Another striking observation was that mothers pointed at and touched the dots on the dice while *rhythmically* saying, “ooone, twooo, three, and foouur”, for example (see Fig. 4). *Rhythmic-sonorous* aspects were key to ensuring correspondence between numerical words, dots, and the pony’s progress along the squares. Some children did it at 30 months. Sometimes children and mothers performed joint actions, for example, one pointing and the other counting (Cavalcante & Rodríguez, 2015). Adults’ multimodal interventions (language, gestures, uses of objects) were essential for “anchoring” the numerical system in prior semiotic systems (that children could understand and employ).

In short, success in children’s play with the dice suggests that the numerical uses of objects are based on semiotic systems previously constructed with adults. These results question seriously the nativist approach to numbers.

¹⁵ In contrast, there is a vast literature about younger children pointing to objects (Butterworth, 2003; Liszkowski, Carpenter & Tomasello, 2007). See also section about self-regulation with private gestures).

Conclusions

As everybody knows, in their first years of life children do not communicate as adults do. It is also obvious that children and adults differ in the way they use objects.

There is a great amount of research devoted to communicative and linguistic development; the same does not apply with objects. One important reason is that psychology often has *naturalized* the material world, considering objects as the “physical reality”, with only physical properties. Often psychology has ignored that humans use objects in the everyday life according to their function, to their pragmatic properties. Fortunately, this reasoning is changing. Voices are gaining ground within the sociocultural psychology field reclaiming a social status of objects as part of the material culture (Moro & Müller-Mirza, 2012; Rosa & Valsiner, in this volume; Sinha, 2014).

The same happens within the ecological perspectives. Alan Costall (2012) for instance, refers to *canonical or cultural affordances*. They differ from *affordances* (Gibson, 1979/2014) in that cultural factors influence canonical affordances.

Culture in chimpanzees gain further ground, for example, when they use or make instruments or convey techniques to new generations (Goodall, 1990).

To say children “explore” objects is absolute banal. Children only “explore” objects when they realize noncanonical uses. When they do not know the rules of use and do with objects what they physically allow.

In this chapter we have examined the following *cultural* uses: *rhythmic-sonorous, proto-canonical, canonical or functional, symbolic, metacanical, uses with a self-regulatory function, and numerical uses*. These uses are linked between them. Their development during the firsts years of life is spectacular. Their presence, as a cascade, follows a developmental “ordered” path.

Canonical or functional uses have a pivotal status. Once children use objects by their function, according to specific rules, in the everyday life, they become permanent by their function. This means they are not unique exemplars, as they become *members of classes*. And the community

of users shares classes (any spoon belongs to the class of the spoons, any telephone, any house, any car belong to a class and we know it as users). If first concepts are related to this “everyday doing things in an user’s community”, functional permanence may be a pragmatic link in the origin of concepts (Rodríguez, 2015). Once an object has functional permanence and becomes a member of a class, the door is open to *new* and *more complex uses*. If children and adults understand symbolic uses it is because there is similarity between uses (symbolic and canonical), not between objects. The same happens with metacanonical uses. Symbolic uses, metacanonical uses, numerical uses and self-regulation are based in a way or on another in this functional knowledge.

More complex forms of communication arise with *symbolic, metacanonical, self-regulating, and numerical uses*.

We have stressed several things about the cultural uses.

(1) Infants produce rhythmic-sonorous uses (the most basic cultural ones) owing to adult's interventions. As we have shown they might appear as early as two months of age. They are users before knowing it, in joint action scenarios, when the other offers his/her intentions and introduces him/her into a functional material universe. They know it later in development. First triadic interactions start at the beginning. And little by little children take the initiative through their first year of life.

(2) Adults also realize cultural uses - *rhythmic-sonorous, canonical or functional, symbolic, metacanonical, numerical uses* and so on - *for* children. When children can do them, both adults and children take part in a *common ground* of meanings in the everyday life.

(3) This common ground affects *how they communicate*. Everybody knows that. Once children use spoons to eat, adults adapt their tools of communication to this functional shared knowledge. The communicative scenario is very explicit when adults present the spoon for the first time to children: gestures, diverse demonstrations of use, invitations, suggestions, challenges, and

so on, will be part of it. Shared knowledge between adults and children about the function of objects and instruments impacts communicative intention.

(4) When an adult uses an object *for* the child, the *object used* (regardless of the use) is part of the communicative act. This use is a referent and sign at the same time. This means that objects can be part of the communicative act. The same happens with children. When adults and children use objects, they communicate with each other. This is essential when objects have no names yet for children. All that is part of the “life of objects”.

In conclusion, objects are social in a double sense, because (a) they are part of the material culture, and (b) often they are part of the communicative act. This implies that objects need to be included as protagonists in a pragmatic turn that considers seriously what happens in the everyday life with them.

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