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Primate Communication

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Comparative psychologists interested in the evolution of human language often aim at identifying potential precursors to human language in other species, so they focus on the communicative systems of our closest relatives—nonhuman primates. Critically, communication is defined in different ways across fields. For example, biological approaches often emphasize that communication is mediated by signals that are shaped by evolutionary processes selected for the purpose of communication, and so they focus on the receivers' ability to successfully decode such signals. Some definitions differentiate between involuntary and voluntary forms of communication, with the former also considering invariant displays (such as fur coloration) as a means of communication. Psychological approaches, on the other hand, focus on the cognitive mechanisms underlying communication and the flexible modification of signals over an individual's lifetime. A number of controversies remain about the uniqueness of human language among primate communication systems.

History

Early studies did not specifically target nonhuman *primate communication*, hereafter referred to as primate communication. Instead they simply described postures, facial movements, or calls as part of a species' *ethogram* (i.e., the inventory of all distinct behaviors exhibited by an animal species) [see Animal Cognition]. Such studies were often conducted on free-ranging primates (Baldwin and Teleki, 1976; van Lawick-Goodall, 1968) but did also include those 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 for example, the referential signaling and meaning in vervet monkeys' vocal communication (Seyfarth et al., 1980), the intentional use of gestures in chimpanzees (Tomasello et al., 1985), the occurrence of meaningful combinations of different signals in Diana monkeys (Zuberbühler, 2002), and speech-like rhythmic patterns of communicative mouth movements in geladas (Bergman, 2013). Advancements in both technology and methodology (e.g., video recording, playback experiments) as well as standardized coding manuals adapted for nonhuman primates (e.g., facial action coding system such as chimpFACS [Vick et al., 2007]) allowed researchers to collect and analyze large amounts of audio-visual data with more objective methods in more controlled settings. This enabled more systematic comparison across primate species as well as across studies and research groups.

Core concepts

Modes of communication

Primates communicate with a great variety of signals conveyed via different sensory channels (vision, audition, touch, and olfaction [see Olfaction]). Comparative researchers, however, traditionally differentiate between three different signal types, which convey different sensory information: gestures [see Gesture], which are sensed through vision, audition, and touch; vocalizations, through audition [see Hearing]; and facial expressions, through vision [see Face Perception]. Each signal type aligns with a

distinct theoretical framework on language evolution, suggesting either a vocal, facial, or gestural origin of human language (Slocombe et al., 2011). As such, researchers often 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, comparative researchers study the use of referential signals in primates. These are mostly studied in the vocal domain (Seyfarth et al., 1980), where they are referred to as *functionally* referential signals. This means that a signal needs to be consistently produced in response to a specific eliciting stimulus (context-specific signal production). In addition, the signal alone should be sufficient for listeners to respond appropriately in the absence of the stimulus (context-independent response). In studies of primate gestures, referential use has mostly been studied for 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., 2014). Thus, flexibility has been operationalized in different ways. Researchers study flexibility in signal usage (i.e., one signal used to achieve different goals), flexibility in the receiver's responses to a signal, or flexibility 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 produce their signals in a goal-directed, purposeful way (Leavens & Hopkins, 1998). Different markers of intentional use have been proposed, but studies use them inconsistently to determine if a given signal is used intentionally or not (Liebal et al., 2014). The focus is often on gestures, since both vocalizations and facial expressions were previously considered involuntary expressions of emotional states (Liebal & Oña, 2018).

Questions, controversies, and new developments

Little is known about the development of primates' communicative repertoires or how primates learn to use them appropriately. Different mechanisms have been suggested, including genetic transmission (with gestural repertoires being largely genetically determined), ontogenetic ritualization (where initially noncommunicative behaviors develop into signals through the repeated interactions between individuals), and imitation (where individuals copy signals or part of them from other individuals) (Fröhlich & Hobaiter, 2018; Liebal et al., 2018). Currently, there is a lack of longitudinal data to systematically contrast these different scenarios.

There is also debate regarding the meaning of primate signals. It is still debated if gestures, like functionally referential vocalizations such as predator-specific alarm calls, have specific meanings (Hobaiter & Byrne, 2014) and whether combining different signals creates new meanings (Genty, 2019). An increasing number of studies look for compositional structures in primates' signal combinations to investigate if meaningful elements can be combined into meaningful complex structures (Zuberbühler, 2019).

Researchers also debate *intentional use*, which is thought to be a key property of human language. Many studies investigate if primates are able to produce signals voluntarily. This has mainly been demonstrated for gesture use, but there is increasing evidence that primates might also be able to produce some of their vocalizations intentionally. This challenges the traditional dichotomy between intentionally produced gestures on the one hand and involuntary emotional facial expressions and vocalizations on the other (Liebal & Oña, 2018).

A new development in primate communication studies is a move away from the use of a unimodal approach characteristic of previous studies (specifically, a focus on the vocal modality) and towards a multimodal approach. Researchers are beginning to study several signal types in an integrated way to shed more light on the origins of human language, which arguably did not evolve from a single modality (Slocombe et al., 2011).

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

Finally, it is still fiercely debated whether there are precursors to human language in other species. It has been suggested that animal communication might differ qualitatively from human language (Bickerton, 1992). However, this is at odds with the generally accepted view that studying other primates can shed light on the evolutionary roots of human language.

To summarize, despite the wealth of research, there is still no 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 datasets to enable systematic, potentially automated coding and analyses of different signal types across a wide range of primate species.

Broader connections

Primate communication is of interest to scholars across various disciplines. Linguists examine the structural similarities and differences between primate signals and human language, whether primate signals convey meaning, and how they are used in comparison to human language (Berthet et al., 2022; Schlenker et al., 2016; Scott-Phillips, 2014) [see Psycholinguistics]. Cognitive scientists and comparative psychologists explore the cognitive processes and psychological mechanisms underlying primate communication, such as voluntary control over signal production and the understanding of others' mental states (Graham et al., 2019; Tauzin et al., 2020) [see Theory of Mind]. Neuroscientists focus on the

neurobiological substrates involved in primate communication, comparing them to the mechanisms of language production and comprehension in humans, to draw conclusions about the *language readiness* of the primate brain (Arbib, 2020; Rizzolatti & Arbib, 1998). Evolutionary biologists and ethologists study how signals evolve in response to natural and sexual selection pressures and how communication is influenced by a species' socio-ecological environment (Higham & Hebets, 2013).

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Further reading

- 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

- Arbib, M. A. (Ed.). (2020). *How the brain got language: Towards a new road map*. John Benjamins B.V. https://doi.org/10.1075/bct.112 ↩
- 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. https://eurekamag.com/research/027/120/027120775.php ↩
- 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 ↩
- Berthet, M., Coye, C., Dezecache, G., & Kuhn, J. (2022). Animal linguistics: a primer. *Biological Reviews, 98*(1), 81–98. https://doi.org/10.1111/brv.12897 ↩
- 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*(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 ↩
- Graham, K. E., Wilke, C., Lahiff, N. J., & Slocombe, K. E. (2019). Scratching beneath the surface: intentionality in great ape signal production. *Philosophical Transactions of the Royal Society B: Biological Sciences, 375*(1789), 20180403. https://doi.org/10.1098/rstb.2018.0403 ↩
- Higham, J. P., & Hebets, E. A. (2013). An introduction to multimodal communication. *Behavioral Ecology and Sociobiology, 67*(9), 1381–1388. https://doi.org/10.1007/s00265-013-1590-x ↩
- 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 ↩
- Leavens, D. A., & Hopkins, W. D. (1998). Intentional communication by chimpanzees: A cross-sectional study of the use of referential gestures. *Developmental Psychology, 34*(5), 813–822. https://doi.org/10.1037/0012-1649.34.5.813 ↩
- 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: Social Behaviour and Communication in Biological and Artificial Systems, 19*(1–2), 121–135. https://doi.org/10.1075/is.17040.lie ↩
- 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: Social Behaviour and Communication in Biological and Artificial Systems, 19*(1–2), 121–135. https://doi.org/10.1075/is.17040.lie ↩
- Liebal, K., Schneider, C., & Errson-Lembeck, M. (2018). How primates acquire their gestures: Evaluating current theories and evidence. *Animal Cognition, 22*(4), 473–486. https://doi.org/10.1007/s10071-018-1187-x ↩
- Liebal, K., Waller, B. M., Slocombe, K. E., & Burrows, A. M. (2014). *Primate communication: a multimodal approach*. Cambridge University Press. ↩

- Liebal, K., Waller, B. M., Slocombe, K. E., & Burrows, A. M. (2014). *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

  ↩
- Rizzolatti, G., & Arbib, M. A. (1998). Language within our grasp. *Trends in Neurosciences*, *21*(5), 188–194. https://doi.org/10.1016/s0166-2236(98)01260-0 ↩
- Schlenker, P., Chemla, E., Schel, A. M., Fuller, J., Gautier, J.-P., Kuhn, J., Veselinović, D., Arnold, K., Cäsar, C., Keenan, S., Lemasson, A., Ouattara, K., Ryder, R., & Zuberbühler, K. (2016). Formal monkey linguistics. *Theoretical Linguistics*, *42*(1–2), 1–90. https://doi.org/10.1515/tl-2016-0001 ↩
- Scott-Phillips, T. (2014). *Speaking our minds: Why human communication is different, and how language evolved to make it special*.

  ↩
- Seyfarth, R. M., Cheney, D. L., & Marler, P. (1980). Vervet monkey alarm calls: Semantic communication in a free-ranging primate. *Animal Behaviour, 28*(4), 1070–1094. https://doi.org/10.1016/S0003-3472(80)80097-2

  ↩
- 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

  ↩
- 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

  ↩
- Tauzin, T., Bohn, M., Gergely, G., & Call, J. (2020). Context-sensitive adjustment of pointing in great apes. *Scientific Reports*, *10*(1). https://doi.org/10.1038/s41598-019-56183-7 ↩
- Tomasello, M., George, B. L., Kruger, A. C., Jeffrey, M., Farrar, & 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. https://doi.org/10.1016/S0066-1856(68)80003-2

  ↩
- 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. https://doi.org/10.1007/s10919-006-0017-z

  ↩
- 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.

  ↩