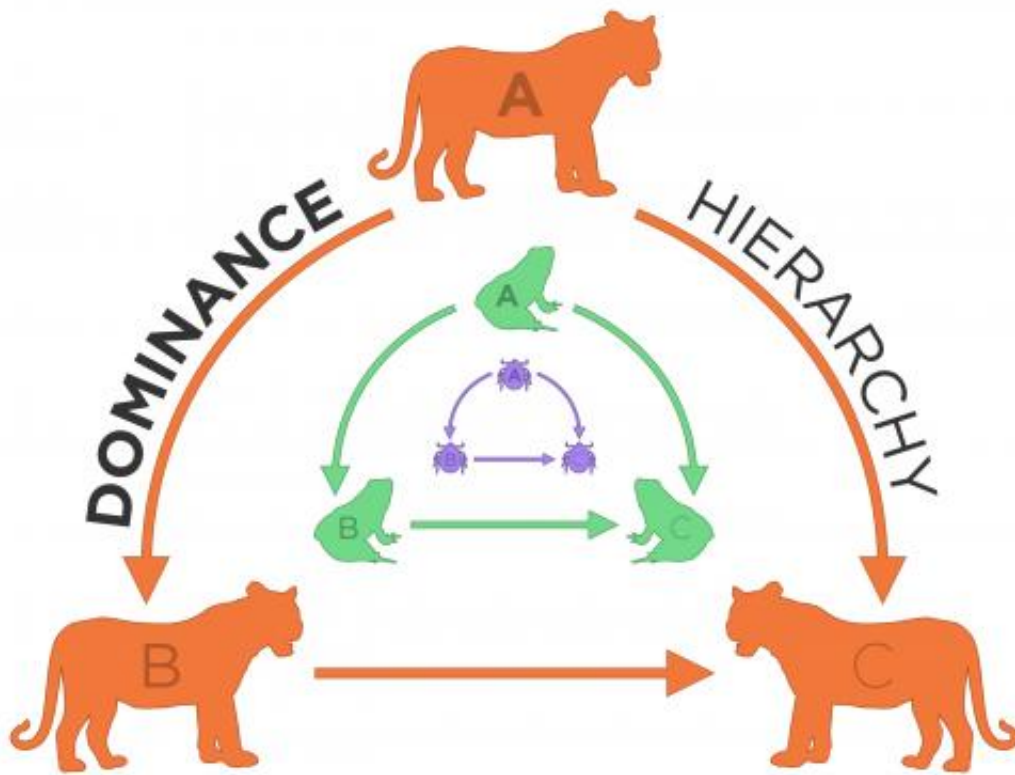


Biologist finds animal groups share dominance dynamics

March 26 2015, by Scott Schrage



Credit: Scott Schrage

The cardinal rules of pecking orders extend well beyond birds and beaks, according to a new study led by a UNL biologist.

Roughly 80 years of data have revealed surprising similarities in the

[social hierarchies](#) of [animal groups](#) ranging from primates and birds to fish and insects, the study reports.

Daizaburo Shizuka, research assistant professor of biological sciences, employed a method called network motif analysis to examine data published across eight decades and 113 studies. Shizuka and a colleague specifically analyzed patterns of dominance and subordination among three-member sub-networks within larger social groups.

The authors found that the vast majority of 172 animal groups featured certain hierarchical patterns either far more frequently or less often than would be predicted by chance.

The results indicate that seemingly disparate animal groups operate according to "strikingly similar" social blueprints, Shizuka said.

"There's an intuition that, say, a bird social hierarchy might be in some way different than that of chimpanzees or fish," said Shizuka, who co-authored the study with the University of Wyoming's David McDonald. "The idea that appeals to me is that maybe we're honing in on some universal features of social systems—some features that we all share."

The study reported that 99 percent of all groups displayed fewer cyclical triads—whereby animal A dominates animal B, which dominates animal C, which in turn dominates animal A—than predicted by chance. The authors also found that 89 percent exhibited relatively few "pass-along" chains of animal A dominating B and B dominating C.

In contrast, 97 percent of groups commonly exhibited a transitive dynamic of animal A prevailing over both B and C, with B also dominating C. The similar but simpler "double-dominant" dynamic, in which A reigns over B and C without any interaction between the latter two, appeared frequently in 80 percent of groups.

Contrary to the authors' expectations, these results held even when comparing [animals](#) in captivity with those living in the wild.

"You'd think that there would be some kind of big difference there, but we didn't really see any systematic difference between those kinds of situations," Shizuka said. "That was really surprising to me."

Comparing networks that vary in size and interaction frequency can prove challenging, Shizuka said, because such differences can spin mathematical patterns where none exist.

"It's a nice idea to say, 'Let's see if social hierarchies are similar among different animals,' but it's actually not so simple," Shizuka said. "These matters of group size or how long you observe a group can generate results that look like they're meaningful patterns but are not. That pushed me to think hard about how exactly we could compare these kinds of things."

Inspired by what he called a "forgotten" study published by sociologist Ivan Chase in the 1980s, Shizuka used network motif analysis to take the air out of previously inflated correlations.

Because scholars have used relatively consistent methods to collect data since dominance hierarchy research emerged in the 1920s, Shizuka said, the authors were able to plug a large sample of secondary data into that analysis.

"Even today, most of this work really depends on people sitting down and observing the animals and scoring behavior," Shizuka said. "I really have to thank the generations of animal behaviorists for collecting and publishing their raw data in a way that we could analyze."

Shizuka said he hopes the study will spur other researchers to consider

how they might leverage network analysis to squeeze fresh insights from existing data.

"It's a new approach to asking and answering questions that have been around for decades," said Shizuka. "What I intended with this paper was really just to provide a new way of looking at the same data.

"Hopefully it will inspire some people to ask pertinent questions that I'm not even thinking of."

The authors' study appears in the April edition of the *Journal of the Royal Society Interface*.

More information: "The network motif architecture of dominance hierarchies." [DOI: 10.1098/rsif.2015.0080](https://doi.org/10.1098/rsif.2015.0080)

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