What is the Impact of Emotions on Decision-Making?

Traditionally, decision-making has been regarded as a rational process, with a conceptualisation of *homo rationalis* underlining this view (Markič, 2009). More recently, emotion has been increasingly acknowledged as an underpinning component of the decision-making process (Ohira, 2011). This essay outlines three current approaches explaining how emotions interact with decision-making. Firstly, the Somato-Marker Hypothesis (Navqi, Shiv, & Bechara, 2006) is a cognitive neuroscientific approach that investigates emotion as a biological phenomenon, measurable physiologically, behaviourally, and neurally, existing to manage decision-making processes. Secondly, Dual-Process Theory (Greene, Sommerville, Nystrom, Darley, & Cohen, 2001; Greene, 2009) is another cognitive neuroscientific approach that investigates emotion as a contextually-dependent phenomenon, measurable both behaviourally and neurally, but only used for deontological ("duty-based", morally-personal) decisions. Finally, the Emotion as Social Information Model (Van Kleef, 2009) is a social cognition approach that investigates emotion as a socially-informative phenomenon required for human interaction, measurable by using behavioural tasks. Thus, an emergent picture will be outlined, whereby emotion is shown to have both internal and external effects on the decision-making process, with its neural basis centred on the *prefrontal cortex* (van den Bos & Güroğlu, 2009). It will be argued that despite theoretical and methodological differences, these approaches converge to the message that emotions are important in decision-making, depending on the scenario. Overall, it is deemed that contemporary *homo affectus* is a more suitable conceptualisation than its predecessor *homo rationalis*.

Since Plato, rationality was increasingly conceived as *the* requisite for decision-making capability, with little acknowledgement given to emotion (Markič, 2009). For example, Simon's (1952, p.102) rationalist model posited that prediction, cost-benefit analysis, and probability inferencing were all that was needed in the fulfilment of a "decision". Recently, this view has become increasingly bombarded with emotivism (Haidt, 2001). Most notably, a cognitive experiment by Kahneman and Tversky (1981) found that the emotive cues "die" and "saved" provoked participants to shun the negative choice "die" and pursue the choice "saved" by merit of their emotive connotation, in spite of the fact that the choices were logically-symmetrical. More widely, emotivism is the prevailing epistemology for decision-making theory. For example, emotive language has been found to influence Supreme Court decision-making (Black et al., 2011). In child development, social and emotional learning – SEL – is increasingly adopted to promote children's ethical decision-making (Devaney et al., 2005). Emotion has also been placed at the centre of City of London Bank traders' experiential accounts of decision-making (Fenton-O'Creevy et al., 2010). Finally, emotion discourse is argued to underpin conversational accounts of understanding people's decisions (Edwards, 1997). Thus, this essay will cite behavioural, physiological, neuropsychological, and neuroimaging evidence demonstrating that emotion impacts on decision-making.

An "emotion" can be defined as a mental and/or physiological state associated with wide varieties of feelings, thoughts, and/or behaviours. A combinatory definition comes from Fenton-O'Creevy et al. (2010): "*...emotions have both a measurable biological reality and exist in the realm of socially constructed personal experience in which emotions have personal and social meaning*" (p.13). Consequently, the methodologies employed to investigate this multifaceted phenomena are diverse, including behavioural, physiological, and neural (Navqi et al., 2006; Greene et al., 2001), as well as expressionist and subjective (Van Kleef, 2009). Specifically, Blanchette and Richards (2010) define "decision-making research" as an examination of how the choice between different options is conducted. This process can be investigated by either studying *intra*personal processes (Navqi et al., 2006; Greene et al., 2001), or *inter*personal processes (Van Kleef, 2009).

The Somato-Marker Hypothesis (SMH) is the prevailing rationale of the first cognitive neuroscientific approach to be discussed (Navqi et al., 2006). Decision-making "*...is influenced by marker signals that arise in bioregulatory processes, including those that express themselves in emotions and feelings*." (Bechara & Domasio, 2005, p.336). In this view, these processes occur *both* consciously and non-consciously, both in aid of emotions narrowing of the decision-making space. It is most commonly investigated with the Iowa Gambling Task, a measure of behavioural and physiological responses (see Figure:1, overleaf; Bechara, Domasio, Tranel, & Domasio, 2005; Blanchette & Richards, 2010). Subjects choose from four decks of cards that provide varying levels of reward and punishment, with the aim to earn as much money as possible. Theoretically, two decks are low-risk/low-reward, and two are high-risk/high-reward. However, they are actually rigged; the low decks overall produce a net gain, whereas the high decks produce a net loss. Behavioural data shows that healthy individuals quickly learn to avoid high-risk decks; however, patients with *ventromedial prefrontal cortex* (vmPFC) damage repetitively choose high-risk decks, suggesting a lack of decision-based learning as a result of the negative emotion experienced from losing (Bechara, Domasio, Tranel, & Domasio, 1997). Physiological measures vis-à-vis skin conductance responses (SCRs), an autonomic index attributable to emotional arousal, also show that healthy individuals elicit larger SCRs *before choosing* a high-risk deck. Conversely, patients with vmPFC damage do not produce this anticipatory response, although they respond accordingly when the reward/punishment is allocated (Bechara, et al., 1997). Other research has found that *amygdala* damage, like vmPFC damage, is also associated with an absent preparatory SCR response to the high-risk deck (Bechara & Domasio, 2005). However, unlike vmPFC damage, *amygdala* damage is also associated with an absent SCR response when the reward/punishment is allocated.

Figure:1

Shows a schematic of the Iowa Gambling Task. The aim is to earn as much money as possible, which is only attainable using low-risk, "good" decks.

(From **Bechara, Domasio, Tranel, & Domasio, 2005, p.160**)

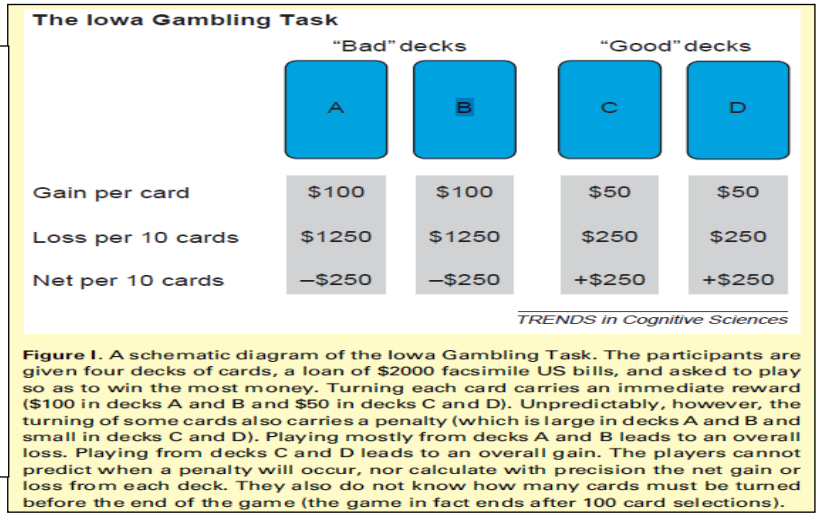

Figure I. A schematic diagram of the Iowa Gambling Task. The participants are given four decks of cards, a loan of $2000 facsimile US bills, and asked to play so as to win the most money. Turning each card carries an immediate reward ($100 in decks A and B and $50 in decks C and D). Unpredictably, however, the turning of some cards also carries a penalty (which is large in decks A and B and small in decks C and D). Playing mostly from decks A and B leads to an overall loss. Playing from decks C and D leads to an overall gain. The players cannot predict when a penalty will occur, nor calculate with precision the net gain or loss from each deck. They also do not know how many cards must be turned before the end of the game (the game in fact ends after 100 card selections).

Thus, the SMH approach argues for a somatic-state activation model, involving both vmPFC and the *amygdala* in decision-making (Navqi et al., 2006). The *amygdala* triggers emotional/bodily states in response to rewards/punishments after making a decision. These states become linked to mental representations of the behaviours that generated them. As these behaviours are deliberated in the future, the associated somatic-state are re-enacted by the vmPFC. The mental representations are made in one of two ways: at the cortical level (such as in *insular cortex*), bodily/emotional state mapping gives rise to conscious "gut feelings" of desire or aversion to the behavioural options; at the subcortical level (such as *mesolimbic dopamine system*), bodily/emotional state mapping occurs non-consciously, with advantageous options chosen without desireful or aversive awareness. Thus, behavioural, physiological, and neuropsychological evidence by the SMH suggests that emotion has a biological basis for the decision-making process, both consciously and non-consciously (Bechara & Domasio, 2005).

Dual-Process Theory (e.g. Greene, 2009) investigates emotional decision-making by using the two-part Trolley Problem (see Figure:2, overleaf; Thomson, 1985). In the first problem, the *footbridge dilemma*, a runaway trolley is headed to kill five people trapped on the track. As a bystander, the only way to save those people is to push a nearby stranger off the bridge to stop the trolley and save the other five people. In the second problem, the *switch dilemma*, the same scenario is evident with five people threatened by a runaway trolley. This time, the bystander's only way to save these people is to turn the nearby track switch, but to do so would kill one person who was on the side track. Behavioural results show that most participants are willing to push the switch in the *switch dilemma*, despite their refusal to push the man off the bridge in the *footbridge dilemma* (Markič, 2009). Previously, theorists have attested that moral decisions are made exclusively by either rationally-driven cognitions (Kohlberg, 1969), or with "intuitions" (gut feelings), with rationalisation occurring *post-hoc* (Haidt, 2001). Dual-Process Theory (Greene et al., 2001; Greene, 2009) synthesises these extremes to explain why these seemingly contradictory decisions can be made. Using the Trolley Problem, Greene et al. (2001) measured both reaction-times and neural activations using brain imaging (fMRI). They found that characteristically deontological ("duty-based") decisions (the duty

"not to kill one person for the benefit of five" in the *footbridge dilemma*) produced significantly differential neural activations compared to characteristically consequentialist ("outcome-based) decisions ("better to save five lives over one life" in the *switch dilemma*). Behavioural data showed that deontological decisions were also quicker than consequentialist decisions, perhaps reflective of the 'kneejerk' negative emotionality involved in deontological decisions, and/or the longer rationalisation process required for consequentialist decisions. Thus, evidence for rationalist *and* emotivist systems to aid decision-making were found, with systems utilisation occurring in accordance with the two stimulus types: "personal" (*footbridge dilemma*), "impersonal" (*switch dilemma*) (Greene, 2009).

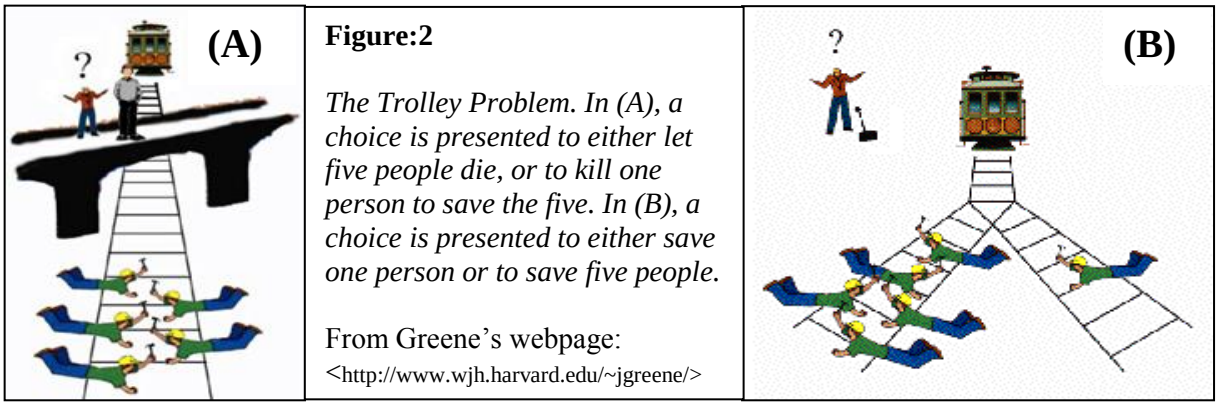

Figure:2

The Trolley Problem. In (A), a choice is presented to either let five people die, or to kill one person to save the five. In (B), a choice is presented to either save one person or to save five people.

From Greene's webpage: <http://www.wjh.harvard.edu/~jgreene/>

Thus, based on behavioural and neuroimaging evidence, Greene (2007) argues that deontological ("personal") decisions are motivated by automatic emotional responses, whereas consequentialist ("*im*personal") decisions are constructed by rationalist cognitions. In this view, activations in the *medial prefrontal cortex* are characteristic of the 'kneejerk' negative emotional response to the *footbridge dilemma*; conversely, activations in *dorsal-lateral prefrontal cortex* are characteristic of the utilitarian decision in the *switch dilemma*. Dual-Processing Theory proposes a "*middle course between traditional rationalism and more recent emotivism*" (Greene et al., 2001, p.2107). Resultant tensions between ("emotional") duty-based and ("rational") outcome-based decisions are therefore evident because they are underpinned by dissociable neural systems capable of fulfilling both decisions, with the scenario being the stimulus for the basis of the decision.

Thus far, an argument has been constructed by cognitive neuroscience that specific regions of the *prefrontal cortex* are responsible for emotion-related decision-making (Navqi et al., 2006; Greene, 2009). These approaches differ in their emphases, with the SMH being more emotivist than the Dual-Process Theory's "middle ground" approach, with the former seeing emotion as a necessary component, and the latter seeing emotion as a contextually-applied component. However, a commonality between these approaches is the designated role of the *prefrontal cortex* in decision-making. Interestingly, patients with emotion-related vmPFC damage have been found to make unusually strong utilitarian decisions – ("supporting harm to promote the greater good") – in response to scenarios similar to the *drawbridge problem*, thus demonstrating the role of vmPFC in processing socially-emotional situations requiring decisions (Koenigs, Young, et al., 2007). This finding nicely

bridges the behavioural, physiological, neuropsychological and neuroimaging evidence from both cognitive neuroscientific approaches, leading to the conclusion that the *prefrontal cortex* impacts on one's ability to engage in emotional decision-making. However, vmPFC damage also has implications for socio-emotional cognition (van den Bos & Güroğlu, 2009). Thus, to investigate the impact of "social" emotion on decision-making, an alternative approach may consider emotions as socially-informative stimuli (Van Kleef, 2009).

Accordingly, an alternative approach of emotional decision-making posits that emotions are socially-informative stimuli, when expressed bodily and facially, which in turn affect the observer's decisions. Inspired by Darwinism, Van Kleef's (2009) Emotion as Social Information (EASI) Model, a socio-functional theory, makes this assertion. Van Kleef, De Dreu, and Manstead (2004) found that expressions of anger and happiness informed participants' decision-making in a computer-mediated negotiation task. Participants received verbal responses during the negotiatory-exchange, some of which were emotionally-driven (e.g. "that pisses me off"). Participants with 'angry' opponents chose to make more concessions than those with non-emotional opponents, with 'happy' opponents receiving the least concessions from participants. Thus, negotiators *inferred* opponents' emotionality to reflect their cognitive state, and made decisions accordingly. Concurrent evidence of emotion's informative effect on negotiator decisions has been found by Steinel, Van Kleef, and Harinck (2008). Thus, evidence suggests that emotional expressions contain information that influences people's decision-making. An outstanding question here, answerable by future cognitive neuroscience research, would be the extent of vmPFC or *amygdala* damage on negotiatory decision-making (Navqi et al., 2006).

Thus, an argument has been forwarded that emotions are important for decision-making, both *intra*personally (Navqi et al., 2006; Greene et al., 2001), and *inter*personally (Van Kleef, 2009). Behavioural, physiological, neuropsychological, and neuroimaging evidence converge to suggest that *homo affectus* better captures our emotional, social and humanitarian disposition than the cold and calculated *homo rationalis*, despite biological capability to make rational decisions in some scenarios (Greene, 2009). The theoretical and methodological differences in the three approaches cited provides an informed view of emotion's involvement in decision-making. As Churchland (2008, p.409) eloquently explains: "*The classical "mind" questions...interlace with questions about morality: where values come from, the roles of reason and emotion in choice, and the wherefore of responsibility and punishment.*" Thus, psychological research investigating the role of emotion in decision-making has obvious contribution to humanity's understanding of the biological, cognitive and indeed philosophical underpinnings of our existence as (non)conscious beings.

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