

Hablando con las manos, oyendo con los ojos ¿Qué puede decirnos la comunicación de primates no humanos sobre el lenguaje humano?

Talking Hands, Listening Eyes¹

What can (non-human) primate communication tell us about human language?

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RESUMEN

La complejidad del lenguaje hace que sea un campo de estudio abordado en perspectiva multidisciplinar. La comunicación entre primates ha servido para establecer un interesante debate teórico sobre cómo emergió y evolucionó el lenguaje moderno. En la última década, los estudios en primatología y en lenguas de signos apuntaban a un origen gestual; sin embargo, nuevas perspectivas integradoras se inclinan a una coevolución de gesto y sonido. Este marco de estudio es especialmente relevante para reflexiones antropológicas que ayuden a reflexionar sobre sus implicaciones ontológicas y culturales.

PALABRAS CLAVE

Comunicación, señales funcionalmente referenciales, primates, lenguas de signos, teoría de la mente, gesto, alarma.

ABSTRACT

Language is a complex field of research that should

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be addressed through a multidisciplinary approach. Communication between primates has proved useful in establishing an interesting debate concerning the origin of modern human language and how it evolved. In the last decade, research in primatology and sign language studies has tended to point to a gestural origin; however, new perspectives have tended to favour the co-evolution of sound and gesture. This framework is especially interesting in the field of anthropological study, which can help to address ontological and cultural implications.

KEY WORDS

Communication; functionally referential signals; primate; sign language; theory of mind; gesture; alarm.

Introduction

Words are powerful tools that not only allow us to communicate with others, but also give us the capacity to shape our environment and create the social world we live in. Language is one of the most complex and interesting phenomena studied by the biological and social sciences, and as a cognitive process it fascinates scientists from many disciplines: linguistics, primatology, cultural anthropology, cognitive psychology, neurology and speech therapy.

One of the biggest challenges faced by these scientists is to try to identify the evolutionary origin of language. In order to address this question, some primatologists have focused their research on communication among non-human primates. This approach has its roots in the idea that language is an evolutionary by-product of an older cognitive mechanism (Hauser, Chomsky & Fitch, 2002); or, simply put, that the capacity which enabled the development of complex language is older than language itself. Research into non-human primates has contributed data from different families of Old and New World primates and a considerable range of alarms and gestures has been documented (Pika & Mitani, 2006; Seyfarth, Cheney & Marler, 1980; Struhsaker, 1967; Wheeler, 2009). Frequently, such research assumes, given that human communication has developed principally along a vocal path (as opposed to sign language), that the best way to trace its roots is to focus upon oral communication in non-human primates (Lemasson, 2011; Zuberbühler, 2005). Primates (especially monkeys) employ a broad range of alarms and other calls that

appear to be functionally referential³ (Fedurek & Slocombe, 2011; Wheeler & Fischer, 2012). However, human children start to point before they learn to talk (Cochet & Vauclair, 2010; Kendon, 2016; Meguerditchian Cochet & Vauclair, 2011), while chimpanzees and gorillas have exhibited the ability to learn American Sign Language, communicating successfully and producing innovations in signing (Fouts, Fouts & Van Cantfort, 1989; Gardner & Gardner, 1969; NFLD Archive, 2015a; NFLD Archive, 2015b; Patterson, 1968; Patterson & Cohn, 1990; Savage-Rumbaugh, Fields & Spircu, 2004). As a consequence, some scientists have begun to argue that the origin of human language could be gestural rather than vocal (Arbib, Liebal & Pika, 2008; Corballis, 2002) and recently others have stated that it would be more appropriate to talk about a co-evolution of the oral-aural and kinesic modalities (Kendon, 2016; Slocombe, Waller & Liebal, 2011).

The two main goals of this essay are:

1) To consider the ethological data on primate gestural and vocal production, summarising and discussing the debate concerning the intentionality/innatism of non-human primate communication.

2) To address the hypotheses concerning the origins of human language, and to assess their limitations through comparison with current data.

The essay will be divided into three parts: the first will offer an overview of the main ethological research into non-human primate vocal and gestural communication, reflecting upon the question of intentionality. The second part will discuss the so-called *Gesture First Hypothesis* as a possible explanation for the origins of human language. Complementarily, I will also discuss Kendon's hypothesis regarding the co-evolution of oral-aural and kinesic modalities (Kendon, 2016). Thirdly, in conclusion, I will offer a brief discussion of the future of interspecies research and reflect upon the epistemological implications of such research.

Primate communication

Primates exhibit numerous distinctive vocal and gestural productions, which are developed in social contexts and vary across species, families and communities (Liebal et al. 2013; Pika et al. 2007); however, they all reflect complex comprehension of a wide range of primate-primate and primate-environment interactions. In intragroup social interactions, communication is crucial and can be expressed through vocal or gestural

³ "(...) are those signals in which production is context-specific, with the relevant contextual feature defining the "referent"; and which elicit specific responses in signal perceivers even in the absence of the supposed referent; that is, responses are stimulus-independent" (Wheeler & Fischer 2012, p.195).

channels. Monkeys tend to produce more vocal sounds, while apes seem to be more limited biologically in this regard and are more likely to communicate using gestures. This behavioural difference might be explained as an evolutionary adaptation to specific ecological pressures (Fedurek & Slocombe, 2011; de Waal & Pollick, 2012). In this section, I will discuss examples of both communication methods and reflect upon cognitive ability in primates. Cases of American Sign Language in non-human primates are not included here, as gestures should not be taken as synonymous with signing.

Primatological research provides many examples of vocal communication across several social situations. Functionally referential signals have been documented in four main contexts: a) *predator avoidance*, b) *food source, food quality and the location of food*, c) *social sexual context* and d) *agonistic interactions* (Liebal et al. 2013). There have been two major milestones in the history of research into monkeys' vocal communication: First, in 1967 it was noticed that vervet monkeys (*Chlorocebus pygerythrus*) produce three different alarms in order to identify the three main predators that harass them (eagles, leopards and snakes). Complementarily, they have specific "escape responses" for each one of these alarms (Struhsaker, 1967). Second, in 1980 Robert Seyfarth and his colleagues conducted an experiment which demonstrated that vervet monkeys are able to produce specific responses to "predator alarm calls", even if the stimulus (the predator) is not present (Seyfarth et al., 1980). Both discoveries were hugely relevant from a linguistics perspective, because they opened the debate surrounding functionally referential signals in non-human animals. Recently, a third milestone in this research field was the documentation of tufted capuchin monkeys' (*Sapajus apella*) false "predator alarms", employed to usurp the resources of their conspecifics (Wheeler, 2009). In addition, it has been documented that Barbary macaque females (*Macaca sylvanus*) produce alarms during sexual encounters. These alarms are related to male ejaculation, providing information to other males about the female's "accessibility" (Fedurek & Slocombe, 2011; Pfefferle et al. 2008). While great apes tend to communicate through gestures they also exhibit food-associated grunts that vary among neighbouring communities (Watson et al. 2015); however, and as I will discuss in a later part of this essay, vocalizations may be genetically limited, and it is not clear how intentional these alarms are (Fedurek & Slocombe, 2011; Hayes & Hayes, 1951; Wheeler & Fischer, 2012).

For their part, gestures play an important role in social life and exhibit a higher level of variation between species and even between conspecific groups (Pollick & de Waal). Captivity / free range factors have been

documented as decisive in the number and type of gestures exhibited (Arbib, Liebal & Pika, 2008; Pika et al. 2007; Pollick & de Waal, 2007; de Waal & Pollick, 2012; Wheeler & Fischer, 2012). Waal & Pollick define gesture as follows: "(...) *Communication by means of hands, feet, or limbs*" (de Waal & Pollick, 2012, p.83). A more detailed definition addresses the complexity of the term: "*'Gesture' includes the movements of the body, especially of the hands and arms, often integrated with spoken expression; the use of manual actions, often conventionalized, to convey something without speech; or the manual and facial actions employed in sign languages*" (Kendon, 2013, p.71). Gestures are dependent upon context, and in response to new pressures apes develop novel gestures. Liebal, Pika & Tomasello (2005) found around 20 gestures exhibited across a range of social contexts (playing sessions, during sexual encounters, nursing, grooming, agonistic interactions), as evidence of social learning. Other apes, such as chimpanzees, produce gestures, the meaning and reception of which are closely related to complex negotiation and persuasion processes, varying not only according to context, but also according to the attitude of the receptor (Hobaiter & Byrne, 2014).

The debate around "*functionally referential signals*"⁴ and the intentionality of communication between primates remains very much alive. Two important questions have emerged: are monkeys trying to report the presence of predators or are they displaying a response to fear? Do they associate the alarms with predators or are they giving a "classical conditioning" response? Critics argue that because non-human primates do not possess a theory of mind⁵, it is not accurate to talk about intentional communication, and that such alarms are instinctive; however, it is my contention that such explanations ignore the role that context plays in how primates produce different patterns of communication (with gesture being the most environmentally mutable). As an argument, dependence upon context supports the intentionality and flexibility of these alarms and gestures. Context understanding has also been documented in non-linguistic

4 It is not my intention here to enter the terminological debate surrounding *frs*; however, I do acknowledge the arguments for its replacement by a more suitable conceptual model, namely Wheeler & Fischer's (2012) suggestion: *context-specific signals*. I believe that this replacement should be extended to humans, given that words are at least as dependent upon context as *frs*.

5 Theory of mind is the ability to attribute different mental states to one's own self and others and to understand that others have mental states which differ from one's own mental state (Penn & Povinelli, 2007; Richard Dawkins Foundation for Reason & Science, 2010; Seyfarth & Cheney, 2003). This means, for example, that a vervet monkey cannot understand that another monkey may not be seeing the leopard in the same way that he does, and even when he produces an alarm call, it is not possible to know that he does so because he wishes to alert the other monkey, or because he is expressing his own fear of the predator.

experimentation: de Waal demonstrated that when capuchin monkeys received an unequal reward in relation to other monkeys performing the same task, they exhibited anger and aggressive behaviour towards those giving the reward (TED, 2012). In response to the position based upon the lack of a theory of mind as an argument for denying intentionality and communication skills in primates, it should be remembered that recent research has raised the possibility that chimpanzees may be exhibiting theory of mind, given their performance in tests (Call & Tomasello, 2008). However, the link between theory of mind and intentionality is highly debatable. For instance, humans with autism are rarely able to pass the famous Sally-Anne theory of mind test (Dani Hernández, 2011). Therefore, if this reasoning were followed, they would be denied a theory of mind, when of course their capacity to communicate intentionally is beyond question.

Which came first, the gesture or the egg?

In recent decades, a new theoretical framework has emerged which posits an alternative origin of language, known as the *Gesture First Hypothesis* (Arbib, Liebal & Pika, 2008; Corballis, 2002; Kendon, 2013; Kendon 2016), the key points of which are summarized below⁶:

- a) Flexibility and plasticity of gestures in apes: In the previous section, we touched upon ethological evidence pointing to a discontinuity in communicative patterns and frequency of gesture production between Hominoidea and other primates (mainly monkeys), resulting from a recent step in intentionality and a change in the strategy of communication (de Waal & Pollick, 2012). Apes display good control over hand and face movements, broad flexibility in the production of gestures and, more importantly, they learn these gestures in a social context. In addition, they are able to produce gestural modifications as a response to new environmental and social pressures (Maestripiერი, 2005; Pollick & de Waal, 2007; de Waal & Pollick, 2012).
- b) Biological limitations of vocal production: One of the main pillars supporting the *Gesture First Hypothesis* is that vocal repertoire and plasticity is genetically-physically determined and fixed (Fedurek & Slocombe, 2011). This has been documented in free-range, captivity and cross-fostered primate experimentation (Hayes & Hayes, 1951). Vocal experimentation comparing the early development of human children with a female chimpanzee (called Viki) showed similarities between three-year-old chimps and human children of the same age; they exhibited the same interests and similar cognitive and social behaviours. However, in the communicative field, Viki did not exhibit analogous

⁶ Part of this structure has been inspired by Kendon's classification (Kendon, 2016)

- capacities (Hayes & Hayes, 1951). This last assumption emerged from an experiment based on oral language, in which the researchers attempted to teach Viki to speak English. This experiment failed: Viki “only” produced three words, displaying considerable vocalization problems and failing to properly contextualize the words “cup”, “mamma” and “papa”. Nevertheless, inability to produce spoken language should not be taken to mean an inability to communicate in other ways.
- c) The importance of sign language for the understanding of oral languages: The relevance of sign languages can be appreciated on two different levels. First, in enabling a better understanding of the neurological processes involved in language development; second, sign languages constitute a “living example” of how signs and gestures are generated. In response to new social pressures, signers innovate by creating new signs to describe and categorize ideas, in the same way as oral languages (Kendon, 2016). It should be remembered that signed language and oral language use are essentially the same. In her research into neurolinguistics using *fMRI*, Emmorey (2001) found that the same areas of the brain’s left hemisphere are involved when speakers and signers talk or sign. In the same vein, linguistic disorders such as aphasia take place in extremely similar ways within the brains of signers and speakers, following brain damage. Signs are produced in a social context and evolve over time. One of the most remarkable examples of socio-linguistic innovation is the case of Nicaraguan Sign Language (Senghas & Coppola, 2001). It was “invented” between 1977 and 1983 by children in a Nicaragua school for the deaf, where there had been no previous contact with other sign languages or alternative ways of communication (Senghas, Kita & Özyürek, 2004). During this period, children from different cohorts generated Nicaraguan Sign Language, evolving it from gestures and home-signs to proper signs and a system of grammar and syntax rules (Senghas & Coppola, 2001; Senghas Kita, & Özyürek, 2004; University of California Television (UCTV), 2015). Sign language evolution is useful for understanding the possible origins of oral language, because as Senghas & Coppola (2001) have noted, signed languages re-creolize signs in each generation, in a process resembling the way in which child speakers transform pidgins into creoles⁷.
- d) Primates learn signed languages and understand spoken words: Experiments involving the teaching of American Sign Language and other ways of communication, such as “*keyboard signs*”, to non-human primates have achieved success. In the first case, Washoe, a female chimpanzee raised in a cross-fostered environment, managed to learn

⁷ “*pidgins (simple systems developed by speakers of incompatible languages); and Creoles (more complex languages that arise in later generations of such mixed-language communities)*” (Senghas & Coppola, 2001, p.328)

more than 100 ASL signs (Chalcraft & Gardner, 2005; Gardner & Gardner, 1969; Fouts, Fouts & Van Cantfort, 1989). Furthermore, during the “sign learning acquisition” process, she made the same kinds of mistakes commonly made by deaf children. In addition, she exhibited typical behaviours displayed by human children when learning to talk, such as signing alone in her play sessions, even in a non-supervised context (Gardner & Gardner, 1969; NFLD Archive, 2015a; NFLD Archive, 2015b). Washoe’s case is a significant example of the cognitive-linguistic abilities of chimpanzees. Language is learned in social contexts, and after learning ASL Washoe was able to teach it to her adoptive son Loulis (Fouts, Fouts & Van Cantfort, 1989). Furthermore, Washoe exhibited broad flexibility in the use of the signs that she knew. She could innovate and produce combinations of those signs: for example, the first time she saw a swan, she combined the signs for “water” and “bird” (Fouts, Fouts & Van Cantfort, 1989). A second example is the case of a female gorilla named Koko, which over a period of 30 months was able to learn 100 ASL signs (Patterson, 1978; Patterson & Cohn, 1990). Finally, Kanzi, a male bonobo, using a keyboard of lexical symbols, was able to produce sentences with meaning and even syntax, and to understand spoken English without specific prior training (NFLD Archive, 2015b; Savage-Rumbaugh, Fields & Spirou, 2004).

- e) Ontogenesis and phylogenetics of the human learning process: Young human children begin to communicate with adults and other children through the use of “babbling”, combined with certain pointing gestures that some authors have defined as symbolic (Kendon 2016; Meguerditchian, Cochet & Vauclair, 2011), demonstrating the importance of gestures in the earliest phases of human language acquisition. Counter intuitively, children’s pointing is highly intentional and can be used in a wide array of social interactions with different specific meanings: *requestive pointing*, *expressive pointing*, *informative pointing* (Grünloh & Liszkowski, 2015). The co-dependence of pointing and babbling is also relevant, as are the performance changes associated with the relative imperiousness of a child’s request (Cochet & Vauclair, 2010). However, it might also be argued that babbling and pointing at the same age support the co-evolution of oral-aural and kinesic modalities hypothesis rather than the gesture first hypothesis (see the discussion in the final section of this article).
- f) Co-speech gestures prominent in human language: As an extension of baby “babbling-pointing”, it is important to address the significance of co-speech gestures: that is, gestures which are performed as part of spoken language production. Research on several languages (English, French, Spanish, Italian) has shown how early speakers use specific gestures inserted into speech, as a method of contributing to the narrative and transmitting more information (Colleta et al. 2015; Marentette et al. 2016). Also, it is interesting to note how these ges-

tural-spoken elements are not exclusively a feature of early speakers. In some languages, such as Italian, a complete coexistence between gesture and speech takes place, to such a degree that in some cases they are inseparable.

Such arguments offer support for the Gesture First Hypothesis; nevertheless, some obvious questions emerge: *If language emerged from the sign channel, why was it developed through the oral channel until the biological-physical features necessary to produce flexible vocalization were achieved? What are the evolutionary advantages of spoken language?* A possible answer is that the change in communicative channel may have been a consequence of environmental pressures. In this scenario, tool use among early hominins increased, and as a result the ability to use the hands to communicate and for other purposes at the same time became adaptive. Recently, it has been suggested that primate vocal behaviours are much more flexible and complex than previously thought. For instance, it has been proposed that neural mechanism is related to vocal perception in primates, and that the way in which this contributes to vocal production could be linked with human speech (Ghazanfar & Eliades, 2014). Kendon (2016) points out that the weight of speech in language is too great for it to be ignored in the phylogenetic study of language. It has also been argued that species with higher vocalization production also exhibit more complex social systems (Freeberg, Dunbar & Ord, 2012). The link between language and complex social systems has been pointed out by Dunbar (2005), who theorized that the ability to exchange information about other members of a group is an adaptation which enables survival and closer relationships between individuals. Clearly, a new framework is developing which posits that language did not emerge in a solely vocal or gestural way, but that it followed a kinesic-oral path. This new approach should not be seen as a rejection of the "Gesture First Hypothesis", but rather as an extension of it.

Conclusion and future questions

- 1) This essay set out to reflect upon the intentionality of non-human primate communication, and to discuss the most appropriate hypotheses for the origins of language. In the light of all the primate communication evidence reviewed and the cross-fostered primate experiments conducted, we find ourselves arriving at two principal conclusions:
 - Assuming that language is a by-product of previous cognitive abilities (present in our relatives), the classical and dichotomous assumption which supposes that human language is arbitrary, while primate communication is conditioned, does not stand up to the evidence produced over time.

- Gesture should be considered a crucial element in the evolutionary study of the origin of human language. Neurolinguistics suggests that signed communication “takes place” in the same way that oral communication occurs. Also, recent cognitive and linguistics research data points to the likelihood that language emerged in a co-evolutionary process, along with speech.
- 2) In order to tackle complex phenomena such as language, isolated disciplinary approaches must be abandoned in favour of a multidisciplinary approach. To answer the big questions, scientists must employ as many resources as possible in the process of building upon global knowledge across all disciplines.
 - 3) Leaving aside the question of the origins of human language, I think it is important to take into account the importance of the latest research in great ape communication. The results of cross fostered experiments are not just important for the fields of primatology or linguistics, but also for the field of ethics. In this regard, new questions emerge: If primates exhibit complex cognitive abilities, such as linguistics skills or an understanding of unfairness, *are experiments with cross-fostered animals morally justifiable? Where should we establish the borders between humanity and animality?*
 - 4) As new research sheds more light on the evolutionary origins of language, it also demonstrates that primate communication is more complex than previously thought. New methodologies will be required in the search for answers to cognitive-linguistics questions. Interspecies research can help us to understand human language, but at the same time experiments involving the teaching of human languages to primates are extremely interesting and useful to us as we seek to clarify the questions surrounding human and non-human primates’ cognitive abilities. Therefore, it is my contention that a rich scenario will await future research and reflection in this field if we turn around our initial question and ask: *What can human language tell us about non-human primate communication?*

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