

# My Dog Can Do It!

As far as cognitive scientists are concerned, the children's game "I spy with my little eye" is anything but child's play. It is based on the assumption that the person whose turn it is can imagine what the other players are able to see – or not. But do dogs and apes, for instance, also share this ability? At the **Max Planck Institute for Evolutionary Anthropology** in Leipzig, scientists study social cognition factors in different species.

TEXT **BIRGIT FENZEL**

**T**heory of mind is the scientific term for the art of mind reading. This ability enables people to apprehend others as individuals with their own perceptions, feelings and thoughts and, based on this, to imagine what is going on with them. For researchers, the theory of mind is one of the cornerstones of learning and teaching, and therefore also of the emergence of culture – one need only think here of the role imitation and demonstration play in the passing on of knowledge in the context of language acquisition.

It was long assumed that the theory of mind was a uniquely human ability that developed over the course of evolution. However, scientists working with Michael Tomasello in the Department of Developmental and Comparative Psychology at the Max Planck Institute for Evolutionary Anthropology in Leipzig observed that chimpanzees also display some of the key features of this ability to perceive the perspectives and intentions of others. In order to find out what apes know about the perceptions of their group members, psychologist Josep Call exploited the extreme food possessiveness displayed by ape house

inhabitants in the Wolfgang Köhler Primate Research Center by concealing pieces of fruit in the enclosure. The lower orders actually dared to take the extra portion only when they had observed that the alpha male had either not noticed the food being hidden or did not have the food in his field of vision.

## POINTERS FOR THE EVOLUTIONARY BIOLOGISTS

This relativizes the hitherto accepted belief that the theory of mind is an exclusively human ability. But how much do apes actually understand about the state of knowledge of others? Is it possible that they are able to use pointing gestures or other referential indications in communicative contexts? "These questions are extremely fascinating for us," says biologist Juliane Bräuer, who researches the social cognition in various animal species in Tomasello's department. "The comparison between the different species provides us with insight into ourselves and what has changed in the course of our development. After all, how human cognition developed during the course of evolution is one of our big questions."

Humans are thus endowed with the ability to put themselves in the perception and action perspectives of others, and this ability plays a major role in early childhood language acquisition. The child learns the names of objects from the mother or father by pointing to them. It is now also assumed that gestures actually lie at the root of language: the sounds and words only followed after the pointing.

However, as Call and his colleagues discovered to their amazement while researching at the Wolfgang Köhler Primate Research Center, the great apes did not follow even the broadest of hints: a series of studies with hidden pieces of fruit showed that pointing does not work in human-ape communication – the apes clearly do not understand what their human test partners want to tell them when they point to a certain container. Based on these findings, it appeared that the ability to interpret communicative gestures is a talent exclusive to *Homo sapiens*. If man's closest relation in ontogenetic terms cannot understand pointing gestures, who can? The answer came from an unexpected source: "My dog can do it!" claimed then doc-



Practice makes perfect – also in the way dogs observe people. According to research, this is not the only communicative skill aimed at humans with which dogs have become experts over a period of 15,000 years.

» Millennia of domestication have transformed dogs into communication professionals with an extensive repertoire of skills.



At best, apes, like this orangutan, would puzzle at communicative gestures such as pointing.

toral student Brian Hare (MAXPLANCK-RESEARCH 2/2006, page 70 ff.).

With this off-hand comment, Hare landed himself a commission to carry out his own research project. It quickly emerged that his dog was not the only extraordinarily gifted canine communicator that was able to interpret human pointing gestures. As had been done in the ape house, the “object-choice test” was used here, too. The dogs were presented with two identical upturned containers, only one of which contained a dog biscuit. The dogs could not have known which container concealed the biscuit as they had not seen it being hidden.

Their human test partner then pointed to the container with the interesting content. After this, the dogs were allowed to choose, and did so, by touching the container of their choice with their noses or paws. If they chose

the correct one, they were rewarded with the contents; if they chose the wrong one, they were left empty-handed. To ensure that the dogs were not being led by their sensitive noses, a control condition was carried out in which there were no referential clues to the correct container. “If the animal made alternately correct and incorrect selections in this case, it was clear that it was not able to smell the food,” says Juliane Bräuer, explaining how Hare’s claim was put to the test.

This study alone revealed that Brian Hare’s claim was no empty promise. The dogs showed a clear preference for the container to which the human had pointed: the unspoken message had clearly been heard. “Hare’s article about dog cognition was published in 1998,” explains the 33-year-old biologist. She herself has been working at the Max Planck Institute since 1999 and wrote her graduate diploma thesis there in 2002. Around the same time, a group of researchers in Budapest were exploring the question as to how human gestures can be of use to dogs.

#### FROM LAST CHOICE TO TOP OF THE CLASS

The scientific community was initially somewhat lukewarm in its reception of the studies carried out in Leipzig and Budapest. “Hardly anyone had any interest in dogs. They were seen as unsuitable test subjects because they live in an unnatural environment. And it was believed that the results of such studies did not reflect their true nature,” says Bräuer, explaining why dogs had moved into research’s blind spot.

Moreover, dogs had long been dismissed as “incomplete” wolves, as they no longer possess many of the skills of their ancestors who did not live in captivity. For example, their sense of smell and hearing are significantly less acute than those of their self-sufficient wild forebears. Nonetheless, even in the earliest of the behavioral studies carried out in Leipzig, the very species that had supposedly become degenerate through domestication astonished researchers with its cognitive and social skills, and emerged from many comparative studies as the new top student who easily outperformed the primates in Pongoland.

But how can a dog do this? Do they learn gestures like a “foreign language” as puppies through their close association with humans? Or could this ability even be innate? To find out, doctoral student Julia Riedel and her colleagues carried out the object-choice test with young dogs ranging between 6 and 16 weeks of age. In order to exclude the possibility that the puppies were simply trying their luck with the container nearest to the hand of the person making the gesture – it is a well known fact that hands are of great interest to dogs – an additional condition was added to the study that forced the dogs to move away from the hand to reach the containers.

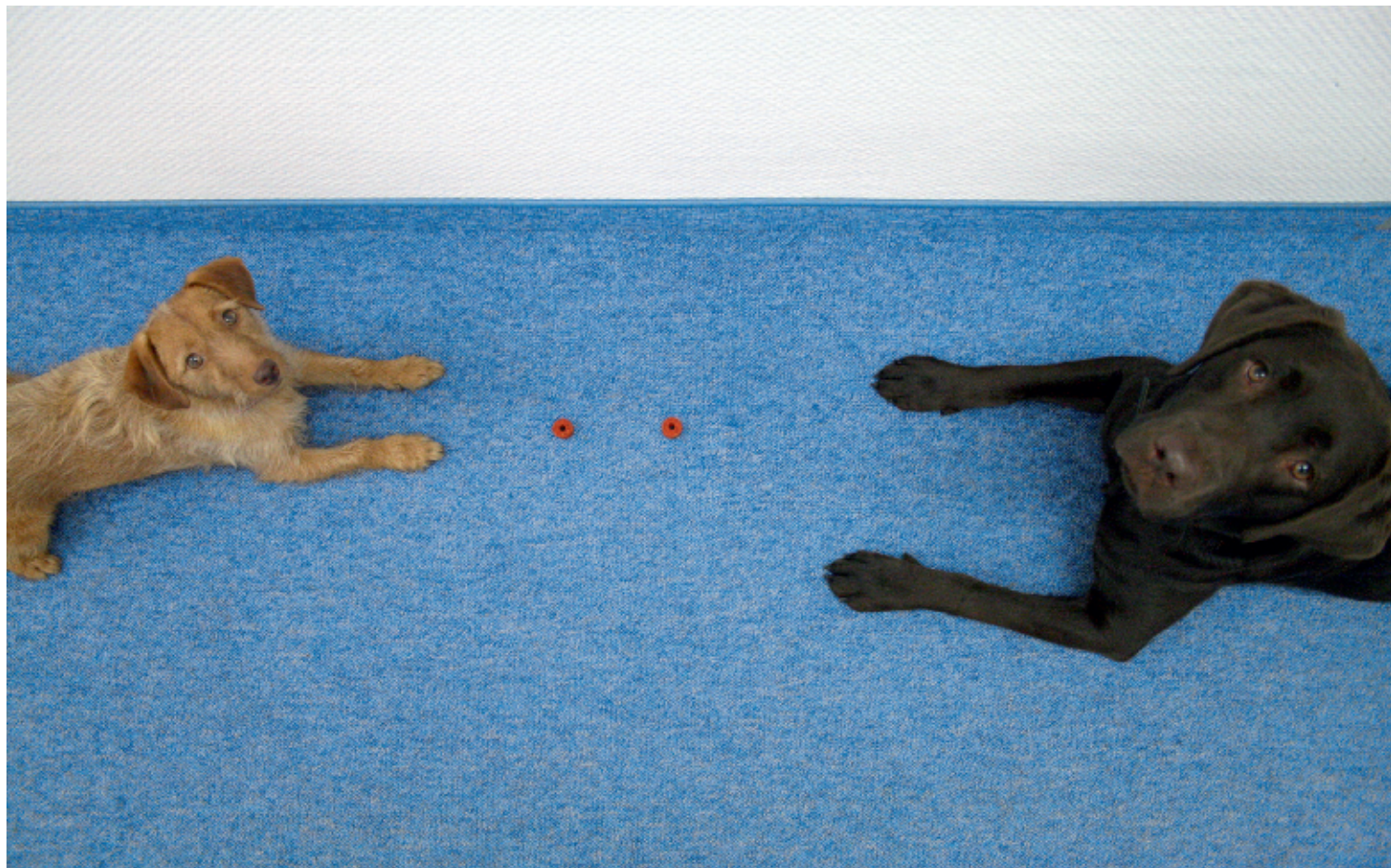
“Puppies of all age groups interpreted the pointing gesture as an indication of hidden food equally well, and selected the correct container,” reports Riedel. This result was an indication that the ability to follow human communicative gestures does not have to be learned by dogs but is innate. “This,





Two containers, one biscuit, no trace of a smell. Even without using their noses, dogs of all breeds were immediately able to establish where the reward was hidden. Unlike the apes, they instantly understood the pointing gesture.





The command “stop” is valid only as long as a person is watching them. In the studies, the dogs were always obedient when the human gaze was directed at them – and almost always stole the treat when they felt unobserved.

in turn, suggests that millennia of domestication played a crucial role in its emergence.” The observation is further corroborated by studies with hand-reared wolves that, despite also being used to humans and their forms of expression, do not understand pointing.

How well dogs actually know what others can and cannot see was demonstrated by a different study that Bräuer developed with her colleague Juliane Kaminski. The idea for the study was inspired by Bräuer’s dog Mora. When out on a walk one day, Mora discovered a thoughtlessly discarded sandwich and viewed it as a welcome addition to her menu. On hearing the command “stop” she obediently dropped her loot and was accordingly praised for this action by her owner. However, as soon as Bräuer turned around, Mora immediately grabbed the sandwich again and quickly devoured it behind her owner’s back.

“The most interesting studies are always those that relate directly to the way in which the tested animal lives,”

says the Max Planck researcher. As most dog owners can confirm, what she had experienced in the park with her dog was very typical of everyday life with the domestic canine: the dog is not allowed on the sofa or bed, but immediately sits on it as soon as he feels unobserved; the dog should stay in its basket, but jumps out as soon as its master leaves the room; the dog is not allowed to take food from the table, but as soon as it is alone in the room, the chocolate is devoured.

### **GOOD BEHAVIOR IS ALWAYS A QUESTION OF VANTAGE POINT**

The design of the study in the dog bungalow, with which Bräuer and Kaminski aimed to establish whether dogs know what others can see, was comparatively simple. To begin with, a treat was placed at the dog’s feet. The humans forbade the dogs to eat it using the usual command. The humans then varied their behavior. On one occasion,

they merely turned away and then left the room entirely; another time, they sat on a stool and played with a Game-boy. “In each case, their attention was not directed at the dog,” Kaminski says, describing the most important condition of the study. Only in the control condition did the humans actually look at the dogs. Each round took exactly three minutes.

“Admittedly, it was not a particularly pleasant test for a well trained dog,” concedes Bräuer. “But under the right conditions, it was ultimately able to ignore the ban, just as my dog had done in the park.” And Mora’s conspecifics did, indeed, behave in exactly the same way as she had. Instead of sitting there obediently, merely enjoying the view of the treat, they quickly stole the food when they felt unobserved. However, they almost never took it when they were watched by their human test partner.

“We can conclude from these results that dogs can distinguish whether a person is watching them or not, and



This study showed that dogs understand the perspective of humans. In most cases, they brought the toy that lay behind the glass barrier. They obviously knew that their test partner could see only that toy, and that the "bring" command could relate only to it.

that they behave differently on this basis," says Juliane Bräuer. A particularly interesting observation that also emerged from these studies is that dogs can also distinguish between open and closed eyes – a remarkable skill.

However, the two researchers did not want to accept these results alone as proof that dogs actually understand what a human can or cannot see in such situations. After all, the dogs may simply have reacted to the eyes of their partners because they have learned that humans are always attentive when their eyes can be seen. To find out whether or not dogs actually understand this cognitive change in perspective, the two researchers embarked on a further series of studies. This time the test took the form of a play situation with two toys that they placed on the floor between the human and the dog. Then they placed a barrier in front of each toy: one barrier was opaque and blocked the human's view of the toy, while the second was transparent and gave a clear view of

the toy. Both objects were equally visible to the dog, which sat on the other side of the barrier.

### RECORD VOCABULARY WITH OVER 200 WORDS

The human participant then asked the dog to bring one of the toys to her using the command "bring" – without, however referring specifically to the toy. If the dogs could understand anything about the person's perspective and what she could see, they would display a preference for the toy behind the transparent barrier, as this was the only one in her field of vision. Therefore, the command could refer only to the toy behind the transparent barrier. If, however, the dog reacted only to the eye as stimulus, it should not show a preference for either of the two toys, and carry each of them to the person with equal frequency, because it would perceive the latter's eyes in conjunction with both toys.

The dogs in fact opted more frequently for the object in front of the transparent barrier. However, it was entirely possible that the dog simply showed a preference for the transparent barrier, for example because the toy looked brighter there or because it had in this way a better view of the human while he carried it. For this reason, the study was supplemented with two further control conditions in which the dog should not have shown any preference for either of the two toys.

In one condition, the person was able to see both objects because she was sitting at the dog's side; in the other one, she could see neither of them because she was sitting with her back to the set-up. The dogs displayed a certain preference for the transparent barrier when the human was turned away from them; however, their greatest preference was reserved for the case in which the human sat opposite and really saw only the toy behind the transparent barrier. "This result could mean





Dogs not only bring objects that are indicated to them by name, they can also distinguish known from unknown objects by a process of exclusion, and in this way learn new words. On request, they also retrieve objects that are shown to them in photos or as miniatures.

that dogs actually do understand, to a certain extent, what humans can see," says Juliane Kaminski.

Whether or not dogs make ideal partners for the game "I spy with my little eye" remains unclear. However, there can be no doubt that they possess the basic skills necessary to play it. Bräuer, who came to work with dogs through her research on apes, has been the scientific coordinator of the dog research for two years, and coordinates ongoing projects with Susanne Mauritz. She enables interested dog owners to register their interest in participating

in the observational studies through media appeals. "People are happy to come to us because they are curious to know what their dogs can actually do, and because they know that we will take good care of the dogs, and challenge them mentally," says Mauritz.

Over the years, the two researchers have gotten to know some particularly gifted dogs that not only are very good at interpreting human gestures and looks, but that also have an astonishing passive vocabulary. "Some can identify several hundred objects by name," says Kaminski. The unbeaten

champion in this particular discipline was Rico, a nine-year-old Border Collie who could recognize and classify over 200 toys by name.

Kaminski and her colleagues carried out a study to investigate whether Rico could learn the names of new toys through a process of exclusion. To this end, they distributed new and known toys in a room while the collie waited in an adjacent room with his owner. He was then asked to bring a toy to the owner, the name of which he had never heard and which he had never seen before. Rico did, in fact, solve this task

» None of this is a question of intelligence, but of optimum adaptation to living conditions in the evolutionary sense.

right off the bat, dismissing another theoretical human USP in one fell swoop: this manner of learning labels for objects, which is known as fast-mapping, was also previously considered to be an exclusively human skill.

## WHAT DOGS REVEAL ABOUT HUMANS

As further studies revealed, Rico is a particularly gifted linguist, but his talent is by no means unique in the canine world. Other representatives of his species almost equaled him in terms of vocabulary. The fact that the best results were achieved by other Border Collies gave the researchers some food for thought. Whether this talent is a particular feature of the Border Collie breed is a fascinating question that remains open, reports Susanne Mauritz. "However, we avoid the term intelligence when we speak about our research."

Instead, the focus is on identifying the special cognitive capacities that an animal species possesses and that are necessary for its survival. This is, above all, a question of specialization and evolutionary adaptation. For example, although dogs mostly achieved better results than other animal species in the studies on human-dog communication, they encountered greater difficulties in studies that required social learning through imitation or the resolution of problems by understanding causal links.

The apes, however, performed particularly well in these tests. When the researcher shook the container contain-

ing the reward, it was immediately clear to the ape that there had to be something inside it. The dogs, on the other hand, were unable to draw conclusions about the contents from the noise. "It is easy to explain these results. They are indicative of the environment in which both species must survive," explains Juliane Bräuer. Due to the enormous competition for food that prevails in groups of apes, an ape would never dream of showing a fellow group member a source of food. Causal understanding, however, is helpful in the search for food in the tropical forest. By shaking a nut, the ape can establish whether it is worth cracking.

Dogs, on the other hand, do not have to worry about looking for food or other problems of this nature. They live with humans who provide for their needs. It is, however, an advantage for them to understand humans as well as possible. As a result, dogs have developed into real communication professionals over the past 15,000 years.

The Leipzig-based researchers are particularly interested in cognitive talents of dogs that are otherwise found only in humans, such as understanding pointing gestures. "This particular canine skill could, perhaps, provide us with information about our own development," hopes Bräuer. "For example, information about what natural selection may have influenced in us humans. It is very likely that we encouraged the friendly, attentive dogs who established contact with us. It is possible, therefore, that in the course of human evolution, friendly individuals succeeded in asserting themselves,

thus fostering in humans an extremely pronounced willingness to cooperate."

The question as to whether such conclusions may be drawn from the skills of the dogs remains purely speculative. However, the work being carried out by the Max Planck scientists may well help in clarifying some of the mysteries that surround human evolution. ◀

## GLOSSARY

### Cognition

Cognition means the faculty of knowledge. It refers both to the mental processes in which individuals engage, such as thoughts, opinions, desires and intentions, and to information-processing operations, such as problem-solving and language. These operations enable individuals to flexibly adapt their behavior and to learn from their interaction with their environment.

### Ontogenesis

This term describes the development of the individual and his characteristics in the biological and psychological sense. Unlike phylogenesis, which refers to the emergence and development of a species, ontogenesis it is limited to the development of the individual.

### Pongoland

The Wolfgang Köhler Primate Research Center ("Pongoland") is a project of the Max Planck Institute for Evolutionary Anthropology and is operated in collaboration with the Leipzig Zoo. The research carried out at the Center focuses on the behavior and cognition of the four species of great apes: chimpanzees, gorillas, orangutans and bonobos. Not only can visitors to the zoo observe the animals in interior and exterior enclosures, they can also observe the work being carried out by the scientists.