

Do somatic markers mediate decisions on the gambling task?

TO THE EDITOR—Recent work suggests that emotions are critical in mediating decisions^{1–3}. A dominant perspective is the somatic marker hypothesis, which posits that emotional bodily responses (‘somatic markers’) can unconsciously bias decision-making^{1,4}. This hypothesis was initially inspired by observations of decision-making deficits among patients with prefrontal damage⁴. The interpretation of these observations depended crucially on the performance of normals using a gambling task in which the accumulation of emotional responses biased decision-making^{5–7}. Here we provide an alternative explanation for the performance of normal subjects on the gambling task by

showing how factors other than somatic markers may alter decision-making.

In the gambling task, a participant is presented with four decks of cards. After turning over a card, participants either win or lose varying amounts of play money. Unknown to the participants, picking from two of the decks (‘good’ decks) will result in eventual gain, whereas picking from the other two decks (‘bad’ decks) will result in eventual loss. The task ends after the selection of the 100th card, when most normal individuals have picked more cards from the good than the bad decks.

In previous studies of this task^{5,6}, experimenters recorded skin conductance responses (SCRs) as a measure of bodily

state. After several rounds of picking cards, it was found that ‘anticipatory’ SCRs, recorded several seconds before each card selection, were significantly higher for the bad decks than for the good decks.

At least two hypotheses may account for this result. First, anticipatory SCRs may be correlates of correct versus incorrect decision-making^{5,6}. Thus, the larger anticipatory SCR magnitude for bad decks represents a cumulative bodily signal that biases participants against choosing from long-term bad decks. A second hypothesis lies in the reward and punishment schedule of the decks. Because the amount of money both gained and lost for each card (per ten cards) is much greater for bad than for good decks (Fig. 1a), participants’ anticipatory SCRs may have been higher for bad decks because they were expecting an immediate higher-magnitude decision.

We have tested these alternative explanations. Only the first hypothesis attributes to SCRs a role in learning and decision-making. In Experiment 1, we replicated the design and primary results of the original gambling task (Fig. 1a–c). Participants picked more cards from the good versus bad decks, and showed higher anticipatory SCRs for bad versus good decks.

In Experiment 2, we changed the card scheme such that good decks were associated with a higher magnitude of punishment and reward than bad decks. If somatic markers drive long-term good/bad evaluation of the decks, as predicted by the first hypothesis, then the magnitude of anticipatory SCRs should be higher for bad decks. If the alternative hypothesis is correct, then there should be higher SCRs for good decks. Results support the second hypothesis: participants picked more cards from good decks, and this selection was accompanied by higher

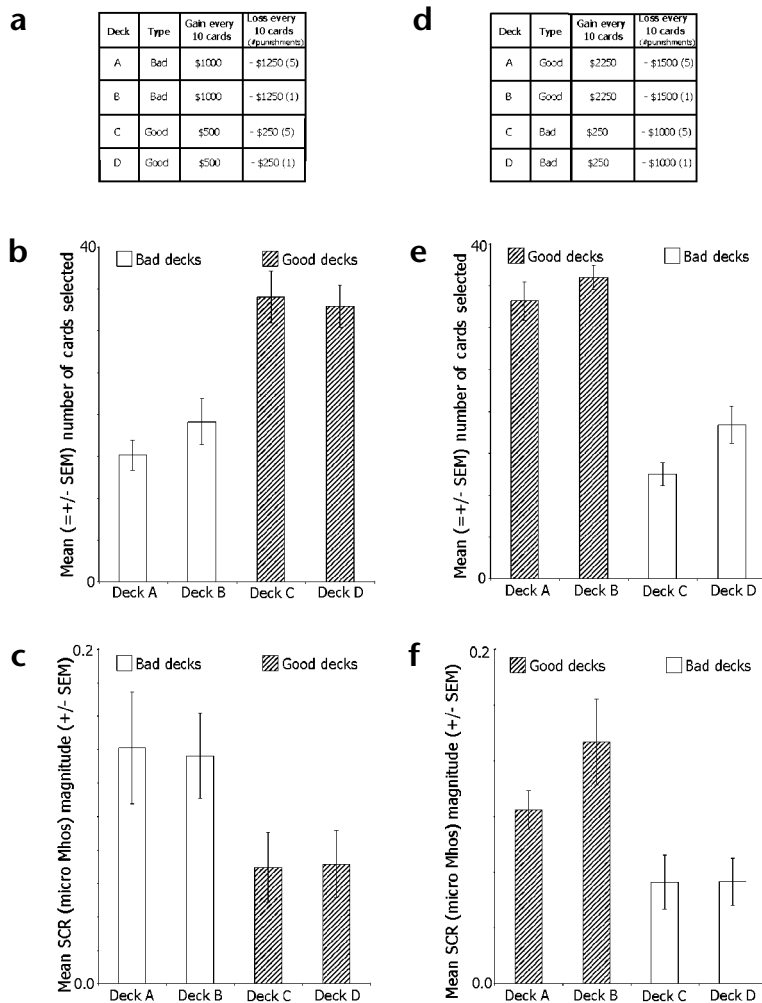


Fig. 1. Original and modified gambling tasks. In each experiment, subjects were five male and five female Harvard undergraduate students. (a) Card scheme for Experiment 1 (original task), in which bad decks had a higher magnitude of punishment and reward than good decks. (b) In Experiment 1, subjects chose more cards from good than bad decks ($t_{38} = -6.47, P < 0.001$). (c) Anticipatory SCRs in Experiment 1 were higher for bad decks compared to good decks ($t_{38} = 2.74, P < 0.01$). (d) Card scheme for Experiment 2 (modified task), in which good decks had a higher magnitude of punishment and reward than bad decks. (e) In Experiment 2, subjects chose more cards from good than bad decks ($t_{38} = 9.67, P < 0.001$). (f) Anticipatory SCRs in Experiment 2 were higher for the good decks than for the bad decks ($t_{38} = 3.57, P < 0.001$).

anticipatory SCRs for good decks than for bad decks (Fig. 1d–f).

Results suggest that across both experiments, card selection is driven by long-term consequences, whereas anticipatory SCRs are driven by the immediate act to be performed, independently of the positive or negative long-term value of the decision. In the original gambling task experiments^{5,6}, anticipatory SCRs were interpreted as correlates of somatic markers that bias individuals' decision-making. However, by changing the schedule of punishments and rewards in Experiment 2, we observed an opposite pattern of SCRs. We conclude that SCRs in the standard version of the gambling task do not provide evidence for the role of somatic markers in decision making.

Ian Tomb, Marc Hauser, Patricia Deldin and Alfonso Caramazza

*Department of Psychology, Harvard University, Cambridge, Massachusetts, 02138, USA [Author: Full mailing address?]
e-mail: mdhauser@wjh.harvard.edu*