

---

## THE COGNITIVE ANIMAL



---

# THE COGNITIVE ANIMAL

Empirical and Theoretical Perspectives on Animal Cognition

edited by

Marc Bekoff, Colin Allen, and Gordon M. Burghardt

A Bradford Book  
The MIT Press  
Cambridge, Massachusetts  
London, England

©2002 Massachusetts Institute of Technology

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher.

This book was set in Times New Roman on 3B2 by Asco Typesetters, Hong Kong. Printed and bound in the United States of America.

Library of Congress Cataloging-in-Publication Data

The cognitive animal: empirical and theoretical perspectives on animal cognition /  
edited by Marc Bekoff, Colin Allen, and Gordon M. Burghardt.

p. cm.

“A Bradford book.”

Includes bibliographical references.

ISBN 0-262-02514-0 (hc. : alk. paper)—ISBN 0-262-52322-1 (pbk. : alk. paper)

I. Cognition in animals. I. Bekoff, Marc. II. Allen, Colin. III. Burghardt, Gordon M.,  
1941—

QL785 .C485 2002

591.5'13—dc21

2001057965

## Contents

Introduction	ix	11	<b>Learning and Memory Without a Brain</b>	77
Contributors	xvii		James W. Grau	
<b>I THE DIVERSITY OF COGNITION</b>	1	<b>12</b>	<b>Cognitive Modulation of Sexual Behavior</b>	89
<b>1 The Inner Life of Earthworms: Darwin's Argument and Its Implications</b>	3		Michael Domjan	
Eileen Crist		<b>13</b>	<b>Cognition and Emotion in Concert in Human and Nonhuman Animals</b>	97
<b>2 Crotalomorphism: A Metaphor for Understanding Anthropomorphism by Omission</b>	9		Ruud van den Bos, Bart B. Houx, and Berry M. Spruijt	
Jesús Rivas and Gordon M. Burghardt		<b>14</b>	<b>Constructing Animal Cognition</b>	105
<b>3 The Cognitive Defender: How Ground Squirrels Assess Their Predators</b>	19		William Timberlake	
Donald H. Owings		<b>15</b>	<b>Genetics, Plasticity, and the Evolution of Cognitive Processes</b>	115
<b>4 Jumping Spider Tricksters: Deceit, Predation, and Cognition</b>	27		Gordon M. Burghardt	
Stim Wilcox and Robert Jackson		<b>16</b>	<b>Spatial Behavior, Food Storing, and the Modular Mind</b>	123
<b>5 The Ungulate Mind</b>	35		Sara J. Shettleworth	
John A. Byers		<b>17</b>	<b>Spatial and Social Cognition in Corvids: An Evolutionary Approach</b>	129
<b>6 Can Honey Bees Create Cognitive Maps?</b>	41		Russell P. Balda and Alan C. Kamil	
James L. Gould		<b>18</b>	<b>Environmental Complexity, Signal Detection, and the Evolution of Cognition</b>	135
<b>7 Raven Consciousness</b>	47		Peter Godfrey-Smith	
Bernd Heinrich		<b>19</b>	<b>Cognition as an Independent Variable: Virtual Ecology</b>	143
<b>8 Animal Minds, Human Minds</b>	53		Alan C. Kamil and Alan B. Bond	
Eric Sidel		<b>20</b>	<b>Synthetic Ethology: A New Tool for Investigating Animal Cognition</b>	151
<b>9 Comparative Developmental Evolutionary Psychology and Cognitive Ethology: Contrasting but Compatible Research Programs</b>	59		Bruce MacLennan	
Sue Taylor Parker		<b>21</b>	<b>From Cognition in Animals to Cognition in Superorganisms</b>	157
<b>10 Cognitive Ethology at the End of Neuroscience</b>	69		Charles E. Taylor	
Dale Jamieson		<b>22</b>	<b>Consort Turnovers as Distributed Cognition in Olive Baboons: A Systems Approach to Mind</b>	163
			Deborah Forster	

<p><b>II</b>    <b>CONCEPTS AND CATEGORIES</b>    173</p> <p><b>23</b>    <b>General Signs</b>    175 Edward A. Wasserman</p> <p><b>24</b>    <b>The Cognitive Dolphin</b>    183 Herbert L. Roitblat</p> <p><b>25</b>    <b>Chimpanzee Ai and Her Son Ayumu: An Episode of Education by Master-Apprenticeship</b>    189 Tetsuro Matsuzawa</p> <p><b>26</b>    <b>The Evolution and Ontogeny of Ordinal Numerical Ability</b>    197 Elizabeth M. Brannon and Herbert S. Terrace</p> <p><b>27</b>    <b>Domain-Specific Knowledge in Human Children and Nonhuman Primates: Artifacts and Foods</b>    205 Laurie R. Santos, Marc D. Hauser, and Elizabeth S. Spelke</p> <p><b>28</b>    <b>The Cognitive Sea Lion: Meaning and Memory in the Laboratory and in Nature</b>    217 Ronald J. Schusterman, Colleen Reichmuth Kastak, and David Kastak</p> <p><b>29</b>    <b>Same-Different Concept Formation in Pigeons</b>    229 Robert G. Cook</p> <p><b>30</b>    <b>Categorization and Conceptual Behavior in Nonhuman Primates</b>    239 Jacques Vaclair</p> <p><b>31</b>    <b>Cognitive and Communicative Abilities of Grey Parrots</b>    247 Irene Maxine Pepperberg</p> <p><b>III</b>    <b>COMMUNICATION, LANGUAGE, AND MEANING</b>    255</p> <p><b>32</b>    <b>Cognition and Communication in Prairie Dogs</b>    257 C. N. Slobodchikoff</p>	<p><b>33</b>    <b>Meaningful Acoustic Units in Nonhuman Primate Vocal Behavior</b>    265 Cory T. Miller and Asif A. Ghazanfar</p> <p><b>34</b>    <b>Exploring the Cognitive World of the Bottlenosed Dolphin</b>    275 Louis M. Herman</p> <p><b>35</b>    <b>Chimpanzee Signing: Darwinian Realities and Cartesian Delusions</b>    285 Roger S. Fouts, Mary Lee A. Jensvold, and Deborah H. Fouts</p> <p><b>36</b>    <b>Primate Vocal and Gestural Communication</b>    293 Michael Tomasello and Klaus Zuberbühler</p> <p><b>37</b>    <b>Gestural Communication in Olive Baboons and Domestic Dogs</b>    301 Barbara Smuts</p> <p><b>38</b>    <b>Animal Vocal Communication: Say What?</b>    307 Drew Rendall and Michael J. Owren</p> <p><b>39</b>    <b>Cracking the Code: Communication and Cognition in Birds</b>    315 Christopher S. Evans</p> <p><b>IV</b>    <b>SELF AND OTHER: THE EVOLUTION OF COGNITIVE COOPERATORS</b>    323</p> <p><b>40</b>    <b>The Mirror Test</b>    325 Gordon G. Gallup, Jr., James R. Anderson, and Daniel J. Shillito</p> <p><b>41</b>    <b>When Traditional Methodologies Fail: Cognitive Studies of Great Apes</b>    335 Robert W. Shumaker and Karyl B. Swartz</p> <p><b>42</b>    <b>Kinesthetic-Visual Matching, Imitation, and Self-Recognition</b>    345 Robert W. Mitchell</p>
--	---

43	<b>Darwin’s Continuum and the Building Blocks of Deception</b>	353	53	<b>The Evolution of Social Play: Interdisciplinary Analyses of Cognitive Processes</b>	429
	Güven Güzeldere, Eddy Nahmias, and Robert O. Deaner			Marc Bekoff and Colin Allen	
44	<b>Integrating Two Evolutionary Models for the Study of Social Cognition</b>	363	54	<b>The Morals of Animal Minds</b>	437
	Brian Hare and Richard Wrangham			Lori Gruen	
45	<b>Field Studies of Social Cognition in Spotted Hyenas</b>	371	55	<b>Eye Gaze Information-Processing Theory: A Case Study in Primate Cognitive Neuroethology</b>	443
	Kay E. Holekamp and Anne L. Engh			Brian L. Keeley	
46	<b>The Structure of Social Knowledge in Monkeys</b>	379	56	<b>The Eyes, the Hand, and the Mind: Behavioral and Neurophysiological Aspects of Social Cognition</b>	451
	Robert M. Seyfarth and Dorothy L. Cheney			Vittorio Gallese, PierFrancesco Ferrari, Evelyne Kohler, and Leonardo Fogassi	
47	<b>From the Field to the Laboratory and Back Again: Culture and “Social Mind” in Primates</b>	385	57	<b>Vigilance and Perception of Social Stimuli: Views from Ethology and Social Neuroscience</b>	463
	Andrew Whiten			Adrian Treves and Diego Pizzagalli	
48	<b>Evolutionary Psychology and Primate Cognition</b>	393		<b>Afterword: What Is It Like?</b>	471
	Richard W. Byrne			Donald R. Griffin	
49	<b>How Smart Does a Hunter Need to Be?</b>	399		Index	475
	Craig B. Stanford				
50	<b>Insight from Capuchin Monkey Studies: Ingredients of, Recipes for, and Flaws in Capuchins’ Success</b>	405			
	Elisabetta Visalberghi				
51	<b>A Cognitive Approach to the Study of Animal Cooperation</b>	413			
	Lee Alan Dugatkin and Michael S. Alfieri				
52	<b>Keeping in Touch: Play Fighting and Social Knowledge</b>	421			
	Sergio M. Pellis				





This is a section of [doi:10.7551/mitpress/1885.001.0001](https://doi.org/10.7551/mitpress/1885.001.0001)

# The Cognitive Animal

## Empirical and Theoretical Perspectives on Animal Cognition

**Edited by: Marc Bekoff, Colin Allen, Gordon M. Burghardt**

### **Citation:**

*The Cognitive Animal: Empirical and Theoretical Perspectives on Animal Cognition*

**Edited by: Marc Bekoff, Colin Allen, Gordon M. Burghardt**

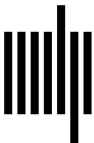
**DOI: 10.7551/mitpress/1885.001.0001**

**ISBN (electronic): 9780262268028**

**Publisher: The MIT Press**

**Published: 2002**

The open access edition of this book was made possible by generous funding and support from Arcadia – a charitable fund of Lisbet Rausing and Peter Baldwin



**The MIT Press**

©2002 Massachusetts Institute of Technology

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher.

This book was set in Times New Roman on 3B2 by Asco Typesetters, Hong Kong. Printed and bound in the United States of America.

Library of Congress Cataloging-in-Publication Data

The cognitive animal: empirical and theoretical perspectives on animal cognition /  
edited by Marc Bekoff, Colin Allen, and Gordon M. Burghardt.

p. cm.

“A Bradford book.”

Includes bibliographical references.

ISBN 0-262-02514-0 (hc. : alk. paper)—ISBN 0-262-52322-1 (pbk. : alk. paper)

1. Cognition in animals. I. Bekoff, Marc. II. Allen, Colin. III. Burghardt, Gordon M.,  
1941—

QL785 .C485 2002

591.5'13—dc21

2001057965