**No Reason Without Emotion?**

**Fiann O'Hagan**

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*A review of Descartes' Error by Antonio Damasio, as for New Scientist . Submitted as coursework for Advanced Technical Communication.*

It is plain common sense to assume that too much emotion causes us to make flawed decisions. To make a sensible decision we must dispassionately weigh the evidence. Neurologist Antonio Damasio treats patients with specific forms of brain injury. He has come to a surprising conclusion: that a reduced level of emotion is just as damaging to rational thought as heightened emotion. Therefore, emotion is as important as logic in making decisions and underpins our thought processes.

Damasio and his neuroscientist wife, Hanna Damasio, have performed detailed examinations of patients with damage to the prefrontal cortex. *Descartes' Error* provides a fascinating insight into these cases from Phineas Gage, the most famous neurological case in history, to `Elliot', a recent patient.

Elliot was a reasonable, successful businessman until he began to suffer from crippling headaches. A brain tumour was diagnosed, located in the ventro-medial portion of the prefrontal cortex, just above the eye sockets. The tumour was successfully removed, but the tissue it had been pressing against was damaged and also had to be removed. At this point, Elliot's life began to unravel even though he was apparently cured. He was unable to hold down a job - he would become engrossed in reading a letter to such an extent that it would take all day.

The strange thing about Elliot was that he appeared to be so undamaged. He continued to have an above average IQ, and in tests he was quite able to predict what would happen next in a given scenario. In the laboratory, he could correctly predict when a situation would come out badly; the very same situations which he handled so disastrously in his own life. Elliot's neurological deficit was so well concealed that Damasio began treating him only after a number of courses of counselling and psychological treatments had failed.

**The Somatic Marker hypothesis**

Elliot's case illustrates what Damasio calls the somatic marker hypothesis. The hypothesis states that the ventro-medial prefrontal cortex is important for integrating emotional responses with higher logical thought. Abstract thought is a property of the cerebral cortex, the most recently-evolved part of the brain. Emotions derive from subcortical structures that are similar in all mammals and reptiles. Fear, rage and sexual desire drive the animal (or human) through these ancient circuits to perform the basic behaviours necessary for survival.

Our ability to predict the future derives from abstract thought processes, but to choose between alternatives requires that each choice be assigned a value. Damasio believes that the value comes from associating each alternative with an emotional state. We perceive the alternatives as states in the body that they would produce: hence the name somatic marker. An extreme example of this is the `butterflies-in-the-tummy' feeling caused by an impending deadline, but Damasio suggests that the same process applies to all decision-making processes. The somatic marker--the body's response to the alternative--provides a bias to the decision. We then make the decision based on the outcome that seems to generate the most favourable emotions.

There is a range of psychological tests designed to highlight the deficits in thought caused by neurological disease. Elliot was able to pass all of these tests with normal or above normal scores. For example, in one test the subject is asked how he could prevent his wife becoming angry after he broke her favourite vase. After each suggestion, the subject is prompted with ``What else could he do?'' In this test, Elliot was able to provide a normal number of suggestions, with valid justifications. But at the end of the experiment he wailed ``And after all this, I still wouldn't know what to do!''

The book describes the long and difficult process of devising a psychological test that was sensitive to the problems Elliot displays. Eventually, Damasio and co-workers devised a gambling test. In the game, there are two packs of cards. The subject starts with $200 of play money and simply has to draw a card from either pack. One of the packs gives rewards of $50 or $100, the other contains smaller amounts. Both packs also contain penalty cards, and in the high reward deck these can be over $1000. Although the subject does not know the rules in advance, the decks are rigged so that the high-risk, high-reward deck always tends to give a net loss.

Because the subjects are not allowed to keep track of the running score, they must form an impression of the relative worth of each deck. While control subjects tend to choose only from the low-risk deck after about thirty rounds, Elliot and other patients with similar damage show a preference for the high-risk deck. They do not form a `danger' impression and so the short term gain is not overridden by the long term risk.

This is the story of Elliot's life since his operation, and it illustrates how important functional emotional systems are to our way of thinking. In *Star Trek* , Mr Spock was supposed to be good with numbers, so he might have done well in the gambling test. But Damasio presents good evidence that he would be in trouble in situations where it is difficult to quantify the potential costs and benefits of each course of action.

Damasio suggests that Descartes' real error was his dualism--not between body and soul, but between body and reason. Descartes asserted that animals are purely mechanical, and that only humans have reason. The soul would influence the body via the pineal gland, which had no other recognised function. It followed, then, that the human body is also mechanical and so there must be a split between the reasoning mind (the soul) and the body, along with the messy emotional problems it brings. While most scientists today reject the notion of an immortal soul, the split between the mind and the body is still entrenched in both scientific and popular thought.

Although Descartes' Error is about humans, there are interesting implications for other fields. The dissociation between reason and emotions and the body is a given in most artificial intelligence work, and in much psychology. It may be that if AI is to claim to model human thought, a largely ignored aspect of the human brain can no longer be overlooked. On the other hand this book will reassure those alarmed by the cold and impersonal nature of science, that intuition is not just a real phenomenon but it is as important to normal life as rational thought.

By providing convincing evidence that emotion is a necessary part of human cognition, Antonio Damasio has done us a great service. This fascinating book should be read by anybody with an interest in human thought or the operations of the brain.

*Descartes' Error: Emotion, Reason and the Human Brain by Antonio Damasio was published by Macmillan, 1996. ISBN: 0333656563, price £12.00*

*Fiann O'Hagan is currently studying for a Masters degree in Knowledge Based Systems at the University of Sussex, Brighton, England.*

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*Fiann O'Hagan, March 1988*