Publications, 2000.

Frost, Peter J., *Toxic Emotions at Work: How Compassionate Managers Handle Pain and Conflict*. Boston: Harvard Business School Press, 2003.

Riggio, Ronald, Susan E. Murphy, and Francis Pirozzolo. *Multiple Intelligences and Leadership*. Mahwah, NJ: Lawrence Erlbaum, 2002.

PARENTING

Recommended Books

Elias, Maurice, Steven E. Tobias, and Brian S. Friedlander, *Emotionally Intelligent Parenting: How to Raise a Self-disciplined, Responsible, Socially Skilled Child*. New York: Harmony Books, 1999.

Elias, Maurice, Steven E. Tobias, and Brian S. Friedlander. *Raising Emotionally Intelligent Teenagers*. New York: Harmony Books, 2000.

Gottman, John. *Raising an Emotionally Intelligent Child*. New York: Simon and Schuster, 1998.

Schure, Myrna. *Raising a Thinking Child*. New York: Pocket Books, 1994.

GENERAL

6 Seconds is a nonprofit organization that supports emotional intelligence in schools, businesses, and families, with an international scope. It is an excellent source for information on resources, articles, and conferences. Website: www.6seconds.org.

Recommended Books

Bar-On, Reuven, and Parker, James D. A., eds. *Handbook of Emotional Intelligence*. San Francisco: Jossey-Bass, 2000.

Barrett, Lisa Feldman, and Peter Salovey. *The Wisdom of Feeling: Psychological Processes in Emotional Intelligence*. New York: Guilford Press, 2002.

Geher, G., ed. *Measuring Emotional Intelligence: Common Ground and*

Controversy. Hauppauge, NY: Nova Science Publishers, 2004.

Salovey, Peter, Marc A. Brackett, and John D. Mayer. *Emotional Intelligence: Key Readings on the Mayer and Salovey Model*. Port Chester, NY: DUDE Publishing, 2004.

Williams, Virginia, and Redford Williams. *Lifeskills*. New York: Times Books, 1997.

A Thoughtful Critique:

Matthews, Gerald, Moshe Zeidner, and Richard D. Roberts. *Emotional Intelligence: Science and Myth*. Cambridge: MIT Press, 2002.

For Tara, wellspring of emotional wisdom

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Notes

Introduction

1. J. A. Durlak and R. P. Weissberg, “A Major Meta-analysis of Positive Youth Development Programs,” presentation at the annual meeting of the American Psychological Association, Washington, DC, August 2005. See also R. P. Weissberg, “Social and Emotional Learning for School and Life Success,” address to the Society for Community Research and Action (APA Division 27), Distinguished Contribution to Theory and Research Award, at the annual meeting of the American Psychological Association, Washington, D.C., August 2005.
2. N. R. Riggs, M. T. Greenberg, C. A. Kusche, and M. A. Pentz, “The Role of Neurocognitive Change in the Behavioral Outcomes of a Social-Emotional Prevention Program in Elementary School Students: Effects of the PATHS Curriculum,” 2005, under review.
3. The EI model seems to be emerging as an influential framework within psychology. The span of psychological fields that now are informed by (and inform) the EI model range from neuroscience to health psychology. The areas with strongest connections to EI include: development, education, clinical and counseling, social, and industrial/organizational psychology, among others. Indeed, segments on EI are now routinely included in many college-level and graduate courses in these subjects.
4. J. D. Mayer, P. Salovey, and D. R. Caruso, “Models of Emotional Intelligence,” in R. J. Sternberg, ed., *Handbook of Intelligence*, Cambridge, Eng.: Cambridge University Press, 2000.
5. Children rated in 1999: Thomas M. Achenbach et al., “Are American Children’s Problems Still Getting Worse? A 23-year Comparison,” *Journal of Abnormal Child Psychology*, 31 (2003): 1–11.

PART ONE: THE EMOTIONAL BRAIN

Chapter 1. What Are Emotions For?

1. Associated Press, September 15, 1993.

2. The timelessness of this theme of selfless love is suggested by how pervasive it is in world myth: The Jataka tales, told throughout much of Asia for millennia, all narrate variations on such parables of self-sacrifice.

3. Altruistic love and human survival: The evolutionary theories that posit the adaptive advantages of altruism are well-summarized in Malcolm Slavin and Daniel Kriegman, *The Adaptive Design of the Human Psyche* (New York: Guilford Press, 1992).

4. Much of this discussion is based on Paul Ekman's key essay, "An Argument for Basic Emotions," *Cognition and Emotion*, 6, 1992, pp. 169–200. This point is from P. N. Johnson-Laird and K. Oatley's essay in the same issue of the journal.

5. The shooting of Matilda Crabtree: *The New York Times*, Nov. 11, 1994.

6. Only in adults: An observation by Paul Ekman, University of California at San Francisco.

7. Body changes in emotions and their evolutionary reasons: Some of the changes are documented in Robert W. Levenson, Paul Ekman, and Wallace V. Friesen, "Voluntary Facial Action Generates Emotion-Specific Autonomous Nervous System Activity," *Psychophysiology*, 27, 1990. This list is culled from there and other sources. At this point such a list remains speculative to a degree; there is scientific debate over the precise biological signature of each emotion, with some researchers taking the position that there is far more overlap than difference among emotions, or that our present ability to measure the biological correlates of emotion is too immature to distinguish among them reliably. For this debate see: Paul Ekman and Richard Davidson, eds., *Fundamental Questions About Emotions* (New York: Oxford University Press, 1994).

8. As Paul Ekman puts it, "Anger is the most dangerous emotion; some of the main problems destroying society these days involve anger run amok. It's the least adaptive emotion now because it mobilizes us to fight. Our emotions evolved when we didn't have the technology to act so powerfully on them. In prehistoric times, when you had an instantaneous rage and for a second wanted to kill someone, you couldn't do it very easily —but now you can."

9. Erasmus of Rotterdam, *In Praise of Folly*, trans. Eddie Radice (London: Penguin, 1971), p. 87.

10. Such basic responses defined what might pass for the "emotional life"—more aptly, an "instinct life"—of these species. More important in evolutionary terms, these are the decisions crucial to survival; those animals that could do them well, or well enough,

survived to pass on their genes. In these early times, mental life was brutish: the senses and a simple repertoire of reactions to the stimuli they received got a lizard, frog, bird, or fish—and, perhaps, a brontosaurus—through the day. But this runt brain did not yet allow for what we think of as an emotion.

11. The limbic system and emotions: R. Joseph, *The Naked Neuron: Evolution and the Languages of the Brain and Body* (New York: Plenum Publishing, 1993); Paul D. MacLean, *The Triune Brain in Evolution* (New York: Plenum, 1990).

12. Rhesus infants and adaptability: "Aspects of emotion conserved across species," Ned Kalin, M.D., Departments of Psychology and Psychiatry, University of Wisconsin, prepared for the MacArthur Affective Neuroscience Meeting, Nov., 1992.

Chapter 2. Anatomy of an Emotional Hijacking

1. The case of the man with no feelings was described by R. Joseph, op. cit. p. 83. On the other hand, there may be some vestiges of feeling in people who lack an amygdala (see Paul Ekman and Richard Davidson, eds., *Questions About Emotion*. New York: Oxford University Press, 1994). The different findings may hinge on exactly which parts of the amygdala and related circuits were missing; the last word on the detailed neurology of emotion is far from in.

2. Like many neuroscientists, LeDoux works at several levels, studying, for instance, how specific lesions in a rat's brain change its behavior; painstakingly tracing the path of single neurons; setting up elaborate experiments to condition fear in rats whose brains have been surgically altered. His findings, and others reviewed here, are at the frontier of exploration in neuroscience, and so remain somewhat speculative—particularly the implications that seem to flow from the raw data to an understanding of our emotional life. But LeDoux's work is supported by a growing body of converging evidence from a variety of neuroscientists who are steadily laying bare the neural underpinnings of emotions. See, for example, Joseph LeDoux, "Sensory Systems and Emotion," *Integrative Psychiatry*, 4, 1986; Joseph LeDoux, "Emotion and the Limbic System Concept," *Concepts in Neuroscience, 2*, 1992.

3. The idea of the limbic system as the brain's emotional center was introduced by neurologist Paul MacLean more than forty years ago. In recent years discoveries like LeDoux's have refined the limbic system concept, showing that some of its central structures like the hippocampus are less directly involved in emotions, while circuits linking other parts of the brain—particularly the prefrontal lobes—to the amygdala are more central. Beyond that, there is a growing recognition that each emotion may call on distinct brain areas. The most current thinking is that there is not a neatly defined single "emotional brain," but rather several systems of circuits that disperse the regulation of a given emotion to farflung, but coordinated, parts of the brain. Neuroscientists speculate that when the full brain mapping of the emotions is accomplished, each major emotion

will have its own topography, a distinct map of neuronal pathways determining its unique qualities, though many or most of these circuits are likely to be interlinked at key junctures in the limbic system, like the amygdala, and prefrontal cortex. See Joseph LeDoux, "Emotional Memory Systems in the Brain," *Behavioral and Brain Research*, 58, 1993.

4. Brain circuitry of different levels of fear: This analysis is based on the excellent synthesis in Jerome Kagan, *Galen's Prophecy* (New York: Basic Books, 1994).

5. I wrote about Joseph LeDoux's research in *The New York Times* on August 15, 1989. The discussion in this chapter is based on interviews with him, and several of his articles, including Joseph LeDoux, "Emotional Memory Systems in the Brain," *Behavioural Brain Research*, 58, 1993: Joseph LeDoux, "Emotion, Memory and the Brain," *Scientific American*, June, 1994; Joseph LeDoux, "Emotion and the Limbic System Concept," *Concepts in Neuroscience, 2*, 1992.

6. Unconscious preferences: William Raft Kunst-Wilson and R. B. Zajonc, "Affective Discrimination of Stimuli That Cannot Be Recognized," *Science* (Feb. 1, 1980).

7. Unconscious opinion: John A. Bargh, "First Second: The Preconscious in Social Interactions," presented at the meeting of the American Psychological Society, Washington, DC (June 1994).

8. Emotional memory: Larry Cahill et al., "Beta-adrenergic activation and memory for emotional events," *Nature* (Oct. 20, 1994).

9. Psychoanalytic theory and brain maturation: the most detailed discussion of the early years and the emotional consequences of brain development is Allan Schore, *Affect Regulation and the Origin of Self* (Hillsdale, NJ: Lawrence Erlbaum Associates, 1994).

10. Dangerous, even if you don't know what it is: LeDoux, quoted in "How Scary Things Get That Way," *Science* (Nov. 6, 1992), p. 887.

11. Much of this speculation about the fine-tuning of emotional response by the neocortex comes from Ned Kalin, op. cit.

12. A closer look at the neuroanatomy shows how the prefrontal lobes act as emotional managers. Much evidence points to part of the prefrontal cortex as a site where most or all cortical circuits involved in an emotional reaction come together. In humans, the strongest connections between neocortex and amygdala run to the left prefrontal lobe and the temporal lobe below and to the side of the frontal lobe (the temporal lobe is critical in identifying what an object is). Both these connections are made in a single projection, suggesting a rapid and powerful pathway, a virtual neural highway. The single-neuron projection between the amygdala and prefrontal cortex runs to an area called the *orbitofrontal cortex*. This is the area that seems most critical for assessing emotional responses as we are in the midst of them and making mid-course corrections.

The orbitofrontal cortex both receives signals from the amygdala and has its own

intricate, extensive web of projections throughout the limbic brain. Through this web it plays a role in regulating emotional responses—including inhibiting signals from the limbic brain as they reach other areas of the cortex, thus toning down the neural urgency of those signals. The orbitofrontal cortex's connections to the limbic brain are so extensive that some neuroanatomists have called it a kind of "limbic cortex"—the thinking part of the emotional brain. See Ned Kalin, Departments of Psychology and Psychiatry, University of Wisconsin, "Aspects of Emotion Conserved Across Species," an unpublished manuscript prepared for the MacArthur Affective Neuroscience Meeting. November, 1992; and Allan Schore, *Affect Regulation and the Origin of Self* (Hillsdale, NJ: Lawrence Erlbaum Associates, 1994).

There is not only a structural bridge between amygdala and prefrontal cortex, but, as always, a biochemical one: both the ventromedial section of the prefrontal cortex and the amygdala are especially high in concentrations of chemical receptors for the neurotransmitter serotonin. This brain chemical seems, among other things, to prime cooperation: monkeys with extremely high density of receptors for serotonin in the prefrontal-amygdala circuit are "socially well-tuned," while those with low concentrations are hostile and antagonistic. See Antonio Damosio, *Descartes' Error* (New York: Grosset/Putnam, 1994).

13. Animal studies show that when areas of the prefrontal lobes are lesioned, so that they no longer modulate emotional signals from the limbic area, the animals become erratic, impulsively and unpredictably exploding in rage or cringing in fear. A. R. Luria, the brilliant Russian neuropsychologist, proposed as long ago as the 1930s that the prefrontal cortex was key for self-control and constraining emotional outbursts; patients who had damage to this area, he noted, were impulsive and prone to flareups of fear and anger. And a study of two dozen men and women who had been convicted of impulsive, heat-of-passion murders found, using PET scans for brain imaging, that they had a much lower than usual level of activity in these same sections of the prefrontal cortex.

14. Some of the main work on lesioned lobes in rats was done by Victor Dennenberg, a psychologist at the University of Connecticut.

15. Left hemisphere lesions and joviality: G. Gianotti, "Emotional behavior and hemispheric side of lesion," *Cortex*, 8. 1972.

16. The case of the happier stroke patient was reported by Mary K. Morris, of the Department of Neurology at the University of Florida, at the International Neurophysiological Society Meeting, February 13–16, 1991, in San Antonio.

17. Prefrontal cortex and working memory: Lynn D. Selemon et al, "Prefrontal Cortex," *American Journal of Psychiatry*, 152, 1995.

18. Faulty frontal lobes: Philip Harden and Robert Pihl, "Cognitive Function, Cardiovascular Reactivity, and Behavior in Boys at High Risk for Alcoholism," *Journal of Abnormal Psychology*, 104, 1995.