Neuroethics and brain function

Edmund T. Rolls (Oxford Centre for Computational Neuroscience – University of Warwick)

Abstract

In Rolls' theory of emotion (2014) it is argued that emotions are states elicited by instrumental reinforcers which are the goals for action, the rewards and punishers. It is argued that emotions solve a fundamental problem in Darwinian evolution, for it is much more efficient for genes to specify goals for actions, rewards and punishers, rather than actions or responses. It is shown that the orbitofrontal cortex is important in emotion for it represents primary, unlearned, gene-specified, reinforcers including the taste and texture of food and face expression; performs rapid learning, and reversal, of stimulus-reward associations; and with the pregenual cingulate cortex has activations that are directly correlated with pleasure, the conscious reports of the subjective state associated with rewards. These reward systems in our brains provide inputs to our value based decision-making mechanisms in the ventromedial prefrontal cortex. Decisions with this emotion-related system are in the interests of the genes.

It is shown using integrate-and-fire neuronal networks that decision-making is inherently probabilistic because of noise caused by the random firing times of neurons in the brain (for a given mean rate), and this decision-making is non-deterministic, and this has implications for free will (Rolls 2012, 2014).

In addition to this emotion-related decision-making system, there is a rational decision-making system that utilizes syntactic reasoning for longer-term planning. This system can take decisions in the interests of the phenotype, of the individual person.

There is thus potentially an inherent conflict between these two decision-making systems, and which one wins may even be influenced by noise in the brain.

Our increasing understanding of the brain mechanisms underlying this processing (Rolls 2014, 2016) has implications for understanding ethical decisions and ethical principles, and raises interesting issues about whether what is right is what is natural: in the end, whatever we decide is ethical must be natural, decided by these brain systems and accepted in some form of social contract that reflects agreement between individuals. These concepts will be discussed.

References

Rolls, E.T. and Deco, G. (2010) *The Noisy Brain: Stochastic Dynamics as a Principle of Brain Function*. Oxford University Press: Oxford.

Rolls, E. T. (2012) *Neuroculture: On the Implications of Brain Science*. Oxford University Press: Oxford.

Rolls, E.T. (2014) *Emotion and Decision-Making Explained*. Oxford University Press: Oxford.

Rolls, E.T. (2016) *Cerebral Cortex: Principles of Operation*. Oxford University Press: Oxford.