Primate Communication

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Communication is defined in different ways. For example, biological approaches often emphasize that communication is mediated by signals which are shaped by evolutionary processes, selected for the purpose of communication and the receivers’ ability to successfully decode such signals (Krebs & Davies, 1993). Some definitions differentiate between nonbehavioral and behavioral forms of communication, with the former also considering invariant displays, such as fur coloration, as means of communication (Smith, 1977). Psychological approaches, on the other hand, focus on the cognitive mechanisms underlying communication and the modification of signals during over an individual’s lifetime. Since comparative psychologists, interested in the evolution of human language, aim at identifying potential precursors to human language in other species (Tomasello, 2010), they often focus on the communicative systems of our closest relatives, the nonhuman primates (hereafter: primates).

# History

Early studies did not specifically target primate communication, but rather described postures, facial movements or calls as part of a species’ ethogram, often in free-ranging primates (van Lawick-Goodall, 1968), but also in captivity (van Hooff, 1973).

In the 1970s, researchers began to increasingly explore the cognitive aspects of primate communication, frequently within the theoretical framework of language evolution. By focusing on some of the key features of human language, researchers investigated referential signaling and meaning in monkeys’ vocal communication (Seyfarth et al., 1980), intentional use of gestures in several ape species (Tomasello et al., 1985), the occurrence of meaningful combinations of different signals (Zuberbühler, 2002) and speech-like rhythmic patterns of communicative mouth movements in monkeys (Bergman, 2013).

Advancements in technology and methodology, such as video recording and playback experiments as well as standardized coding manuals adapted for nonhuman primates (e.g., facial action coding system, e.g., chimpFACS, Vick et al., 2007) have allowed researchers to collect and analyze large amounts of audio-visual data with more objective methods in more controlled settings, which enable more systematic comparisons across primate species.

# Core concepts

## Modes of communication

Primates communicate with a great variety of signals, conveyed via different sensory channels (vision, audition, touch, olfaction). Comparative researchers, however, traditionally differentiate between three different signal types, which can convey different sensory information (gestures: vision, audition, touch, olfaction; vocalizations: audition; or facial expressions: vision). Each signal type aligns with a distinct theoretical framework on language evolution, suggesting either a vocal, facial or gesture origin of human language (Slocombe et al., 2011). As such, researchers usually focus on one of these signal types in isolation, corresponding to their preferred theory of language evolution.

## Referential signals

Many words in human language refer: that is, they pick out objects in the world. To identify equivalents to referential words in human language, comparative researchers study the use of referential signals in nonhuman primates. These are mostly considered in the vocal domain (Seyfarth et al., 1980). For a signal to be *functionally* referential, it must be consistently produced in response to specific events (context-specificity). It must also be 'context-independent', as the signal alone should be sufficient for listeners to respond appropriately. Referential use of gesture been mostly studied with regard to pointing. Pointing does not have an inherent meaning; instead, its meaning is defined by the context in which it is used.

## Flexible use

Flexibility in a communicative system is often seen as a hallmark of cognitive complexity. Flexibility can be evident in different ways, including the ability to either modify a given signal, or to add signals to an existing repertoire during an individual’s development (Liebal et al., 2013). Thus, flexibility has been operationalized in different ways. Researchers study flexibility in signal usage (e.g., one signal used to achieve different goals), flexibility in the receiver’s responses to a signal, or in combining different signals into longer, potentially meaningful sequences.

## Intentional use

As intentional production is a key feature of human language, comparative researchers investigate if nonhuman primates also use signals in a goal-directed, purposeful (Leavens & Hopkins, 1998). The focus is often on gestures, because both vocalizations and facial expressions are considered involuntary expressions of emotional state (Liebal & Oña, 2018). Different markers of intentional use were proposed, but studies use them inconsistently to determine if a given signal is used intentionally or not.

# Questions, controversies, and new developments

Little is known regarding how nonhuman primates acquire their communicative repertoires and how they learn to use them appropriately. Different mechanisms have been suggested, including genetic transmission, ontogenetic ritualization, social negotiation, and imitation (Fröhlich & Hobaiter, 2018). However, there is a current lack of longitudinal approaches that systematically contrast these different scenarios.

Furthermore, most existing studies on primate communication use a unimodal approach, with the majority of studies conducted in the vocal modality. However, human language most likely did not evolve from a single modality (Slocombe et al., 2011). Hence a multimodal approach that studies several signal types in an integrated way is crucial to shed more light on the origins of human language.

It remains fiercely debated whether we can find precursors to human language in other species, and it has been suggested that animal communication might differ qualitatively from human language (Bickerton, 1992). For gestures, it is still debated if they have specific meaning(s) (Hobaiter & Byrne, 2014), and whether by combining different signals, new meanings can be created (Genty, 2019). An increasing number of studies look for compositional structures in primates’ signal combinations or sequences (Zuberbühler, 2019). At least for vocalizations, there is increasing evidence that primates might be able to produce them intentionally, undermining the traditional dichotomy between intentional gestures and emotional facial expressions and vocalizations (Liebal & Oña, 2018).

Finally, methods continue to evolve. An increasing number of studies use automated methods, to extract calls and network analyses to automatically detect facial movements (Mielke et al., 2022).

To summarize, despite the wealth of research, we still lack a comprehensive picture of primate communication. To achieve this, it is essential to use a multimodal approach, to study the developmental trajectories of primate communication, and to compile existing data sets to enable systematic, potentially automated coding and analyses of different signal types across a wide range of primate species.

# Key references

* Call, J., & Tomasello, M. (Eds.). (2020). *The gestural communication of apes and monkeys*. Psychology Press.
* Fischer, J., & Price, T. (2017). Meaning, intention, and inference in primate vocal communication. Neuroscience & Biobehavioral Reviews, 82, 22-31.
* Liebal, K., Waller, B. M., Slocombe, K. E., & Burrows, A. M. (2014). *Primate communication: a multimodal approach*. Cambridge University Press.
* Waller, B. M., Whitehouse, J., & Micheletta, J. (2017). Rethinking primate facial expression: A predictive framework. *Neuroscience & Biobehavioral Reviews*, *82*, 13-21

# References

Baldwin, L. A., & Teleki, G. (1976). Patterns of gibbon behavior on Hall´s Island, Bermuda: A preliminary ethogram for Hylobates lar. In D. M. Rumbaugh (Ed.), *Gibbon and siamang* (Vol. 4, pp. 21–105). Karger.

Bergman, T. J. (2013). Speech-like vocalized lip-smacking in geladas. *Current Biology*, *23*(7), R268–R269. https://doi.org/10.1016/j-cub.2013.02.038

Bickerton, D. (1992). *Language and Species*. The University of Chicago Press.

Fröhlich, M., & Hobaiter, C. (2018). The development of gestural communication in great apes. *Behavioral Ecology and Sociobiology*, *72*(12), 194. https://doi.org/10.1007/s00265-018-2619-y

Genty, E. (2019). Vocal–gestural combinations in infant bonobos: New insights into signal functional specificity. *Animal Cognition*, *22*(4), 505–518. https://doi.org/10.1007/s10071-019-01267-0

Hobaiter, C., & Byrne, R. W. (2014). The meanings of chimpanzee gestures. *Current Biology*, *24*(14), 1596–1600. https://doi.org/10.1016/j.cub.2014.05.066

Hobaiter, C., & Byrne, R. W. (2017). What is a gesture? A meaning-based approach to defining gestural repertoires. *Neuroscience & Biobehavioral Reviews*, *82*, 3–12.

Krebs, J. R., & Davies, N. B. (1993). *An introduction to behavioural ecology*. Cambridge, MA, US: Blackwell Scientific Publications, Inc. (1993). xii, 420pp.

Leavens, D. A., & Hopkins, W. D. (1998). Mea. *Developmental Psychology*, *34*(5), 813–822.

Liebal, K., & Oña, L. (2018). Mind the gap–moving beyond the dichotomy between intentional gestures and emotional facial and vocal signals of nonhuman primates. *Interaction Studies*, *19*(1–2), 121–135.

Liebal, K., Waller, B. M., Burrows, A. M., & Slocombe, K. E. (2013). *Primate Communication: A Multimodal Approach*. Cambridge University Press.

Mielke, A., Waller, B. M., Pérez, C., Rincon, A. V., Duboscq, J., & Micheletta, J. (2022). NetFACS: Using network science to understand facial communication systems. *Behavior Research Methods*, *54*(4), 1912–1927. https://doi.org/10.3758/s13428-021-01692-5

Seyfarth, R. M., Cheney, D. L., & Marler, P. (1980). Vervet monkey alarm calls: Semantic communication in a free-ranging primate. *Animal Behaviour*, *28*, 1070–1094.

Slocombe, K. E., Waller, B. M., & Liebal, K. (2011). The language void: The need for multimodality in primate communication research. *Animal Behaviour*, *81*(5), 919–924. https://doi.org/10.1016/j.anbehav.2011.02.002

Smith, W. J. (1977). *The Behavior of Communicating: An Ethological Approach*. Harvard University Press.

Tomasello, M. (2010). *Origins of Human Communication*. MIT press.

Tomasello, M., George, B. L., Kruger, A. C., Farrar, M. J., & Evans, A. (1985). The development of gestural communication in young chimpanzees. *Journal of Human Evolution*, *14*(2), 175–186. https://doi.org/10.1016/S0047-2484(85)80005-1

van Hooff, J. (1973). A structural analysis of the social behaviour of a semi-captive group of chimpanzees. In M. von Cranach & I. Vine (Eds.), *Social communication and movement, studies of interaction and expression in man and chimpanzee* (pp. 75–162). Academic Press.

van Lawick-Goodall, J. (1968). The behavior of free-living chimpanzees in the Gombe Stream Reserve. *Animal Behaviour Monographs*, *1*(3), 161–311.

Vick, S. J., Waller, B. M., Parr, L. A., Smith Pasqualini, M. C., & Bard, K. A. (2007). A cross-species comparison of facial morphology and movement in humans and chimpanzees using the facial action coding system (FACS). *Journal of Nonverbal Behavior*, *31*(1), 1–20.

Zuberbühler, K. (2002). A syntactic rule in forest monkey communication. *Animal Behaviour*, *63*(2), 293–299. https://doi.org/10.1006/anbe.2001.1914

Zuberbühler, K. (2019). Syntax and compositionality in animal communication. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *375*(1789), 20190062. https://doi.org/10.1098/rstb.2019.0062