with the typical "WEIRD" subjects (westernized, educated, industrialized, rich, and democratic; p. 273).

This volume covers some of the most important issues of human nature. The author believes that scientists should be activists and need to be making meaningful contributions to the understanding of our species. As just one example supporting this assertion, he states, "I think the science encapsulated in this book should transform every nook and cranny of the criminal justice system" (p. 171). Sapolsky describes how his own fieldwork on baboons provided him with observations permitting optimism in regard to social group conduct in respect to aggression and placidity. It is easy to see how this volume might result in readers adopting a similarly optimistic view about human relations at the levels of the individual, community, state, nation, and international union. Almost anyone could benefit from taking the time to engage with Sapolsky's personable, caring, and well-informed coverage of the best and worst of our behavior.

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STUDYING ANIMAL LANGUAGES WITHOUT TRANSLATION: AN INSIGHT FROM ANTS.

By Zhanna Reznikova. Cham (Switzerland) and New York: Springer. $159.00 (hardcover); $119.00 (ebook). viii + 92 p.; ill.; no index. ISBN: 978-3-319-44916-6 (hc); 978-3-319-44918-0 (eb). 2017.

This short book, which summarizes the work of Reznikova and colleagues since 1979, will be of use to theorists and practitioners. For theorists, the author argues in favor of an alternative approach to animal communication. The shadow of human language looms large over the field, especially within cognitivist schools. Animal abilities are often compared against Hockett's famous list of design features (p. 5); they are thought to be functionally referential (a simulacrum of bona fide reference (p. 15); they are described via translation: "*Food here now*!" Reznikova advocates a different approach. Information theory allows us to capture meaning without translation (cf. W. F. Harms. 2004. Primitive content, translation, and the emergence of meaning in animal communication. Page 40 in *Evolution of Communication Systems: A Comparative Approach*, edited by D. K. Oller and U. Griebel. Cambridge (MA): MIT Press) by quantifying the accuracy and efficiency of behavior. Further, it offers this in ignorance of the mechanism by which communication occurs.

Of interest to practitioners are several experimental suggestions. When we know the quantity of information an ant must transmit, and the time it takes to do so, we can calculate its transmission rate. The following experiment demonstrates the use of this method to support an argument for "distant homing," the ability to find a target without cues or persistent signals such as scent trails. A laboratory colony of *Formica sanguinea* were placed near a "binary tree," an artificial bifurcating maze. Scouts were allowed to find food on one branch (out of 16, 32, or 64) and return to the nest to recruit foragers. The correct branch is identified by the sequence of turns required to reach it. It turns out regular sequences such as LLLLLL are transmitted by scouts to foragers faster than semiregular sequences such as LRLRLR, which are themselves transmitted faster than random sequences like RRLRRR. The experimental design is intended to preclude the use of cues by foragers: purportedly, the only way they can successfully reach the target is with information provided by prior antennal contact with the scout. Reznikova argues that this result shows that ants *compress* their messages (cf. S. Popp et al. 2017. *Insectes Sociaux* doi: 10.1007/s00040-017-0583-6).

Given these and other results, we are left with important questions. For example, how similar do two species' ecologies have to be before comparison becomes meaningful? Ryabko and Reznikova (2009. *Entropy* 11:836–853) compared the transmission rates of *F. sanguinea* and *F. polyctena*. If the difference is significant and can be tied to hypotheses about foraging ecology or colony structure, the information-theoretic paradigm would be somewhat vindicated. Further, Reznikova argues that much can be inferred about cognitive ability (see Chapter 6 for impressive claims about numerosity). More would be known if the mechanism of transmission were revealed. It is a benefit of the informational approach that the details of antennal communication can be blackboxed, but such extraordinary hypotheses about compression and arithmetic are probably best vindicated by opening the box and deciphering the code inside.

In summary, we have a collection of experiments undertaken over several decades, bundled with an argument in favor of an unorthodox approach to animal communication. A case has certainly been made for this alternative methodology; how strong it is awaits further scrutiny.

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