

may exist in the animal kingdom, but it is not clear that sequencing alone is sufficient.

The second difficult issue is that Lieberman's account places too strong an emphasis on the basal ganglia, to the exclusion of the cortex. In part, this may be due to his criticism of universal grammar. He claims that proponents of universal grammar equate dedicated language "modules" with localized cortical structures such as Broca's and Wernicke's areas, but I do not believe that either Chomsky or Pinker has actually made that claim. Although Lieberman demonstrates that neither region is dedicated to language, in the process he appears to go too far and discounts a substantial body of evidence for cortical involvement in language. Even if no cortical region is actually dedicated to language, many clearly contribute to it and, by most accounts, play more important roles than subcortical structures. Consequently, some discussion of these contributions would have helped to balance the focus on the basal ganglia. Nonetheless, Lieberman's emphasis on the basal ganglia highlights the fact that subcortical structures are undoubtedly an important, if underappreciated, component of neural language circuits and may provide an evolutionary link to our prelinguistic past.

Discussions of language tend to start from the assumption that it is a uniquely human trait without antecedent in the animal kingdom. *Toward an Evolutionary Biology of Language* forcefully challenges this assumption. Lieberman brings together a wide range of evidence from comparative anatomy, physiology, neurobiology, genetics, neuropsychology, and linguistics to illuminate the protolinguistic abilities in other species. Specific aspects of his arguments are certainly contentious, but his basic premise is compelling: Although the individual traits necessary for language can be found in other animals, it is the unique combination of these abilities in humans that yields language.

References

1. M. H. Christiansen, S. Kirby, *Trends Cogn. Sci.* **7**, 300 (2003).
2. N. Chomsky, *Aspects of the Theory of Syntax* (MIT Press, Cambridge, MA, 1965).
3. M. D. Hauser, N. Chomsky, W. T. Fitch, *Science* **298**, 1569 (2002).
4. T. Q. Gentner, K. M. Fenn, D. Margoliash, H. C. Nusbaum, *Nature* **440**, 1204 (2006).
5. W. T. Fitch, M. D. Hauser, *Science* **303**, 377 (2004).

10.1126/science.1132135

BEHAVIORAL ECOLOGY

An Honest and Deceitful Review

Katherine E. LeVan and Noah Wilson-Rich

These words are signals. Their sole purpose is to convey information to you, the receiver. But should you trust these words or view them skeptically?

With *The Evolution of Animal Communication: Reliability and Deception in Signaling Systems*, William Searcy and Stephen Nowicki provide a fascinating perspective on the honesty of signals in animal communication systems. Their contribution to the Princeton series Monographs in Behavior and Ecology is a timely addition to research on the

The Evolution of Animal Communication
Reliability and Deception in Signaling Systems

by William A. Searcy and Stephen Nowicki

Princeton University Press, Princeton, NJ, 2005. 286 pp. \$85, £55. ISBN 0-691-07094-6. Paper, \$39.50, £26.95. ISBN 0-691-07095-4. Monographs in Behavior and Ecology.



Signaling at a nest. Studies of social communication in animals often use social insects such as the European paper wasp (*Polistes dominulus*).

evolution of animal signaling systems. Searcy (the University of Miami) and Nowicki (Duke University) offer a comprehensive yet concise review of what we currently know concerning signal reliability in animals, enriched with many in-depth examples.

The book starts strongly by explicitly setting forth necessary definitions (e.g., signal, reliable, deception) and by providing a detailed yet accessible explanation of biological signaling models. The useful

The reviewers are at the Department of Biology, Tufts University, Medford, MA 02155, USA. E-mail: noah.wilson_rich@tufts.edu

introduction also presents a succinct historical overview of ideas concerning reliability and deceit in animal communication, which should prove valuable for students seeking to gain perspective on this sometimes highly contentious field.

In an innovative organizational scheme, three subsequent chapters consider signaling systems located at three positions along a continuum that ranges from overlapping to opposing evolutionary interests: "Signaling When Interests Overlap" focuses on communications between related individuals, "Signaling When Interests Diverge" considers signaling between the sexes, and "Signaling When Interests Oppose" concentrates on interchanges between competitors. The authors' account is strengthened by their use of a uniform framework across these chapters, each of which begins by reviewing theoretical models and then explores a few relevant signaling systems in detail. The reviews of the illustrative signaling systems are organized to consider several important questions: Do receivers respond to

these signals? How reliably do these signals convey information? What costs do these signals incur? What evidence exists for deceptive use of signals? Each example is carefully reviewed and thoughtfully discussed. Searcy and Nowicki do an outstanding job of presenting evidence concisely yet accurately; they often include data figures reproduced from the original research papers. We especially appreciated the recurrent reminders of how difficult it can be to gauge what specific aspect of signaler quality is (or is not) reflected in a signal. Also, the authors give thorough consideration to the many potential categories of signal costs (including development, energy, and perform-

ance costs as well as costs imposed by third-party receivers).

At the outset, the authors defend their focus on communication within rather than between species, yet the chapter “Honesty and Deception in Communication Networks” convincingly demonstrates the importance of considering the broader social environment in which signaling occurs. The study of communication networks expands the scope of dyadic animal relations (i.e., parenting, mating, and aggression) in a way that includes eavesdroppers who act upon the signals meant for the primary receiver (1). These third-party receivers may exert additional selective pressures on signals and thus affect signal reliability at evolutionary equilibrium.

Arguably, the book’s principal weakness lies in the limited range of examples the

authors provide to illustrate in these four chapters, which are heavily biased toward birds. Contrary to the (possibly deceitful) cover illustrations, the book includes relatively few examples of signaling drawn from invertebrates, amphibians, and mammals. This emphasis is somewhat understandable because the authors’ own research interests provide them with considerable expertise on avian signals, and it also reflects the fact that much research has been devoted to understanding the reliability of bird signals. However, the absence of insect signaling examples seems particularly unfortunate. For example, the exclusion of social insects (the epitome of signalers and receivers with overlapping interests) is puzzling. Furthermore, although Searcy and Nowicki discuss a wide variety of signaling modalities, they give little consideration to and no examples of chemical signals.

The Evolution of Animal Communication will serve as a wonderful reference for any researcher looking to understand what is currently known about the reliability of animal signals. In addition, it provides an accessible entry into a large and wide-ranging body of literature, usefully highlights the many gaps in our knowledge, and points out fruitful directions for future research. The book also provides an excellent basis for a seminar course at an advanced undergraduate or graduate level (2). Trust us.

References and Notes

1. P. McGregor, *Animal Communication Networks* (Cambridge Univ. Press, Cambridge, 2005).
2. The book formed the basis of a seminar course at Tufts University, and we thank the organizers, P. Starks and S. Lewis, and our fellow students for many insightful discussions.

10.1126/science.1135747

NOTA BENE: FILM

Some Noble Causes from Nobelists

Actor and filmmaker Turk Pipkin’s independent film *Nobelity* opens with a question: How can we secure the future for the next generations? Beginning with images of his own children, Pipkin expands the picture to view children around the globe. The film presents nine recent Nobel laureates who discuss what they consider the major problems currently confronting humanity and the solutions that they propose. These contemporary geniuses obviously enjoyed the opportunity to present their opinions on a personal level, and proceeds from the film will help support particular projects (many of which were started by the laureates themselves) that work toward possible solutions. In some ways, the goals of the film are reminis-

cent of the Grand Challenges in Global Health enumerated by Harold Varmus (Medicine, 1989) and his colleagues [*Science* 302, 398 (2003)]. But the film goes further: it challenges us to vocalize a need for change and take positive steps toward solutions.

While the film serves as a call to action, it also offers a personal glimpse of scientists as real people who want to solve problems facing us all. The laureates’ opinions and concerns fall under various themes of decisions, challenges, disparities, change, knowledge, persistence, and peace. Steven Weinberg (Physics, 1979) starts off with a strong statement on climate change and global warming, noting that “the burden of proof should be not to prove that it is happening but that it isn’t.” Pipkin then takes the viewer to exotic locales and hometowns of the fea-

tured laureates. The physicist Ahmed Zewail (Chemistry, 1999) talks about topics ranging from his femtosecond research to using education to build understanding between cultures. Environmentalist Wangari Maathai (Peace, 2004) considers persistence, deforestation, and erosion. Varmus addresses disease and health disparities. Two of the laureates are no longer with us: Joseph Rotblat (Peace, 1995) discusses the need for clean water, and Richard Smalley (Chemistry, 1996) argues for nuclear disarmament. In light of current events—the technological boom in India side by side with a growing water deficit and the issue of the nuclear capabilities of North Korea and Iran—their statements remind us of the valuable wealth of knowledge they left.

Amartya Sen (Economics, 1998) highlights the need to eliminate hunger, concerns over population, and the advantages of offering experiential education. Jody Williams (Peace, 1997) calls for a ban on land mines. Their statements are thought provoking, but tend to reinforce the film’s mood as more of an ethnographic documentary of scientists’ views of the state of the planet than an exhortation to social or political change. The movie ends with a moving summation on our approach to life by Desmond Tutu (Peace, 1984): “The sea is actually made up of drops of water.

Nobelity

by Turk Pipkin

Monterey Media,
Thousand Oaks, CA, 2006.
84 minutes. DVD, \$24.95.
www.nobelitythemovie.com

cent of the Grand Challenges in Global Health enumerated by Harold Varmus (Medicine, 1989) and his colleagues [*Science* 302, 398 (2003)]. But the film goes further: it challenges us to vocalize a need for change and take positive steps toward solutions.

While the film serves as a call to action, it also offers a personal glimpse of scientists as real people who want to solve problems facing us all. The laureates’ opinions and concerns fall under various themes of decisions, challenges, disparities, change, knowledge, persistence, and peace. Steven Weinberg (Physics, 1979) starts off with a strong statement on climate change and global warming, noting that “the burden of proof should be not to prove that it is happening but that it isn’t.” Pipkin then takes the viewer to exotic locales and hometowns of the fea-



Nine Nobelists. Sen, Maathai, Smalley, Rotblat, Tutu, Varmus, Zewail, Weinberg, and Williams.

What you do, where you are, is of significance.”

Documentaries have become a fashionable venue for individuals and groups to advocate favored agendas. At first, it may seem that *Nobelity* is following the same popular formula. But the sincerity of the Nobel laureates makes this film a uniquely intimate though sobering effort by these individuals to express themselves outside of research labs or scientific journals.

—ANITA C. WYNN

10.1126/science.1136769