

Tapping out a message

In animal-communication research, the understanding of group behaviour is important. The development of the framework for communication networks 15 years ago has provided the field with a great conceptual advance. It takes into account that many signalling interactions do not only involve a sender and a receiver — bystanders may also eavesdrop to gain valuable information about the relative strength, aggressiveness or levels of cooperation in potential opponents or partners. Consequently, signallers may adjust their behaviour to address eavesdroppers as well as the main recipient. Such audience effects can increase levels of both aggression and cooperation in communication networks, which are seen in many diverse species across a wide range of taxa.

This framework concept links to the field of animal cognition. Animals in a group must keep track of relationships between group members to form the most beneficial coalitions, but the complexity of following these relationships increases exponentially with group size. Baboon females, for example, know both the relative rank and the matrilineal membership of all other group females. In humans, cooperation between individuals in a large group may yield benefits through indirect reciprocity — eavesdroppers are more willing to help individuals who have contributed to the public good. Two new books remind us that the physical aspects of animal communication are also important.

In *Vibrational Communication in Animals*, animal behaviourist Peggy Hill provides an up-to-date overview of this field. Because the field of vibrational communication deals with a communication channel that is alien to our own species, research can be both frustrating and exciting. Many case studies in the book read like lawsuits in which a combination of indices provides a compelling case in the

absence of more direct evidence. That may be caused by the complex technical equipment required to measure the propagation of signals in the material being vibrated. But the rest of Hill's work is a beautiful case of integrative biology, highlighting anatomical and neurophysiological studies that describe the organs that receive and emit signals, and the behavioural studies needed to document that a species uses vibrational information in its communication. Owing to the introduced dichotomy between vibrational and auditory communication, scientists must exclude the auditory route as the primary information channel to conclude that animals use vibrational signals.



Rat-a-tat: banner-tailed kangaroo rats drum to their own beat.

Hill makes a strong case that vibrational communication is widespread in animals. She uses an impressive collection of examples drawn across taxonomic groups. Particularly enjoyable is the case of the banner-tailed kangaroo rat — individuals develop their own signature foot-drumming, which they keep for life unless a new similarly drumming neighbour warrants adjustments to guarantee individual recognition. Another amazing story is about treehoppers, in which kin groups of these plant-eating insects use vibrational signals to

coordinate their movements from a depleted resource to a better one — a wonderful example of groups acting as information centres.

A take-home message of Hill's book is that there are many unresolved questions that warrant more research. Signals could be varied to test if they still convey meaning, or to show that encoded information is simple. A new framework might predict under which circumstances vibrational communication will be selected over other means. A better understanding may also yield practical benefits: there are many anecdotes about certain animal species that can sense earthquakes or tsunamis and take evasive action. Overall, the book demonstrates beautifully the strength of research on animal behaviour, the appreciation of the great diversity of species and their adaptations to their specific ecological niches.

In *Coding and Redundancy*, zoologist Jack Hailman classifies man-made and animal-evolved signals according to the information coded within them. Key attributes include the type of information — binary, multivalued or multivariate — and the level of redundancy. Hailman's approach is novel, and his writing is easy to follow. Because the goal of the book is to classify, it does not say much about recent studies of animal communication. Instead,

it offers a historic background, describing how, until the late 1970s, communication was just one part of a broad natural-history data set collected by ethologists. The book ends abruptly without drawing major conclusions. The author states in the introduction that "characterising how signals encode information is only the first step in understanding animal communication". Let us hope that someone will be challenged to take the next step and combine the classification with a functional approach that considers how manipulation, deception and eavesdropping by potential friends and opponents, including predators, may have selected for specific information encoding and levels of redundancy.

These two books will provide behavioural ecologists with new ideas about the mechanisms underlying communication, which may give fresh insights into signal evolution. One can ask, as in *Vibrational Communication in Animals*, how signals might be designed and adjusted to deceive, to keep communication private, or to address an audience as well as a receiver. This interaction between proximate and ultimate questions is where we can achieve major advances in our understanding. ■

Vibrational Communication in Animals

by Peggy S. M. Hill

Harvard University Press: 2008. 272 pp.

Coding and Redundancy: Man-Made and Animal-Evolved Signals

by Jack P. Hailman

Harvard University Press: 2008. 272 pp.

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