Devious Butterflies, Full-Throated Frogs and Other Liars

Next Article in Science (1 of 10) »

Joe McDonald/Corbis

The green frog has been known to deceive eavesdroppers with its croak.

By CARL ZIMMER
Published: December 26, 2006

If you happen across a pond full of croaking green frogs, listen carefully. Some of them may be lying.

Corbis

Dishonesty has been documented in crustaceans and primates alike.

A croak is how male green frogs tell other frogs how big they are. The bigger the male, the deeper the croak. The sound of a big male is enough to scare off other males from challenging him for his territory.

While most croaks are honest, some are not. Some small males lower their voices to make themselves sound bigger. Their big-bodied croaks intimidate frogs that would beat them in a fair fight.

Green frogs are only one deceptive species among many. Dishonesty has been documented in creatures ranging from birds to crustaceans to primates, including, of course, Homo sapiens. "When you think of human communication, it's rife with deception," said Stephen Nowicki, a biologist at Duke University and the co-author of the 2005 book "The Evolution of Animal Communication." "You just need to read a Shakespeare play or two to see that."

As Dr. Nowicki chronicled in his book, biologists have long puzzled over deception. Dishonesty should undermine trust between animals. Why, for example, do green frogs keep believing that a big croak means a big male? New research is offering some answers: Natural selection can favor a mix of truth and lies, particularly when an animal has a big audience. From one listener to the next, honesty may not be the best policy.

"I think it could explain a lot of mysteries in the evolution of communication in animals, including humans," said Stephen P. Ellner, a mathematical biologist at Cornell University.

Tales of animal deception reach back at least as far as Aesop's fables. In the late 19th century, the

MOST POPULAR

E-MAILED | BLOGGED | SEARCHED

1. Costs of a Crisis: Diabetics Confront a Tangle of Workplace Laws
2. Saying Yes to Mess
3. What's Wrong With Cinderella?
4. Editorial: Exercise for Your Aging Brain
5. Nanny Hunt Can Be a 'Slap in the Face' for Blacks
6. As Minds Age, What's Next? Brain Calisthenics

naturalist George Romanes made a semi-scientific study of deceptive animals. In his 1883 book, "Mental Evolution in Animals," Romanes wrote about how one of his correspondents had sent him "several examples of the display of hypocrisy of a King Charles spaniel."

By the mid-1900s, scientists had documented deception in cases where one species fooled another. Some nonpoisonous butterflies, for example, evolved the same wing patterns that poisonous species used to warn off birds. Within a species, however, honesty usually prevailed. Animals gave each other alarm calls to warn of predators; males signaled their prowess in fighting; babies let their parents know they were hungry. Honesty benefited both the sender and the receiver.

"The point of signaling was to get information across," Dr. Nowicki said. "Deception was almost not an issue."

There was just one hole in this happy arrangement: it presented a great opportunity for liars. Shrikes, for example, regularly use alarm calls to warn one another of predators. But sometimes the birds will use false alarm calls to scare other shrikes away from food.

Imagine that a shrike fools other shrikes with a false alarm. It eats more, and therefore may hatch more babies. Meanwhile, the gullible, less-nourished shrikes hatch fewer babies. If false alarms become common, natural selection should favor shrikes that are not fooled by them.

When scientists created mathematical models of this theory, they found that dishonesty could undermine many vital kinds of communication. The challenge, then, was to find out how honesty countered the advantage of deception. "The liars ought to be able to take advantage of the system, so that you'd have selection on the listeners to ignore the signals," said Jonathan Rowell, a postdoctoral researcher at the University of Tennessee.

Amotz Zahavi, a biologist at Tel Aviv University, proposed a way for honesty to prevail. His idea was that honesty won out only because lying carried a relatively large cost. His theory eventually led to elaborate mathematical models and experiments that confirmed it.

Roosters attract hens, for example, with their large red combs. Hens benefit from choosing mates in good condition, because their chicks will tend to be in good condition as well. The bigger and brighter a comb, the better condition the rooster is in.

Theoretically, a weak rooster could fool hens by growing a deceptively large comb. But it costs a weak rooster more than it does a strong one to build a big comb. This tradeoff leads to honest signals from weak and strong roosters alike.

"The mystery of why there is honesty was suddenly solved," Dr. Ellner said. "All the big problems fell away."

But if they had explained why deception did not win out, why did it continue to thrive? "We couldn't explain all the dishonesty," Dr. Ellner said.

Dr. H. Kern Reeve, an evolutionary biologist at Cornell, said that "deception is popping up with a surprising frequency."

Even crustaceans can lie. Male stomatopods dig burrows, to which they try to attract females. Some males choose to try to evict other stomatopods from their burrows and take them over. These conflicts are dangerous because stomatopods can deliver crushing blows with their claw-like appendages. But the stomatopods rarely come to blows. Instead, males raise themselves up and extend their appendages, like a boxer raising his gloves. The sight of big appendages causes smaller stomatopods to back down.

Yet even the biggest, meanest stomatopod has his moments of weakness. Like all crustaceans, they must molt. A freshly-molted stomatopod has a soft, tender exoskeleton. Even in this vulnerable state, however, males will still raise up their claws in a bold crustacean bluff.

Dr. Rowell recently created a more complicated model of animal signals that may explain why deception is so common. Previous models examined only a single animal sending a signal to a single receiver. But real signals are rarely so private. "They're not happening in a one-on-one

7. Questions Couples Should Ask (Or Wish They Had) Before Marrying
8. Hormones and Cancer: Assessing the Risks
9. The Doctor's World: The Man on the Table Devised the Surgery
10. Op-Ed Contributor: The Peaceful Crusader

Go to Complete List »

situation," Dr. Rowell said. "They're really happening in public."

A signaler may have different relationships with different listeners. In some cases, honest signals are best. But eavesdroppers may be able to use honest signals for their own advantage.

To capture this extra layer of complexity, Dr. Rowell built a mathematical model with two receivers instead of one. The signaling animal could choose to be honest or dishonest. The receivers could respond to the signal as an honest one or a dishonest one.

Working with Dr. Ellner and Dr. Reeve, Dr. Rowell discovered that honesty and deception could reach a stable coexistence in the model. The signalers could sometimes be dishonest, and yet the receivers continued to believe the signals despite the deception.

Dr. Rowell and his colleagues published the details of their model in the December issue of The American Naturalist.

"It's really important," Dr. Nowicki said of the study. "They're coming up with new angles that could explain how you could have more deception and keep it stable."

Dr. Rowell argues that real-world cases of deception, like bluffing, support the model. When a male green frog or stomatopod bluffs, other males have to decide whether to heed the signal or to ignore it and attack. Attacking is risky, because it is possible that the signaler is not bluffing.

"The challenger isn't willing to take that gamble," Dr. Rowell said.

The model also showed how deception could be used against eavesdroppers. Green frogs — along with many other frogs and toads — attract females with a distinctive mating call. Dr. Ellner's rough translation of their call: "I'm looking for female frogs, and if you come on my lily pad, I'll show you a good time."

In most cases, male frogs follow up on their mating calls by courting the females they attract. But sometimes they attack instead. This deceptive reaction may be a way for the males to cope with other males that eavesdrop on them. Such eavesdroppers, instead of holding onto their own territory, sneak around and try to intercept females attracted to the mating calls of other males.

If males are always honest in their mating calls, they may lose out to sneaky males. But if they attack, they can ambush the sneaky males and drive them away. Natural selection thus favors deception, despite the fact that the frogs sometimes attack potential mates. The females, meanwhile, are better off trusting the mating calls than ignoring them.

Dr. Reeve cautioned that the model was only the first step in understanding how networks of listeners can drive the evolution of deception. "Right now it needs to be tested in detail, experimentally," he said.

Different species may be prone to different levels of deception. Solitary animals may evolve to be more honest than animals that spend long lives in big societies. If that is true, then humans may be exquisitely primed to deceive.

"We're in a network of individuals watching us," Dr. Reeve said. "If you provide a signal to one individual, it's being eavesdropped on by lots of other people."

Dr. Rowell is exploring cases of human deception with his model. In one case, he examines how terrorist organizations communicate to their sleeper cells.

"Your two listeners are the government and terrorist sleeper cells," Dr. Rowell explained. "The sleeper cells don't have a direct communication with whoever your terrorist signaler is.

"They might give something out over the Web, and the government picks it up. You find that you can very easily get a level of dishonesty from the terrorist signaler to get the government to waste resources on phantom attacks. You can see this evolution going on between sleeper cells and the government."

Next Article in Science (1 of 10) »

Tips

To find reference information about the words used in this article, hold down the ALT key and click on any word, phrase or name. A new window will open with a dictionary definition or encyclopedia entry.

Related Articles

THE WAY WE LIVE NOW: 1-16-05: THE ETHICIST; Friendly Counsel (January 16, 2005)

Related Searches

Lying
Animals
Evolution
Duke University

INSIDE NYTIMES.COM

TimesSelect

Roberts: Pressure of Playing in N.Y.

N.Y. / REGION »

To Send a Page, Press #, and Hope It Still Works

TimesSelect

Of Insults and Apologies

The power of "sorry" is great, writes Richard Conniff, but insults can hurt body as well as mind, says Daniel Goleman.

DINING & WINE »

Hungary Returns to a Sweet Past

GREAT HOMES »

Blog: Dream Home Diaries

MOVIES »

A Friendship Develops, and Obsession Follows

Home | World | U.S. | N.Y. / Region | Business | Technology | Science | Health | Sports | Opinion | Arts | Style | Travel | Jobs | Real Estate | Automobiles | Back to Top