

Published online 17 August 2011 | Nature | doi:10.1038/news.2011.484

News

Hyenas can count like monkeys

Ability suggests intelligence evolved to keep track of social interactions in large groups.

Jo Marchant

Hyenas can count up to three. Researchers playing recorded calls to the wily carnivores found that wild spotted hyenas (*Crocuta crocuta*) responded differently depending on whether they heard one, two or three individuals.

The result adds numerical assessment to the list of cognitive abilities that hyenas share with primates, and supports the idea that living in complex social groups — as both primates and hyenas do — is key to the evolution of big brains.

Sarah Benson-Amram, a zoologist at Michigan State University in East Lansing, and her colleagues played recordings of hyena calls, or whoops, to members of two hyena clans in the Masai Mara National Reserve in southwestern Kenya¹. The recordings were made in Tanzania, Malawi and Senegal, so the calls were unfamiliar to the Kenyan clans, and would have been interpreted as belonging to potential intruders.

The recordings each consisted of three bouts of whooping, from one, two or three different animals. In 39 trials involving resting adults — mostly lone females — Benson-Amram measured how vigilant the animals became while the recordings were playing by comparing the amount of time they spent facing the speaker with the amount of time they spent looking away or resting.

Although some females became equally watchful in response to all of the recordings, most of the animals distinguished between one, two or three intruders, their attentiveness increasing with the number of unique calls they heard. The finding is published in *Animal Behaviour*.

A similar ability has been shown before in lions (*Panthera leo*)², chimpanzees (*Pan troglodytes*)³ and black howler monkeys (*Alouatta pigra*)⁴. But in those studies, the calls were all played at once, so the animals could simply have been responding to the total amount of noise in the chorus.

To avoid that, Benson-Amram played the calls consecutively — either repeating the same call or mixing whoops from two or three individuals. To work out how many opponents they faced, the listening hyenas not only had to remember how many calls had sounded overall, but also had to recognize whether they had heard each particular caller before.

Michael Wilson, an anthropologist at the University of Minnesota in Minneapolis who carried

out the previous study with chimps, describes the work as "very elegant" and says it makes sense that hyenas should be so adept with numbers. "Their livelihoods depend on defending group territories and keeping track of how many rivals they face," he says. "You don't want to start a fight with the neighbours if you are outnumbered."

Big groups, big brains

Benson-Amram's PhD supervisor, Kay Holekamp, has spent more than 20 years studying hyenas' cognitive skills to probe the 'social intelligence hypothesis', which posits that primates evolved big brains to keep track of complex social rivalries when living in big groups.

Hyenas offer the perfect opportunity to test that idea. They live in hierarchical and socially volatile clans of up to 90 individuals, with clashing sub-groups of varying sizes. "Hyenas have been exposed to the exact same suite of selection pressures as monkeys," says Holekamp. If the social intelligence hypothesis is correct, hyenas should be as bright as primates.

Holekamp has already found that hyenas do indeed rival primates in terms of many social skills, including distinguishing kin from non-kin⁵ and keeping track of the relative social status of different individuals⁶.

But the latest study is one of the first to investigate a non-social skill in hyenas. As well as having a role in inter-group conflict or clan warfare, the rudimentary ability to assess number would be useful in other situations, such as when competing with lions for food.

Hyenas probably can't distinguish individual numbers much higher than three — primates generally manage six or seven at most. But Benson-Amram says that hyenas might be able to judge the relative size of larger groups to resolve conflict without fighting.

Overall, Holekamp says, there are "tremendous and very interesting convergences" between the intellectual abilities of hyenas and primates. Hyenas seem to be smarter than other carnivores such as lions, which live in smaller groups, and which Holekamp describe as "surprisingly robot-like in their responses to situations".

"Hyenas live in primate-like groups, and appear to have primate-like cognitive skills," agrees Wilson.

But although a complex social environment is "an important driver" of intelligence, Holekamp cautions that it's not the whole story. Even though hyenas experience virtually identical social pressures, "monkeys tend to be smarter than carnivores", she points out. "Clearly other things are important as well."

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