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PREFACE

The Greeks worshiped the goddess Mnemosyne (from whom the term mnemonics originated), praying to her for retention of experiences that were particularly important to them. Thus, it seems that since ancient time people have understood that not all experienced events are equally likely to be remembered. Although many factors can influence which experiences we remember and which we forget, one critical determinant is whether the experience is infused with emotion. We are much more likely to remember events with emotional importance and personal significance than we are to remember the more mundane of life’s experiences. Over the past couple of decades, there has been increasing interest in understanding how emotion influences memory formation and retrieval, both at the level of behavior and at the level of the brain.

My own interest in the topic began when I was working with Alzheimer’s disease patients. One woman explained how her husband had forgotten about attending the first birthday party of his granddaughter within weeks of the party’s occurrence. The son of another patient expressed dismay that his mother was unable to remember that he recently had gotten married. These anecdotes spurred my desire to understand emotion’s effects on healthy individuals’ memories and in those with an age-related disease. At that time, there was little research examining how emotional memory changes as adults age. Over the past few years, however, research on emotional memory in older adulthood and in age-related disease has increased dramatically. This book provides a review of the recent advances in understanding emotion–memory interactions across the adult lifespan, integrating studies using behavioral, neuropsychological, and neuroimaging approaches. We are still far from having a complete picture of how emotion influences human memory, and there are many questions that remain to be answered. I hope that by pointing out some inconsistencies and gaps in the literature, this book will inspire further research into the intricacies of emotion’s modulation of memory.

I have benefited from phenomenal mentors and colleagues throughout my research career. I am particularly indebted to Suzanne Corkin,
Emotion, Memory, and Their Interactions

Historical Perspective on Emotion–Cognition Interactions

For centuries, scholars assumed that cognition and emotion were separable. Although cognition could trigger emotional responses and emotional processing could influence cognitive thought, the two types of processes were considered to be non-overlapping and distinct (Aristotle, trans. 1991; Plato, trans. 1992). Moreover, in the instances where interactions between emotion and cognition were thought to occur, the effects were assumed to be opposing. Emotional processes were thought to hijack cognitive ones, making individuals prone to irrationality. Conversely, rational thought was believed to curtail emotional processing.

Over the past two decades, empirical evidence has forced a re-examination of these assumptions. Counter to the notion that emotion processes will always impede cognitive ones, many studies have revealed instances in which emotional engagement results in cognitive enhancement rather than cognitive decline. For example, having an emotional (or affective) response to a stimulus often aides in decision making; individuals who lack emotional reactions perform more poorly on a range of decision-making tasks than do individuals who show intact affective processing (e.g., Bechara, Damasio, & Damasio, 2000). Individuals also are better at detecting and maintaining focus on stimuli with emotional meaning (e.g., Dolan & Vuilleumier, 2003) and, as is the focus of this book, individuals often show mnemonic benefits for stimuli that are emotionally relevant.
Although there continues to be significant debate about how best to conceptualize emotion and cognition (e.g., Lazarus & Folkman, 1984; Neisser, 1976; Zajonc, 1984), researchers no longer can ignore the robust interactions between these processes or treat them as opposite ends of a continuum.

Indeed, interest in emotion–cognition interactions has exploded in the last few years. A literature search conducted using the National Library of Medicine’s search engine revealed just over 8500 articles that included the keywords “emotion and cognition.” Over half of these articles had been written in the last decade. Interest in the intersection between emotion and cognition has been far-reaching. Behavioral economics, which assumes the premise that markets operate within a framework influenced by human limitations in rationality, has forced an evaluation of how human cognition acts within an emotionally vibrant context. Affective computing within artificial intelligence and computer science has led to re-examinations of the links between intelligent thought and affective response. The examination of emotion–cognition interactions has spurred a host of cross-disciplinary fields of research (e.g., affective neuroscience, social cognitive neuroscience, neuroeconomics), yielding new insights into the behavioral and neural intersection between emotional and cognitive processes.

This book explores the influence of emotion within the cognitive domain of memory. Despite many metaphors of memory as a storage cabinet, containing files of every past event, in reality we remember only a fraction of life’s experiences. A multitude of factors can influence what we remember and what we are doomed to forget, but one critical contributor is the emotional salience of the event. Events that evoke emotional reactions are more likely to be remembered than events that lack emotional importance. In this book, we examine the cognitive (thought-level) and neural (brain-level) processes that lead to effects of emotion on memory.

This book is organized in three parts. The first part (which you are now reading) presents a broad overview of emotion and memory. In order to understand the myriad interactions between emotion and memory, first it is necessary to describe how emotion and memory may be broken down into core components. Neither the term emotion nor the term memory describes a single entity. Both are umbrella terms used to describe a host of related, but distinct, processes. Thus, there is no single effect of “an emotion” on “a memory.” Rather, the interactions between emotion and memory vary depending on the type of emotion assessed (e.g., whether pleasurable or aversive) and on the type of memory assessed (e.g., whether measuring short-term storage or long-term retention of information).

The second section of this book describes the effects of emotion on young adults’ memories, focusing on the effects of emotion on the transient storage of information, and on the retention of information over the long term. I discuss the effects of emotion on the memory processes
that we use consciously, and on the processes that guide our actions even when we are unaware of their influence. Occasionally, I describe effects of emotion on other types of cognitive processes (e.g., attention, perception) that have downstream effects on memory. For example, emotion exerts strong influences on attentive and pre-attentive processes, biasing the likelihood that individuals will detect, and will remain focused on, emotional information in the environment (reviewed by Dolan & Vuilleumier, 2003; Pessoa, 2005). Although not direct effects of emotion on memory, these influences of emotion nevertheless have significant consequences for memory performance. Information to which we attend, or about which we think deeply, will tend to be remembered better than information that grabs our attention only transiently. Throughout the chapters of Section II, I put particular emphasis on examining the extent to which memory for emotional information is supported by distinct cognitive or neural processes from those that support memory for non-emotional information. That is, does emotion enhance memory by boosting the same processes that help us to remember non-emotional information? Alternatively, is information with emotional relevance better remembered because of the engagement of entirely different processes that we do not use when remembering non-emotional information? Although it may seem contradictory, the answer to both questions may be “yes.” I present evidence that individuals recruit emotion-processing regions when learning or retrieving emotional information, and that activity in these regions seems to correspond with improved memories for these experiences. However, these regions seem to exert their effect, at least in part, through modulation of the same types of processes as are recruited when individuals remember non-emotional information.

The third segment of this book discusses the interactions between emotion and memory that occur in older adults, examining how advancing age changes the processing and retention of emotional information. An influential framework for understanding age-related changes in emotional memory has described the aging process as one in which people become more focused on emotional goals and on situations that elicit feelings of well-being (Carstensen, Isaacowitz, & Charles, 1999). This section examines the extent to which the focus of older adults on emotional goals influences the types of experiences to which they attend and about which they remember. Interestingly, older adults sometimes seem to attend to positive information in the environment at the exclusion of negative information, and they often remember more positive information than younger adults (a “positivity effect” as described by Mather & Carstensen, 2005). However, there appear to be limits on this positivity effect. I describe instances in which older adults are just as likely as young adults, or even more likely, to focus on negative information in the environment and to remember negative experiences. I also present evidence
that, in both young and older adults, negative information can be remembered with more detail than positive information. I pay particular attention to the cognitive processes that may lead to age-related preservation or change in emotional processing and emotional memory, with particular consideration to differences between relatively automatic processing of emotional information (which may remain fairly stable with aging) and more controlled and deliberative processing of emotional information (which may be altered with aging). See Mather (2006) for more discussion of this intriguing dissociation.

What Is Emotion?

Before we proceed to examine the effects of emotion on memory, first it is necessary to talk a bit about what is meant by emotion. In 1884, William James posed the question, “What is an emotion?” Although there has been extensive discussion regarding how best to answer that question, there still is no clear consensus. Emotion is a term that has been used widely to connote a variety of feeling states. There is no single agreed upon definition of emotion, most likely because the term refers not to a single, discrete entity, but rather to a set of processes that include subjective feelings, cognitive appraisals, physiological reactions, and expressive actions. There continue to be significant debates about how best to characterize emotion (see Barrett, 2006; Barrett et al., 2007; Izard, 2007; Frijda & Sundararajan, 2007; and Panksepp, 2007 for recent debates regarding the construct of emotion). At the heart of these debates is the question of whether emotional experience is fractionated into discrete entities (e.g., fear, happiness) or whether emotion is better described by changes along dimensions of experience. An influential framework, and the one that I adopt throughout this book, describes emotional experiences within a two-dimensional space with axes of valence (how pleasant or unpleasant) and arousal (how excited/agitated or soothed/placated; Lang, Greenwald, Bradley, & Hamm, 1993; Lang, Bradley, & Cuthbert, 1998a, 1998b; Reisenzein, 1994; Russell, 1980; Russell & Barrett, 1999; Schlosberg, 1954). Although a lot of research examining the effects of emotion has been restricted to examining how people remember high-arousal versus low-arousal information, I describe a number of studies that have focused on understanding to what extent the effects of emotion on memory depend upon the combination of valence and arousal experienced.

Beyond how we conceptualize the fragmentation of emotional space, however, what is meant by emotion will differ depending on how it is elicited or measured. For example, if we use self-report to measure emotion, then we are examining the subjective feelings or cognitive appraisals
associated with emotion. If, in contrast, we rely on physiological measurements, then we are measuring emotion as a change in the biological (but not necessarily psychological) state of the organism. Because of the influences that they can have on the meaning of emotion, it is important to describe briefly the types of research methods used to elicit and assess emotion.

Eliciting and Assessing Emotions

For quite a while, the study of emotion seemed to be an intractable topic. How could one systematically study a construct that, at its core, seemed tied to an introspective state unique to each individual? Although it is impossible to assure that, for example, my state of fear is equivalent to yours, over the past few years great strides have been made in developing standardized methods for eliciting and assessing emotions.

Often emotions are elicited through presentation of external stimuli, such as narrated film slides, colored photographs, or verbal or auditory stimuli. Researchers have compiled extensive databases of stimuli that have been rated for their emotional content as well as along other dimensions (e.g., Bradley & Lang, 1999; Lang, Bradley, & Cuthbert, 1999), making it easier for researchers to select stimuli matched on a host of variables (e.g., verbal frequency, object familiarity), thus reducing the concern that effects attributed to emotion may actually be due to differences in other non-emotion dimensions. In other cases, emotions can be elicited through internal generation of information, such as remembering emotional events, imagining emotional situations, or enacting emotional actions or postures.

Sometimes, researchers present these stimuli in close proximity to one another, with the intended result being that participants fluctuate relatively rapidly between emotional states. For example, an individual may feel pleasure upon seeing a picture of a smiling baby but may soon feel displeasure if the following picture is of an injured child. This methodology allows researchers to examine the effects of short-term fluctuations of emotional state on, for example, memory performance. In other words, are individuals better able to remember the injured child, which elicited a feeling of displeasure, than to remember the smiling baby linked with a feeling of pleasure?

In other instances, researchers are interested in how less transient changes in emotional state influence cognitive ability or they wish to investigate the effect of emotions not easily elicited by single stimuli presented in the laboratory (e.g., embarrassment, stress, anger). “Mood induction procedures” often are used to achieve these goals. These procedures range in their design. Participants may listen to music that evokes feelings of excitement or melancholy; they may be exposed to other primary