The amygdala becomes reward-sensitive when an outcome cannot be assigned to the correct decision

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1 Summary

• Optimal decision making requires us to be able to detect changes in the environment and update learned contingencies accordingly. A cardinal test of this ability has been reversal learning.

• In a recent experiment, we showed in monkeys that a lesion to the orbitofrontal cortex (OFC) keeps reward processing intact but is fatal to the ability to associate rewards with their correct contingent choices [3].

• Investigations in rats revealed a similar reversal effect, but also led to the surprising finding that an additional lesion to the amygdala restored the ability for reversal learning [2,3].

• We found a potential explanation for this phenomenon: the amygdala becomes reward-sensitive when contingencies are ambiguous.

2 Experimental design

In a novel probabilistic decision-making paradigm, 24 healthy participants had to learn the reward probabilities of two options while undergoing \textsuperscript{18}O-MRI.

3 Behavioural validation of the design

• Our experimental manipulation in humans induced the same behaviour that was observed in OFC-lesioned macaques.

4 Imaging analysis

• OFC activity was examined in a companion abstract (see oral presentation \#366 W7h).

5 Imaging results

• When, as in previous fMRI experiments, direct contingencies could be made between choice and outcome (contingent and control condition), amygdala BOLD activity at the time of processing the outcome of a decision did not distinguish rewarded from unrewarded trials.

• By contrast, when exact contingencies could not be established, and hence competing OFC mechanisms could not operate (non-contingent condition), reward-sensitivity emerged in the amygdala bilaterally.

6 Conclusions

• Contingent and non-contingent reversal learning can be robustly induced in subjects purely on the basis of different experimental instructions.

• While activity in the left OFC indicates whether the correct contingency is being applied, the amygdala becomes reward-sensitive when contingencies are ambiguous.

• The simpler reward-processing system of the amygdala, which emerges in the absence of contingent choice, might account for the reversal deficit witnessed when a lesion is made to the OFC. We will test this hypothesis in a future study by examining interactions between OFC and amygdala.

References