Linguists team up with primatologists to crack the meaning of monkey calls

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It has long been known that monkeys convey information through alarm calls, but now a combined team of linguists and primatologists has laid the groundwork for a systematic 'primate linguistics.'

In a series of five articles published in multiple linguistics journals, the authors have brought the general methods of contemporary linguistics to bear on monkey morphology (pertaining to the structure of calls), syntax (how the calls are put together into sequences), and semantics (what calls and call sequences mean), building on several earlier studies conducted within primatology.

"We can now study the form and meaning of monkey calls using methods from theoretical titi monkeys linguistics," explains Philippe Schlenker, a senior researcher at Institut Jean-Nicod within France's National Center for Scientific Research (CNRS) and a Global Distinguished Professor at New York University. "Using this approach, we can compare one monkey species to another and see, for instance, that some of their calls have been preserved over three million years."

The research, which Schlenker co-authored with Emmanuel Chemla, a research scientist at France's National Center for Scientific Research (CNRS), and Klaus Zuberbühler, a professor at Switzerland's University of Neuchâtel, appears in the journals *Natural Language & Linguistic Theory*, Lingua and Theoretical Linguistics and follows an earlier study in Linguistics & Philosophy. The team of authors includes several other primatologists and linguists, as well as a statistician.

The authors emphasize that monkey languages in no way have the complexity of [human language](#), but that they still display exciting and sometimes challenging formal properties.

With respect to primate morphology, Campbell's monkeys, found in Africa, make a distinction between roots (especially "hok" and "krak") and suffixes ("-oo"), and their combination allows the monkeys to describe both the nature of a threat and its degree of danger. For instance, "hok" warns of serious aerial threats - usually eagles - whereas "hok-oo" can be used for a variety of general aerial disturbances; in effect, the suffix "-oo" serves as a kind of attenuator. The same monkeys display a limited amount of dialectal variation in the meaning of a call, "krak," which has a leopard-related meaning in one site and a 'general alert' meaning in another, from which leopards are absent (this was the topic of the first article in the series, published in 2014).

But calls are also combined in interesting ways - a possible instance of elementary 'primate syntax,' which raises questions about how the meanings of monkey calls are combined ('primate semantics'). Campbell's monkeys have "boom" calls, which usually come in pairs - but these are constrained to appear at the beginning of call sequences. In Putty-nosed monkeys, "pyows" are used as general calls ('there is an alert'), while "hacks" are usually raptor-related (e.g. 'there is an eagle'). But a small number of "pyows" followed by a small number of "hacks" have a distinguished status and trigger group movement ('let's move!').

This raises a question for 'primate semantics,' the researchers observe: Can the meaning of these 'pyow-hack sequences' be derived from the meaning of the calls they contain? 'No,' answered earlier researchers, who went on to compare 'pyow-hack' sequences to 'idioms' in human language: although 'kick the bucket' contains the words 'kick' and 'bucket,' the expression has a meaning, namely 'die,' which involves no kicking and no bucket. More sophisticated methods used in the present

analyses suggest that there might in fact be more regularity than meets the eye in 'pyow-hack' sequences, and that in the end these might not have to be analyzed as idioms.

The same general issues arise in remarkable call sequences produced by Titi monkeys (South America): with just two calls (A and B), they encode information about both predator type and predator location, so that 'raptor in the canopy' (e.g. AAAA...), 'raptor on the ground' (e.g. AAA...BBBB...), 'cat in the canopy,' (e.g. ABBBB...), and 'cat on the ground' (e.g. BBBBB...) give rise to four distinct sequence types. While these might seem to display a complex grammatical organization, the authors argue instead for a deflationary analysis in which the complexity of the sequence reflects, in part, changes in the environmental context, with each call having its own regular meaning independently from the others (A = 'there is a serious danger up,' B = 'there is an alert').

The authors insist that monkey languages should be analyzed on their own terms, without arbitrarily importing concepts from human language - and in most cases they assign a simple meaning and structure to them. But one tool of contemporary linguistics, called 'implicatures,' has proven illuminating.

An implicature arises when the meaning of a word is enriched because it competes with a more informative alternative - for instance, "possible" competes with "certain," which is more informative, and for this reason "possible" usually comes to mean "possible but not certain" (for instance: "It's possible that John is the culprit" - which implies that this is not a certainty). The authors note that in many cases a general call - for instance the Titi B-call, for 'general alerts' - competes with a more specific call - for instance the Titi A-call, for 'serious danger up.' If a threat licenses the specific call (for instance the A-call because a raptor appeared), monkeys don't normally start sequences with the general call (e.g. B), and thus they seem to prefer the more informative alternative -

a version of 'monkey implicatures.'

Besides offering a precise typology of the properties of several monkey languages, the authors suggest that extraordinary time depth can be obtained by comparing the calls of related species. Thus the Campbell's "boom" calls exist in several species that diverged millions of years ago. Plotting the species that do and don't have "booms" on a 'phylogenetic tree' (a family tree of related monkey species) obtained with chronologically precise DNA methods, one can see that entire, coherent subfamilies have "booms," which strongly suggests that their most recent common ancestor had them as well millions of years ago. This paves a way for an 'evolutionary monkey linguistics' that could explain how monkey communication evolved over millions of years.

"These findings show that methods from linguistics can illuminate communication systems beyond human language," notes Schlenker, "and in the future they might find further domains of application beyond primates."

  More information: sites.google.com/site/philippe … l_monkey_linguistics

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