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The Cambridge Handbook of Human Affective Neuroscience

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To the memory of
David Servan-Schreiber, superb colleague and
generous friend who introduced me to, among many
other things, the field of Human Affective
Neuroscience (JA)
Jon Driver, a truly inspiring mentor whose
guidance and friendship have been a unique
experience that is still very much alive in my work (PV)

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Introduction

Understanding human emotion and the mechanisms underlying its generation or expression has been a central preoccupation of thinkers for millennia. Yet, its scientific study, particularly from a biological perspective, is quite recent, especially in comparison to that of other mental processes, such as vision, language, attention, or memory. Despite this late start, neuroscientific approaches to emotion have experienced a dramatic growth over the past decade. This has led to the birth of the new area of affective neuroscience, which has extended the field of cognitive research initiated in the previous decade. This new development was in large part due to important advances in the use of noninvasive functional neuroimaging techniques – such as positron emission tomography (PET), electroencephalography (EEG), magneto-encephalography (MEG), and, particularly, functional magnetic resonance imaging (fMRI). Together with refinements in more traditional methods, such as lesion studies, behavioral measures, and physiological recordings, the new techniques helped scientists make subjective and "private" affective processes more "visible" and amenable to experimental research in humans.

Largely building on previous research in neurophysiology, human affective neuroscience research began by focusing on the so-called basic emotions, particularly fear, mostly through visual stimuli (e.g., facial expression). However, as illustrated in the wide range of topics covered here, emotion research now covers different sensory modalities, processes, interactions with other systems, as well as individual differences. Emotion is now an accepted component of many "unrelated" disciplines, such as social psychology, economics, marketing, politics, and philosophy.

This book is intended to provide a wide yet comprehensive, up-to-date, and authoritative review of the cognitive neuroscience of human emotion that is both rigorous and accessible. Naturally, to keep the book manageable and of a reasonable size, we had to make some difficult choices in terms of its contents. Rather than choosing a few snippets from the entire field of affective neuroscience, we decided to focus on a specific area within the field. With this in mind,

we explicitly left out nonhuman animal work. This does not mean in any way that we underestimate the importance of this research. Indeed, as stated in many of the chapters, research in experimental animals has been critical in providing the framework in which human affective neuroscience has developed; the authors were encouraged to highlight corresponding links with animal and biological sciences whenever possible. However, adding this perspective to the book would have required substantial coverage of molecular and cellular techniques that go beyond the aims of a single book. We also left out more clinically oriented research, such as emotional dysfunction in psychiatric and neurological disorders, although several of the chapters, especially those in the *Individual Differences* section, are highly relevant to this important area of knowledge.

One of the key features of this volume is that all the invited authors are established, yet young researchers – the Generation X of human affective neuroscience research – representing more than 20 institutions across three continents. They are some of the most active researchers who have contributed to the field and are still doing so.

The volume's 28 chapters are organized into seven independent yet complementary sections. We believe that this organization of topics will help readers gain a broad and structured view of the field.

Section I provides an introduction to the study of emotion from a cognitive neuroscience perspective. It is followed by a methodology section (Section II) that presents some of the most effective and widely used approaches to measure emotional responses. It describes the various techniques in a rigorous yet accessible manner, with particular emphasis easy-to-follow on affective neuroscience research – highlighting the advantages and limitations of each approach and providing concrete examples to help the reader appreciate these issues.

Section III consists of six chapters covering emotional perception and expression across different modalities (visual, auditory,

olfactory, and somatosensory) and different domains within a given modality (e.g., auditory: voices and music; vision: faces and bodies). We decided to take this approach rather than, say, dividing the section according to the basic emotions, because most researchers, and thus their work, tend to focus on one of these domains but often encompass several emotions and/or processes. Thus, this structure, although somewhat arbitrary (because emotion is typically multimodal) will be most helpful to readers and reflects the current mainstream directions in human affective neuroscience.

Section IV follows with a description of how emotion and cognition interact. In this large and ever growing field, we focus on some of the most studied topics; namely emotion-attention interactions, emotion regulation, and decision making. Because of its importance and the large literature associated with it, interactions between emotion and learning and memory are covered in a separate section (Section V); its three chapters cover implicit and explicit aspects of memory, aversive learning, and reward learning. Chapters in Section VI address recent research in the so-called higher emotions, including morality, empathy, and other social emotions. Finally, Section VII covers some of the most studied individual differences – namely sex and gender, anxiety, age, and genotype – in emotional processing.

This book is particularly aimed at scientists and students of all levels (undergraduate, graduate, and postdoctoral) from psychology, neuroscience, and cognitive science, as well as people from other disciplines – including medicine, biology, computer science, economics, sociology, and political science – who have an interest in the relation between emotion and their area of study or research. In addition, this book should be useful to more clinically oriented professionals, including physicians and therapists, who are interested in gaining a better understanding of the neurobiological bases of human emotions.

Section I

INTRODUCTION TO HUMAN AFFECTIVE NEUROSCIENCE