

The Science of the Mind

Series Editor

Tetsuro Matsuzawa

Inuyama, Japan

For further volumes:

<http://www.springer.com/series/10149>

Shigeru Watanabe · Stan Kuczaj
Editors

Emotions of Animals and Humans

Comparative Perspectives

 Springer

Editors

Shigeru Watanabe
Department of Psychology
Keio University
2-15-45 Mita, Minato-ku
Tokyo 108-8345
Japan

Stan Kuczaj
Department of Psychology
The University of Southern Mississippi
118 College Dr. #5025
Hattiesburg, MS 39406
USA

ISSN 2192-6646

ISBN 978-4-431-54122-6

DOI 10.1007/978-4-431-54123-3

Springer Tokyo Heidelberg New York Dordrecht London

ISSN 2192-6654 (electronic)

ISBN 978-4-431-54123-3 (eBook)

Library of Congress Control Number: 2012946620

© Springer Japan 2013

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

I occasionally take a course removed from my area of expertise to broaden my perspective. In addition, I have found that researchers from different areas often approach the same topics different ways. For example, I attended a philosophy course taught by Dr. Ogawa. Part of the class focused Nussbaum's book "Upheavals of thought: The intelligence of emotion" (2001). Although emotion is a traditional topic in psychology and neuroscience, areas such as economics and politics also focus on emotion (see popular books like "Economia emotive" by Motteriloni 2006 and translated into Japanese in 2008). Dr. Ogawa's course convinced me that it was important to consider ideas about emotions from as many disciplines as possible. As a result, Stan Kuczaj and I organized an interdisciplinary symposium titled "Emotional animals, sensitive humans" in 2009 at Keio University in Tokyo. The chapters in this book are based on the talks given at that symposium, talks which were both lively and stimulating.

The term "emotion" is derived from the French word "emouvoir, which in turn evolved from the Latin word "emovere". Emovere has two elements, "e" and "movere". The former means "out" and the latter "move". This is relevant because the empirical research of emotion divides emotion into internal emotion (such as feeling) and external emotion (expression of the emotion). Despite its longevity in human language, emotion was introduced into the academic study of mind rather recently. Early treatments of emotion tended to refer to "passion" instead of emotion. For example, Descartes wrote a book "*Les passions de l'ame*". It is only recently that the study of emotion replaced considerations of passion in philosophy and psychology. Hume who introduced the new word "emotion" but the words were not well defined and there were a lot of confusion in usage of the passion and emotion in seventeenth and eighteenth centuries. Gradually, the passion disappeared at least in field of psychology.

According to Nussbaum, one classic view of emotion is that of the Greek and Roman stoics, where emotion is considered a cognitive/appraisal or evaluation system. James (1884) and Lange (1885) proposed another also well-known view of emotion called the "James-Lange" hypothesis. The emphasized the role of autonomic feedback in producing the experience of emotion. Cannon (1927) criticized

this idea, noting that many different emotions seemed to be “caused” by the same visceral change. Damasio (1994) developed a more sophisticated version of the James–Lange hypothesis called the “somatic-marker” hypothesis in which the bodily change elicited by an event leads to a bodily feeling that contributes to decision making of the organism. Now we know that the neural activity in the subcortical system (periaqueduct grey, amygdala, etc.) evoked by the visceral change can be modified by cortical system (ventromedial part of prefrontalis and anterior cingulate cortex etc.). So it is not plausible to assume different emotional feelings evoked by the same visceral change in different contexts. Psychologists and neuroscientists sometimes separate emotion, which is the unconscious physical response to event, and the feeling produced by the emotional response. In this view, the feeling is an explanation of the emotional bodily response. The cognitive/appraisal hypothesis does not separate the two processes. Rolls (1999) proposed a more operational definition of emotion. According to him, emotions are states elicited by rewards or punishers. Such states have several functions, namely elicitation of autonomic and endocrine response to prepare for appropriate response, communicative and social functions of emotional expression and so on.

The Greek and Roman stoics denied emotion in children and animals, a view shared by some contemporary scholars as well. This view was disputed but Nussbaum examined emotion in children and animals. In fact we have tradition of comparative study of emotional expression of animals since Darwin (1872), who proposed three principles of emotional expression. The first is the principle of serviceable association habits, the second the principles of antithesis, and the third the principle of actions due to the constitution of the nervous system independently from the first of the will and independently to a certain extent of habit (or simply the direct action of the nervous system). These principles are applicable to both humans and animals. He gathered information on facial expression of different races and pointed out similarity among them. He claimed a single line of modern human evolution based on these observations. Perhaps it is easier to understand continuum of emotion between humans and animals than the ordinal continuum of intelligence for people. Perhaps it is easier to estimate emotional state of your pets than thought of them. Similar phylogenetic contingency or selection pressure might produce a similar expression in different species. Nussbaum mentioned findings in ethology and developmental psychology and claimed emotion in children and animals. The chapters in this book focus on the nature of emotions and the possibility of emotions in pre-verbal children and non-verbal animals. It may be important to point out that emotion is free from language faculty in animals and some children.

Part I of this book concerns the evolutionary origin of emotions. The first chapter describes emotion and social performance. The second chapter examines hormonal factors in aggressive behavior in fish. The famous parrot Alex, who unfortunately died in 2009, showed not only higher cognitive functions but also colorfulness of his emotional life. The third chapter examines the relation between cognition and emotion in parrots. Another non-primate species that shows higher cognitive function is the dolphin. The fourth chapter concerns the emotional expression of dolphins and its function. Humans play but so do many other animals. We feel pleasure during

play, in other words, some part of playing behavior is maintained by self-reinforcement. The fifth chapter clarifies the relationship between play and emotion. The last chapter in Part I is “animal aesthetics”. Nussbaum wrote that art influences emotions. Her example was music, but other forms of art have reinforcing properties for animals, suggesting that art can evoke emotion in animals. The seventh chapter examines this possibility.

Part II focuses on human studies. The first chapter (Chap. 8) in Part II provides a broad overview of human emotions. Chapter 9 examines “mentalizing” and emotion in human infants. The last chapter in this section relates emotions to neuroscience.

The chapters in Part III examine the relationship between emotion and other aspects of the human experience. The role of emotion in memory is the subject of Chap. 11. The effect of emotions on human logical judgment is the subject of Chap. 12. The final chapter provides a brief summary of the book as well as recommendations for future research on emotions. Finally, Professor Kuczaj arrives at an overall conclusion.

Tokyo, Japan

Shigeru Watanabe

References

- Cannon WB (1927) The James-Lange theory of emotion: a critical examination and an alternatives theory. *Am J Psychol* 39:106–124
- Damasio AR (1994) *Descartes’ error*. Putman, New York
- Darwin C (1872) *The expression of emotions in man and animals*. University of Chicago Press, Chicago
- Descartes R (1649) *Les passions de l’ame*. Gallimard, Paris
- James W (1884) What is emotion? *Mind* 9:188–205
- Lange C (1885) The emotions. In: Dunlap E (ed) *The emotions*. Williams and Wilkins, Baltimore
- Motteriloni M (2006) *Economia emotiva*. RCS Libri S.P.A., Milano
- Nussbaum MC (2001) *Upheavals of thought: the intelligence of emotion*. Cambridge University Press, New York
- Rolls ET (1999) *The brain and emotion*. Oxford University Press, Oxford

Contents

Part I Emotion in Animals

1 Emotions Are at the Core of Individual Social Performance.....	3
Kurt Kotrschal	
1.1 Introduction.....	4
1.2 Common Mechanistic Grounds in Vertebrate Emotionality and Sociality.....	5
1.3 Conservative Vertebrate Brains.....	6
1.4 Coping with Stress: In the Context of Emotionality.....	12
1.5 Individuality, Temperament, Personality.....	13
1.6 Why Are Humans Drawn into Companionships with Animals?.....	14
1.7 Social Universals Allow for Social Relationships Between Humans and Their Companion Animals.....	15
References.....	16
2 Hormonal Modulation of Aggression: With a Focus on Teleost Studies.....	23
Kazutaka Shinozuka	
2.1 Introduction.....	24
2.1.1 Aggression in Fish.....	24
2.1.2 Approaches to Investigate Mechanisms of Emotional Behavior.....	27
2.2 Behavioral Effects of Peptide Hormones on Aggression.....	29
2.2.1 Teleosts.....	29
2.2.2 Birds.....	31
2.2.3 Rodents.....	32
2.2.4 Interspecific Comparison.....	33

2.3	Action Sites of Peptide Hormones in Teleosts.....	34
2.3.1	Peripheral Action	34
2.3.2	Central Action: Anatomical Studies	35
2.3.3	Central Action: Functional Studies.....	36
2.4	Conclusion	41
	References.....	42
3	Emotional Birds—Or Advanced Cognitive Processing?	49
	Irene M. Pepperberg	
3.1	The Four Studies.....	51
3.1.1	Object Permanence Experiment.....	51
3.1.2	Phonological Awareness	52
3.1.3	Insightful String Pulling.....	53
3.1.4	Numerical Tasks.....	54
3.2	Implications of the Data.....	57
3.3	Conclusions.....	60
	References.....	60
4	Why Do Dolphins Smile? A Comparative Perspective on Dolphin Emotions and Emotional Expressions	63
	Stan A. Kuczaj II, Lauren E. Highfill, Radhika N. Makecha, and Holli C. Byerly	
4.1	Animal Emotions?	66
4.2	Methods for Studying Animal Emotions	67
4.2.1	Physiological Measures.....	68
4.2.2	Behavioral Measures.....	69
4.2.3	Behavioral and Physiological Measures	70
4.2.4	Studying Emotions in Wild Populations	71
4.2.5	Animal Personality and Animal Emotion	71
4.3	Dolphin Emotions?	73
4.3.1	Dolphin Vocal Expressions of Emotions	74
4.3.2	Dolphin Use of Posture to Express Emotions.....	75
4.3.3	Touch as a Mode of Dolphin Emotional Expression?.....	76
4.3.4	Do Dolphins Grieve?.....	77
4.4	Conclusions.....	78
	References.....	80
5	Play and Emotion	87
	Stan A. Kuczaj II and Kristina M. Horback	
5.1	Types of Play.....	90
5.2	Emotions and Play	95
5.3	Play Signals.....	98
5.3.1	Play Signals Vs. Playing with Signals	102

5.4 Benefits of Play 102

5.5 Conclusions..... 105

References..... 106

6 The Use of Emotion Symbols in Language-Using Apes..... 113
 Heidi Lyn and Sue Savage-Rumbaugh

6.1 Emotion and Language-Using Apes 114

6.2 Methods..... 116

6.2.1 Participants..... 116

6.2.2 Data Collection 117

6.2.3 Coding..... 118

6.2.4 Database..... 119

6.3 Results..... 120

6.3.1 Use and Comprehension of Internal State Words 120

6.3.2 Pragmatic Force and Co-Construction..... 123

6.4 Discussion..... 124

References..... 126

**7 Animal Aesthetics from the Perspective
 of Comparative Cognition 129**
 Shigeru Watanabe

7.1 From Experimental Aesthetics to Comparative
 Cognition of Art..... 130

7.2 Discriminative and Reinforcing Properties
 of Auditory Art 133

7.2.1 Reinforcing Property of Music for Animals 133

7.2.2 Discriminative Stimulus Properties of Music 137

7.2.3 Conclusion 142

7.3 Discriminative and Reinforcing Properties of Visual Art..... 144

7.3.1 Reinforcing Property of Visual Art..... 144

7.3.2 Discriminative Stimulus Property of Complex
 Visual Stimuli..... 145

7.3.3 Discriminative Property of Painting Style 145

7.3.4 Discrimination of “Beauty” 146

7.3.5 Strategy of Discrimination of Aesthetic Stimuli..... 147

7.3.6 Conclusion 151

7.4 Creation of Art..... 151

7.4.1 Motor Skills..... 152

7.4.2 Does Animal Art Symbolize Something Outside? 152

7.4.3 Functional Autonomy of Animal Art..... 154

7.4.4 Do Animals Enjoy their Product? 156

7.5 Conclusion 156

References..... 157

Part II Emotion in Humans

8 The Unique Human Capacity for Emotional Awareness: Psychological, Neuroanatomical, Comparative and Evolutionary Perspectives..... 165
 Horst Dieter Steklis and Richard D. Lane

8.1 Introduction..... 166

8.2 Theory of Levels of Emotional Awareness 167

8.3 Normative and Clinical Observations with the Levels of Emotional Awareness Scale 169

8.4 A Model of the Neural Substrates of Implicit and Explicit Emotional Processes..... 171

8.5 Reflective Awareness 173

8.6 The Comparative Approach: A Caution 174

8.7 Emotions and Emotional Awareness in Nonhuman Primates..... 178

8.8 Naturalistic Behavior Observations 178

8.9 Experimental Studies 182

8.10 Neural Correlates 191

8.11 Discussion and Evolutionary Considerations 196

References..... 199

9 The Development of Mentalizing and Emotion in Human Children 207
 Shoji Itakura, Yusuke Moriguchi, and Tomoyo Morita

9.1 Introduction..... 208

9.2 The Development of Mentalizing 209

9.3 Developmental Cybernetics 210

9.3.1 Inference of Robot Intention 210

9.3.2 False Belief of a Robot..... 215

9.3.3 Word Learning from a Robot 216

9.4 The Neural Basis of the Development of Mentalizing..... 218

9.5 Conclusion 219

References..... 220

10 Emotion, Personality, and the Frontal Lobe..... 223
 Satoshi Umeda

10.1 Basic and Advanced Emotions 224

10.2 Functional Neuroanatomy of Advanced Emotion 225

10.3 Neural Substrates of “Theory of Mind” 230

10.4 Personality Change After Damage to the Frontal Lobe..... 231

10.5 Neuropsychological Investigations 232

10.6 Theory-of-Mind Performance After Brain Injury 234

10.7 Acquired Autism Trait After Medial Prefrontal Damage 235

References..... 238

Part III Emotion, Consciousness and Memory

11 Origin and Evolution of Consciousness and Emotion: Has Consciousness Emerged from Episodic Memory? 245
 Takashi Maeno

11.1 Introduction..... 246

11.2 What Is Evolution?..... 246

11.3 Evolutionary Journey of Control Systems Among Living Organisms..... 249

11.4 Acquisition of Episodic Memory Through Evolutionary Processes

253

11.5 Relationship Between Consciousness and Episodic Memory

255

11.6 Is the Phenomenon of Consciousness Evolutionarily Necessary?

258

11.7 Death Belongs to Evolution

263

References..... 264

12 The Logic of Memory and the Memory of Logic: Relation with Emotion..... 265
 Philippe Codognet

12.1 Introduction..... 266

12.2 Memory in the Flesh

267

12.3 Memory in the Genes..... 271

12.4 Binary Notation..... 272

12.5 From Computing to Biology

273

12.6 Conclusion

275

References..... 276

13 Conclusions: Emotions (and Feelings) Everywhere..... 277
 Stan A. Kuczaj II

References..... 280

Index..... 281

