

Without a Sound

During language acquisition, gestures seem vital to learning how to speak. They help us emphasize and structure what we say. **Simone Pika** from the Humboldt Research Group at the **Max Planck Institute for Ornithology** in Seewiesen wants to know whether gestures were an evolutionary precursor of human language and how they develop. To investigate this question, the researcher studies the communication strategies of great apes in natural environments, but also corvids and human infants.

TEXT **CATARINA PIETSCHMANN**

An incredible cacophony of vocalizations echoes through the rainforest, followed by hectic scurrying. Chaos is in the air. Baboons have hunted down a small antelope, but a group of chimpanzees immediately snatches away their prey. As Bartok, the alpha male, lugs the carcass around, some members of his group beg him to share some of the meat.

Bartok, however, wants to be the first to eat, so he settles down with the dead animal less than four meters away from the blonde woman. Simone Pika has been following the chimpanzees for quite some time during her daily treks through Uganda's Kibale National Park, and she can hardly believe that Bartok is sitting so close to her now.

Two males have the courage to approach Bartok and the scientist. While one of them simply sits down next to the alpha male, opens up his outstretched hand and then gently starts plucking at the antelope, the other male is less self-confident. Although he also sits down next to Bartok, he then

starts making begging and appeasement gestures: he ducks down, sways backwards and forwards, whimpers like a chimpanzee child, and makes a facial expression called a fear grin. The message: Don't hurt me, but give me some of that delicious stuff. And it works! Bartok tears the antelope apart and shares small pieces of the meat with both of them.

RESEARCHERS KEEP THEIR DISTANCE

"When you actually get to see something like this in the wild, you can't help sitting in the camp that night and just smiling from ear to ear," says Pika, thinking back to that day. Because unlike in the days of the young Jane Goodall, scientists no longer lure wild chimpanzees with food, but instead track them down in the rainforest day after day, guided by the animals' nests, feeding grounds and calls, all the while making sure to keep an observer distance of at least seven meters. Only in very rare and specific contexts, such as

the highly-aroused situation of hunting, do they not increase their distance from the animals when it falls below this minimum.

Yet Pika doesn't need to get any closer to film the gestures that are exchanged between the animals. The 43-year-old is the Leader of the Humboldt Research Group "Evolution of Communication" at the Max Planck Institute for Ornithology in Seewiesen. She wants to solve one of evolution's biggest mysteries: how did human language evolve?

According to one theory, our ancestors initially gesticulated with each other before using speech. That means they could have communicated simple information using gestures. "But, like many of my colleagues, I now believe this to be a rather unlikely scenario, because individuals use gestures to communicate with each other mainly

Like all great apes, gorillas also communicate via gestures. The animals use this form of communication mainly in relaxed settings and across short distances.



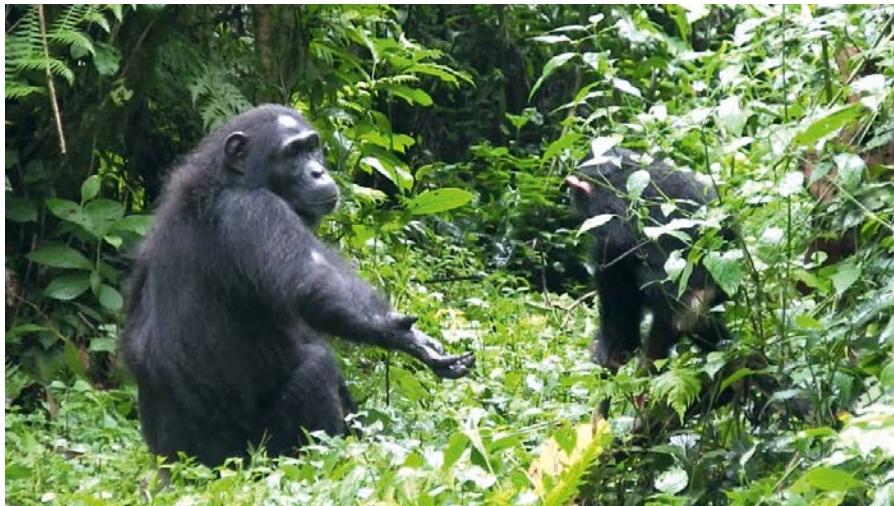
when they are in a relaxed setting and can touch or at least see each other,” says Pika.

But what if an animal wants to warn other members of its group of a predator, and the group is far away in the dense rainforest? “Then vocalizations are, of course, much more effective than gestures.” That is why most researchers now believe that calls and gestures evolved in parallel.

While writing her doctoral thesis under the supervision of Michael Tomasello at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Pika studied the gestures used by gorillas and bonobos in various wildlife parks and zoos across Europe. But is their behavior similar to that of their fellow apes living in the wild? Or do animals in captivity gesticulate primarily because they lack a natural environment and are constantly in each other's presence?

To find answers, the young researcher had to observe her subjects in their natural habitats. “In 2005, when I was given the opportunity to study a group of chimpanzees in Kibale National Park, nothing could hold me back. I will always remember that very first day: Not a single chimpanzee anywhere in sight, but the forest was filled with their calls, which are known as pant-hoots and can be heard hundreds of meters away. The wild chimpanzees called out much more frequently than their counterparts in captivity, indicating to us that calls play a very different role in natural habitats,” Pika explains.

Pant-hoots let chimpanzees know who is in which part of the forest and with whom. The animals also use these characteristic calls to claim rich feeding grounds for themselves. When greeting each other, they use quieter pant-grunts. Pika has observed that some animals also accompany these grunts with



gestures. In a new study being conducted with her postdoctoral fellow Dr. Eva Luef, the researcher is therefore aiming to find out whether chimpanzees, like humans, have certain greeting customs, and if so, whether these greetings vary depending on an individual's social rank within the group. Consequently, gestures would be relevant in situations in which humans, too, would talk to each other: in direct exchanges, when individuals are in very close proximity to each other.

In 2010, Pika received the Alexander von Humboldt Foundation's Sofja Kovalevskaja Award, which is endowed with 1.65 million euros. She uses these funds to study the evolution and development of communication in three different model groups: in children growing up in different cultures; in great apes, our closest living relatives; and in species that have a similarly complex social structure – corvids. Using this approach, Pika aims to determine the degree to which our ancestors had developed communication skills, and which factors are responsible for the fact that only humans are capable of speech.

Today, there is a scientific consensus that apes use gestures to communicate with each other. Pointing gestures, however, were considered to be an exclusively human trait until recently. Yet chimpanzees living in zoos have been observed to clearly point to highly desirable food, such as grapes and bananas, indicating to their keepers: I want that! It appears that chimpanzees and bonobos in captivity learn that they can bring a human's attention to a particular object by pointing at it, and that they will ultimately receive the object. This kind of exchange has only rarely been observed in nature, and only between friends or between mothers and their offspring.

GROOM ME HERE!

The pointing gestures that have been observed in chimpanzees living in their natural environments mostly occur in the context of animals grooming each other. Grooming is more than just a hygienic behavior: it plays an important role in establishing and maintaining social relationships. Simone Pika dis-

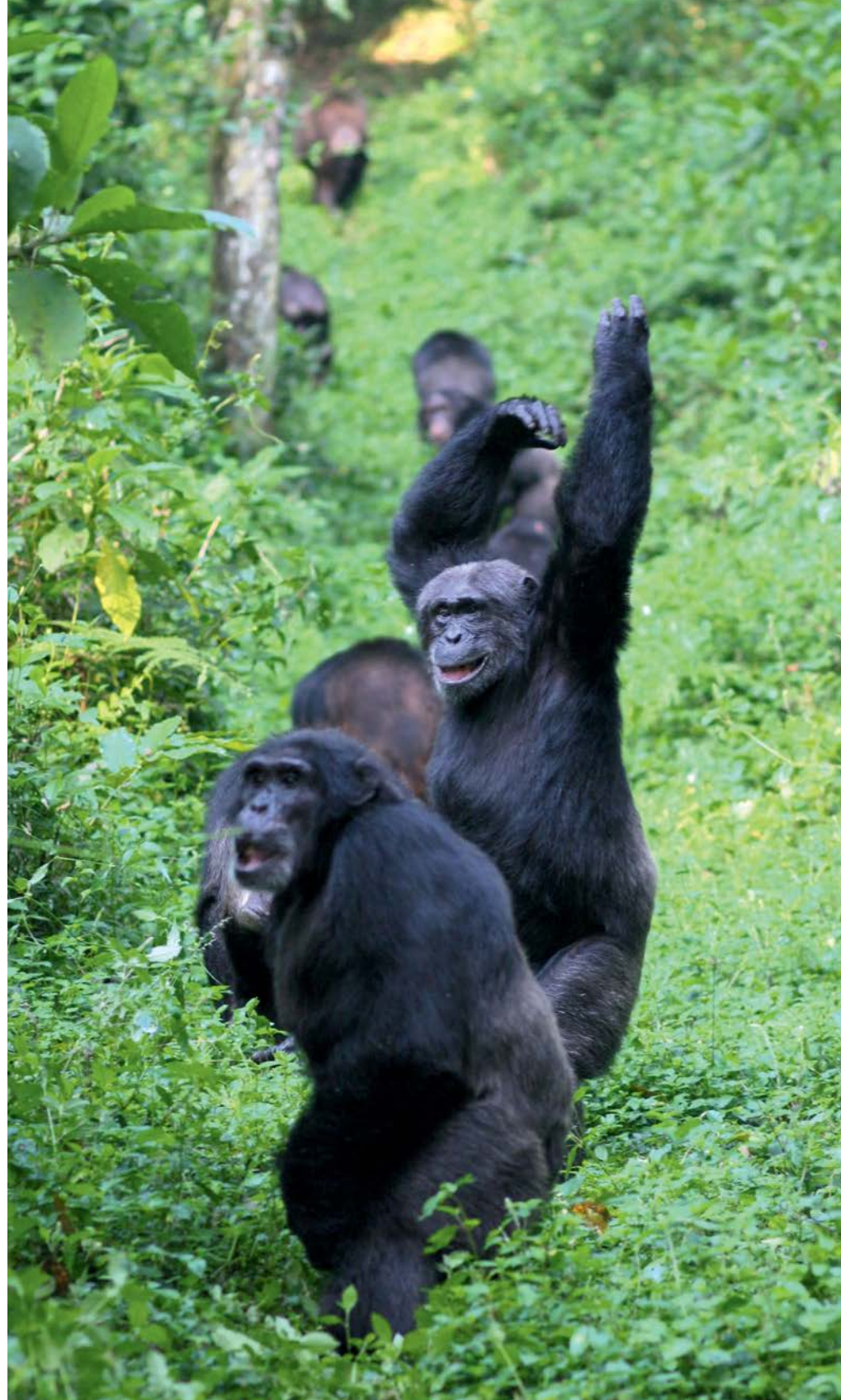
Left The more independent young chimpanzees become, the less their mothers carry them around. By stretching out her arm and making eye contact, this chimpanzee mother is telling her child that it's time to go to one of the safest places in the rainforest of Uganda's Kibale National Park: onto mom's back.

Right Chimpanzees use more than 100 different types of gestures. Some gestures are used by only one single member of a group. The male chimpanzee Dolphi, for example, raises his arms vertically above his head to signal to the alpha male (front) that he should follow the group.

covered that chimpanzees use distinct scratching gestures to let others know that they want to be groomed, but more importantly, they use them to signal where. "This means chimpanzees know that their counterpart understands the meaning of the gesture," says the Max Planck researcher.

Many species of birds also use referential gestures when performing courtship displays – despite the fact that birds and humans sit on two very divergent branches of the evolutionary tree. Ravens are a prime example: not only are they intelligent and capable of learning, but they also use objects as pointing tools. Pika discovered that ravens pick up objects with their beaks with the intention of offering or showing them to other group members, or to attract the attention of a potential mate. And sometimes they just want to scuffle with each other for it.

"Children do that too – and chimpanzees, surprisingly, don't. They do scuffle for things, but they don't hold up objects to show or offer them to others. In the case of chimpanzees, most gesture-based interaction doesn't in-



volve objects," says Pika. This indicates that apes use pointing gestures only to attract the attention of conspecifics, but never to inform them of something going on in their immediate surroundings.

Just like apes, ravens also groom each other – called preening – but only on the body parts that are out of their

own reach. They do so by scooting closer to their partner and presenting the part of their body that itches. Young birds also enjoy spreading their wings and sliding down a snowy slope on their backs. Normally, birds only lie on their backs when they are dead. Yet a raven lying on its back is sending a dif-



ferent message: I can afford to lie in this crazy position because I am strong and healthy! Ravens are also known to make kicking gestures with their feet.

The pointing gestures displayed by ravens and apes are therefore a typical case of parallel evolution, because the two different species can't have learned this behavior from a common ancestor. "Studying ravens helps us uncover such examples of similar yet independent evolution and understand the reasons why gestures evolved. After all, not everything that humans and apes

do was necessarily done by our common ancestors," says Simone Pika.

Humans use vocalizations to communicate from the day they are born – sometimes much to the chagrin of exhausted parents. But even for babies and toddlers, gestures are a key communication tool before they learn to speak. To date, though, very little research has been conducted in this area. Pika, now the mother of an almost two-year-old daughter, was sensitized to this topic as a result of her work with great apes and wanted to find out more.

That's why, four years ago, when she started to work at the Max Planck Institute in Seewiesen, she set up a playroom for toddlers in a lakeside building that legendary behavioral scientist Konrad Lorenz once used to observe wild geese. Together with the members of her working group, Pika studied how toddlers communicate with their parents from the age of five and a half months until the time at which they are capable of saying three words.

Very early on, children utter sounds that appear to be questions. At the age of nine to twelve months, most toddlers start using pointing gestures. "Initially, they point at something without making sure that others attend to their gestures. Maybe they do it because the gesture helps them internalize something and structure their thoughts," says Pika. Only later in their development do children also establish eye contact with their parents when pointing to an object they want, as if to say: This teddy bear, I want, Mommy!

Gestures help children learn to speak. But why do adults gesticulate? For one

PARENTS, JOIN IN THE RESEARCH!

First sounds, then gestures, and then finally the first words! Simone Pika and her assistant Monika Krug developed a speech calendar for parents who wish to record the stages of their child's language development from the ages of 0 to 24 months. Parents interested in participating in this study have the option of anonymously taking part in the "Milestones of Language" study, which started in November 2015 and runs until the end of 2017.

For more detailed information and the download version of the language calendar, please visit www.orn.mpg.de/milestones

Left Ravens are very social animals. Similar to apes, these birds also strengthen and nurture social relationships by preening distinct body parts.

Right Simone Pika studied the gestures used by individually marked ravens living in a raven colony at the Cumberland Wildlife Park in Grünau, Austria. In Seewiesen, she works with captive and hand-raised ravens to find out more about how their communicative signals evolve.



thing, we talk with our hands to help our conversation partner visualize what we're saying. "But we also do it for ourselves. This is evident from the fact that gestures are always formed before or while the respective word is being uttered. Our hands communicate an idea faster than our mouth does," the scientist explains. Gestures help us structure our thoughts. This is commonly observed in toddlers: the more difficult the subject, the more illustrative gestures they use.

From 2003 to 2005, Simone Pika studied an interesting phenomenon at Edmonton University in Alberta, Canada: gestures used by bilingual adults. Do people gesticulate differently in their mother tongue than they do in their second language? Yes – especially when they are more fluent in their native language. In that case, people tend to use more visual gestures when speaking their second language. The study also revealed that, when learning a language that traditionally uses a lot of gestures, a person will soon start gesticulating more in his or her mother tongue, as well.

The first researcher to compare the evolution of communication in humans and apes was Russian scientist Nadezhda Ladygina-Kohts. She discovered that a child's first attempts at speaking include gestures and facial expressions that are surprisingly similar to those of baby chimpanzees. At that time, several attempts were made to raise baby apes like human children in a normal household. A gorilla named Toto, for example, lived with a family in Central Africa for nine years. Yet all efforts were in vain – none of the animals ever learned to speak. Today we know that the anatomy of the larynx and its neural connections with the tongue prevent monkeys and apes from producing complex sounds, let alone words.

PIONEERS OF THE FIELD

In the late 1960s, scientists were able to teach a female chimpanzee named Washoe more than 300 signs in American Sign Language. Washoe used sign language to communicate not only with her trainers, but also with her adopted son. And she combined signs on her

own to form new meanings: the first time she saw a duck, for example, she signed "water" and "bird."

The gorilla Koko and the orangutan Chantek also learned sign language. A bonobo named Kanzi is able to use a keyboard with symbols that stand for – but do not resemble – particular objects. When he is in the mood for pizza, for example, he presses the pound symbol. The key with the triangle on it stands for "banana."

"But these are isolated cases. Very rarely did the animals create new words using the basic vocabulary they were taught. Furthermore – and I believe this is highly significant – most of their communication dealt with themselves in the present moment in time: I want to eat, I want to play, let's go out to the garden," says Pika. Unlike humans, she explains, chimpanzees and other great apes don't communicate their thoughts about what happened yesterday or what will happen tomorrow.

So anatomical features aren't the only reason apes are incapable of speech. They don't seem to possess a world of thought that they can or want to pass

» A comparison of the complexity of vocalizations and gestures produced by great apes doesn't help explain the evolution of language.

on using language. For them, gestures are thus an efficient form of communication without symbolism. However, it does bear a certain resemblance to human language and human communication in terms of the underlying structure of communication, which includes cooperation, turn-taking behaviors and negotiation.

In the animal kingdom, it is birdsong that comes closest to the complexity of human language, especially as regards the ability to learn and form new combinations: Songbirds and parrots are able to recombine individual notes and note sequences to create new verses. Moreover, they imitate notes, voices

and sounds, such as mobile phone ring-tones or the noise of a revving engine.

However, birds don't appear to use their songs to communicate something new to their conspecifics. "The main message of birdsong is: 'This is my territory!' and 'Look how impressive I am!'" says Pika. Consequently, this is another communication structure that differs significantly from human language in many respects.

BONOBOS COMMUNICATE FASTER THAN CHIMPANZEES

Back to gestural signaling of great apes: in a comparative study into the communication strategies of wild chimpanzees in Uganda and Ivory Coast and bonobos in the Democratic Republic of the Congo carried out with her doctoral student Marlen Fröhlich and other colleagues, Pika discovered that there are even differences in the way closely related species – such as chimpanzees and bonobos – communicate. The scientists discovered that bonobo mothers and their children exchange information faster and more fluently than chimpanzee mothers and their offspring.

Temporal relationships between social actions involved in bonobo gestural sequences are more similar to social actions in human conversations than to those of chimpanzees. For example, when a bonobo mother wants to get up and leave, she turns toward her child and holds out her outstretched arm in the child's direction. Almost simultaneously, the offspring walks up to her and climbs onto her back. In other

words, the recipient of the gesture responds even before the entire message has been conveyed.

In the case of chimpanzees, in contrast, communication between mother and child is often characterized by longer negotiations: the mother turns toward her child and extends her arm in its direction. They both look at each other. The mother moves her arm in the offspring's direction once again, but this time faster and using a shorter range of motion. Only now does her child walk up to her and climb onto her back.

These observations may indicate that bonobos anticipate their counterpart's actions much more quickly than chimpanzees. Or that they can simply afford to react more quickly, thus possibly choosing a "wrong" response, because their society is more tolerant and less aggressive. Furthermore, the females have greater influence. These different communication styles correspond to the results of comparative studies that focus on the structure of the brain: the regions that play an important role in the ability to feel empathy are more developed in bonobos than in chimpanzees.

In light of her findings, Simone Pika concludes that, "The similarities and differences between the vocalized sounds and gestures of our closest extant relatives won't help us solve the mystery of how language evolved. Language is based on a range of cognitive skills that already existed before the advent of speech."

One of the prerequisites for acquiring language is what is known as interactive intelligence. When we talk to each other, we continuously alternate: one person speaks, the other listens, then the listener replies, and so on. A conversation is like a game of ping-pong, where questions and answers fly



When toddlers point at something, they initially do it for themselves. A little later in their development, they learn that gestures can convey distinct messages to others. They then start making eye contact with their parents to make sure they have their attention.

Simone Pika studies the development of communication in individuals from three model groups: human children from different cultural backgrounds, several species of great apes (bonobos, chimpanzees and gorillas) and corvids (crows and ravens). Her findings show that gestures are particularly developed in social animals that cooperate with members of their own species.

back and forth; a game based on a specific set of rules as regards the roles of the participants and the temporal sequence. The speaker and the listener cooperate with each other – otherwise, their communication would fail.

Can precursors of this type of cooperation be observed in apes? “Clearly, yes,” says Pika. When a mother plans to leave and wants her child to come with her, she must make it clear that the gesture is directed at her infant, and also make sure that her offspring understands what she intends to communicate. Without such communicative cooperation between mother and child, such an interaction would not work.

So animal communication is essentially not all that different from human communication with regard to the type and purpose of the exchange. Yet animals appear to manage just fine without language. Would it even be advantageous for chimpanzees if they could speak? Simone Pika nods. “Of course. Language has virtually catapulted us into a new universe: We can think about symbols and exchange information about objects that aren’t in our immediate vicinity or that don’t even exist, about things that happened yesterday or that might happen tomorrow.”

Moreover, language is the foundation of writing. Writing allows us to record our experiences and pass them on to our descendants. This ensures that our knowledge doesn’t get lost, and that



it grows from generation to generation. “There’s no doubt about it: language makes us humans one of the most powerful species on earth,” Pika emphasizes.

But what if evolution had taken a slightly different course? What if gorillas and chimpanzees had acquired this

skill before we did? Is the thought of a distant planet in another galaxy where apes actually are in charge really just science fiction? If not, we can only hope that they treat their closest relatives with greater respect than we treat them here on earth. ◀

TO THE POINT

- **Gestures foster human language:** they help babies learn to speak. Adults use gestures to emphasize what they say and to structure their thoughts.
- **Gestures alone are not the precursors of human language.**
- **Many different species of animals also communicate using gestures.** Great apes and ravens even point at things to draw the attention of other members of their species to particular objects.

GLOSSARY

Bonobos: Along with chimpanzees (*Pan troglodytes*), bonobos (*Pan paniscus*) are our closest extant relatives. Although they are also called pygmy chimpanzees, they are almost the same size as chimpanzees. However, their body and head are more graceful, their face is darker, and the mouth of bonobo children has a more reddish hue than that of young chimpanzees. Bonobos are found only in the Democratic Republic of the Congo, south of the Congo River.

Pant-hoots: These particularly loud calls emitted by chimpanzees can be heard in the rainforest from miles away. The calls generally consist of several elements, which can vary in their structure. Chimpanzees can recognize each other by their pant-hoots and use this distinct call in different contexts, such as when traveling through the rainforest or arriving at rich feeding grounds.