Effect of somatic marker hypothesis on making decisions

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The Somatic-marker hypothesis (SMH) was first proposed by Demasio (1996), to explain the process of decision-making, while incorporating the role of emotion. This hypothesis developed after working with neurological patients who had damage to the prefrontal region, specifically in the ventral and medial regions, and presented severe impairments in decision making abilities (Damasio, 1979, 1994). As patients did not show any other impairment to their mental abilities, other than a compromised ability to express emotion, Damasio was able to investigate a link between emotion and decision-making ability. However, this link has been opposed by the Expected Utility Theory, which considers a rational approach to decision-making, in which emotion does not play a role (Friedman & Savage, 1948).

Demasio states within the SMH that people are able to make decisions through interaction between emotion and rationality, to produce the most appropriate outcome. These interactions are made by the emotional response and information from environmental input being presented in the form of physiological arousal, allowing an individual to assess their emotional response to a situation (Gazzaniga, Ivry & Mangun, 2009). He argued that emotion is most commonly presented through alterations in an individual’s physiological state, as these emotions are represented within the brain as temporary changes in the activity pattern of somato-sensory structures. Although human emotion has been primarily linked to the functions of the limbic system, the SMH proposed that despite the involvement of emotion, the neuronal circuit involved in decision making incorporates a variety of brain regions outside of these classic limbic system structures (MacLean, 1949). Damasio argues that in this process the emotional responses require multiple sources of feedback from the periphery brain in order to assist decision making (Damasio, 2004).

There have been found to be two different forms of stimuli which cause an alteration in physiological states of humans allowing decision-making to later occur; primary inducers are innate or learned stimuli which rely on the amygdala to produce a physiological change; secondary inducers are entities which are produced through the recall of a personal experience of a primary inducer and rely on the ventromedial prefrontal cortex (VMPFC) to activate somatic states; these are most common in the face of uncertain outcomes, as they rely on information provided by similar past experiences. These somatic states, which are experienced when a stimuli is presented, are the result of responses aimed at the brain which lead to; the central nervous system (CNS) releasing neurotransmitters, a modification of the state of somatosensory maps, and an alteration in the transmission of signals from the body to somatosensory regions. The body receives information from these changes, and combines them to be interpreted as an emotion (Bechara, 2004).

After a somatic state has been produced by a primary inducer, signals are then received by the brain to produce somatic state patterns in the brainstem nuclei and in the somato-sensing cortices. Once this somatic state alteration has occurred due to the initial presentation of a primary inducer, the pattern is stored for later recall. Later presentation of this primary inducer or a related secondary inducer can cause the somatic state pattern to be recalled and produce a similar emotional response. As a result, the brain is able to produce a prediction model of alterations expected to occur in the body, allowing the individual to respond more effectively and rapidly to the stimuli, without having to wait for the changes in physiology to be produced by the periphery (Dunn, Dalgleish, & Lawrence, 2006). This reaction is summarised by the SMH, as the process allows an individual to be influenced in decision-making by the basic biasing signals which are produced as a result of the neurotransmitters being released in the cerebral cortex and the diencephalon. For every response to a situation that an individual contemplates, a somatic state is created, which serve as an indicator of the expected outcome (Damasio, Tranel & Damasio, 1991; Damasio, 1996). This causes the somatic state to apply a biasing effect of an individual's behaviours, feelings, and cognitive patterns in response to a situation.

Evidence of the link between emotion and decision-making was provided by Domasio, when he observed a patient who had damage to the orbitofrontal cortex. He found that the patient E. V. R was able to generate reasonable solutions when presented with a social reasoning task, however, was unable to prioritize these solutions, identifying the most effective (Saver & Damasio, 1991). Prior to this, the orbitofrontal cortex had primarily been associated with the control of emotion. This suggests that the decision-making process relies on information provided by the emotion region of the brain, in order to provide a reasonable response. Alternatively, some psychologists argue that the orbitofrontal cortex plays a leading role in applying social knowledge to the decision-making process rather than considering an individual's emotional response, due to the recognition of which rules can be applied to a particular social situation, rather than assessing somatic markers (Gazziniga et al., 2009).

More evidence was provided by the neuropsychologist Le Doux (1996) who found that humans and animals responded to stimuli which could potentially harm them so quickly it was unlikely they could have considered the risks posed to them being in that situation. He argued that this quick " emotional evaluation" of stimuli is an innate response which has developed with evolution to preserve our species in the face of danger, rather than cognitively processing the unfolding events. Considering his evidence, LaDoux explains that our emotional circuitry is designed to have a greater influence on our rational approaches to decisions, rather than our rational thoughts over-riding our emotions.

Despite the SMH satisfactorily explaining how our emotions have an unconscious effect on our decision making process, we must also consider the fact that emotions are also known to act consciously on our rational judgement. Some psychologists have suggested that this allows us to employ our emotions as another form of information which we integrate into our logical decision-making process (Schwarz, 2000). When presented with a range of alternatives, it is suggested that we consider the emotions relating to the options before us, which we are often very aware of.

Strong empirical evidence has been provided from data on the Iowa Gambling Task (IGT), a decision-making task which is believed to rely on emotional-related feedback from the body to enable an appropriate response (Bechara, Tranel, Damasio & Damasio, 1996). The data indicated the lesions in the VMPFC cause impairments in decision-making, particularly the ability to select the most appropriate and advantageous option. This behavioural impairment has therefore been associated with the absence of predictor signals which allow an individual to differentiate between good and bad decisions. IGT has been praised as a sensitive, ecological measure of decision-making impairment, however, assumptions required for it to support the SMH have been criticised as unsound. The first assumption was that this learning is possible due to predictor marker signals produced by the body. Evidence from psychophysiological profiles compiled during the IGT did not support this suggestion (Tomb, Hauser, Deldin & Caramazza, 2002), resulting in the lack of a causal relationship being established between disrupted feedback from the periphery and impaired decision-making. This suggests that the " predictor changes" may actually represent the expectancy anticipation towards the outcome, once the decision has already been made (Amiez, Procyk, Honore, Sequeira & Joseph, 2003). It is also suggested that the tasks which aimed to measure implicit learning as the reward/punishment schedule as being cognitively inexplicable, in fact demonstrated accurate knowledge of the tasks possible outcomes (Maia & McClelland, 2004). It was found that cognitive mechanisms, including working-memory exert a strong influence on task performance.

Further support was given for the SMH in the business environment, as it is able to explain why we often rely on " gut feelings" when making a decision, and find them to be better predictors for a decision outcome than market data and past research. Physiological evidence from these studies identifies the involvement of the striatum and anterior cingulated in recognizing patterns and calculating the probabilities of outcomes. It was found that these areas respond immediately when presented with repeated or alternative somatic state patterns (Huettel et al. 2002). Alternatively, Rolls (1999) provides criticism, as he argues that the SMH proposes a very inefficient view that peripheral responses are located in the execution route, and for interpretation and measurement of this peripheral response to occur simultaneously. Rather, he suggests that reinforcement association, located in the orbitofrontal cortex and amygdala, is more than efficient enough to allow emotion-based learning to occur. This learning would consequently alter behaviours via the orbitofrontal-striatal pathways, through implicit or explicit processes.

An alternative theory to decision-making is the Expected Utility Theory (EUT) (Bernoulli, 1738 cited 1997) which states that an individual is able to select an appropriate resolution in risky circumstances by comparing their expected “ utility values”. These are calculated by adding the utility value of the outcomes multiplied by their respective probabilities, for each option available (Mongin, 1997). The expected utilities are determined by considering the probability of each possible outcome (gain or loss) for a particular option (Hoogendoorn, Merk & Treur, 2006). This theory of decision-making considers a rational approach, in which emotion does not cause a bias towards the decisions made.

However, much criticism has been provided by Kahneman and Tversky (1974, 1979) when considering this theory as a practical model for human decision-making. They found in numerous studies that humans are particularly bad at estimating probabilities objectively, and so their emotions may cause a bias in the final decision-making process. This has been reinforced by many others (Ellsberg, 1961; Fellner, 1961) who highlight the difficulty in determining the level of uncertainty in a given situation. They also suggest that people are not often aware of the exact probabilities associated with the possible outcomes, and so this problem, combined with the issue of ambiguity has been the focus for much further research Kahnenman & Tversky, 2000).

To conclude, the Somatic Marker Hypothesis proposed by Damasio (1994) suggests that when an individual experiences a situation, alterations in their physiological state are represented within their body as changes in their somato-sensory state. These changes are represented as an emotion towards that particular situation and act as an indicator of the expected outcome. When faced with a similar situation in the future, which requires a decision, Damasio suggested that an individual extracts emotional information supplied by somatic marker to facilitate them in the decision-making process. Evidence for this theory has been provided by numerous studies of neurological patients who had damage to the prefrontal region, and presented severe impairments in decision making abilities (Damasio, 1979, 1994). However, psychologists Gazziniga et, al. (2009) suggest that although emotion does play a role in decision-making, it is involved in the recognition of socially acceptable activities, rather than assessing somatic markers. In contrast, the Expected Utility Theory approaches decision-making in a much more rational way. It states that an individual assesses the probability of loss or gain for each available outcome in order to select the most advantageous choice of action. Bachara & Demasio (2005) has since suggested further research to fully explore some unanswered questions posed by the SMH. Little research has previously been conducted into the different kinds of decision-making and the relationship it may have with recruiting different neural networks for different tasks. Secondly, he proposed investigating if we are able to successfully identify when emotions are helpful or a hindrance in decision-making and if there are any individual differences.