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Research & Books

From the issue dated April 15, 2005

Clever Canines

Did domestication make dogs smarter?

By COLIN WOODARD

Budapest, Hungary

Vilmos Csányi's department has literally gone to the dogs. Canines have the run of the place, greeting visitors in the hall, checking up on faculty members in their offices, or cavorting with one another in classrooms overlooking the Danube River, six floors below.

And, not infrequently, they go to work in the laboratories, where Mr. Csányi and his colleagues are trying to determine just how much canine brains are capable of.

There are no cages at Loránd Eötvös University's department of ethology, the study of animal behavior. And why would there be? asks Mr. Csányi, the department's founder and chairman. "The human world is the dog's natural environment," he says, as a gregarious adolescent mutt pokes into the office, wags his tail, and leaves. In adapting to our environment, Mr. Csányi argues, our best friends have acquired a remarkable number of mental traits that closely resemble our own.

Mr. Csányi's team has been studying canine cognition for the past decade and, in the process, has built a body of experimental evidence that suggests dogs have far greater mental capabilities than scientists have previously given them credit for. "Our experiments indicate a high level of social understanding in dogs," he says.

In their relationship with humans, dogs have developed remarkable interspecies-communications skills, says Mr.

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Csányi. "They easily accept a membership in the family, they can predict social events, they provide and request information, obey rules of conduct, and are able to cooperate and imitate human actions," he says. His research even suggests that dogs can speculate on what we are thinking.

The latest findings to come out of the department suggest that dogs' barks have evolved into a relatively sophisticated way of communicating with humans. Adam Miklósi, an ethology professor, set out in a recent experiment to see if humans can interpret what dogs mean when they bark. He recruited 90 human volunteers and played them 21 recordings of barking Hungarian mudis, a herding breed.

The recordings captured dogs in seven situations, such as playing with other dogs, anticipating food, and encountering an intruder. The people showed strong agreement about the emotional meaning of the various barks, regardless of whether they owned a mudi or another breed of dog, or had never owned a dog. Owners and nonowners were also equally successful at deducing the situation that had elicited the barks, guessing correctly in a third of the situations, or about double the rate of chance.

For many dog owners those may not sound like particularly surprising findings, given that people talk to their dogs all the time, expect their instructions to be followed, and apparently receive information back from their pets. But in scientific circles, animal-cognition studies have largely ignored dogs, focusing instead on closer human relatives, like chimpanzees and gorillas. Dogs, as a result, have not been considered very brainy.

Until recently, dogs were thought to be intellectually inferior to wolves. A study published in 1985 by Harry Frank, a psychologist at the University of Michigan at Flint showed that wolves could unlock a complicated gate mechanism after watching a human do it once, while dogs remained stumped, even after considerable exposure. This led some in the field to conclude that dogs' intellectual capacity diminished during domestication.

The Inhibited Animal

That never sat well with Mr. Csányi who, like many in dog-loving Hungary, had dogs of his own. Dogs, he suspected, were simply more inhibited than their wild

cousins, requiring permission from their masters before doing something as rash as opening a gate, which they may have regarded as a violation of their master's rules. So eight years ago, he and his colleagues conducted a problem-solving experiment of their own. With their masters present, 28 dogs of various ages, breeds, and levels of training had to figure out how to pull on handles of plastic dishes to obtain meat on the other side of a wire fence. Regardless of other factors, the dogs with the strongest relationship with their owner scored worst, continually looking to their owners for permission or assistance. The best results came from outdoor dogs, who obtained the food, on average, in one-third the time. Most telling, when owners were allowed to give their dogs permission, the gap between indoor and outdoor dogs vanished.

That made the researchers wonder what else the dogs could accomplish by taking cues from people. Chimpanzees, our closest relatives, have been shown to follow a human's gaze, but they do very poorly in a classic experiment that requires them to extract clues by watching a person. In that test, a researcher hides food in one of several containers out of sight of the animal. Then the chimp is allowed to choose one container after the experimenter indicates the correct choice by various methods, such as staring, nodding, pointing, tapping, or placing a marker. Only with considerable training do chimps and other primates manage to score above chance.

Dogs, however, performed marvelously, and even outdoor dogs with no particular master could solve the problem immediately. (The researchers controlled for the scent of the food.) By 2001 a raft of experiments by Mr. Csányi's team and another led by Michael Tomasello of the Max Planck Institute for Evolutionary Anthropology, in Leipzig, Germany, showed that dogs were far more skilled than either chimps or wolves at using human social cues to find food. Those results left researchers with this question: If dogs can pick up on human cues, do they turn the tables and put out cues for humans to understand?

To find out, Mr. Csányi and Réka Polgárdi, a graduate student, went to the homes of Budapest's many dog owners. After introducing the researchers to the dogs, the owners would leave the room. Then the dogs would watch Mr. Csányi hide a piece of food somewhere inaccessible to them. When the owners returned, the dogs would run or glance back and forth from master to

hiding place, clearly signaling its location. More-recent experiments substituted nonfood objects and had similar results, which suggests the dogs may be placing themselves in their owner's shoes, and realizing that the humans are ignorant of the object's location.

The Hungarian researchers also discovered that dogs excel at imitating humans. In one of the laboratories down the hall from Mr. Csányi's office, Zsófia Virányi, a post-doctoral researcher, demonstrates with Tódor, an enthusiastic little mutt that she hand-raised to serve as a member of a control group for another experiment. Tódor sits attentively as Ms. Virányi spins around in a circle and comes to a stop. "*Csinal!*" or "you do it!" she says, at which Tódor does a little 360 on the tiled floor and lets out an enthusiastic bark. He easily imitates Ms. Virányi's bowing and lifting an arm (or paw, in his case). But he gets confused when she produces two buckets each containing a block, and lifts one out, then asks Tódor to do the same. Amid a chorus of yelps and barks, he pokes his nose in and out of the buckets.

"Some dogs find the bucket trick very easy; others have a hard time turning around," Ms. Virányi explains as Tódor lies down on the floor and watches the surrounding humans with what appears to be good cheer. "He's very concerned about breaking things, so he doesn't like it when the block or bucket moves because of his actions."

In the experiments, some dogs could imitate previously unseen actions performed by a person they hadn't had close contact with. Other dogs could learn how to operate a simple ball-dispensing machine after watching humans do so, a finding that won Mr. Csányi's department one of its two awards from the American Psychological Association.

"We thought it would be very difficult for dogs to imitate humans because chimps have great difficulty with it, despite having much larger brains," Mr. Csányi says. "But it turns out they love to do it. This is not a little thing because they must pay attention to the person's actions, remember them, and then apply them to their own body. ... No other animal could do this."

Wolves Without Manners

So where did dogs acquire the ability and motivation to observe, imitate, communicate with, and behave like people? In the computer lab, Mr. Miklósi, the ethology

professor, shows videos that he believes provide part of the answer.

Two years ago, Ms. Virányi and other graduate students began hand-raising a group of wolf cubs. They cuddled and hand-fed them, took them for walks and played with them, while other students raised dog puppies of the same age. Dogs descended exclusively from wolves some 15,000 to 135,000 years ago, according to genetic studies, and the researchers wanted to see if wolves could be socialized to communicate with people.

At five weeks of age, the wolf cubs were introduced to a room containing their hand-raiser and an adult dog, both sitting motionless, and the human staring into space. Mr. Miklósi shows a video of what happened: A gawky wolf cub stumbles awkwardly up to the dog, sniffs it a bit, then does the same to the human before climbing into the person's lap and going to sleep. No eye contact is made with its caregiver; the cub appears to treat the person like a comfortable piece of furniture.

Mr. Miklósi's next video shows a dog puppy wandering into the same situation. It too wanders over to the dog for a sniff, but then waddles over to its caregiver, stares it in the face and begins yipping for attention. When the caregiver remains motionless the dog wags its tail, barks, and begins licking the person, trying to establish contact. It then sits down in front of the caregiver, ears up, apparently waiting for contact.

A similar pattern emerged in tests of young adult dogs. In one, the subject is given the opportunity to try to remove a piece of meat from under a cage by pulling on a rope in the presence of its caregiver. The dogs and wolves both mastered this promptly. But in experiments where the rope was anchored, the dogs tried a couple of times, then turned to their masters for assistance or cues. The wolves, by contrast, continued yanking on it until exhausted, never once giving their caregivers so much as a glance.

"The wolves wouldn't ever figure out if a human's eyes were open or closed, and were only interested in the meat," notes Mr. Miklósi. "The dogs were of course interested in the meat, but knew that one way to get it might be to figure out what the human wants them to do." Given that both sets of animals were raised in the same fashion, the dogs' interest in communicating with humans to solve problems appeared to be innate, probably an evolutionary byproduct of their

domestication, says Mr. Csányi.

Further evidence for that theory comes from an experimental fur farm in Siberia, where Russian geneticists have spent the last 50 years breeding a population of tame foxes. The process was simple: Humans would approach a fox cage, and the foxes that showed the least panic or aggression were selected for breeding. After only 18 generations, the foxes displayed remarkably doglike behaviors: sitting on a person's lap and barking for attention -- actions rarely seen in wild canines.

A team of researchers led by Brian Hare of the Max Planck Institute, in Leipzig, tested the foxes' ability to follow human social cues, using the same classic tests that Mr. Csányi uses on dogs and others use on chimps. The results, published in *Current Biology* in February, showed the tame foxes' abilities to be entirely comparable to dogs, while ordinary foxes performed as badly as wolves.

Mr. Hare calls those findings surprising because the Russian breeders hadn't been selecting their animals for intelligence. "You might just be breeding dogs that are friendlier," he says, "but wind up with a dog that's smarter" because it communicates better with people, making it more able to solve problems.

A Challenge to Pet Theories

But not everyone will go so far as the Hungarians in crediting dogs with relatively high cognitive skills. Michael J. Owren, assistant professor of psychology at Cornell University, says Mr. Csányi's team may be underestimating the flexibility of associative learning, the most basic kind of learning that comes not from "thinking" out the problem, but simply by associating events or objects with one another, as Pavlov demonstrated with his dogs. "Dogs are supremely sensitive to cues being produced by humans and are able to interact with humans very effectively," Mr. Owren says. "The question then becomes to what extent are they showing sophisticated cognitive processing and to what extent is their behavior being molded by this extreme attentiveness to people?"

"The Hungarians are using pet-class dogs who have been socialized in a very unique way, but there is no accounting for that," adds Raymond P. Coppinger, a dog cognition specialist at Hampshire College, in Amherst,

Mass. "To be talking about dogs in general when you are only referring to this small population of dogs from the Western world that have been bred for all sorts of specific tasks is going to lead us astray about what dogs can do or how they evolved."

Mr. Coppinger is also concerned that researchers are failing to properly control for the "Clever Hans effect," named after a horse that tapped out the answers to mathematical problems more than a century ago. Scientists ultimately concluded that the horse was picking up inadvertent cues from the person who posed the question; Hans was clever enough to figure out that he would get a treat if he stopped tapping when the human in front of him subtly reacted to the arrival of the "correct answer"; the horse didn't actually know arithmetic.

Dogs have fooled scientists before. In the early 1990s, scientists at the University of Laval, in Quebec City, published studies showing that dogs could locate objects by mentally representing the past locations and movement of the object. The finding caused a stir because dogs had not previously been found to possess such abilities. But last year Emma Collier-Baker and two other researchers at the University of Queensland, in Australia, repeated the experiments and discovered that researchers had inadvertently tipped the dogs off by leaving the tool used to move the target object adjacent to the correct hiding place. When that oversight was corrected, the dogs' performed no better than chance.

"If dogs have representational mental abilities, I don't think anyone has demonstrated it yet," says Mr. Coppinger, who suspects dogs are solving most experimental tasks using simple associative abilities. "For a lot of these experiments you may be giving the dog a cue that they are able to pick up on."

In response, Mr. Miklósi says the experiments have, in fact, controlled for the "Clever Hans effect"; he is particularly confident that the dogs are not picking up cues directly from people because in most tests, they have never seen the experimenter before. Moreover, they are fairly slow in understanding gestures, like the lift of an eyebrow to indicate the location of a hidden object. "They can learn it with training, but the dogs we use in most experiments only see the experimenter two or three times, often a week or more apart, and don't get the chance to learn our body language."

With training and encouragement, however, the dogs do show remarkable abilities to learn from humans. In a laboratory down the hall, Ms. Virányi shows Tódor two pieces of paper. He watches intently as she taps her foot on the left sheet, then he stares her in the face, tongue wagging. "*Csinal*," she commands after a moment, and Tódor quickly steps on the paper, wagging his tail and barking excitedly. There's no way to know for sure if Tódor and other dogs are in fact thinking their way around life's problems, but if not then one thing is certain: They're extremely good at fooling people into thinking they are.

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