Chapter 6
Emotion in the Pursuit of Understanding

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ABSTRACT
Theories of cognitive processes, such as decision making and creative problem solving, for a long time neglected the contributions of emotion or affect in favor of analysis based on use of deliberative rules to optimize performance. Since the 1990s, emotion has increasingly been incorporated into theories of these cognitive processes. Some theorists have in fact posited a “dual-systems approach” to understanding decision making and high-level cognition. One system is fast, emotional, and intuitive, while the other is slow, rational, and deliberative. However, one’s understanding of the relevant brain regions indicate that emotional and rational processes are deeply intertwined, with each exerting major influences on the functioning of the other. Also presented in this paper are neural network modeling principles that may capture the interrelationships of emotion and cognition. The authors also review evidence that humans, and possibly other mammals, possess a “knowledge instinct,” which acts as a drive to make sense of the environment. This drive typically incorporates a strong affective component in the form of aesthetic fulfillment or dissatisfaction.

1. INTRODUCTION
The early stages of cognitive psychology in the 1960s and 1970s were largely driven by computer-related concepts such as information processing and pattern recognition, concepts that left little room for emotion or affect. Yet as more knowledge of both experimental psychology and cognitive neuroscience emerged in the 1980s and 1990s, it became apparent that cognitive processes such as attention, memory, categorization, and decision making could not be understood in real-world settings without including the effects of emotional influences on these processes.
The decision psychologist Ellen Peters (Peters, 2006) outlined four roles that emotions can play in behavioral choices, sometimes playing more than one of these roles at a time. These four are (1) a guide to information; (2) a selective attentional spotlight; (3) a motivator of behavior; and (4) a common currency for comparing alternatives. Role (1) means that both positive and negative emotional responses to potential alternatives can sharpen the decision maker’s understanding of the situation in which he or she has to make a response. Role (2) means that out of the confusion of information available to the decision maker, attention can be focused on those items most relevant for satisfying current emotional needs (e.g., a tourist walking in a foreign city selectively attends to restaurant signs when hungry but to historical markers when curious). Role (3) means that anticipated pleasure motivates people or animals to approach objects, or anticipated pain motivates them to avoid objects. Role (4) means that emotion facilitates choices between dissimilar alternatives, such as going to a movie or working on a research paper, by providing common units such as “happiness” or “pleasure” on which to compare these alternatives.

The roles that Peters proposed for emotion are consistent with well-known clinical data on the pathologies in decision making that arise from disconnection between emotion and thinking processes. Specifically, such disconnection results from damage to the orbitofrontal cortex (Damasio, 1994), a key area for linking emotion-related brain regions with cortical information-processing regions. Orbital lesions disable the various facilitatory roles of emotion in decision making, resulting in decisions that might be impulsive and contextually inappropriate (as in the famous 19th century patient Phineas Gage) or else might be overly deliberate and obsessive (as in Damasio’s own patient Elliot).

Hence, the evidence is clear that while excessive or misdirected emotion can at times interfere with effective decision making, emotion per se makes positive contributions to decision making and other cognitive processes, and therefore has adaptive value for the organism. Moreover, several behavioral biologists have noted more specific adaptive functions for particular emotions such as happiness, sadness, anger, fear, disgust, and surprise (e.g., Plutchik, 1970).

While emotions influence cognitions, the reverse is also true: the results of cognitive processes generate emotions. An example is the discomfort produced when a person is aware of cognitive dissonance between two beliefs arising from different sources (Festinger, 1957). Discomfort from cognitive dissonance has been shown to occur not only at the feeling level but also at the physiological level, in the form of skin conductance responses (Croyle & Cooper, 1983).

### 2. DUAL PROCESSES?

The last section provides behavioral evidence that emotion and cognition are deeply interconnected and difficult to separate. In further support of this notion, neuroscientists have found that brain areas cannot be neatly separated into specialized “emotional” and “cognitive” regions (e.g., Pessoa, 2008; Swanson, 2005).

In spite of this evidence, both experimental psychology and cognitive neuroscience have still not quite shaken off the long-standing myth of Western culture that “emotion and reason are opposites.” This is a myth that Damasio (1994) partly attributes to the influence of Cartesian philosophy, and it has echoes in the writings of other philosophers from Aristotle to Adam Smith. The rational-emotional dichotomy pervades day-to-day speech; for example, in colloquial American English we say that a person “acts emotionally” if he or she performs a behavior based on a short-term emotion that is ill considered and flies in the face of reasonable solution of a problem. The phrase is applied, for example, to someone who commits a crime of passion or falls in love with an
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