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Passionate rationalism: the role of emotion in decision making

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Abstract

Purpose – The purpose of this paper is to argue that emotion has a central role to play in rational decision making based on recent research in the neuroanatomy of emotion. As a result, traditional rational decision-making theories, including Herbert Simon's modified model of satisficing that sharply demarcates emotions and values from rationality and rational decision making, need substantial revision. The paper concludes by outlining some central features of a theory of emotional decisions that is biologically more realistic than the traditional rationalist-cognitive model.

Design/methodology/approach – The paper employs contemporary scientific as well as traditional philosophical criteria in its argumentation. Methodologically, it can be described as an example of applying naturalistic philosophy to a central issue of human thought and experience, and how humans are able to value things at all on the basis of their neuroanatomy.

Findings – The paper presents some initial features of a new theory of emotional decisions that is biologically more realistic than the traditional rationalist-cognitive model.

Originality/value – The significance and originality of this paper lies in the fact that it proposes causal investigations of the real bases for rational decision making as a central human feature which runs counter to conventional wisdom and has far reaching implications for education, to name just one discipline; it demonstrates the importance and necessity of interdisciplinary research; and it outlines an exciting new research agenda that promises to be more productive in terms of understanding and hence planning for, the way in which humans make decisions.

Keywords Cognition, Decision making, Epistemology, Individual behaviour

Paper type Conceptual paper

Introduction

Decision making has long been identified with the rational coordination of beliefs and desires, both in its non-technical, folk-psychological expression, and in the more arcane models of maximising expected utility, or multi-criterial modelling under various epistemic conditions. Because the medium of analysis of what goes on inside the heads of decision makers is linguistic/symbolic, these processes are usually treated in a way that abstracts from the causal machinery of cognition and instead focuses on certain normative canons of reasoning defined over symbolic representations.

Mental activity so defined was considered the hallmark of what it means to be a rational human being. The modern legacy of this assumption is played out in many domains of the social sciences, including economic theory and theories of social choice. In the domain of administrative-organisational theory, Simon's (1976) view of decision making is one prominent example that continues to be influential. But there are good reasons for revising such approaches in light of the development of greater understanding of the causal processes of thought.

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According to recent behavioural and neuroscience data, cognition and rational decision making is not exclusively the product of symbol manipulation, but require the support of emotion. More strongly, the neuroscientific evidence now available points to the necessity of emotion in the process of reasoning and decision making; indeed, when emotion is absent rationality has been shown to break down (some overviews and discussions of recent developments in the emotion-cognition debate are Damasio, 1996, 1999, 2003; Glannon, 2007; Clark, 1997, 2001; Churchland and Churchland, 1998; Churchland, P.M., 2007; Churchland, P.S., 2002; Tancredi, 2005; Gazzaniga, 2005; Quartz and Sejnowski, 2002).

This remarkable insight has been demonstrated most prominently in the so-called somatic marker hypothesis (SMH) advocated by Damasio (1996, 1999, 2003) and Damasio and colleagues (Bechara and Damasio, 2005; Bechara *et al.*, 2000; Damasio *et al.*, 1991). SMH is a highly controversial neuroscientific study of decision-making behaviour which claims that ordinary practical decision making is governed by emotional factors of which there is no awareness (see Sanfey and Cohen, 2004; Maia and McClelland, 2004 for critical discussions). This startling result has challenging consequences for understanding a whole range of human activities, including decision making in organisational contexts, including those pertaining to schools.

Drawing especially on the work of Damasio and his Iowa research team, Thagard (2006, 2001, 2000), Barnes and Thagard (1996), and Thagard and Millgram (1997), this paper is a first attempt at outlining some central features of a theory of emotional decisions that is biologically more realistic than the traditional rationalist-cognitive model. It involves showing that the traditionally presumed "disconnect" between cognition and emotion is not defensible, and to lay out some of the evidence for the intricate connection between reason and emotion.

Acknowledging that the neuroscientific evidence for how humans actually make decisions is still accumulating, and although translation and extension into other disciplinary domains is risky, it is nevertheless possible to shed some light on the limitations of classical decision theories underpinning administrative/managerial decision making, including Simon's more moderate version of satisficing.

As connectionist neuroscience has brought much greater understanding of what human cognition consists in and how it is generated by a better understanding of brain architecture and function especially in terms of the brain's parallel distributed processing capacity, its organisation in interconnected neural nets, and its fundamental ability to recognise patterns at the sub-symbolic, neuronal level, this knowledge naturally extends to the study of emotion (for an overview, see Churchland, 2002; Clark, 2001, 1997). Just as human cognition has been shown to include but not be identical with the ability to use symbols leading to a subsequent expansion (or softening) of the traditional understanding of cognition, rationality and knowledge, a further adjustment or correction will eventuate once the place of emotion and its relation to cognition and subsequent decision making has been clarified. The expression "the theory of emotional decisions" is thus not a theory where decisions are "emotional" in the commonsense understanding of the term. Rather, it denotes the proper place of emotion in the processes of decision making.

The knowledge we gain from (affective) neuroscience at the most fundamental level is of a causal kind: what makes the human organism biologically capable of selecting from an infinite array of goals and options. As organisation or decision theorists, we learn that classical theories of decision making may well be lopsided and need correcting to

account for the real human processes that allow for decisions to be made. As practicing managers or administrators, we learn that when faced with an array of – possibly conflicting and ill-defined choices – our "hunches" or "gut feels", our sweaty palms or increased heart rates, are to be taken note of as indications of non-conscious decision processes our brains and bodies generate from past experience. Of course, we should not simply "trust our gut" but treat it as a kind of early warning system to reconsider planned action. Given the neuroscientific and behavioural data we now have such signalling is a legitimate part in rational decision-making processes and should be incorporated in further theorising.

It might be objected here that we already know that emotions are "involved" in decision making, and gut feelings and hunches are already on the agenda when making decisions in ordinary life. And rightly so, because it would indeed be odd if we were not aware of bodily manifestations of emotion in certain circumstances. However, we have learnt only recently how and why these bodily manifestations arise, what emotions are as distinct from feelings, when they arise and, even more interestingly, what happens when there is a "disconnect" between the emotional pathways that connect emotion and cognition in the making of decisions. It is these insights that determine decision making. But before entering the cognition-emotion debate, it is instructive to examine Simon's theory of decision making under bounded rationality since it does accept some limitations in the way humans come to their decisions, an acknowledgement not shared by classical social choice theories.

High reason, classical decision making, and bounded rationality

An anecdote told by Thagard and Millgram (1997) serves nicely to illustrate the dilemma of classical decision theories:

> [...] an eminent philosopher of science once encountered a noted decision theorist in a hallway at their university. The decision theorist was pacing up and down, muttering, "What shall I do? What shall I do?"
>
> What's the matter, Howard?? Asked the philosopher.
>
> Replied the decision theorist: "It's horrible, Ernest – I've got an offer from Harvard and I don't know whether to accept it."
>
> "Why Howard," reacted the philosopher, "you're one of the world's great experts on decision making. Why don't you just work out the decision tree, calculate the probabilities and expected outcomes, and determine which choice maximizes your expected utility?"
>
> With annoyance, the other replied: "Come on, Ernest. This is serious."

As advocated by classical decision theories, maximisation of a person's utility is governed by three broad conditions under which the rationality of individual preferences can be expressed:

(1) conditions of uncertainty, where some or all probabilities are unknown;

(2) conditions of risk, where all probabilities of outcomes are known, an individual's preferences are assumed to maximise expected utility; and

(3) conditions of certainty, where all outcomes are known, an individual's preferences are assumed to maximise utility (Harsanyi, as cited in Evers and Lakomski, 1991, p. 177).

The above definition covers classical decision theory in general terms and despite the fact that it has been subjected to substantial critique (Tversky and Kahneman, 1999; Kahneman *et al.*, 1999; Goldstein and Hogarth, 1997; Bechara and Damasio, 2005) it continues to be influential, especially in modern economic theory. Simon's account of decision making under conditions of "bounded rationality" (Newell and Simon, 1972), provides a somewhat less austere theory in that he acknowledges the limitations of human rationality and human information processing without, however, sacrificing the possibility of making a correct decision. Compared with the requirements of classical choice theory to make optimal choices (that come with high costs), he advocates that we satisfice rather than optimise. Human behaviour falls short of rationality in the following ways:

- Rationality requires a complete knowledge and anticipation of the consequences that will follow on each choice. In fact, knowledge of the consequences is always fragmentary.
- Since these consequences lie in the future, imagination must supply the lack of experienced feeling in attaching value to them. But values can be only imperfectly anticipated.
- Rationality requires a choice among all possible alternative behaviours. In actual behaviour, only a very few of all these possible alternatives ever come to mind (Simon, 1976, p. 81).

However, despite bounded rationality, correct administrative decisions are possible insofar as the domain where values and preferences are arbitrated is avoided. This domain deals exclusively with policy decisions.

In general, a correct administrative decision for Simon is one that makes for the realisation of certain "given" values in a given situation. Accomplishing these given values itself is a factual matter of assessing whether the resources applied have been employed effectively or efficiently. Values and human preferences, since they are non observable, are externalised in this instrumental way and their origins or status is of no concern in scientific administrative decisions but are to be adjudicated in the area of policy. (For extensive discussion on Simon's empiricist philosophical framework, see Evers and Lakomski, 1991, Chapter 1). Questions of policy are questions of arbitrating between different values, and value judgments are a matter of "human fiat" (Simon, 1976, p. 56). Validating a factual proposition, on the other hand, is a matter of "its agreement with the facts." The affective side of human behaviour, i.e. subjective feelings, preferences, "values" are excluded from rational decision making which, true to empiricist doctrine, has no purchase on rational decision making.

This is not to deny that Simon acknowledges human values and preferences as important. He comments explicitly on the limitations of human choice imposed by their psychological environment. To overcome these limitations, he notes, human beings have developed some working procedures that "[. . .] consist in assuming that he [human being] can isolate from the rest of the world a closed system containing only a limited number of variables and a limited range of consequences" (Simon, 1976, p. 82). Successfully manipulating these variables, that is, our factual knowledge is what defines human rationality and intelligence.

The problems with this influential perspective are many but are not the subject of this discussion (Evers and Lakomski, 2000, Chapter 3). In a nutshell, though, while symbol

systems manage to be successful in executing a range of (narrowly defined) thinking tasks, they are subject to computational limits in information processing such as speed and organisation of a system's computations and size of its memories. Even such a well-specified game as chess cannot be played perfectly by a symbol system because this would require analysis of more chess moves than there are molecules in the universe, a feat that is computationally impossible. Simon acknowledges that if exact computation in chess is impossible, then so are the problems of everyday life. Therefore, he concludes, "[. . .] intelligent systems must use approximate methods to handle most tasks. Their rationality is bounded" (Simon, 1990, p. 6; emphases in original). Bounded rationality remains a key to his theory of rationality, albeit in "updated" form.

Finally, it is revealing what Simon and colleagues single out as leftover issues and their effects on the cognitive architecture they developed that still need to be resolved. These include:

(1) acquiring capabilities through development, of living autonomously in a social community, and of exhibiting self-awareness and a sense of self [. . .];

(2) how to square their cognitive architecture with biological evolution which puts a premium on perceptual and motor systems; and

(3) how to integrate emotion, feeling and affect into cognitive architecture (Newell *et al.*, 1996, p. 127).

In other words, everything that we consider as truly human. The chasm between "high reason," as Damasio calls it, body and world could not be more evident, nor the problems more obvious that such a perspective on mind and cognition creates for itself. Simon's work, and that of classical decision theory, is testament to the predominance of rationalist assumptions that have no truck with biological brains, their development and architecture, and with emotion (a fascinating discussion on the neural basis for deductive reasoning is Goel, 2007). So what of emotion?

Emotion enters the equation

Even on classical accounts of decision making, the relevance of emotion is undisputed, although it is always portrayed as compromising rationality. To see the arguments for this portrayal, consider again the basic machinery of much decision making. This consists of choosing that course of action that is most likely to realise what we value most. Whether described in familiar folk-psychological terms or in the more arcane terminology of mathematics.

One of the constraints that is in operation here is the requirement that we are able to value alternatives in a relatively clear way. That is, it assumes a stable value, or preference, structure over the alternatives being adjudicated. But if values are construed broadly as conceptions of the desirable with motivating force (Hodgkinson, 1978, p. 105), then it will be difficult, conceptually, to find a clear demarcation between values and emotion. For if it about anything at all, emotion is a source of motivation and affects what we regard as desirable. The problem is that emotions fluctuate and can change with the passing show of experience, and with a range of bodily influences. Since decision making regularly assumes deferred alternatives, an unstable value structure compromises the theoretical basis on which alternatives are being ranked. One's preferences may change well before any outcomes come into play as alternatives.

Worse still, emotion can render values inconsistent. For example, people can value procedural impartiality in evaluating alternatives but want to give short shrift to the consideration of some alternatives to which that have very strong feelings of opposition. This problem spills over into the very nature of specifying decision alternatives, since we are prone to evaluate differently equal situations that are described differently. Thus, people tend say they would prefer a surgical procedure with an 80 per cent survival rate rather than one with a 20 per cent mortality rate, even though the two are actuarially equivalent.

Emotion also figures in such fundamental epistemic processes as learning from experience, a requirement for fixing on reasonable estimates concerning the likelihood of alternative outcomes of possible actions, or decisions. Consider how we might adjust our theories of the world in the light of evidence. The key issue is resolving what is known as the "stability/plasticity dilemma" (Carpenter, 1989, pp. 25-6). We have views on many issues and we change our minds from time to time as a result of discovering new information. But what is the correct balance here? If we err on the side of plasticity, our minds will be like a beach with every new wave of experience washing over and obliterating all that was previously written in the sand. On the other hand, if we err on the side of stability, our minds are more like concrete with engravings almost entirely unsusceptible to successive waves of experience. In epistemology, and methodology, this latter condition is known as confirmation bias, with even evidence contrary to expectation being interpreted as supporting one's viewpoint. Holding one's views with a passion inclines us to confirmation bias with its corresponding limitations on learning. But being disinterested in one's views can result in a failure to accumulate knowledge, a necessary condition for developing intellectual structures that can match the complexity of the world in which we live.

In the absence of an agreed methodological solution to these problems, it is important that we at least try to develop an understanding of the role of emotion in decision making.

The cognition-emotion debate

The neglect of emotion in serious scientific study until recently (Damasio, 1999) can largely be accounted for by the general trend to study the mind/brain as if it had nothing to do with evolution. Simon's theory is only one well known example amongst many that reflects this view. The last two decades of research in cognitive neuroscience, however, have seen a remarkable change. The idea that emotion and cognition are two separate systems that interact only occasionally is no longer accepted in light of behavioural and neuroscience data that demonstrate not just their interaction but, more strongly, the view that their integrative operation is necessary for adaptive human functioning (Ochsner and Phelps, 2007).

From an evolutionary perspective, of course, this is hardly surprising. Emotions, in fact, have quite unique qualities. They are embodied, and as Dolan (2002, p. 1191) notes, they:

> [. . .] manifest in uniquely recognizable, and stereotyped, behavioural patterns of facial expression, comportment, and autonomic arousal. Second, they are less susceptible to our intentions than other psychological states insofar as they are often triggered unawares; and thirdly, and most importantly, they are less encapsulated than other psychological states as evident in their global effects on virtually all aspects of cognition.

The renewed emphasis on the scientific study of emotion has already led to significant developments evidenced by the emergence of neuroethics (Glannon, 2007; Gazzaniga, 2005; Tancredi, 2005; Illes and Raffin, 2002; May *et al.*, 1996) and affective neuroscience (Davidson, 2003).

In the sections to follow, we consider the SMH and what it claims about the connection between cognition and emotion.

The SMH, reasoning and decision making

Feelings and emotions

To begin with, in everyday life we commonly conflate emotions and feelings. Such conflation has caused difficulties with the research on emotions. It appears that what we call emotions is a bundle consisting of background emotions, primary or basic emotions (fear, anger, disgust, surprise, sadness, and happiness) and social emotions (sympathy, embarrassment, shame, guilt, pride, jealousy, envy, gratitude, admiration, indignation, and contempt). The latter Damasio (2003, pp. 43 onwards) calls the emotions-proper. Background emotions in contrast are not prominent in behaviour but are in evidence when we, for example, detect whether someone is enthusiastic about or bored by a task we asked them to perform; or, they are present in the experienced diagnostician who by merely observing a patient is able to make an assessment of the illness. This we often call "tacit knowledge."

We do not know very much yet about how the brain triggers social emotions, but deeply engrained in the organism's brain, they are "a gift of the genome of certain species" (Damasio, 2003, p. 46).

Given their evolutionary history, is seems that the brain machinery for emotion and for feelings was assembled in instalments (Damasio, 2003, p. 80). The machinery of emotion came first which facilitated reactions to an object or event, and then the machinery for feelings came after. This machinery makes possible the production of "a brain map and then a mental image, an idea, for the reactions and for the resulting state of the organism [. . .]" The working hypothesis and definition for a feeling "is the perception of a certain state of the body along with the perception of a certain mode of thinking and of thoughts with certain themes" (Damasio, 2003, p. 86). Feelings seem to emerge when something like a critical "body" mass of mapped detail gets to a critical point. Their substrate is thus the set of neural patterns that map the body state and which give rise to a mental image of the body state. "A feeling of emotion is an idea of the body when it is perturbed by the emoting process" (Damasio, 2003, p. 88; also Dolan, 2002). How these processes play out will be seen in the next section. Of particular significance is to see what happens when the brain machinery relevant to the production of emotions has been injured.

The most famous case study in neuroscience is that of Phineas Gage (Damasio, 1996, Chapter 1; Restak, 1984, Chapter 4; see also www.deakin.edu.au/hmnbs/psychology/gagepage/), whose sad fate presents one of the earliest examples of the impact of brain injury on everyday decision making and personality.

Working as a construction foreman for a railroad company in Vermont in 1848, an iron bar Gage used to tamp down explosives, shot out of the hole. The charge blew up in his face, and the iron bar entered Gage's left cheek, shot through his skull diagonally and exited through the top of the head. Amazingly, he was not killed. Gage recovered after a few months, but it was observed that "Gage was no longer Gage." His personality had

changed remarkably. Whereas previously he was outgoing, social, had a sense of responsibility, cared for his work, and was liked by his fellow workers, after the accident he no longer seemed to care, had become prone to fly off the handle, and did not show respect for the social conventions as he had done before the accident. Also, his decision-making ability regarding what was or was not in his best interests, and planning for the future, had disappeared. In fact, the choices he made were poor and turned out badly for him.

A second important aspect in Gage's story is the discrepancy (dissociation) between his negative character changes and the seemingly normal state of his cognitive capacities and behaviours that showed no impairment. In other words, his value or ethical system that shaped his (former) character had become split from his cognitive faculties and behaviour. What had become clear, albeit unwittingly, as Damasio (1996, p. 10) points out, is:

> [. . .] that something in the brain was concerned specifically with unique human properties, among them the ability to anticipate the future and plan accordingly within a complex social environment; the sense of responsibility toward self and others; and the ability to orchestrate one's survival deliberately, at the command of one's free will.

The somatic marker hypothesis

It took the modern neuroscientific research methods of functional magnetic resonance imaging, positron emission tomography, electroencephalography, direct neuronal recordings, and work with brain-damaged patients to learn how the brain actually makes decisions (Sanfey and Cohen, 2004). In particular, the work of Damasio and his colleagues with patients who suffered lesions in the ventromedial prefrontal cortex (VMPFC; the "underbelly" of the frontal lobe right behind our eyebrows, Damasio, 1996, p. 32) showed exactly what had happened in Gage's case. These patients, including Damasio's patient "Elliot," the modern Phineas Gage, demonstrated normal cognitive abilities as per standard tests, but also showed poor decision-making behaviour. Personality changes were described by their families as "emotionally flat," "decides against his best interest," "doesn't learn from his mistakes," "is impulsive," etc. (Sanfey and Cohen, 2004, p. 16709).

The SMH maintains that emotions have a significant influence on decision making, that is, people make decisions, sometimes primarily, at gut or emotional levels rather than engaging in a "rational" assessment of the future outcomes of weighing options and alternatives in some kind of cost-benefit analysis, as standardly assumed in theories of choice (Clore and Huntsinger, 2007). SMH "provides a system-level neuroanatomical and cognitive framework for decision making and suggests that the process of decision making depends in many important ways on neural substrates that regulate homeostasis, emotion, and feeling" (Bechara, 2004, p. 30; Bechara *et al.*, 2000).

What happens in ordinary life goes something like this. You contemplate a bad outcome in connection with a particular response option, let us say you picture informing your employee that he is not getting the promotion he was expecting, and you experience a negative, unpleasant gut feeling. A somatic marker "marks" a body image. In doing so, it makes you attend to the negative consequences of the action you contemplated – not supporting the promotion since you considered it unearned – it serves as a kind of alarm signal. As you know from your own experience, having experienced such examples of markers before, you may have immediately rejected the action you had planned without giving it any further thought. Or you may not on further reflection on the likely response

you might get from your employee. The point is, the considerable benefit of such an early warning system, according to Damasio *et al.*, that it shrinks the pool of available options for selection in that at least one negative option may be eliminated immediately.

This does not mean that we may not also carry out the kind of rational cost-benefit analysis of our action, described above, but if and when we do, we have fewer alternatives to crunch through. Damasio and colleagues believe that in this manner somatic markers make decision making more accurate and efficient. Specifically, "*somatic markers are a special instance of feelings generated from secondary emotions.* Those emotions and feelings *have been connected, by learning, to predicted future outcomes of certain scenarios*" (Damasio, 1996, p. 174; emphases in original). A negative somatic marker functions like an alarm bell while a positive somatic experience serves as an incentive. Their basic workings, in simplified form, are as follows:

> When the choice of option X, which leads to bad outcome Y, is followed by punishment and thus painful body states, the somatic marker system acquires the hidden, dispositional representation of this experience-driven, non-inherited, arbitrary connection. Re-exposure of the organism to option X, or thoughts about outcome Y, will now have the power to re-enact the painful body state and thus serve as an automated reminder of bad consequences to come (Damasio, 1996, p. 180).

Given the physiology of emotions, there are two mechanisms for the somatic marker process. In the "body loop," "the body is engaged by the prefrontal cortices and amygdala to assume a particular state profile, whose result is subsequently signalled to the somatosensory cortex, attended, and made conscious" (Damasio, 1996, p. 184). In the second mechanism, the body is by-passed (see Bechara, 2004, p. 38, for a simple diagram of both loops). The prefrontal cortices and amygdala "tell the somatosensory cortex to organize itself in the explicit activity pattern that it would have assumed had the body been placed in the desired state and signalled upwards accordingly" (Damasio, 1996, p. 184). "As if" mechanisms have arisen as a result of social learning in the sense of being "tuned" as a consequence of experiencing punishment or reward. As we mature, decision-making strategies begin to depend in part on "symbols" of somatic states. The important question here arises as to which decisions engage the "body loop" and which engage the "as if" loop? This is a question still investigated with great interest.

Also, somatic markers can become conscious, that is, they become a feeling, as "feeling" was defined in the preceding section. But when they do not, this does not mean that no evaluation of a contemplated choice has been undertaken. It is just that the evaluation did not rise to consciousness, and hence did not become a feeling. While the explicit imagery related to, say, a negative outcome is generated it would not produce a perceptible body state but instead inhibit those neural circuits in the brain which mediate approach behaviours. This mechanism might well be the source for what we call "intuition." As a result of inhibition of the tendency to act, chances of making a bad decision may be reduced. This might well buy time for conscious deliberation and possibly making a more appropriate decision, or avoiding a negative one altogether (Will you support the promotion or not?). It is in this sense that somatic markers are said to bias cognitive processes of decision making. Indeed, it is this very biasing function of somatic markers, it is claimed, that makes decision making possible at all.

The most telling experimental support for the SMH, and the most often cited study, is the Iowa gambling task (Damasio *et al.*, 1991; Bechara *et al.*, 2000; Bechara and Damasio, 2005):

> Subjects have to choose between decks of cards which yield high immediate gain but larger future loss, i.e. long term loss, and decks which yield lower immediate gain but a smaller future loss, i.e. a long term gain. The task consists of four decks of cards named A, B, C, and D. The goal in the task is to maximize profit on a loan of play money. Subjects are required to make a series of 100 card selections. However, they are not told ahead of time how many card selections they are going to make. Subjects can select one card at a time from any deck they choose, and they are free to switch from any deck to another at any time, and as often as they wish. However, the subject's decision to select from one deck versus another is largely influenced by various schedules of immediate reward and future punishment. These schedules are pre-programmed and know to the examiner, but not to the subject. The reward/punishment schedules are set in such a way so that two of the decks of cards (A and B) yield high immediate gain but larger future loss, i.e. long term loss (disadvantageous decks), and two of the decks (C and D) yield lower immediate gain but a smaller future loss, i.e. a long term gain (advantageous decks) (Bechara, 2004, p. 31).

When compared with normals subjects with lesions in the VMPFC did not avoid choosing the "bad" decks, indeed they preferred them. In other words, they continued to make decisions that were not to their long-term advantage. This behaviour pattern was also characteristic in their ordinary lives in relation to personal and social matters where it is normally not possible to calculate exact future outcomes, and where we have to make decisions based on hunches and guesses.

On further testing VMPFC patients' inability to "foresee the future" (Bechara), a psychophysiological measure was introduced while patients made decisions during the task in order to ascertain their skin conductance response (SCR). Interestingly, after learning how the task works, normals began to generate SCRs prior to selecting any cards, that is, while they were contemplating from which deck to choose, with more pronounced SCRs evident when selecting risky cards. In stark contrast, no SCRs were generated by the VMPFC group before picking up any card. These outcomes were seen to provide strong support for the SMH's veracity, i.e. that decision making is guided by emotional signals, generated in the anticipation of future events.

As noted above, the important question for organisation and educational administration theorists is whether our decision making is always associated with emotion and body states. And the answer is that it is not. Interestingly, considering the three classical decision-making options:

(1) choice under certainty;

(2) choice under risk; and

(3) choice under ambiguity, it appears that body loop operations become more prominent when decisions move from certainty to risk to ambiguity.

On the other hand, where outcomes are explicit and predictable, the "as if" loop will be engaged. Since practical decision making in educational-organisational contexts is very often characterised by uncertainty it seems that body loop operations play a much more central part, a suggestion that needs to be backed up by more evidence and whose implications are yet to manifest.

As has been stated earlier, the SMH is controversial and has given rise to considerable debate (Maia and McClelland, 2004; Sanfey and Cohen, 2004; Dunn *et al.*, 2005). There is no scope in this paper to engage in any of the complex discussion, but there seems little disagreement regarding the general claim that emotions do indeed influence

decision making. What is contested, *inter alia*, is the further claim that normals choose advantageously before being consciously aware of the advantage of one pair of decks over the other (Maia and McClelland, 2004). Sanfey and Cohen (2004, p. 16709) are probably right when noting that the challenge presented by Maia and McClelleand is more a challenge to the "standard for what counts as evidence of an unconscious influence on behavior [. . .]".

Making emotional decisions

Since humans are not quite the efficient and effective thinkers traditional models of decision making assumed, underpinned by conceptions of the mind that decreed reason to be disembodied and void of emotion, and if the SMH is generally correct, then emotional decisions are part and parcel of our biological make-up, whether we "know" them or not. The task then shifts to developing models of thought that are holistic to the point of including values and emotion into both substantive theories of the world and into our epistemic processes for improving those theories.

Traditionally, this problem has been approached by proposing global, or coherence, criteria for theory excellence – such things as consistency, simplicity, comprehensiveness, and explanatory unity (Thagard, 2000). Theories imply observational consequences and empirical evidence is a source of feedback to theoretically motivated expectation. The point at which the stability/plasticity dilemma is resolved is that set of revisions that maximises global coherence. Unfortunately, construed in this way, the problem is computationally intractable. Calculating coherence over even a small number of belief elements cannot be done in polynomial real time; that is, the task grows exponentially. The only realistic solution is to opt for shortcuts that bracket off large parts of our theory from this epistemic exercise. However, this is a matter of how we feel about the various components of our theory, which parts we want to hold constant and which we want to put up for grabs. In this sense, some form of confirmation bias is not just unavoidable. It is methodologically essential for the processes of theory development to move ahead in real time. Having the appropriate emotional commitments to our beliefs is therefore crucial. But these commitments also need to have a dynamics if we are to be able to theorise over a wide range of contingencies.

Some simple heuristics are always in play; never change first your highest priority theoretical assumptions; change the parts that have least impact on the whole; and so on. What would be really nice to have would be a good causal account of epistemically progressive decision making where these various influences are better understood. It is one of the attractions of cognitive neuroscience that it holds out such a hope and is beginning to deliver on that hope.

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