

Antonio Damasio The Feeling of What Happens (1999)

as it relates to consciousness. It is not possible to cite every author who has published recent and important texts on this general issue, but I recommend a number of books or collections by philosophers of mind who have given careful thought to these problems. Their positions and mine do not always coincide, but I have enjoyed reading all of the following: John Searle, *The Rediscovery of the Mind* (Cambridge, Mass.: MIT Press, 1992); Patricia and Paul Churchland, *On the Contrary* (Cambridge, Mass.: MIT Press, 1993); David J. Chalmers, *The Conscious Mind* (New York: Oxford University Press, 1996); Daniel Dennett, *Consciousness Explained* (cited earlier); Thomas Nagel, *The View from Nowhere* (New York: Oxford University Press, 1986); Colin McGinn, *The Problem of Consciousness* (Oxford: Basil Blackwell, 1991); Owen Flanagan, *Consciousness Reconsidered* (Cambridge, Mass.: MIT Press, 1992); Ned Block, Owen Flanagan, Günter Güzeldere, eds., *The Nature of Consciousness: Philosophical Debates* (Cambridge, Mass.: MIT Press, 1997); Thomas Metzinger, ed., *Conscious Experience* (Paderborn, Germany: Imprint Academic/Schöningh, 1995); Fernando Gil, *Modos de Experiencia* (Lisbon: Imprensa Nacional, 1998); Jerry A. Fodor, *The Modularity of Mind* (Cambridge, Mass.: MIT Press, 1983).

9 H. Damasio, and A. Damasio, *Lesion Analysis in Neuropsychology* (New York: Oxford University Press, 1989).

10 The separation of consciousness into at least two levels of phenomena is well supported by cognitive and behavioral analyses and validated by the neurological observations I present here. The separation is a must when it comes to proposing biological mechanisms capable of producing consciousness. No single mechanism is likely to deliver both core and extended consciousness. This problem has also been identified in another biological account of consciousness, Gerald Edelman's. The dichotomy he proposes also separates the "simple" from the "complex," although his categories do not correspond to mine. Gerald Edelman divides consciousness into primary and higher-order consciousness, but his primary consciousness is simpler than my core consciousness and does not result in the emergence of a self. Edelman's higher-order consciousness is also not the same as my extended consciousness, because it requires language and is strictly human.

Other authors have proposed dichotomous classifications of consciousness. For instance, Ned Block divides consciousness into access, or A-consciousness, and phenomenal, or P-consciousness. Neither concept is related to the notions of core and extended consciousness. See Gerald Edelman, *The Remembered Present* (New York: Basic Books, 1989); Ned Block, et al., *The Nature of Consciousness* (cited earlier).

11 A consensus has been developing recently that subjectivity is the "hard problem" of consciousness, although discussions of subjectivity usually do not consider that it requires a subject—a sense of self—and that the means whereby

we have a sense of self, illusory or not, must be an important aspect of elucidating consciousness. The term "hard problem" was introduced to a large public by David Chalmers in *The Conscious Mind* (cited earlier) and is the latest designation for the old qualia problem. For an earlier statement of the problem see J. Levine, "Materialism and qualia" (cited earlier). For a recent discussion of this problem see John Searle, *The Mystery of Consciousness* (New York: New York Review of Books, 1997).

12 For an account of how the visual system achieves such object representations see David Hubel's *Eye, Brain and Vision* (New York: Scientific American Library, 1988) and Semir Zeki's *A Vision of the Brain* (Oxford: Blackwell Scientific Publications, 1993).

13 B. Spinoza, *The Ethics*, Part IV, Proposition 22 (Indianapolis: Hackett Publishing Co., Inc., 1982, first published 1677).

Chapter Two: Emotion and Feeling

1 Ludwig von Bertalanffy, *Modern Theories of Development: An Introduction to Theoretical Biology* (New York: Harper, 1962, originally published in German in 1933); P. Weiss, "Cellular dynamics," *Review of Modern Physics* 31 (1959): 11–20; Kurt Goldstein, *The Organism* (New York: Zone Books, 1995, originally published in German in 1934).

2 See Gerald Edelman, *The Remembered Present* (cited earlier) and Antonio Damasio, *Descartes' Error*. Other notable exceptions: Theodore Bullock authored a biological text written from an evolutionary perspective, *Introduction to Nervous Systems* (San Francisco: W. H. Freeman, 1977); Paul MacLean talked about a triune brain, each of the three tiers belonging to an evolutionary age in "The Triune Brain, Emotion, and Scientific Bias," in *The Neurosciences: The Second Study Program*, ed. F. O. Schmitt (New York: Rockefeller University Press, 1970); and Patricia Churchland launched neurophilosophy with an invocation of the value of considering evolution in *Neurophilosophy: Toward a Unified Science of the Mind-Brain* (Cambridge, Mass.: MIT Press, Bradford Books, 1986).

3 Some of the examples of this change can be found in the work of Jean-Didier Vincent and Alain Prochiantz in France, Joseph LeDoux, Michael Davis, James McGaugh, Jerome Kagan, Richard Davidson, Jaak Panksepp, Ralph Adolphs, and Antoine Bechara in North America; and Raymond Dolan, Jeffrey Gray, and E. T. Rolls in Britain, to name but some of the most visible.

4 A. Damasio, *Descartes' Error* (cited earlier); A. Damasio, "The somatic marker hypothesis and the possible functions of the prefrontal cortex," *Philosophical Transactions of the Royal Society of London, Series B (Biological Sciences)* 351 (1996): 1473–20; A. Bechara, A. Damasio, H. Damasio, and S. Anderson, "Insensitivity to future consequences following damage to human prefrontal cortex," *Cognition* 50 (1994):

- 7-15; A. Bechara, D. Tranel, H. Damasio, and A. Damasio, "Failure to respond autonomically to anticipated future outcomes following damage to prefrontal cortex," *Cerebral Cortex* 6 (1996): 215-25; A. Bechara, H. Damasio, D. Tranel, and A. Damasio, "Deciding advantageously before knowing the advantageous strategy," *Science* 275 (1997): 1295-95.
- 8 For a discussion on the cognition of rationality see N. S. Sutherland, *Irrationality: The Enemy Within* (London: Constable, 1992); for its cognitive and biological aspects see Patricia S. Churchland, "Feeling Reasons," in Paul M. Churchland and Patricia S. Churchland, *On the Contrary* (cited earlier).
- 9 Other languages that have conveyed the heritage of Western philosophy and psychology have long had available the equivalent of the separate English words *emotion* and *feeling*. For example: Latin: *ex movere* and *sentire*; French: *émotion* and *sentiment*; German: *Emotionen* and *Gefühl*; Portuguese: *emoção* and *sentimento*; Italian: *emozione* and *sentimento*, and so on. The two words were probably coined in those several languages because many clear-eyed observers, as they considered the two distinguishable sets of phenomena, sensed their separation and saw the value of denoting them by different terms. Referring to the whole process by the single word *emotion*, as is now common practice, is pure carelessness. Nor should it be forgotten that in its more general meaning the word *feeling* denotes perceptions related to the body—feelings of malaise or well-being, feelings of pain, the feeling of something touched—rather than an appreciation of what is seen or heard. The wise coiners of the word *feeling* were probably under the correct impression that feeling an emotion had a lot to do with the body, and they were right on the mark.
- 10 D. Tranel and A. Damasio, "The covert learning of affective valence does not require structures in hippocampal system or amygdala," *Journal of Cognitive Neuroscience* 5 (1993): 79-88.
- 11 There is also evidence from studies in healthy individuals, without brain lesions, that preferences can be learned nonconsciously and quite rapidly. See P. Lewicki, T. Hill, and M. Czyzewska, "Nonconscious acquisition of information," *American Psychologist* 47 (1992): 796-801, for a specific experiment. For reviews of this area of studies, see J. Kihlstrom, "The cognitive unconscious," *Science* 237 (1987): 285-94; Arthur S. Reber, *Implicit Learning and Tacit Knowledge: An Essay on the Cognitive Unconscious* (New York: Oxford University Press, 1993).
- 12 Deciding what constitutes an emotion is not an easy task, and once you survey the whole range of possible phenomena, one does wonder if any sensible definition of emotion can be formulated, and if a single term remains useful to describe all these states. Others have struggled with the same problem and con-

cluded that it is hopeless. See Leslie Brothers, *Friday's Footprint: How Society Shapes the Human Mind* (New York: Oxford University Press, 1997) and Paul Griffiths, *What Emotions Really Are: The Problem of Psychological Categories* (Chicago: University of Chicago Press, 1997). At this point, however, my preference is to retain the traditional nomenclature, clarify the use of the terms, and wait until further evidence dictates a new classification, my hope being that by maintaining some continuity we will facilitate communication at this transitional stage. I will talk about three levels of emotion—background, primary, and secondary. This is revolutionary enough for one day, given that background emotions are not part of the usual roster of emotions. I will refer to drives and motivations and pain and pleasure as triggers or constituents of emotions, but not as emotions in the proper sense. No doubt all of these devices are intended to regulate life, but it is arguable that emotions are more complex than drives and motivations, than pain and pleasure.

10 Emotions have varied temporal profiles. Some emotions tend to be engaged in a "burst" pattern. They go through a fairly rapid onset, a peak of intensity, and rapid decay. Anger, fear, surprise, and disgust are cases in point. Other emotions have more of a "wavelike" pattern; some forms of sadness and all of the background emotions are prime examples. It should be clear that many variations of profile are possible depending on circumstances and on individuals.

When states of emotion tend to become fairly frequent or even continuous over long periods of time, it is preferable to refer to them as *moods* rather than emotions. I believe moods should be distinguished from background emotions; a particular background emotion can be sustained over time to create a mood. If people think you are "moody" it is because you have been sounding a prevailing emotional note (perhaps related to sadness or anxiety) consistently for a good part of the time or maybe you have changed your emotional tune unexpectedly and frequently. Fifty years ago you would have been called "neurotic," but nobody is neurotic anymore.

Moods can be pathological, and we speak, then, of mood disorders. Depression and mania are the standard examples. You are depressed when the emotion sadness is dragged on for days, weeks, and months, when melancholic thoughts and crying and loss of appetite, sleep, and energy are not a single burst or a gentle wave but a continuous mode of being, physically and mentally. The same applies to mania. It is one thing to jump with joy at the right event or to be enthusiastic about your prospects in life, it is another to sustain the joy and exuberance on for days on end, justifiably or not. For powerful descriptions of the experience of mood disorders see Kay Redfield Jamison, *An Unquiet Mind* (New York: Knopf, 1995); William Styron, *Darkness Visible: A Memoir of Madness* (New York:

Random House, 1990); and Stuart Sutherland, *Breakdown: A Personal Crisis and a Medical Dilemma*, updated edition (London: Weidenfeld and Nicolson, 1987). See Robert Robinson for medical information on mood disorders.

Because moods are dragged-out emotions along with the consequent feelings, moods carry over time the collections of responses that characterize emotions: endocrine changes, autonomic nervous system changes, musculoskeletal changes, and changes in the mode of processing of images. When this whole package of reactions is deployed persistently and inappropriately over long periods of time, the cost to the individual so affected is prohibitive. The term *affect* is often used as a synonym of "mood" or "emotion" although it is more general and can designate the whole subject matter we are discussing here: emotions, moods, feelings. Affect is the thing you display (emote) or experience (feel) toward an object or situation, any day of your life whether you are moody or not.

The critical differences between "background" emotions and the "conventional" emotions thus rest with: (1) the source of the immediate inducer, which is usually external or representing the exterior in the case of "conventional" emotions, and is internal in the case of background emotions; and (2) the focus of the responses, whose targets favor the musculoskeletal and visceral systems in "conventional" emotions but favor the internal milieu in "background" emotions. The entire evolution of emotions must have begun with background emotions. When we compare background emotions to "the big six" and to the so-called "social" emotions, we note a progressive degree of specificity of the inducers, of specificity of the responses, and of specificity of the response targets, a progressive differentiation of controls, from global to local.

P. Ekman, "Facial expressions of emotions: New findings, new questions," *Psychological Science* 3 (1992): 34-38.

The terms "social" or "secondary" should not suggest that these emotions are solely generated by education within a culture. In an interesting essay on the emotions, Paul Griffiths (*What Emotions Really Are*, cited earlier) notes, correctly, that secondary emotions are not the result of culture alone; this made me realize that I did not emphasize this idea strongly enough in *Descartes' Error*. No doubt the role played by society in the shaping of secondary emotions is greater than in the case of the primary emotions. Moreover, it is clear that several "secondary" emotions begin to appear later in human development, probably only after a concept of self begins to mature—shame and guilt are examples of this later development; newborns have no shame and no guilt but two-year-olds do. That does not mean, however, that secondary emotions are not biologically preset, in part or mostly.

- 14 R. Bandler and M. T. Shipley, "Columnar organization in the midbrain periaqueductal gray: Modules for emotional expression?" *Trends in Neurosciences* 17 (1994): 379-89; M. M. Behbehani, "Functional characteristics of the midbrain periaqueductal gray," *Progress in Neurobiology* 46 (1995): 575-605; J. E. Bernard and R. Bandler, "Parallel circuits for emotional coping behaviour: New pieces in the puzzle," *Journal of Comparative Neurology* 401 (1998): 429-46.
- 15 A. Damasio, T. Grabowski, H. Damasio, A. Bechara, L. L. Ponto, and R. Hichwa, "Neural correlates of the experience of emotion," *Society for Neuroscience Abstracts* 24 (1998): 338. Our finding of brain-stem activation in negative emotions is novel, and so is the finding of hypothalamic activation in sadness. Our finding of activation in ventromedial prefrontal cortex confirms previous findings of M. E. Raichle, J. V. Pardo, and P. J. Pardo; E. M. Reiman, R. Lane, and colleagues; and Helen Mayberg.
- 16 See Joseph LeDoux, *The Emotional Brain: The Mysterious Underpinnings of Emotional Life* (New York: Simon and Schuster, 1996) for a review of animal research in the topic of fear.
- 17 M. Mishkin, "Memory in monkeys severely impaired by combined but not separate removal of amygdala and hippocampus," *Nature* 273 (1978): 297-98; Larry Squire, *Memory and Brain* (New York: Oxford University Press, 1987); F. K. D. Nahm, H. Damasio, D. Tranel, and A. Damasio, "Cross-modal associations and the human amygdala," *Neuropsychologia* 31 (1993): 727-44; Leslie Brothers, *Friday's Footprints* (cited earlier).
- 18 A. Bechara, D. Tranel, H. Damasio, R. Adolphs, C. Rockland, and A. R. Damasio, "A double dissociation of conditioning and declarative knowledge relative to the amygdala and hippocampus in humans," *Science* 269 (1995): 1153-58.
- 19 R. Adolphs, D. Tranel, and A. R. Damasio, "Impaired recognition of emotion in facial expressions following bilateral damage to the human amygdala," *Nature* 372 (1994): 669-72. R. Adolphs, H. Damasio, D. Tranel, and A. R. Damasio, "Cortical systems for the recognition of emotion in facial expressions," *Journal of Neuroscience* 16 (1996): 7678-87.
- 20 R. Adolphs, and A. R. Damasio, "The human amygdala in social judgement," *Nature* 393 (1998): 470-74.
- 21 Curiously, when the brain mechanisms underlying emotion are compromised, the ability to attribute emotion to the simple chip is impaired. This is what Andrea Heberlein and Ralph Adolphs have just shown in our laboratory. Patients with damage to specific emotion induction sites describe the shapes and movements of the chips in an accurate, matter-of-fact manner. Spontaneously, however, they fail to assign emotions to the chips or to their interrelations. The manifest intellectual level of the show is perceived without flaw

but the emotional subtext is not detected. A. S. Heberlein, R. Adolphs, D. Tranel, D. Kemmerer, S. Anderson, and A. Damasio, "Impaired attribution of social meanings to abstract dynamic visual patterns following damage to the amygdala," *Society for Neuroscience Abstracts* 24 (1998): 1176.

22 Eric R. Kandel, Jerome Schwartz, and Thomas M. Jessell, eds., *Principles of Neural Science*, 3rd ed. (Norwalk, Conn.: Appleton and Lange, 1991).

23 I have previously described this episode in *Descartes' Error*, and I will briefly summarize it here.

24 P. Rainville, G. H. Duncan, D. D. Price, B. Carrier, and M. C. Bushnell, "Pain affect encoded in human anterior cingulate but not somatosensory cortex," *Science* 277 (1997): 968-71; P. Rainville, R. K. Hofbauer, T. Paus, G. H. Duncan, M. C. Bushnell, and D. D. Price, "Cerebral mechanisms of hypnotic induction and suggestion," *Journal of Cognitive Neuroscience* 11 (1999): 110-23; P. Rainville, B. Carrier, R. K. Hofbauer, M. C. Bushnell, and G. H. Duncan, "Dissociation of pain sensory and affective dimensions using hypnotic modulation," *Pain* (in press).

25 See A. K. Johnson and R. L. Thunhorst, "The neuroendocrinology of thirst and salt appetite: Visceral sensory signals and mechanisms of central integration," *Frontiers in Neuroendocrinology* 18 (1997): 292-33, for a review of the complex mechanisms involved in behaviors such as thirst.

Chapter Three: Core Consciousness

1 John Searle has presented a lucid defense of this position in *The Rediscovery of the Mind* (cited earlier). Daniel Dennett has argued similarly in *Consciousness Explained* (cited earlier).

2 The descriptions of coma and vegetative state are presented in chapter 8 and are well covered in textbooks of neurology. A standard reference is the text by Fred Plum and Jerome B. Posner, a classic volume in which they survey their unique experience in the neurology of coma. See F. Plum and J. B. Posner, *The Diagnosis of Sleep and Coma*, 3rd ed. (Philadelphia: F. A. Davis Company, 1980).

3 Jean-Dominique Bauby, *Le scaphandre et le papillon* (Paris: Editions Robert Laffont, 1997); J. Mozersky, *Locked In: A Young Woman's Battle with Stroke* (Toronto: The Golden Dog Press, 1996).

4 The descriptions of epileptic states and of akinetic mutism are standard, and can be found in numerous articles and textbooks of neurology. Accessible references include: Wilder Penfield and Herbert Jasper, *Epilepsy and the Functional Anatomy of the Human Brain* (Boston: Little, Brown, 1954); J. Kiffin Penry, R. Porter, and F. Dreifuss, "Simultaneous recording of absence seizures with video tape and electroencephalography, a study of 374 seizures in 48 patients," *Brain* 98 (1975): 427-40; F. Plum and J. B. Posner, *The Diagnosis of Sleep and Coma* (cited earlier); and

A. Damasio and G. W. Van Hoesen, "Emotional disturbances associated with focal lesions of the limbic frontal lobe," in *The Neuropsychology of Human Emotion: Recent Advances*, ed. Kenneth Heilman and Paul Satz (New York: The Guilford Press, 1983): 85-110. The inferences I draw on the standard evidence, as far as consciousness is concerned, are based on my own observations of patients so affected.

5 I discuss this evidence in chapter 5, in the context of outlining the representation of objects.

6 My comments on epilepsy and emotion pertain to the situation of absence seizures. When automatisms occur in the setting of so-called temporal lobe seizures, emotions can appear before or during the episode. Partial impairments of emotion are not associated with abolition of core consciousness. For instance, the patients with ventromedial frontal lobe lesions described in *Descartes' Error* only lose secondary emotions. They lose their ability to react with embarrassment in a social situation or to react with fear in relation to a possible financial loss in the distant future, but most of their background emotions and primary emotions remain in place. Likewise, as we saw in the discussion of patient S, damage to the amygdala impairs some primary and secondary emotion related to fear, but not other primary and secondary emotions, and it does not compromise background emotions at all.

Chapter Four: The Hint Half Hinted

1 This is an issue that deserves further attention. I have encountered few exceptions to the observation that impaired core consciousness goes with impaired emotion, but it would be important to study the exceptions systematically. In my experience, they consist largely of "shamlike" bursts of rage or laughter, i.e., unmotivated behaviors suggestive of release of automated routines, and they occur in persistent vegetative state or in nonabsence seizures associated with temporal lobe damage.

2 The work of Francis Crick exemplifies this position. Inasmuch as a comprehensive elucidation of consciousness requires an understanding of the process of image making, Crick's approach is fruitful—we certainly must understand how the brain comes to form images, and his hypotheses offer several testing opportunities. But Crick believes that "there are many forms of consciousness, such as those associated with seeing, thinking, emotion, pain and so on" and that "self-consciousness—that is, the self-referential aspect of consciousness—is probably a special case of consciousness. In our view, it is better left to one side for the moment." F. Crick, *The Astonishing Hypothesis: The Scientific Search for the Soul* (New York: Scribner, 1994). My concern is that the elimination of self-reference may create a barrier to the comprehensive solution of the problem of consciousness.