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Friday, October 9, 2009

The Wild Side



Olivia Judson

October 6, 2009, 9:45 pm

'Leopard Behind You!'

I'd like to continue Predator Appreciation Month with reflections on one of the more intriguing effects that predators can have on their prey: the development of a vocabulary of alarm. (Or should that be "an alarming vocabulary"?)

This isn't a complicated vocabulary, with thousands of words. Nonetheless, it's clear that for many animals, alarm calls are more than simple squawks of fear. Vervet monkeys, for instance, use different sounds to warn of different types of predator. "Leopard!" is not the same as "snake!" or "eagle!" If you hide a loudspeaker in the bushes, and startle unsuspecting monkeys by playing recordings of "snake!" at them, they will look around at the ground. "Eagle!" makes them look

up. "Leopard!" sends them scampering to the trees.

Vervets aren't unique. Other primates — including Diana monkeys and Campbell's monkeys — also distinguish between eagles and leopards. (Diana monkeys are elegant animals, with fur of several colors. Also, like male vervets and Campbell's monkey that's a tasteful shade of blue.)



Tim Ockenden/Agence France-Presse

Diana monkeys protectively cradle a baby.

Some animals make rather subtle distinctions. Gunnison's prairie dogs have a different sound for each of coyotes, dogs, hawks and humans. More impressive, they describe what a particular dangerous animal looks like: a human in a blue shirt is announced

differently from a human in a yellow shirt. Similarly, meerkats — those charismatic mongooses that stand on their hind legs to scan for predators — give calls that announce both the general type of predator (coming from the sky, coming from the ground) and how close it is — in other words, how urgently everyone should react. Black-capped chickadees — small songbirds that live in North America — have calls that say whether a predator is flying or resting, and if it is resting, how dangerous it is. For example, pygmy owls eat lots of songbirds; horned owls don't. Sure enough, chickadees kick up more of a fuss about perched pygmy owls than they do about perched horned owls.

In and of itself, it's not surprising that the sounds animals make are not just noise, or a reflection of the state an animal's in (scared, happy and so on). But the subtlety of the calls — the full amount of meaning they contain — is only now being appreciated. Decoding animal sounds isn't straightforward; indeed, alarm calls are among the easiest sounds to study, because the animals hearing the alarms tend to respond in ways that are easy for us to understand and describe — for instance, they stop eating and look about, or run away.

But here's what I particularly like about all this: animals of one species often respond to the alarms of another. In a small way, it's like those childrens' stories that have rats talking to toads, or elephants arguing with ostriches.

Diana monkeys, for example, don't use the same sounds for "eagle!" or "leopard!" as Campbell's monkeys do. But they respond to recordings of a Campbell's monkey shouting "eagle!" or "leopard!" just as they would to a shout from one of their own, or a sighting of the predator itself. Yellow-casqued hornbills — forest birds that have problems with eagles but not leopards — react to Diana monkey shouts of "eagle!" but ignore their cries of "leopard!" (Yellow-casqued hornbills remind me of aging rock stars: their head feathers have that kind of wild look.)

Predators sometimes respond too. After all, alarm calls don't just let other animals know there's danger in the area. They can also let a predator know that it's been seen. Ambush predators, like leopards, often give up and go away once an alarm has been sounded.

Paying attention to the cries and hoots of others can be particularly important for animals that have a bad view of the neighborhood, or that spend a lot of time alone and thus don't get warnings from their own kind. An example: Gunther's dik-dik, a species of miniature antelope. These creatures live in pairs, in large territories. They have many enemies — leopards, lions, eagles, hyenas, vultures and the like — and spend much of their time hiding in thickets of undergrowth, where they don't have a good view. So perhaps it's not surprising that they tune into the alarm calls of go-away birds — which sit high in the tree-tops, announcing passing predators.

All of this makes sense: you'd expect animals to evolve to pay attention to all the

information available to them, especially in matters of life and death. The more important question is, how do they come to know what the different calls mean?

The short answer is, we don't really know yet. However, there are three basic possibilities. One: they are born with the knowledge — it's innate. Two: they learn by personal experience, or by watching the fates of others. Three: it's some combination.

Young vervet monkeys, for example, appear to have an innate tendency to shout "eagle!" — but they do it at anything that's in the air, be it an eagle, a vulture or a falling leaf. They shout "snake!" at long, thin things on the ground — like twigs. As they get older they learn to refine their calls. This seems to be through positive reinforcement — when they make the right call, adults join in and do it too. (It's tempting to think there may be negative reinforcement as well. One researcher reported seeing a mother run up a tree after her infant gave a "leopard!" alarm. But there was no leopard — only a harmless mongoose — and when the mother caught up with the infant, she gave it a smack.)

Moreover, many animals are quick to make associations between sounds and danger. In areas where wolves have been absent and then reintroduced, female moose that have lost a calf to wolves are much more attentive than other females to the sounds of wolf howls. Perhaps dik-dik fawns see their parents reacting to the cries of the go-away bird, and learn to do it too.

This subject is not merely of academic interest. Many programs in animal conservation depend on reintroducing captive animals to the wild. But if an animal doesn't know what to be afraid of, it probably won't last long Out There. Understanding how animals acquire fear of predators — and then teaching them what to be afraid of, and what to listen out for — may be essential if newly freed animals are to survive.

Notes:

For vervet monkeys responding differently to different alarms, and for young vervets being trigger happy, see Seyfarth, R. M., Cheney, D. L. and Marler, P. 1980. "Monkey responses to three different alarm calls: evidence of predator classification and semantic communication." Science 210: 801-803; for a more lengthy, and fascinating, discussion of all this, see Hauser, M. D. 1996. "The Evolution of Communication." MIT Press. (The description of a young vervet being smacked by its mother for making the wrong call is given on page 309.)

For Diana monkeys making different sounds for leopards and eagles, see Zuberbühler,

K., Noë, R. and Seyfarth, R. M. 1997. "Diana monkey long-distance calls: Messages for conspecifics and predators." *Animal Behaviour* 53: 589-604. For the same phenomenon in Campbell's monkeys, see Zuberbühler, K. 2001. "Predator-specific alarm calls in Campbell's monkeys, *Cercopithecus campbelli*" *Behavioral Ecology and Sociobiology* 50: 414-422.

For human shirt colors being announced by prairie dogs, see Slobodchikoff, C. N., Paseka, A. and Verdolin, J. L. 2009. "Prairie dog alarm calls encode labels about predator colors." *Animal Cognition* 12: 435-439. For meerkats giving information about predator type and the urgency with which listeners should respond, see Manser, M. B., Seyfarth, R. M. and Cheney, D. L. 2002. "Suricate alarm calls signal predator class and urgency." *Trends in Cognitive Science* 6: 55-57. For different call types in black-capped chickadees, including assessments of predator danger, see Templeton, C. N., Greene, E. and Davis, K. 2005. "Allometry of alarm calls: black-capped chickadees encode information about predator size." *Science* 308: 1934-1937.

For an interesting discussion of the difficulties in interpreting animal noises, see Hauser, M. D. 2000. "A primate dictionary? Decoding the function and meaning of another species' vocalizations." *Cognitive Science* 24: 445-475.

For Diana monkeys understanding the calls of Campbell's monkeys, see Zuberbühler, K. 2000. "Interspecies semantic communication in two forest primates." *Proceedings of the Royal Society of London B* 267: 713-718. For yellow-casqued hornbills tuning into Diana monkey shouts of "eagle!" but not "leopard!" see Rainey, H. J., Zuberbühler, K. and Slater, P. J. 2004. "Hornbills can distinguish between primate alarm calls." *Proceedings of the Royal Society of London B* 271: 755-759.

For leopards giving up when they realize they've been detected, see Zuberbühler, K., Jenny, D. and Bshary, R. 1999. "The predator deterrence function of primate alarm calls." *Ethology* 105: 477-490. For an excellent general overview of what we know about alarm calls, see Zuberbühler, K. 2009. "Survivor Signals: The Biology and Psychology of Animal Alarm Calling." *Advances in the Study of Behavior* 40: 277-322.

For Gunther's dik-dik responding to calls of the go-away bird, see Lea, A. J. et al. 2008. "Heterospecific eavesdropping in a nonsocial species." *Behavioral Ecology* 19: 1041-1046. For moose that have lost calves to wolves becoming sensitive to wolf calls, see Berger, J., Swenson, J. E. and Persson, I.-L. 2001. "Recolonizing carnivores and naïve prey: conservation lessons from Pleistocene extinctions." *Science* 291: 1036-1039. For a review of animals learning about predators by observing others, see Griffin, A. S. 2004. "Social learning about predators: a review and prospectus." *Learning and Behavior* 32: 131-140. For an example of how pre-release predator training can help captive-reared animals to survive in the wild, see Shier, D. M. and Owings, D. H. 2007. "Effects of social learning on predator training and postrelease

*survival in juvenile black-tailed prairie dogs, *Cynomys ludovicianus*." *Animal Behaviour* 73: 567-577.*

Many thanks to Dan Haydon for insights, comments and suggestions.

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1.

As usual a great post. I like the idea of the different calls and the alluding to the need to train reintroduced species to predators including of course man. I wonder how much different warning calls relate to the development of language. It seems we may not be all that unique vocal wise. The world of nature does seem to open up to those who listen.

— Mark

2.

(It's tempting to think there may be negative reinforcement as well. One researcher reported seeing a mother run up a tree after her infant gave a "leopard!" alarm. But there was no leopard — only a harmless mongoose — and when the mother caught up with the infant, she gave it a smack.)

this is not negative reinforcement, it is punishment. reinforcement, be it positive or negative, increases behavior, the former by providing something positive, the latter by removing something negative (taking ibuprofen is negatively reinforced by the removal of your headache)

— bahr weiss

3.

Almost as remarkable as the subtlety and complexity of animal communication is the systematic resistance to acknowledging such communication and its implications. The scientific establishment positively prides itself on its denial that animals have emotions, intentions, and rudimentary forms of language.

The refusal to embrace the revolutionary work of Irene Pepperberg with Alex the gray parrot is among the many conspicuous symptoms of this attitude.

(Also, I can't let this lovely column go without wondering out loud exactly what shade of blue is considered tasteful in the feminine assessment of primate scrotums.)

— David E. Moody

4.

Dr. Doolittle I presume? If I could talk to the animals!

— Neal Jettpace

5.

I absolutely loved this article!

Last year I was startled to hear caws of the local crows so stridently uttered. I went out into my patio and observed a coyote trotting along the crest of the hill behind my place. A group a half-dozen or so crows were circling the predator and warning everyone in earshot that he was on the prowl.

I have several bird feeders in my patio. One is a sack of nyjer seeds that the

Goldfinches just love. Also I have a pair of Western Scrub Jays that have been visiting my patio to get peanuts over the past five years.

One of the Jays had arrived but was behaving very strangely. He was running back and forth on the patio fence top and then hopping into the adjacent Bougainvillea and just sitting there. All the time ignoring my offering of a peanut. Then suddenly the Goldfinches exploded off the sack and a second later a large bird swooped by within a foot of my face to land briefly on the top of my patio fence.

It was a Red Tailed Hawk who had just made an unsuccessful attempt to nail a Goldfinch. And his presence is what spooked my Scrub Jay.

That Hawk has hunted my neighborhood for several years and I have seen him bag a Mourning Dove on one occasion.

— *John Newlin*

6.

With reference to both 'Leopard Behind You!' and "Predator Appreciation Month", I'd point everyone to

http://www.huffingtonpost.com/2009/10/06/man-mauled-by-tiger-after_n_310598.html

I can't verify the source, but in the words of Chris Rock, "that tiger didn't go crazy, that tiger went tiger".

How exactly should we express our appreciation for natural selection?

— *Jeff*

7.

This is so very interesting, but why should we be surprised as genetically we are 99.4% identical to Chimpanzees, so how far can we actually be genetically even from these lesser primates..if they are lesser or lower...

As I heard Leakey say recently "after all we are Apes ourselves", hairless apes but Apes none the less...so why wouldn't they develop some rudimentary form of language..?

— *TJ Colatrella*

8.

Another enthralling essay. Delightful!

Higher primates, I would note, on anecdotal evidence, seem to have lost the knack. Witness the election of so many predators to public office. despite clearly

identifiable warning noises.

— *Barry Blitstein*

9.

Some prey have different colors for different predators. The common chameleon (*Chamaeleo chamaeleon*) will climb to the underside of its branch and change color to perfectly match its environment when it senses a potential bird predator, but when threatened with less visually acute snakes it won't bother to camouflage carefully, but will move to the upper side of the branch.

Visit my website: <http://www.DianaBarshaw.com> for more about chameleons.

— *Diana Barshaw*

10.

96 lines of text and 57 lines of notes. Judson, you are bound to teach us how science is done: I hope we are listening.

— *David Kraut*

11.

Science rocks.

— *clayton*

12.

O Judson writes:

“Young vervet monkeys, .. to shout “eagle!” .. at anything that’s in the air, be it an eagle, a vulture or a falling leaf. They shout “snake!” at long, thin things on the ground — like twigs.”

This closely resembles how measure words are applied to categories in Chinese. Linguists have many hypotheses concerning the origin of these measure words, but imitation of (development from?) animal alarms is one hypothesis I haven't come across before.

— *frank mayer*

13.

Fascinating!

14.

Thank you! This is exactly the column I was requesting last week. Points me in the direction I'm trying to think. You didn't mention "laughter" or "territorial defence", and I'm sure this week's subject was planned prior to my comment/request; but this was very nice to read, like an answer. Especially intriguing are the sections on interspecies communications, not only among preyed-upon species (wow, interspecies co-operation in territorial defence via vocal signs), but also between prey and predators (some of the hoots have got to be comparable to nervous, derisive laughter when the sighted bird flies off or the leopard desists). Naturally, predators themselves wouldn't usually have much interest in announcing their arrival.

Aggressive intent announcement clearly does occur intra-species, for instance when would-be dominant males (or females? Maybe sometimes, like with Hyenas. You tell me) fight for nominal control over a herd. Or among humans, who first domesticated themselves, then brought plenty of other animals and plants into their civilised bubble. Many domesticated animals communicate on a very complex level with their human tenders, vocally or otherwise. Dogs and classically trained horses immediately spring to mind. But intra-human communications have long since developed so far past the simple, highly meaningful interjection that they run the gray gamut from utmost aggressivity to abject acquiescence, as well as rock-like ignorance to the fine lattice-work of nearly unapproachable intelligence.

Unlike what advertisers claim to represent though, your column is always really new and improved. How do you do that? Above all, appreciate the references this time, too.

— James DeVries

15.

Lovely article! As a boy, I recall reading Jim Corbett's, *Man Eaters of Kumaon* - several times over. A keen hunter-naturalist, Corbett detailed various sounds, from different alarmed animals, that indicated specific events like "tiger on-the-prowl", not resting. So not only are the messages precise, they can be picked up by humans, with practice.

I always wondered how Corbett managed to survive hunting man-eating tigers and leopards on foot, in thick Indian jungles for decades, armed with WWI-vintage rifles and tracking equipment. Learning to make out subtle distinctions in animal cries must have gone a long way.

I remember his assertion that tigers always approached hunters from downwind, just as they do their prey, for they know not that humans cannot smell them out. Similarly, I wonder if predators adjust their behavior, assuming humans can also decode giveaway signals from animal alarmists.

— *Vijay*

16.

Humans, especially birdwatching humans, can use animals' calls to their benefit too. Over here in Britland I've got on to more than one hobby (a bird-chasing falcon) when swallows have started a very characteristic chattering call.

— *Andy Gibb*

17.

Regarding the existence of emotions in animals, Darwin certainly believed that animals were capable of emotions such as sadness and affection. This was beautifully illustrated in the recent Darwin exhibition at Cambridge University's Fitzwilliam Museum with artists' paintings of dogs and monkeys showing various facial expressions compared to photographs of human expressions.

<http://www.darwinendlessforms.org/gallerydarwin/animal-kin/>

— *TH*

18.

Animal communication does not have to be vocal. Rabbits and gerbils drum with their hind feet on the ground to warn each other and show predators that they are alerted to their presence. Drumming on the ground bears the advantage that also their conspecifics in burrows underground are warned.

Konrad Lorenz so aptly described the interplay of environmental stimuli and innate behavior to acquire such behavior in his observations on imprinting in gray geese.

You may wish to read more on Lorenz's discovery here:

<http://brainmindinst.blogspot.com/2009/06/konrad-lorenz-imprinting-functional.html>

— *Peter Melzer*

19.

We have been feeding the birds in our backyard feeders for years now. We have

developed a kinship with them. The blue jays calls are most aggressive and we have learned three. Hawk, Cat, and Food. The jays will yell when I fill the feeders, they will yell when there is a cat and when there is a hawk (sharp shinned in our yard) and we have learned each. The birds will fly up to the trees for cat, will hold still for hawk and will start to fly in for food.

We don't share this story often as people think it's a bit nutty, but were convinced nonetheless. Good to read confirmation that the animals do have distinct (human discernable) calls about different dangers, and in our case food.

— J.S.

20.

For a fascinating study of intra species communications, with an understandable soft spot for babblers, see Amotz Zahavi: The Handicap Principle: A Missing Piece of Darwin's Puzzle

— Gidi Arbel

21.

I love the essays, so much in so few words. The capitalization of "Out There", the appreciation of the shade of blue of monkey scrotum.

I'll forever more be listening to the sounds of birds and chipmunks and realizing that they could be warning the elk.

— rc

22.

very interesting. do animals of a single species raised in different areas of the world have the same "language," given the existence of the same predators in the different areas?

— david barber

23.

This is one of the most astonishing articles I've read in a long time. - That from someone who believes animals are conscious like humans (to some lesser degree of consciousness, however).

But I had no idea that animals possessed the abilities Judson describes, abilities that I would call language. It's not language to the degree that humans have. But after reading this article, I suspect that similar relationships of proportionality to

human faculties apply to both an animal's level of consciousness and language abilities.

To me the most astonishing paragraphs of this astonishing piece are those that demonstrate language learning: Young vervet monkeys learning to refine the use of the calls for snake and eagle, for instance. Or the dik-dik learning to understand the calls of other species. It seems evident that these faculties are not innate.

Wittgenstein expended some effort in his later philosophical years (post-Tractatus) clarifying the notion of language. The concept of the meaning of words, in his view, is much broader than the mapping from a noun to the thing it stands for. Meaning is basically signaling—like the way a surgeon in the OR signals to a nurse with the words “scalpel” or “clamp.” The surgeon is not simply uttering nouns.

The animals Judson describes are signaling to each other. In that sense their speech is not so different from human speech. What is so astonishing is the complexity and detail of it. I had no idea!

— *Mark Pine*

24.

Predator Appreciation Month...

I thought this was going to be about Letterman.

— *Ba da boom.*

25.

Thanks for the interesting essay.

If the predators respond to alarm calls by discontinuing the hunt, would it not be possible to use such alarms to protect livestock?

— *doug goodwin*

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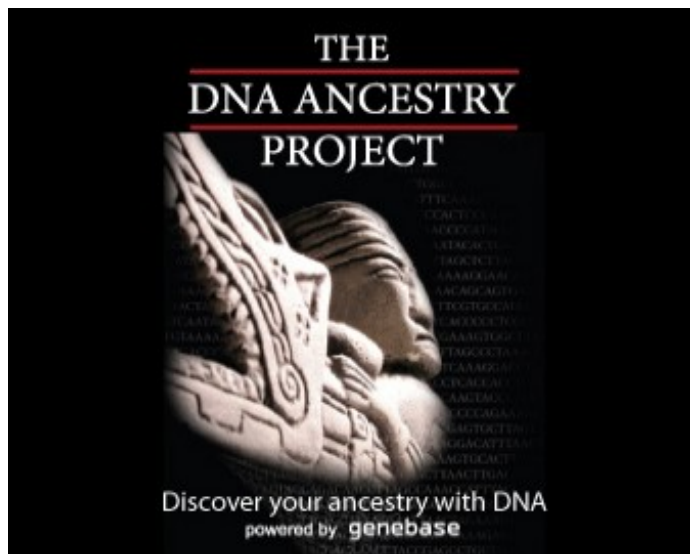
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About Olivia Judson

Olivia Judson, an evolutionary biologist, is the author of "[Dr. Tatiana's Sex Advice to All Creation: The Definitive Guide to the Evolutionary Biology of Sex](#)," which was made into a three-part television program. Ms. Judson has been a reporter for The Economist and has written for a number of other publications, including Nature, The Financial Times, The Atlantic and Natural History. She is a research fellow in biology at Imperial College London.



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Comments of the Moment

“ Dogs can talk. One only has to understand the vocabulary.”

— Joe (Burnaby, BC)

['Leopard Behind You!'](#)

“ Junk DNA (the extra DNA that no one really understands yet) seems to be the new frontier in biology. As Einstein once noted, "God doesn't play dice." There must be some reason these vestigial genes hang around.”

— Mark Moorstein

The Fantasy Genome Project

“ Is there any doubt that if man were to disappear that nature would quickly reclaim every place that man called home?”

— Guy Thompto

Humpty Dumpty and the Ghosts

“ If we collected all the microflora in our body and put it in a bottle, it would nearly fill a half gallon container.”

— Gary

Microbes 'R' Us

“ Nature is considerably more creative and inventive than humankind. Without Nature there isn't any humankind. Without humankind, Nature is fine.”

— David

Guest Column: Let's Hear It for the Bees

“ My favorite variation of the old saying: The early bird gets the worm, but the second mouse gets the cheese.”

— Kevan Olesen

Guest Column: Larks, Owls and Hummingbirds

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Maybe it was because I saw the headline early this morning not on the N.Y. Times's website or the Wall Street Journal's, but rather on Google News. I instantly assumed that the Onion had successfully landed a story on the home page of that fine aggregator. "Barack Obama Wins Nobel Peace Prize," the headline said. I chuckled, silently congratulated the Onion on its clever idea, and clicked the link.

Nicholas D. Kristof

[Obama and the Nobel Peace Prize](#)

Barack Obama winning the Nobel Peace Prize? Seems a bit premature to me.





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