Emotion

Emotions suffuse our lives: a symphony of feeling – usually whispering and murmuring in pianissimo but occasionally screaming and shouting in fortissimo crescendo – filling every waking moment and even invading our dreams. We can always be conscious of how happy, sad, annoyed, or anxious we feel, and also of the feelings we have relative to other persons: pride, envy, guilt, jealousy, trust, respect, or resentment. Developments in brain imaging and in capturing nuances of nonverbal display now enable the objective study of emotion and how biologically based primary emotions relate to higher-level social, cognitive, and moral emotions. This book presents an integrated developmental-interactionist theory of emotion, viewing subjective feelings as voices of the genes: an affective symphony composed of dissociable albeit interactive neurochemical modules. These primordial voices do not control, but rather cajole our behavior with built-in flexibility enabling the mindful application of learning, reason, and language.

Ross Buck is Professor of Communication Sciences and Psychology at the University of Connecticut.
STUDIES IN EMOTION AND SOCIAL INTERACTION
Second Series

Series Editors

Keith Oatley
University of Toronto

Antony S. R. Manstead
Cardiff University

Titles published in the Second Series:

The Psychology of Facial Expression, edited by James A. Russell and José Miguel Fernández-Dols

Emotions, the Social Bond, and Human Reality: Part/Whole Analysis, by Thomas J. Scheff

Intersubjective Communication and Emotion in Early Ontogeny, edited by Stein Bråten


Communicating Emotion: Social, Moral, and Cultural Processes, by Sally Planalp

Emotions across Languages and Cultures: Diversity and Universals, by Anna Wierzbicka

Feeling and Thinking: The Role of Affect in Social Cognition, edited by Joseph P. Forgas

Metaphor and Emotion: Language, Culture, and Body in Human Feeling, by Zoltán Kövecses

Gender and Emotion: Social Psychological Perspectives, edited by Agneta H. Fischer

Causes and Consequences of Feelings, by Leonard Berkowitz

Emotions and Beliefs: How Feelings Influence Thoughts, edited by Nico H. Frijda, Antony S. R. Manstead, and Sacha Bem
Identity and Emotion: Development through Self-Organization, edited by Harke A. Bosma and E. Saskia Kunnen

Speaking from the Heart: Gender and the Social Meaning of Emotion, by Stephanie A. Shields
Emotion

A Biosocial Synthesis

Ross Buck
University of Connecticut
To Nora, Maya, Will, Hannah, and all the children
People learn to hate, and if they can learn to hate, they can be taught to love, for love comes more naturally to the human heart than its opposite.

Nelson Mandela, *Long Walk to Freedom*

We live in a world where we have to hide to make love, while violence is practiced in broad daylight.

John Lennon
## Contents

| List of figures | page xi |
| List of tables | xiv |
| Foreword by Arvid Kappas | xv |
| Preface | xix |
| Acknowledgments | xxii |

### PART I: A biosocial view of emotion

1 A developmental-interactionist theory of emotion 3
   - The essences of emotion 4
   - Developmental-interactionist theory 8
   - Relating emotion and cognition 15
   - A biosocial synthesis of emotion 25

### PART II: Biological emotions: a readout view

2 Neurochemical systems: evolution and function 33
   - Neurochemical systems: neurotransmission and neuromodulation 34
   - The evolution of neurochemical systems 38
   - Neurochemical systems: structure and function 42
   - Conclusions: emotion and the arousal/arousability of neurochemical systems 58

3 Structure of neurochemical systems of emotion 64
   - The central nervous system as a hierarchy of neurochemical systems 64
   - Emotion I: peripheral physiological arousal 65
   - Emotion II: display and communication 72
   - Emotion III: subjective experience of affective feelings and desires 1 – arousal and reward-punishment mechanisms 84
   - Emotion III: subjective experience of affective feelings and desires 2 – selfish competition versus prosocial cooperation 96
   - Summary and conclusions 139
Contents

4 Attachment: the evolution, development, and neurochemistry of sociality 145
The evolutionary biology of natural law: the state of nature and the social contract 145
Communication and the evolution of social organization 147
The evolution of sociality 152
The development of sociality 174
The neurochemistry of sociality 183
Conclusions: emotion, communication, and social organization 200

PART III: Higher-level emotions: an ecological-systems view 203

5 Cognitive and linguistic emotions 205
From biological to higher-level emotions 205
Cognitive emotions: from awe to ennui 209
Language and emotion 220
Summary and discussion 244

6 Social emotions 246
The nature of social structure 247
Attachment and social emotions 255
Self-conscious emotions 257
An ecological-systems view of social emotions 260
Attachment and social emotions 269
Research on primary social emotions 271
Evidence supporting the ecological-systems model 284
Advantages of the ecological-systems approach 292
Conclusions 295

7 Moral emotions: the passions of civility 296
Gust/disgust and moral emotions 297
The development of morality 298
The need for social structure 304
The neuroscience of morality 316
Primary moral emotions 331
The morality of subjugation: authoritarianism and pseudospeciation 341
The GREAT emotions 352
Conclusions: doing well, doing good, destroying the enemy, and avoiding exploitation 361

Bibliography 363
Index 423
Figures

1.1 Three readouts of emotion. page 10
1.2 Emotional expression, emotional communication, and social biofeedback. From Buck (1999, Figure 3).
   © American Psychological Association. Reprinted with permission. 13
1.3 The relationship between knowledge by acquaintance and knowledge by description.
   From Buck (1984, Figure 2.2). Adapted with permission. 18
1.4 The low and high roads to cognition. Drawn from description in LeDoux (1996). 23
1.5 General model of biological and higher-level emotions. 25
2.1 Neurochemical systems. From Buck (1988a, Figure A1). Used with permission. 35
2.2 Neurochemical arousal and subjective experience. 61
3.1 Selye’s General Adaptation Syndrome. Drawn from description in Selye (1950). 70
3.2 The neurocultural model of facial expression. Drawn from description in Ekman and Friesen (1969b). 76
3.3 A hierarchical model of emotional display and control. From Buck (1984, Figure 3.6). Reprinted with permission. 78
3.4 Symbolic, spontaneous, and pseudospontaneous (posing) communication. 79
3.5 Relationships between expressiveness and sending accuracy. 82
3.6 Areas of the brain associated with reward. 93
3.7 The major limbic system pathways. Illustration in the public domain. 98
xii  List of figures

3.9 MacLean's three subdivisions of the limbic system. From Buck (1999, Figure 5). © American Psychological Association. Reprinted with permission. 101

3.10 Emotion systems emerging from analyses of human neuroimaging studies. From Kober et al. (2008, Figure 7). Adapted with permission. 104

3.11 Brodmann areas. Illustration in the public domain. 118

3.12 Brain systems involving automatic versus controlled processing. From Lieberman (2007, Figure 1). Reprinted with permission. 124

3.13 Patterns of brain activation when viewing spontaneous emotional displays. From Powers et al. (2007). 138

3.14 A developmental-interactionist model of the appraisal process. From Buck (1988a, Figure 1.6). Used with permission. 140

3.15 A model of initial sensory processing. From Buck (1988a, Figure 9.1). Used with permission. 143

4.1 The relationship between spontaneous and symbolic communication. Adapted from Buck (1984). Used with permission. 149

4.2 Illustration of quorum sensing. 154

4.3 Lobster and crayfish dominance and submission postures induced by neurochemicals. From Livingstone et al. (1980, Figure 1). Reprinted with the permission of the senior author and the American Association for the Advancement of Science. 158

4.4 Comparison of Australopithecus (Lucy) and Chimpanzee bodies. Illustration 5-17 from Adrienne Zihlman, The Human Evolution Coloring Book. © 1982 by Coloring Concepts, Inc. Reprinted by permission of the author and HarperCollins Publishers. 164

4.5 Stages of emotional development. 182

4.6 The affective microscope. From Peery (1978). With kind permission from Springer Science and Business Media. 199

5.1 Relationships between biological and higher-level emotions. 207

5.2 Exploration in children: cognitive growth cycles. 212

5.3 Hierarchy of cognition. 219

5.4 Cognitive consistency/balance; cognitive dissonance. From Buck (1988a, Figures 9.5 and 9.6). Used with permission. 224

5.5 Effects of a social-cognitive intervention (SC) and an emotion education intervention (CSE) on reported condom use. From
List of figures

Ferrer et al. (2011, Figure 1). © American Psychological Association. Reprinted with permission.  242

6.1 Predicted and obtained behavior of the teacher when the learner/victim responded to shocks by vocal objection. From Milgram (1965, Figure 3). Reprinted with permission of Alexandra Milgram.  251

6.2 Hypothesized relationships between attachment, expectancy, social motives, and social emotions.  263

6.3 The dynamics of social emotions defining a dominant-subordinate relationship.  266

7.1 Correspondence of fertility decline to the year of Globo entry in Brazil. From La Ferrara et al. (2008, Figure 5). Reprinted with the permission of the senior author and the American Economic Association.  316

7.2 The structure of the primary moral emotions.  332

7.3 Dynamics of moral emotions.  335

7.4 Civility: the dynamics of the GREAT emotions.  353
# Tables

2.1 Major types of psychoactive drugs. page 40  
2.2 Common drugs, neurochemical systems and associated affects. 60  
5.1 Specific cognitive emotions: common words in English used to label feelings associated with combinations of situational contingencies. 215  
5.2 Pearson product-moment correlations between rated emotion and rated liking for seven music videos. 233  
6.1 Correlations with twinned emotions on the part of the self and other: US sample. 288  
6.2 Correlations with twinned emotions on the part of the self and other: Japan sample. 289
Foreword

One of the defining pursuits of humanity is arguably to find answers to the big questions, such as where do we come from, where are we going, and who are we? Understanding humanity, in turn, cannot be achieved without a grasp of the concepts we currently refer to as cognition, motivation, and emotion. While thinkers in all cultures have tackled these for more than two thousand years, I join a significant number of fellow contemporary researchers in tracing the beginnings of scientific emotion research to the nineteenth century. Today’s emotion science is standing on the shoulders of giants like Charles Darwin and William James. With the power of their interdisciplinary interests and their intellectual ideas they forged both the foundations and the prototypes of modern emotion theories. When reflecting on these achievements – and I recommend going back to read some of these texts in the original – I cannot help but marvel regarding one fact: someone like Darwin, or James for that matter, could be aware of basically all relevant research of the day. With respect to the output, all relevant research could fit in a decent library.

How times have changed! Today, knowledge is produced at a rate that prevents many a scientist from even retrieving, let alone reading all relevant material that is published, and this does not include the digestion of pertinent studies and publications. Today, we are further away from such a holistic analysis, and even more so from the capacity to synthesize the necessary bigger picture of emotion research. Yet, given the flood of research, we need an integrative view more than ever. Emotion science is a particularly tough cookie to swallow. An understanding of emotions does not just benefit from an interdisciplinary approach, emotion science requires a multidisciplinary approach! Affective processes cannot be understood at one level alone – they demand the multilevel approach that, for example Cacioppo and Berntson (1992), propagate. In “pop psychology,” and the science columns of major national news outlets, there is presently much talk of how neuroscience provides the answers, all answers, to psychological questions. And while it should be clear to even the most critical reader that
neuroscience has advanced our understanding of many psychological concepts, including emotions, it is completely false to believe that the new tools will do the trick on their own. Permitting myself an analogy, modern DNA analyses have revolutionized forensics—but they do not solve cases. In my mind, it is the same with the fine tools we now have for looking at the activity of the living brain. For me, personally, all the bits and pieces we have accumulated in the last century regarding emotions, whether they are at the level of cells, of organs, of the organism, of psychological processes, of interactions in networks of different sizes, or of descriptions of cultural values and practices—all these pieces are like an enormous puzzle that requires to be put together, using creativity, critical analysis, and the capacity to really transcend a view that is solely based on one of these individual levels, viewing the others only as auxiliaries. I am still baffled by how some people, and not only lay-people, are surprised when a newly published study demonstrates a psychological process to be accompanied by specific brain activity. Where did they think this would happen? And yet, just because there is a specific central nervous activation, I would not be able to tell whether this pattern is learned or hard-wired. If it is learned, whether it can be derived from mere observation of a few cases, or whether it takes a lifetime of learning to make the connections. It is here that other disciplines must work with neuroscience. Personally, I find it important to underscore how much of emotion psychology in 2014 is still focused on the individual alone. Emotions, and already Darwin pointed that out, have very important intrapersonal and interpersonal functions. In fact, in some cases, it makes much more sense to think of emotional processes in terms of larger units than the individual. But, this is perhaps easier to say for a biologist than for a modern, or post-modern, psychologist. The pervasiveness of social processes in all of emotion is still not yet something that is in the minds of many.

Emotion research is notorious for a multitude of definitions and approaches. Cornelius (1996) likens the stories emotion theorists weave to the ancient tale of the blind men who try to describe an elephant; their descriptions differ wildly because each of them can grasp, literally, only a part of the animal and not the elephant in its entirety; in fact, this analogy is echoed in the preface later in the present book. This is the challenge at stake in the here and now. And it is here that attempts are needed to put all of these pieces together. We need attempts at perceiving The Big Picture and converting it to a coherent narrative. And it is here where this book comes in that you are holding in your hands whether in the good old-fashioned print format or on a digital device. Ross Buck’s Emotion: A Biosocial Synthesis draws that Big Emotion Picture with bold strokes. I am not surprised at the scope and the power
of synthesis that Ross wields in this text – however, I sit in awe as it is revealed page by page. Ross Buck’s writing had a significant influence on my thinking at an early stage in my career. While attending grad school at Dartmouth College, in the late 1980s, two of his books left a particularly strong impression on me – Human Emotion and Motivation (1976) and – even more so – The Communication of Emotion (1984). I remember very well the first time I witnessed Ross in action, asking very thoughtful questions at the 1994 meeting of the International Society for Research on Emotion (ISRE), for which I have the honor of presiding at the moment. Since then we have met many times and I continue to enjoy his views on emotion research, as he continues to integrate biological and social aspects of emotion theories.

This book, using a systems approach, convincingly ties together all the levels I mentioned before – and it particularly bridges that still wide-open divide between neuroscience and the social layers – which might be due to the fact that unlike many of our colleagues in the “emotion business,” Ross is located in a Communication as well as a Psychology Department. The result is inspiring. This is the type of big synthesis of which we see perhaps less than a handful per decade. I am glad to benefit once again from his deep and broad insights. And I know that this book will inspire many students and scholars of the emotions. It provides not only a very useful conceptual framework, but also a guideline, a kind of road-map for the future trajectory of emotion research. Surely, as new research, particularly in social neuroscience, provides new insights on specific processes or structures in the years to come, details of the story will change, but just as in Magda Arnold’s opus magnum Emotion and Personality, it is the functional analysis that will likely stand the test of time for quite a while.

To be clear – this is no product of a “consensual analysis” like Kleinginna and Kleinginna’s attempt at defining emotions (1981b). This is a highly personal view, with a specific framework, idiosyncratic terminology, and strong choices – Ross Buck’s power of vision is the strength of this book. Yet, it does not require the reader to believe every bit, or to buy into each element. Doubtlessly, this book will stimulate exchanges, discussions, as well as controversies, while pushing emotion research to the next frontier.

Arvid Kappas
Bremen, December 2013
Preface

“There will never be an integrative theory of emotion.”

Niedenthal and Brauer (2012, p. 275)

Emotion is attracting burgeoning interest in the social, behavioral, and life sciences, but although the empirical evidence demonstrating its importance is overwhelming, important conceptual and definitional difficulties remain. In the issue of the journal Emotion Review current at this writing there was an extensive section on the definition of emotion, with one paper asserting that it is a concept “in crisis” and seriously questioning whether the concept of emotion “can be expected to operate as part of a truly scientific lexicon” (Dixon, 2012, p. 338). Emotion is widely considered to be momentary, fleeting, ephemeral, and resistant to study; while cognition is somehow stable, enduring, and well suited to empirical investigation. Also, the Annual Review of Psychology summary of the emotion field current at this writing began by questioning whether scientists can or should study emotion, and concluded that an integrative theory of emotion is impossible because the very definition of the term “emotion” is useful only in the context of a given research program (Niedenthal and Brauer, 2012). This recalls the famous parable from India about ten blind men arrayed around an elephant, each trying to describe the nature of the beast from his restricted experience of feeling a trunk, a leg, a tail; and arguing heatedly.

In this book I aim to present a general synthesis of the biological and social aspects of emotion. I regard emotion as an ever-present phenomenon central to all living things, evolving from the first stirrings of life nearly four billion years ago. I submit that only by understanding emotion can we understand motivation and cognition: each of these is involved with the others so closely that we cannot fully comprehend one without understanding how it relates to the others. Also, only by understanding emotion can we appreciate the fundamental similarities between human beings and other animals, as well as the fundamental difference: the human capacity for language. And, only by
understanding emotion can we appreciate how fundamentally we differ from even the most impressive of computing machines. Computers are, in the final analysis, merely tools.

A major conceptual aim of this book is to describe how biological emotions are natural kinds discoverable by science, and how they relate to higher-level social, cognitive, and moral emotions. Biological emotions are seen to constitute natural kinds at two levels. First, they are based upon primary motivational-emotional systems (primes) associated with readouts of specifiable neurochemical systems in the brain. Second, biological emotions are natural kinds in that they are organized by their functions in the ecology: e.g. the physical and social environment in which the individual lives. It is at the ecological level that emotions can be organized and defined in terms of specifiable and observable displays, such as facial expressions, vocalizations, body movements, and postures; as well as intimate touches, scents, and odors. These displays are responded to automatically by preattunements to those displays in receivers, this process often involving mirror neuron systems. These display–preattunement associations take the phenomenon of emotion out of the head of the individual, as it were, into the social and communicative environment.

Chapter 1 introduces a general biosocial approach that views emotions in terms of emergent systems involving an interaction between biological potential and social experience over the course of development: a developmental-interactionist theory. Emotions emerge naturally and effortlessly from underlying biological potential as self-organizing dynamical systems over the course of development. This view might be termed “emotiocentric” in contrast to other approaches in the behavioral and social sciences. The chapter considers how experienced emotion, or affect, relates to other aspects of experience; as well as other aspects of emotional responding: expressive displays and physiological responses. The chapter also considers the process of emotional education: the complex ways that we learn to label and understand our subjective affective feelings and hopefully attain emotional competence.

The next three chapters consider basic biological emotions that are directly related to specifiable neurochemical systems in the brain: the active ingredients to the emotion cocktail, as it were. These include widely recognized dimensions of emotion – arousal and valence – as well as discrete emotions: the primary affects of happiness sadness, fear, anger, and disgust. They also include less widely acknowledged reptilian emotions (sex and power) and prosocial emotions (attachment, love, nurturance, bonding, separation anxiety).

Later chapters in the book consider “higher-level” social, cognitive, and moral emotions, and how these are grounded in the biological
emotions but emerge to respond to universal ecological contingencies. I regard biological emotions as contributing the physiological bases for higher-level emotions. This book takes an ecological-systems view of higher-level emotions; they obtain their primordial experiential “fire” from biological emotions associated with attachment, expectancy, and a hypothesized emotion of moral approbation termed gust. Thus “fired” biologically, higher-level emotions respond as emergent dynamical systems to ecologically universal social and situational challenges occurring naturally during development.
Acknowledgments

It is a pleasure to acknowledge the support from others that made this book possible. Many thanks to Keith Oatley for his careful and useful editorial work. Collaborative work in recent years has led to publications with Michael Beatty, Rebecca Chory-Assad, Jack Dovidio, Jeff Fisher, Mark Hamilton, Rob Henning, Tim Levine, Adam Pearson, and Tessa West. In particular, collaborative work with R. Thomas Boone on emotional expressivity in social dilemma games; Reuben Baron on perceptual theory; Arjun Chaudhuri on emotion and persuasion; Whitney A. Davis and Mohammed Kahn on emotion in risk communication; Benson Ginsburg on the theory of communicative genes; Yumi Iwamitsu on emotion expression in cancer; David A. Kenny on dyad-level data analysis; Kent Kiehl on fMRI analysis of responses to spontaneous facial displays; Elliott D. Ross on brain mechanisms of emotion; and C. Arthur Van Lear on communication theory has contributed immeasurably to this book.

I am indebted to many students, including Erika Anderson, Emil Coman, Mats Georgson, Christian Rauh, Ipshita Ray, Nanciann Norelli Smith, and Georgios Triantis. In particular, a number of my doctoral students have contributed ideas and research particularly relevant to a number of aspects of the developmental-interactionist analysis offered here. These include work with Arjun Chaudhuri on emotion and persuasion; Michelle Pulaski Behling on music and emotion; Caroline Easton and Jacquie Cartwright-Mills on emotional communication in schizophrenia patients; Cheryl Goldman on emotional communication in behaviorally disordered children; and Megan Sheehan on emotional communication and personality. I particularly wish to acknowledge in this regard the work of Mike Miller, Christopher Kowal, Stacie Renfro Powers, Stephen Stifano, Rebecca Ferrer, Makoto Nakamura, Emil Coman, Ed Vieira, Maxim Polonsky, and Christian Rauh. Also, I am indebted to students in my graduate seminars on Nonverbal Communication, Motivation and Emotion, and Emotion and Persuasion who have read and commented on parts of this book as it has developed over the years; to Hillary Siddons, who did yeoman
work assisting with the preparation of the references; and to Mike Miller, who was enormously helpful in obtaining permissions. Needless to say, none of my colleagues is responsible for any failings of this book, but they have contributed greatly to its strengths.

The cover figure is based on the idea of a mandala combining a brain, globe, and Greek masks. It was brilliantly realized by Donna Drasch, an artist from Ashford, Connecticut, USA; and was the logo for the Newsletter of the International Society for Research on Emotions (ISRE) when I was editor and is still used occasionally by ISRE. I am very grateful to the artist and to ISRE for permission to use it for a cover illustration, as it captures the essence of the view of emotion as a biosocial synthesis. I am also very grateful to Arvid Kappas, current president of ISRE, for writing the Foreword. With his broad and deep understanding of emotion, Arvid’s views are greatly valued.

Finally, I am deeply indebted to my family for their support and encouragement: my children Ross William Buck, Maria Lenore Buck, Nancy Jenney Buck, and Theodore Reed Buck; my daughters-in-law Meghan Gaffney Buck and Jennifer Saraceno Buck; and grandchildren Eleanor Violet and William Christopher Buck (Bill and Meghan’s children) and Maya Rose and Hannah Judith Buck (Ted and Jenn’s daughters). This book is dedicated to my grandchildren. And of course this work would have been impossible without the help and support of my wife, Marianne Jenney Buck: the love and joy of my life.