Giving Computers Emotions—Why and How†

Joseph S. Fulda

Affective Computing by Rosalind W. Picard is one of those few books which set a new paradigm for a field, in this case AI. AI has had several paradigms: toy systems, high-performance systems, rule-based systems, systems for general intelligence, logic-based reasoning systems, knowledge-based systems. These paradigms have, of course, overlapped considerably and have also interacted with each other, but only some have met their promise. Each paradigm was introduced because of perceived deficiencies in prior paradigms or perceived efficiencies or proficiencies in the paradigm being introduced. To these and other paradigms, Picard wants to add cognitive-affective systems.

In this essay, we will briefly review what she means by such systems, why she wants to develop them, and how she envisions them. [1]

Picard has a strong grounding in psychology, neuroscience, and cognitive science: Thus when she speaks about human emotions, she is able to document her claims with a goodly number of studies from the relevant literature. Emotions, she notes, are integral to human perception. Thus, when "subjects are asked to quickly jot words they hear, ... they are more inclined to spell 'presents' than 'presence' if they are happy, and to spell 'banned' than 'band' if they are sad." Similar results obtain when resolving lexical ambiguity in homophones. Emotions are also integral to human decision-making. Naturally occurring emotions excite the limbic system, which is "functionally intertwined" with the neocortex and through which all sensory input must first pass, and which is sometimes involved in "higher" functions once thought to be the exclusive province of the neocortex. Thus it is no surprise that humans with a deficit in basic emotional processing have impaired perception and impaired decision-making. In particular, patients with *frontal lobe disorders* that impair communication between the limbic system and the neocortex test at normal and often above-normal intelligence and seem somewhat like *Star Trek*'s Spock, but are in fact unable to act rationally however they present and test. Since they do not "feel" bad after making a mistake, they continue to make them, over and over again.

Likewise, when asked to make a simple decision—such as appointment scheduling—for which there is no rationally superior time, they are simply unable to reach a decision, lacking the emotion of embarrassment at keeping the other person waiting too long.

For all these reasons, it is important to give computers emotions. Computers show the same deficits in perception and decision-making that affect humans with impaired emotional processing. Computers today, writes Picard, "will scroll screenfulls of information past you regardless of whether you are sitting forward eagerly ... or have begun to emit loud snoring sounds. Computer-based communication is affect-blind, affect-deaf, and generally speaking, affect-impaired."

Giving computers emotions means giving them the capacity to recognize human emotions and to respond with affect. Human emotions are expressed through affect in facial expressions, tone of voice, posture, and many other like modalities called *sentic modulation*. Patients with frontal lobe disorders do *know* that they should feel bad when the occasion calls for it, but they do not show sentic modulation: They do not *feel* bad. As a result they do not act appropriately.

Wearable computers can monitor the body so as to perceive the sentic modulation of various emotional states. Thus, an emotionally intelligent computer—one trained in such perception—should be able to watch a "video of a person, containing one or more modalities of expression such as voice, face, gesture, or gait" and recognize the emotion being displayed as well as a person can—a variant of the Turing Test, one for emotional intelligence. Picard makes a fine analogy to speech recognition: Just as speech recognition is person-dependent but experience gained with different people allows more general speech recognition, affect recognition is person-specific, but time and practice makes affect recognition generalizable over persons. Affect recognition alone, for example, opens a range of possibilities in computer-assisted learning, to name one application field.

But computers can also be made to respond with a full range of cognitive-affective behaviors, just as we do. The simplest and most obvious starting point would be to give those computer voices appropriately varying tonalities! The result of this and other more advanced features which are the computer's sentic modulation will more likely more closely resemble human perception and decision-making, a richer and

fuller intelligence than rules and logic alone can ever bestow.

Picard summarizes her view succinctly with a quote from Andrew Fletcher: “Let me write the songs of a nation; I don’t care who writes its laws,” and finds that “systems of laws or rules used by computers have useful applications, despite the acknowledged brittleness of ... rule-based systems. ... However, laws and rules are not sufficient for understanding or predicting human behavior and intelligence.” Giving computers emotional intelligence, particularly the capacities to recognize and respond to (and even with) human emotion, are, according to this study, the way to make computers understand songs—the drummers to which we march—as well as the logical laws we follow.

Reference

[1] Rosalind W. Picard, *Affective Computing* (MIT Press, 1997), pp. 1-137. The remainder of her book, on implementing such systems, is of less relevance to and too technical for this forum. Readers interested in a brief overview of Part II are referred to my forthcoming review in *Computing Reviews*.