

Monkeys *that almost* speak

Typical of the Atlantic Rain Forest, the woolly spider monkeys have a singular form of communication

CARLOS FIORAVANTI

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Louise is one of the most restless spider monkeys in the small reserve close to the city of Caratinga, in the north of Minas Gerais. With her pink face, small nose and prominent eyelashes, as if she were wearing make-up, she is the one who has most amorous encounters with all the adult males of the group. Until he died last year, Cutlip, recognized by the scar on his lip that earned him his name, was one of the centers of attention for the band and was frequently sought out by his fellows to be given hugs, in constant shows of affection.

A few years ago, the special social organization of the woolly spider monkeys (*Brachyteles arachnoides*) surprised the researchers. Found for decades from



A representative
of a society governed by
friendship: no quarrels

the south of Bahia to Paraná, but today marooned in remnants of the Atlantic Rain Forest in Minas Gerais, Rio de Janeiro, Espírito Santo and São Paulo, these about 1.5 meter tall monkeys, including the tail – also called mono-carvoeiros in Portuguese – charcoal monkeys, because of their all-black faces, like coal miners –, form communities that are run on the basis of fraternity and free love. Not only Louise, but any other female of the group, even Cher, the most discrete and isolated, mate with all the adult males they live with – normally one third of the groups, which have between 15 to 50 members. When they come on heat, they warble, something like a *teeteete*, or then squeals and shrill whistles, like *seeee*, which they use to call the males, who remain nearby waiting for their turn. There are not quarrels or contests. The spider monkeys, the largest monkeys in the Americas, have managed to create a hierarchy that is governed by affection. At the center of the group are not the strongest, but the most liked, who stand out because it is they who are given most hugs by their companions, like Cutlip or Irv, recognized by the cross-shaped patches on his nose.

But the discoveries about the language of the spider monkeys are even more impressive. When they make their way through the forest, hidden by the foliage of the trees as they get further away from each other, these monkeys communicate in a way that has still not been found in any other species of primate. They recombine 14 elements of sound, which are like the vowels and consonants of human language, and produce a rich variety of calls – longer or shorter, higher or lower pitched –, in a process similar to the one we use to form words. Such is the reorganization of the sounds that one gets the impression that the spider monkeys even try to be inventive: when they strike up a conversation, they rarely repeat what the others have already said.

A researcher for the Language Studies Institute (IEL) of the State University of Campinas (Unicamp), Eleonora Cavalcante Albano guarantees: these sounds from the woolly spider monkeys, described for the first time, form a natural language with a clear social sense, which helps to maintain the cohesion of the group. It only loses to ours, because it is possibly not symbolic. “It is a language that indicates the objects of the world, but it is not known if it represents them”, she says. In a hypothetical situation, a spider monkey manages to tell another spider monkey that a tree is laden with fruit only if it is in front of it, but it has no way of telling about the tree where it had been yesterday, nor to issue a specific sound for each kind of tree that it knows. In their vocabulary and in the recombinations of sounds, though, spider monkeys are unbeatable when compared with other Brazilian species of primates, amongst these the capuchins, the pygmy marmoset and the tamarins, which have a complex vocal communication. The spider monkeys’ ability for recombining sounds is also greater than two other species known for the noise

they make: the African chimpanzee and the gibbon from the forests of Indonesia and Malaysia.

At two different times, in July 1990 and August 1991, anthropologist Francisco Dyonísio Cardoso Mendes, a researcher at the Catholic University of Goiás, in Goiânia, covered the Caratinga Biological Station, a 9-square kilometer remnant of the Atlantic Rain Forest, and registered all the sounds he could in 138 hours of recordings. In an analysis of this material, concluded at the end of last year, Mendes put to good use the linkage he had established with Charles T. Snowden, at the University of Wisconsin, United States. He also worked with the supervisor for his MSE and PhD theses, psychologist César Ades, a researcher from the Psychology Institute (IP) of the University of São Paulo (USP) and one of the greatest Brazilian authorities in ethology, the science that studies animal behavior. Together, Mendes and Ades transformed the recordings into sonograms, a sort of graph that shows the frequency, intensity and duration of the sounds, and they discovered that the spider monkeys’ vocabulary is made up of 38 basic vocal calls. Twenty four of these are used in specific situations: there are sounds for play, at the moment of an hug, or as a warning in a situation of danger; there is also the crying of the babies that feel they have been abandoned, the mothers’ calls to their straying offspring, or the grunts of satisfaction after they have stuffed themselves full of fruit. But up to this point, nothing distinguishes spider monkeys from other animals. “These sounds are born more or less ready, like the barks of dogs, and they are used in specific contexts”, says Mendes.

It was the calls of the spider monkeys as they leap from one tree to another that were completely foreign to reports previously made by other scientists. Made up of 14 elements of sound, this form of communication, which is the most common among them, was called sequential interchange, for a simple reason: one monkey calls and another answers, one at a time, less than 10 seconds later, almost like a conversation in which one waits for the other to finish before expressing himself. As the researchers discovered, there are two basic kinds of call within this category. The first is made up of whinnies, quite similar to the sounds from mares on heat or of male horses wanting to announce themselves. What identifies a whinny are the long, low-pitched and hoarse elements of sound, like an *oh-ohhh* (with the *h* standing for a harsh, guttural sound). This set includes short, high-pitched sounds which are mixed with low pitched sounds and result in contrasting compositions, something like *how*-(as in owl) *eehhoo* as in (hood) *uhh*. Uttered by animals who are further away, over 50 meters from the center of the group, this whinnying has a tone of anger or protest, meaning something like: “I’m far behind, wait for me, you hasty lot!” The second group of basic sounds is the staccatos, made up only of short and sharp sounds, like *ee-ee-ih*. Produced by monkeys that are close to the center of the group, the staccatos



One woolly spider monkey tells another where it is: language helps to maintain the cohesion of the group

can be translated as something like: I'm here, it's all right". But in both cases, the interpretations are still frail. "The search for the meanings of the sounds is like the work of anthropologists when they find a new culture", Ades likens.

The sonorous inventiveness of the spider monkeys leapt before the eyes with an examination of the way that organize the 14 units of sounds that make up the whinnying and the staccatos. In the 648 calls recorded by Mendes, there were 534 different sequences, still taking into consideration repetitions of the *ttptrrrtArZ* kind – each letter corresponds to a sound, now in a graphic representation of the spider monkeys' communication (the lower case letters stand for short sounds and the upper case letters, long sounds). Once the redundancies were eliminated, 320 original sequences were left, without any repetition of phonemes, and 231 orders in which the different kinds of sounds would be combined, in longer or shorter calls. The spider monkeys' vocal production is very rich in information, at the same time as it shows a certain reproductibility, which is a result of a clear set of rules for sequential organization", Ades comments. "As in human language, there are elements of sound used mainly at the beginning of calls, others mainly in the middle, and others only at the end", says he.

At the beginning, it seemed as if the hue and cry had a very clear function: helping the members of the group to locate themselves in relation to the others, and so preventing them from getting lost – something fatal when one is dealing with a species that only knows how to live in a community. There is a certain logic: covered by foliage and 10, 20 or 50 meters away from each other, monkeys cannot see each other. Shouting out from time to time indicates where they are, in a sort of call. But the whinnies and the staccatos do other jobs. "The spider monkeys let loose these calls not only when they are in movement, but also when they are resting or eating, as if they were talking all the time", says Mendes. Used more by adult monkeys, the whinnies and staccatos are more frequent in the morning, before the group starts looking for food, at the end of the afternoon, at the time they settle in the tree tops before sleeping, or when meeting other groups, and they contest for a place to rest or to feed themselves.

The Don Juans and their harems

In a line of research started ten years ago, César Ades has been analyzing the differences in behavior between two groups of animals with a probable common origin, but which today have quite different life styles. One is the cavy (*Cavia aperea*), an animal of 25 centimeters in length at the most, that lives freely, scattered over South America. The other is the guinea pig (*Cavia porcellus*), domesticated some 6,000 years ago in the Peruvian Andes, in a process in which it may have gained or lost skills, in a way that is similar to dogs, from the moment that their ancestors, the wolves, got close to a settlement some 15,000 years ago and discovered that they could win their food instead of hunting it.

Patrícia Ferreira Monticelli, who is studying for a doctorate under César Ades, found that the mating of guinea pigs is a much longer and more lively ritual than it is with cavies. Drawing close to the female, the male guinea pig starts a dance, the “rumba”, in which he wags the rear of his body and utters a long *prooo-ooorrr* sound— this is the courting call, which he uses to try to at-

tract the female. Afterwards, the male runs after the female, which responds to his approach by running and crying out *eeec*. The cavy, though, seems to be in a hurry: he dances a rumba that is broken up by warning gestures, and his call is lower, something like a *prooor-prooor*. “The cavy is courting and looking around him at the same time”, Patrícia says. “He reacts instantly to any strange noise that he may hear while he is with the female, and he even produces a special warning call, which sounds like *derrrr*.”

Domestication may have liberated reproductive behavior. “The male guinea pig frequently courts the female cavy, but a male cavy rarely courts a female guinea pig”, says Ades. “The guinea pig’s obsession with reproduction is much greater. The male courts the female all the time, even when she is outside the period for reproduction.” Both the male guinea pig and the male cavy participate very little in taking care of their offspring. There may even be rivalry between father and son. At the age of one month, the young male guinea pigs start to take a beating from their fathers, if they venture to

court the females, which includes their mothers and sisters, even though they are not yet able to copulate. When they are adult, the males form harems with six or seven females – and they have their favorites. The domesticated species is more flexible than the other in its social organization. “With the guinea pigs, when the population density increases, the animals split into subgroups, each male with his females, and each respecting the other’s territory”, the researcher comments. “The cavies are much less tolerant and do not form subgroups.”

Amongst the rodents, the guinea pigs and the cavies have one of the richest vocal repertoires, with 12 different calls, including cries of pain and of defense, alarms in the face of danger and the *shoot-shoot-shoot* that they make all the time when they are in a group. The offspring that gets separated from their mothers utter a very high-pitched and repetitive whistle, like *ooeec, ooeec, ooeec*, thanks to which they manage to return to the group. César Ades’ team discovered that this whistle contains what they call a vocal signature, with charac-

“If we had shown that there are specific sounds for each situation and for each kind of social interaction, it would be demonstrated that spider monkeys can speak”, comments Ades. The recombination of sounds that these monkeys avail themselves of is precisely the mechanism by which human beings produce language and meanings – of course, with a far wider repertoire, with 33 elements of sound or phonemes. For example, the words ‘gruesome’ and ‘some grew’ are made of the same phonemes, but the meaning changes in accordance with the order in which they are used. “Could it be that there are common rules for recombining sounds for both monkeys and humans?”, Ades wonders. A positive reply could bring the two universes closer together. Immediately, the knowledge built up could be of assistance in the projects for breeding or maintaining this species that is threatened with extinction, of which there must be less than a thousand individuals left.

It can no longer be said that we humans have a marvelous form of communication, which is speech, and other animals just a simple communication”, says the researcher from Goiânia. Until recently, the sounds of the primates were seen merely as instinctive responses to situations of fear, pain or joy, for example. No one would even cogitate this of the enigmatic hullabaloo of the spider monkeys, which, to give a free run to the imagination, recalls the primitive pleasure of uttering sounds that we still experience, when turning a yawn or a sneeze into a public scandal. A strictly evolutionist approach can also be adopted. “If there is no danger, it is possible to display oneself and to show individuality”, Ades says. “For other animals, producing sounds is to expose oneself to predators.”

Mendes has been intrigued with the sounds of spider monkeys even since he first heard them, in 1985. That was when he began to study the social struc-

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Contrasts: a domesticated species, the female guinea pig takes care of offspring of another mother, while the cavy (near left) remains aloof

teristics that distinguish one offspring from another, to make it possible to be recognized by their mothers.

“Recognition of one’s offspring is a crucial biological necessity”, the researcher comments. “In nature, if a mother fails to recognize her own children, she is subject to waste time protecting the offspring of others and feeding them, to the detriment of her own.” In her doctorate, concluded last year, Rosana Suemi Tokumaru, who was recently hired by the Federal University of Espírito Santo (UFES), proved in experiments that female guinea pigs recognize their offspring according to the smell of each one of them, and they

spend more time close to them than to the offspring of other mothers.

Suemi wanted to see whether they would recognize their offspring at a distance, just by means of their whistles on separation. First, she created a learning situation, in which the mothers would hear repeatedly the whistle of one of their offspring, which would come in contact with her after the call. Afterwards, in another situation, a mother would have to choose between the whistle of one of her own offspring and one of an offspring of someone else. But the mothers did not distinguish between the calls, and would turn both to one and to the other. “The offspring’s whistle of se-

paration did not develop because of recognition by the mother”, Ades observes. “The call of the offspring works, because the mother is usually near by, and also because adults in the group are benevolent with regard to the youngsters, and even act as safety points.” Something like a child that has gotten lost in a shopping center and already feels comforted when someone pays attention to him or her, even if it is not the mother. The benevolence is so great, as Adriana Toyoda Tokamatsu proved in a work that is under way, that it is common for breastfeeding mothers to allow the offspring of others to have access to their milk. It may be another trait of domestication.

ture of these animals, under the joint supervision of Ades and primatologist Karen Strier, from the University of Wisconsin, United States. A pioneer in the study of this species, which she has been accompanying since 1982, it was Karen who gave the names to the animals and taught Mendes to identify each one of them by the color of their fur, by their shape and by the marks on their faces. From observing them so much, he also learned to distinguish each monkey according to its temperament – there are those that are quieter or more restless, those that are more sociable or more isolated.

Mendes quickly discovered that he was looking at one of the most peaceful species of primates ever studied. The woolly spider monkeys do not bother about sharing trees to eat or to rest with members of the same band. “The groups are organized by friendly contact, not by power”, says the researcher, based on his more than 990 hours of observation in this stage of the work. The peaceful behavior can be explained, at least in part, by the fact that the males are usually related to each other, since they have remained in the same group since they

were born. It is only very rarely that they quarrel, even though one of the favorite pastimes of the youngsters is to provoke each other: they pester each other all the time, tickling or pulling their arms or legs. Even when adult, the spider monkey hugs each other frequently, with an embrace lasting up to several minutes every two and a half hours. Sometimes, five or six monkeys hug each other, using only their tails to hang from the branches.

Differently from what happens with other species of primates, the males seem not to contend for the females, which, when on heat, give attention to all of them. Scientists ponder that there may be, though, competition for sperm: the greater the quantity of sperm produced, the greater the probability of fecundating the female. This hypothesis gains strength in the light of the huge size of the spider monkeys’ testicles, about 20 centimeters in length, and of their abundant ejaculation, to the point of running down trees of up to 15 meters in height, after copulation, until reaching the ground. The fact that the females mate with so many partners means that no male spider monkey knows which are really its children. Nor do the children, in turn, know who their father is. They do not seem to mind.