COGNITION VERSUS EMOTION?
REVISING THE RATIONALIST MODEL OF DECISION MAKING

Abstract

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. Based on research in affective neuroscience, and the Somatic Marker Hypothesis, it presents some evidence that the traditionally presumed "disconnect" between cognition and emotion is not defensible, that reason without emotion is not possible, and that therefore rationalist theories of decision making need substantial revision if they want to be of practical use in organizational contexts.

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1. INTRODUCTION

Ever since Descartes has cognition been identified with the ability to manipulate symbols in the head, to be good at logic, mathematics, or other symbols such as words. Mental activity so defined was considered to be the hallmark of what it means to be a *res cogitans*, or 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–organizational theory, Herbert Simon's view of decision making is one prominent example that continues to be influential.

On the other side of the cognition–emotion divide, emotion (and the body) are said to have nothing to do with cognition and rationality. Indeed, emotion was considered to be too subjective, elusive and vague, and to be the opposite of reason. It must be kept separate from cognition for fear of contaminating rational thought. The body, similarly, had nothing to do with the seat of reasoning. It is not that emotions were considered unimportant; quite the opposite, but they are entirely independent from reason. This picture is now changing.

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 even, the neuroscientific evidence we now have 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, 2003, 1999, 1996; Glannon, 2007; Clark, 2001, 1997; the Churchlands, 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 the so-called *Somatic Marker Hypothesis* (from "soma"=body; SMH hereafter), advocated by Damasio (2003, 1999, 1996) and Damasio and colleagues (Bechara and Damasio, 2005; Bechara, Damasio, and Damasio, 2000; Damasio, Tranel, and Damasio, 1991). SMH is the currently most controversial neuroscientific study of decision making behavior which claims that ordinary practical decision making is governed by emotional factors of which there is no awareness (see Sanfey and Cohen, 2004, and Maia and McClelland, 2004 for critical discussions). This is a startling result, which has challenging consequences for understanding a whole range of human activities, including decision making in organizational (and any other) contexts.

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 business, 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 organization in interconnected neural nets, and its fundamental ability to recognize patterns at the sub symbolic, neuronal level, this knowledge naturally extends to the study of emotion (for an overview see Churchland, P.S. 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 but signals 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. What we learn theoretically as organization or decision theorists is that classical theories of decision making are 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 theorizing.

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.

2. 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, maximization of a person’s utility is governed by three broad conditions under which the rationality of individual preferences can be expressed:

> (i) Under conditions of uncertainty, where some or all probabilities are unknown, and
> (ii) Under conditions of risk, where all probabilities of outcomes are known, an individual’s preferences are assumed to maximize expected utility.
> (iii) Under conditions of certainty, where all outcomes are known, an individual’s preferences are assumed to maximize 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 (e.g. Tversky and Kahneman, 1999; Kahneman, Slovic and Tversky, 1999; Goldstein and Hogarth, 1997; Bechara and Damasio, 2005) it continues to be influential, especially in modern economic theory. In organizational decision making, 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 behavior falls short of rationality in the following ways:

> (1) 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.
> (2) 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.
> (3) Rationality requires a choice among all possible alternative behaviours. In actual behavior, 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, but need to be clearly demarcated from policy decisions, the domain where values and preferences are arbitrated.

In general, a correct administrative decision for Simon is one that makes for the realization 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 externalized 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, Ch. 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 behavior, i.e. subjective feelings, preferences, "values" are excluded from rational decision making which, true to empiricist doctrine, has no purchase on rational decision making.

Just to be clear on this point, Simon acknowledges human values and preferences as important, and 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, our factual knowledge, is what defines human rationality and intelligence in his scheme of things.

This core belief is expanded in the so called *Physical Symbol Systems Hypothesis* (PSSH) which further formalizes human reasoning by identifying it with the capacity to manipulate linguistic and quasi-linguistic symbols in the head (see Evers and Lakomski, 2000, Ch.3 for a fuller discussion). This thesis is the hallmark of classical AI, a discipline to which Simon has also made important contributions in his later life. Echoes of the Cartesian *res cogitans* and Kantian pure reason are readily detectable here. The most notable point for present discussion is that Simon, following information processing psychology, was primarily concerned with the internal processing structures of the brain and the symbolic representations of the mind. As he says, it is physical symbol systems that determine intelligence, and "*and only such systems.*" (Simon, 1990, p. 3). Symbols, though, go beyond the merely linguistic or verbal and include designate words, mental pictures, diagrams, and other representations of information (Simon, 1990).

What is particularly important here is that classical AI, and Simon, did not consider that the architecture of real brains is of any significance for the PSSH since what is at issue are the higher cognitive processes such as information processing, problem–solving, and planning. These operate at a higher level of abstraction, are far removed from the neuronal level, and therefore not relevant for the determination of rationality.

The problems with this influential perspective are many, and it might even be said that much of contemporary connectionist cognitive science is dedicated to disproving or correcting the PSSH (see Evers and Lakomski, 2000, Ch. 3). In a nutshell, 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 organization 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 left–over 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, Rosenbloom and Laird, 1996, p. 127)

In other words: everything that is 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?

3. THE COGNITION–EMOTION DEBATE

The fate of emotion and its exclusion from serious study until recently is colourfully described by Damasio (1999, p. 39):

> Throughout most of the twentieth century, emotion was not trusted in the laboratory. Emotion was too subjective, it was said. Emotion was too elusive and vague. Emotion was at the opposite end from reason … and entirely independent from emotion. This was a perverse twist on the Romantic view of humanity. Romantics placed emotion in the body and reason in the brain. Twentieth–century science left out the body, moved emotion back into the brain, but relegated it to the lower neural strata associated with ancestors who no one worshiped. In the end, not only was emotion not rational, even studying it was probably not rational.

The neglect of emotion in serious scientific study can largely be accounted for by the general trend to study the mind/brain as if it had absolutely nothing to do with evolution. Simon's theory is only one well know 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 doctrine 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 (e.g. 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 “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”. (Dolan, 2002, p.1191). The renewed emphasis on the scientific study of emotion has already led to significant developments evidenced by the emergence of *neuroethics* (see Glannon, 2007; Gazzaniga, 2005; Tancredi, 2005; Illes and Raffin, 2002; May, Friedman, and Clark, 1996) and *affective* neuroscience (Dole, 2002; Davidson, 2003).

In the sections to follow, I want to consider in some detail the *Somatic Marker Hypothesis* (SMH) to look more closely how the connection between cognition and emotion manifests. But before the SMH is discussed, it is important to be clear on what emotions are and how they differ from feelings.

4. EMOTIONS AND “FEELING” A FEELING

In everyday life we commonly but mistakenly 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 emotions* and *social emotions*, what Damasio (2003, pp. 43 onws.) calls the emotions–proper. Background emotions are not prominent in behavior 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 skilful diagnostician who silently observes various movements in a patient, for example. This we often call “tacit knowledge”.

Primary (or basic) emotions are the emotions with which we are most familiar: they comprise fear, anger, disgust, surprise, sadness, and happiness and are the most easily identifiable emotions in cross cultural contexts, as well as being detectable in non human species, and arise in circumstances that are also consistent across cultures and species. The knowledge we currently have about the neurobiology of emotions comes from the study of the primary emotions, with fear leading the way, followed by disgust, sadness, and happiness.

The social emotions consist of sympathy, embarrassment, shame, guilt, pride, jealousy, envy, gratitude, admiration, indignation, and contempt. There is no sharp divide between the primary and the social emotions, and what Damasio (2003, p. 45–46) calls the “nesting principle” applies here too: “Think of how the social emotion “contempt” borrows the facial expression of “disgust”, a primary emotion that evolved in association with the automatic and beneficial rejection of potentially toxic foods.”

We do not know very much yet about how the brain triggers social emotions. What we do know though is that the descriptor “social” is not confined to human society or culture, and that social emotions are not a necessary product of education since they can be exhibited by simple animal species (see *C elegans*, a modest worm, that only sports 302 neurons and about 5,000 interneuron connections – a small brain by anyone’s measure that nevertheless facilitates the social behavior of congregating together when food is scarce or danger is nearby!). Some of these emotions are innate others are not and need to be triggered by an appropriate environmental stimulus. What is beyond doubt is the fact that these sophisticated behaviors – in the absence of language and culture – are deeply engrained in the organism's brain, and 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.

5. THE SOMATIC MARKER HYPOTHESIS, REASONING AND DECISION MAKING

The most famous case study in neuroscience, the sad fate of Phineas Gage (Damasio, 1996, Ch. 1; Restak, 1984, Ch. 4), presents one of the earliest examples of the impact of brain injury on everyday decision making.

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 he was outgoing, social, had a sense of responsibility, cared for his work, and was liked by his co 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 actively disadvantaged 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 behaviors 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 behavior. What had become clear, albeit unwittingly, as Damasio (1995, 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."

It took the modern neuroscientific research methods of functional magnetic resonance imaging (fMRI), positron emission tomography (PET), electroencephalography (EEG), 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 of memory and general intelligence, but also showed poor decision making behavior. 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 (see 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, Damsio and Damasio, 2000).

What happens in ordinary life goes something like this. You contemplate a bad outcome in connection with a particular response option, let's 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*., is 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 believes 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 reenact 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, but a few comments will follow later.

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 that, it is claimed, 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* (IGT) (Damasio, Tranel, and Damasio, 1991; Bechara, Damasio, and Damasio, 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 behavior 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, "normals", after learning how the task works, 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 somatic marker hypothesis'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 organizational theorists and social scientists generally 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 organizational contexts is largely characterized 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, Dalgliesh, and Lawrence, 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 (e.g. Maia and McClelleand, 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 …".

6. MAKING EMOTIONAL DECISIONS: SKETCH OF A THEORY

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.

In healthy humans, non conscious biases guide behavior before conscious knowledge does. Our gut feelings, heart rates, or what we call intuitions, are the overt signs and symbols of such covert body activity. Without these markers "pre-sorting", i.e., delimiting the decision space, advantageous behavior may be seriously jeopardized since overt knowledge in form of linguistic representations may not be sufficient to help us decide in our best interests. Indeed, in humans with prefrontal damage decision making turns out to be just that: disadvantageous, risky, *and* unchanging even after becoming aware of the fact that their choices were not in their best interests. What characterized their choices was "myopia of the future", as the Damasio team calls it, they could not anticipate future negative or positive outcomes of their actions. Emotion and reason had come asunder, with subsequent and often tragic consequences.

The empirical findings of how emotions are indispensable to cognition in everyday decision making provide powerful evidence for constructing a new theory of decision making that properly incorporates human affect and therefore broadens the conception of what it means to make *rational* decisions. The analytical framework of most promise is the *coherence theory of (emotional) decisions*, sketched by Barnes and Thagard (1996), Thagard and Millgram (1997), and developed further by Thagard (2000, 2001, 2006). (For discussion of Thagard's model of *decision making as constraint satisfaction* see Evers and Lakomski, 2000, Ch. 6.)

Beginning from the assumption that people come to their decisions by considering various, often competing goals and actions and giving them order of priority in light of some accepted goals, rational decision making consists in making decisions that cohere best with our current objectives and goals. For example, I want to watch a favourite TV show which comes on shortly but also finish this paper, which is already overdue. I cannot easily accomplish both since enjoyment of a program and the accomplishment of a research outcome, plus satisfying my professional ethos of generally delivering papers on time, are not consistent with each other. The decision "rule" that can be applied here is that I make an "inference to the best plan", in Thagard and Millgram's terminology. Unlike traditional decision models that assume one ultimate goal or end, and also unlike Simon's more moderate decision model of *satisficing,* this model accepts that we have many and conflicting goals simultaneously, and that deciding between them is not a straightforward linear calculation but involves a holistic assessment of what is important to us. Moreover, we "sometimes look round for goals to be achieved by the actions at our disposal. … a runner who likes to run every day may adopt the goal of running in a marathon. Running every day facilitates running the marathon, not the other way around, but here the goal is adopted to fit the means for accomplishing it." (Thagard and Millgram, 1997, p. 10). Means and ends are never fixed but are interchangeable, an insight we already have from Pragmatist philosophy.

Since actions and goals may be in conflict, deciding how to order them to reach the most coherent outcome, i.e. best satisfy existing goals, a procedure is needed that helps specify the relations between them so that we can come to the most coherent actions, but that also helps us decide which plans to adopt which, in turn, might necessitate a revision of previously accepted goals. Thagard and Millgram (1997, p. 3) and Thagard (2000, pp. 127-135) specify six principles:

(1) **Symmetry** Coherence and incoherence are symmetrical relations: if factor (action or goal) F_1, coheres with factor F_2,, then F_2 coheres with F_1

(2) **Facilitation** Consider actions A_1, …, A_n that together facilitate the accomplishment of goal G. Then (a) each A_1 coheres with G, (b) each A_1 coheres with each other A_1, and (c) the greater the number of actions required, the less the coherence among the actions and goals.

(3) **Incompatibility** (a) if two factors cannot both be performed or achieved, then they are strongly incoherent. (b) If two factors are difficult to perform or achieve together, then they are weakly incoherent.
(4) **Goal priority** Some goals are desirable for intrinsic or other noncoherence reasons.
(5) **Judgment** Facilitation and competition relations can depend on coherence with judgments about the acceptability of factual beliefs.
(6) **Decision** Decisions are made on the basis of an assessment of the overall coherence of a set of actions and goals.

(Thagard, 2000, p. 128).

To test out these principles, and to see how decisions arise from them, Thagard and Millgram devised a computational model, DECO (=Deliberative Coherence) that successfully makes realistic decisions. Thagard combined these principles of his coherence theory of (emotional) decisions with the SMH, and suggests the following. As we saw, Damasio's somatic markers mark response options (out of a potentially infinite pool) that signal either a positive or negative action. In Thagard's terminology, somatic markers indicate positive or negative *valences*. But since decision making depends on evaluating goals, it might be more appropriate to consider somatic markers as the representation of *goals*. This then means that those goals most important to us are represented by somatic markers, or make themselves "felt". The more important our values or goals the stronger the markers, or "emotional tags" (Barnes and Thagard, 1996). As we learnt in the previous sections, where the VMPFC and amygdala were impaired decision making had lost its emotional tag, and every option was just as good (or bad) as any other, as is movingly described by Damasio (1996, Ch. 3) in the case of "Elliot". It is this very biasing function that makes decision making possible in the first place. What is gained from the SMH is that it provides an account of why and how goals can be prioritised efficiently without necessarily having to have conscious knowledge of them. It is in this sense that the SMH offers a possible explanation that thoroughly naturalises the modus of decision making by going all the way down (or back) to the neuronal level, which was rejected as irrelevant by Simon.

Once somatic markers have made their presence felt we do not yet compare the contents of goals themselves but their emotional tags. In this way unmarked information is not part of any further coherence considerations. In a general sense, then, when we make "inferences to the best plan", we do so both in terms of goal relevance but also in terms of emotion relevance. At the deepest computational level the activation of the choices we make integrally depends on emotion. If we combine the principles of deliberative coherence (DECO) with the function of somatic markers, a theory of emotional decisions might contain the following features (Barnes and Thagard, 1996, p. 429):

(1) Decisions arise when new information is inconsistent with one or more currently held goals. The mismatch yields a negative emotion which produces a rupture in ordinary activity
(2) The decision juncture causes a simulation to occur, in which goals are re-evaluated on the basis of new information. This evaluation of goals elicits somatic markers.
(3) Once the goals are prioritised by somatic markers, new options are simulated and evaluated
(4) Coherence calculations produce the best option and equilibrium is restored between the present situation and existing goals.

7. CONCLUSION: BEYOND “KANTIAN MONSTERS”

From the neurological evidence we have so far, we can say with some degree of confidence that not only are reason and emotion integrally connected, but without emotion reasoning is impossible and decisions cannot be made. The evocative term “Kantian monster” (DeSousa, 1990, p. 14, as cited by the Churchlands, 1998, p. 237) rather aptly captures the rationalist decision maker when appraised in the light of the neurological evidence. For, ironically, if we were true to Kantian precepts in terms of making perfectly rational decisions unsullied by emotion we would resemble the serial killer and psychopath rather more than we would resemble the rational being (Tancredi, 2005 provides some fascinating profiles). In other words, only people whose brains do not function normally due to damage in the frontal lobes and amygdala are “perfectly rational” in the Kantian sense. It is probably no accident that Mr Spock, of Star Trek fame, has been conceptualised as a semi-alien! To make good decisions we depend on the very thing that is banned from rationalist decision theory: emotion.

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