

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

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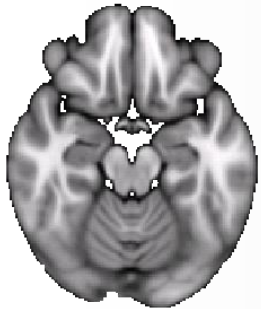
Optimal decision making and contingency learning



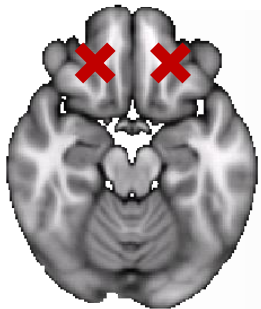
Optimal decision making requires contingency learning, that is, the ability to associate an outcome with the decision that caused it.

How is this implemented in the brain?

What mechanisms support contingency learning?

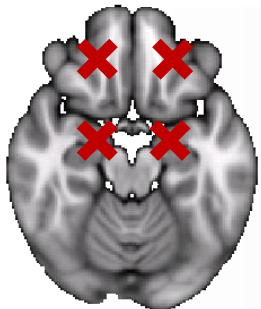
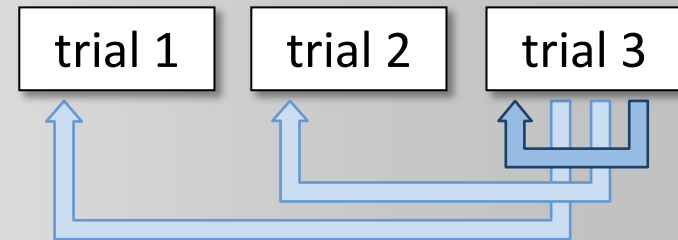


Normal contingency learning in the **healthy** brain.



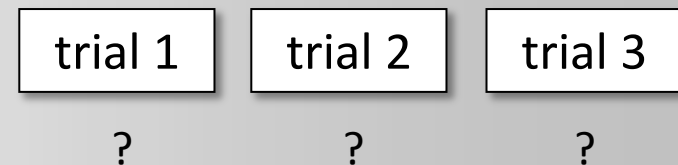
An **LOFC lesion** unmasks a different form of contingency learning.

Walton et al. 2010 *Neuron*



An **additional amygdala lesion** restores normal contingency learning.

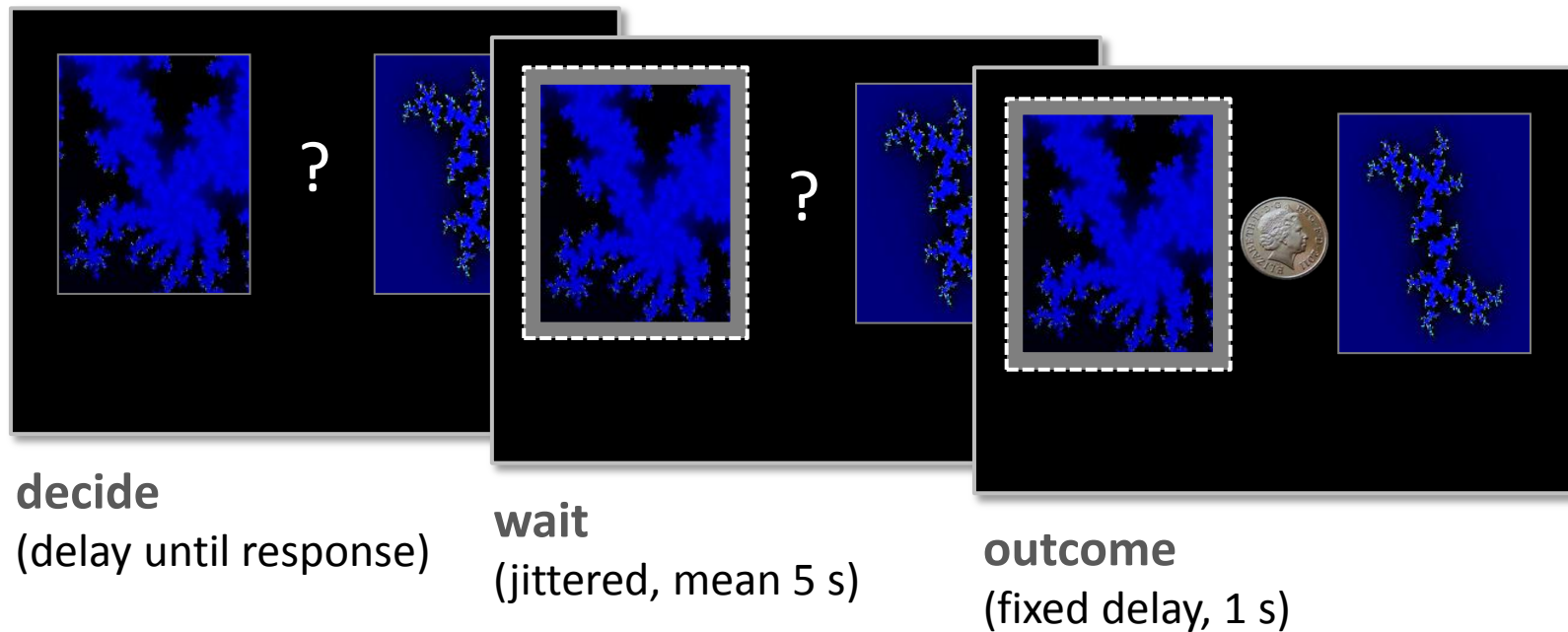
Rudebeck & Murray 2008 *J. Neur.*
Stalnaker et al. 2007 *Neuron*



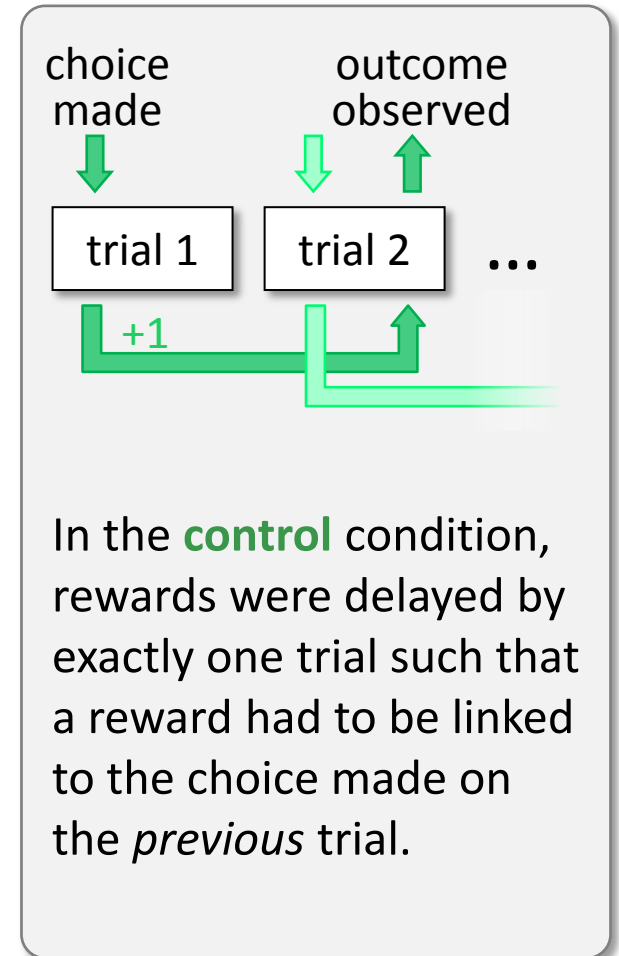
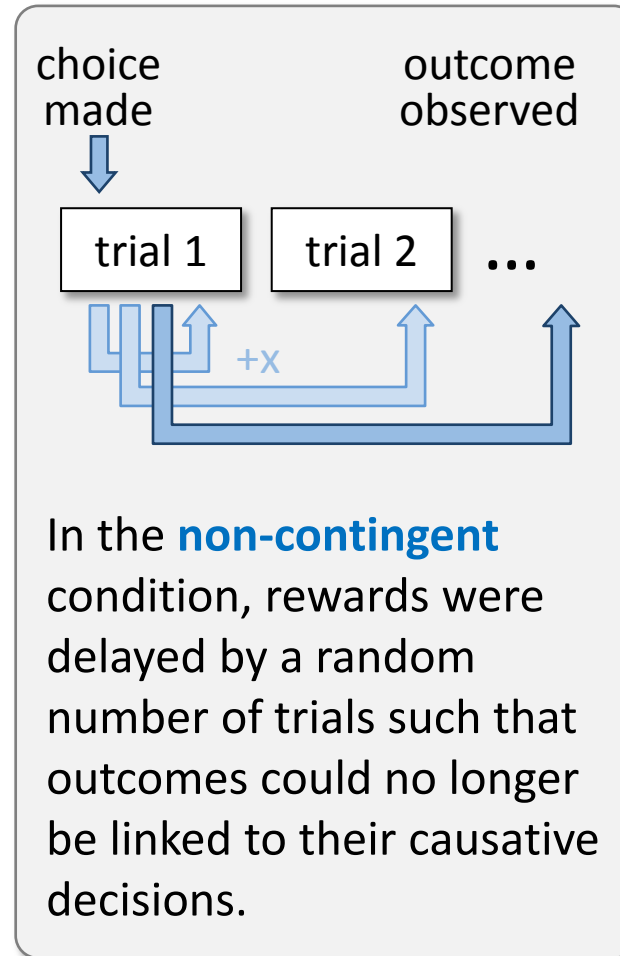
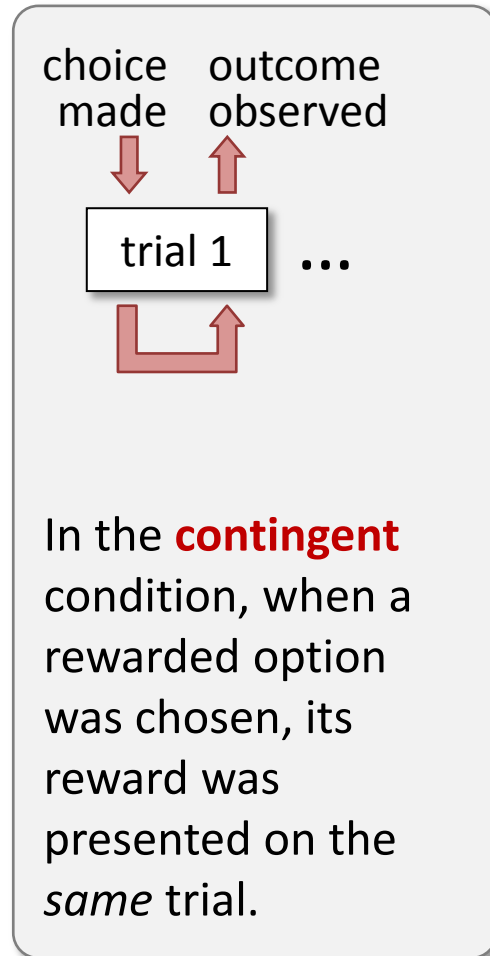
z = -18mm

Experimental design

We examined the role of the amygdala in reversal learning using a simple decision-making task. Subjects had to learn, by trial and error, the reward probabilities of two options.

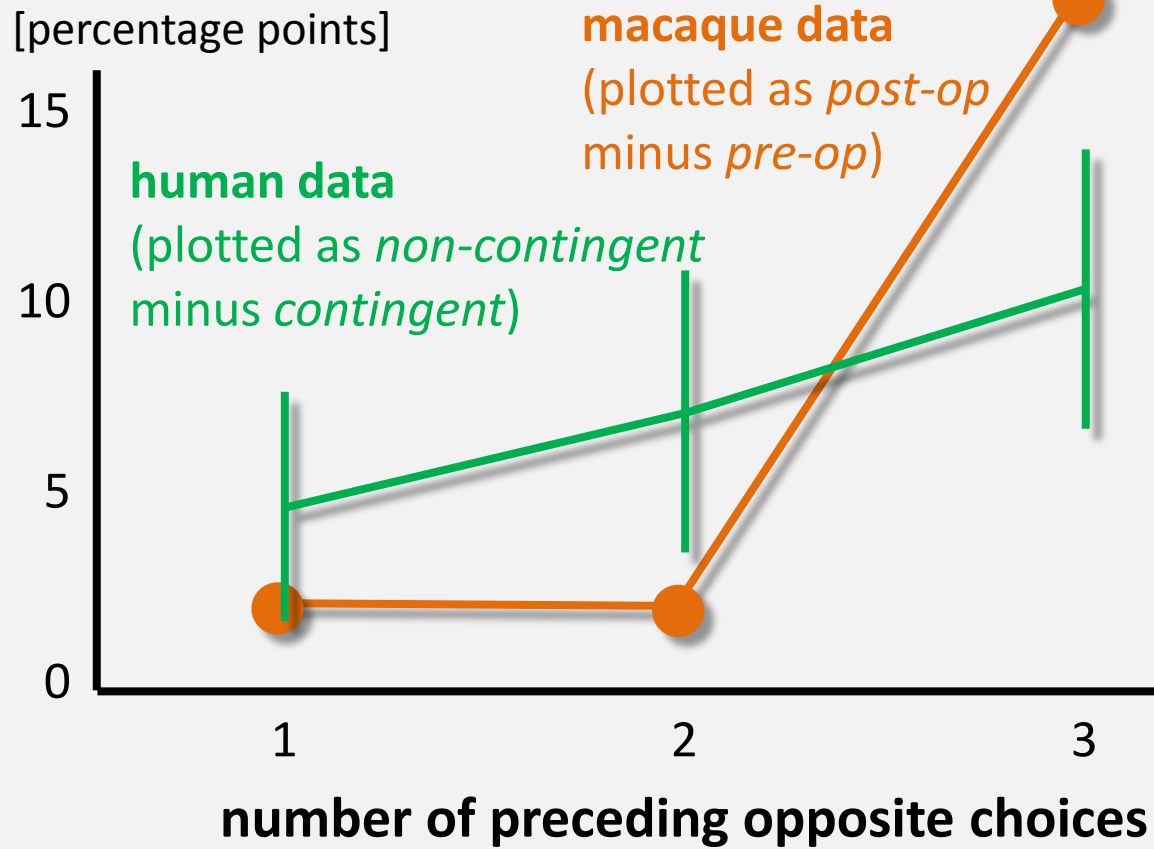


Experimental design

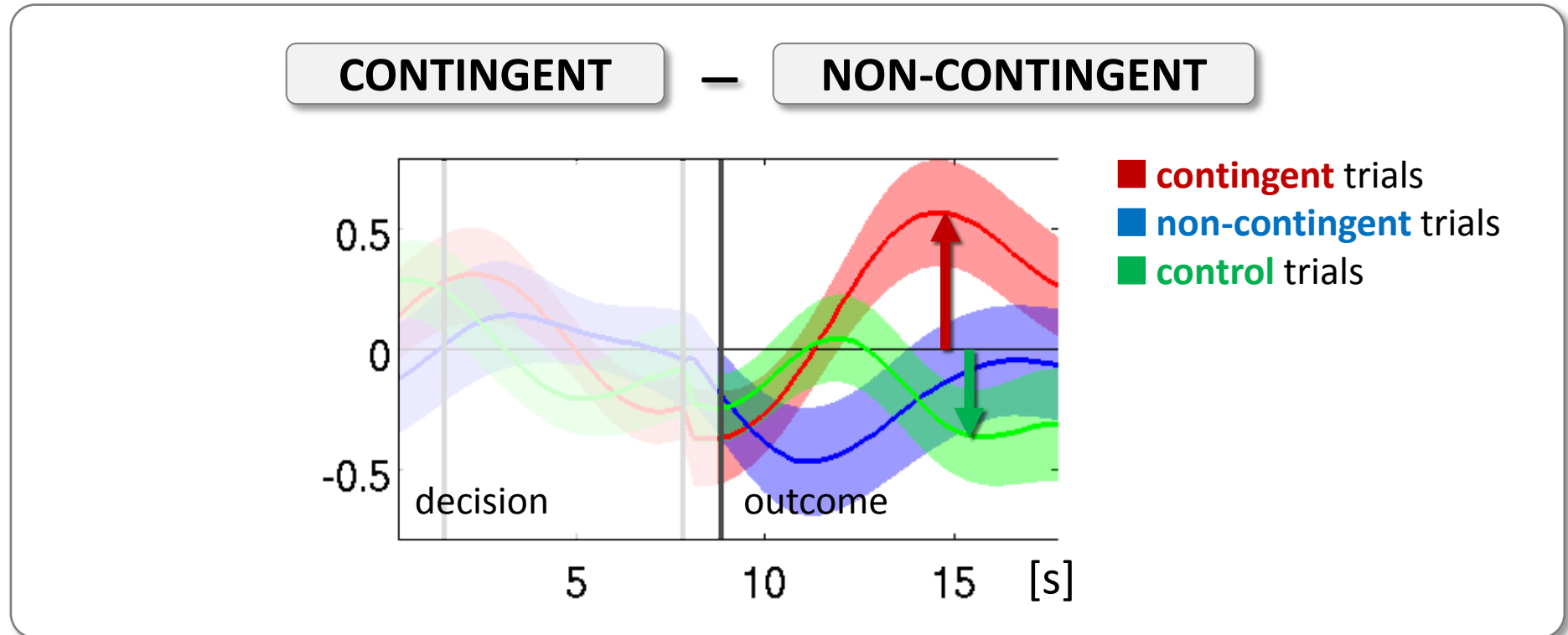
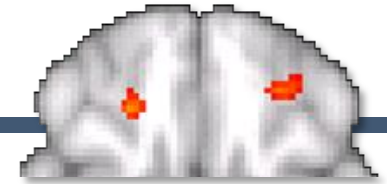


Non-contingent learning in healthy humans

Misattribution of reinforcement



OFC links outcomes to their causative decisions



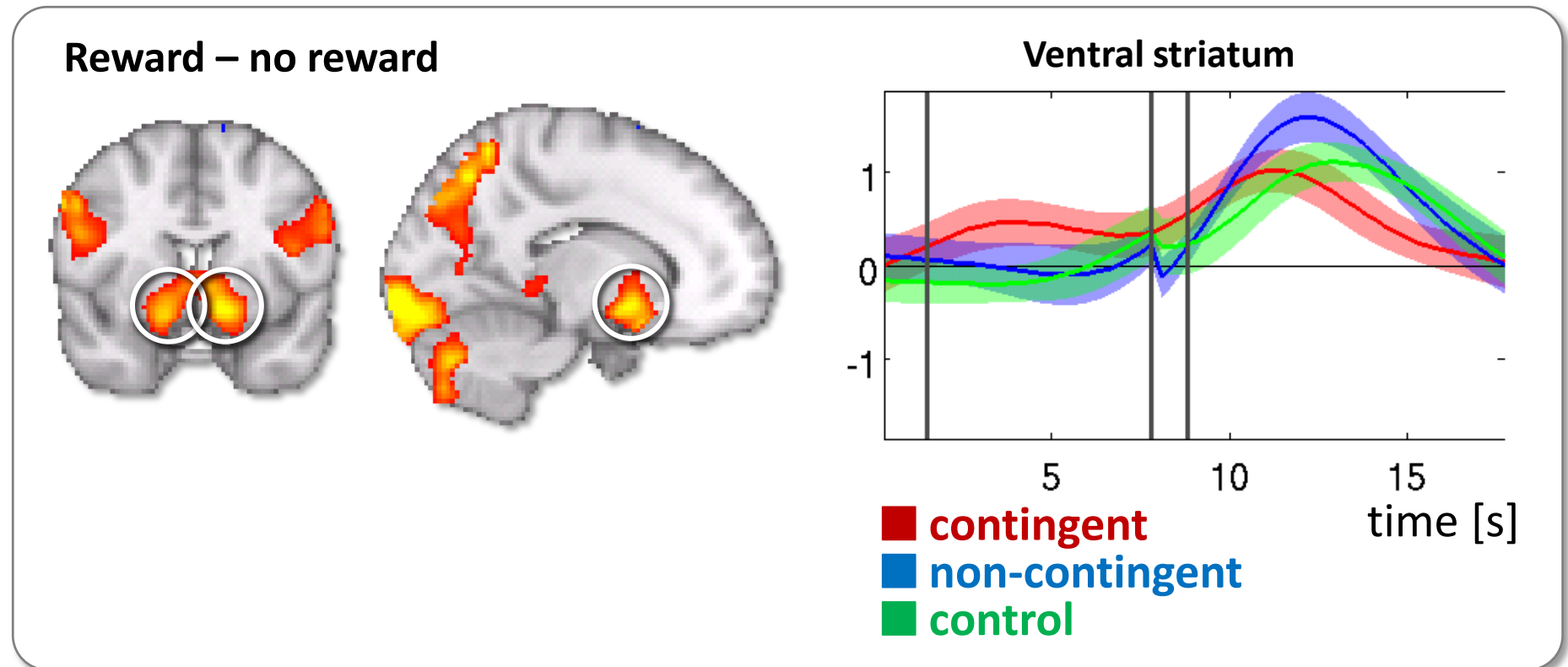
Hypothesis 1: ~~LOFC encodes reward.~~

Hypothesis 2: ~~LOFC encodes reward prediction errors.~~

Hypothesis 3: LOFC encodes the application of correct contingencies.

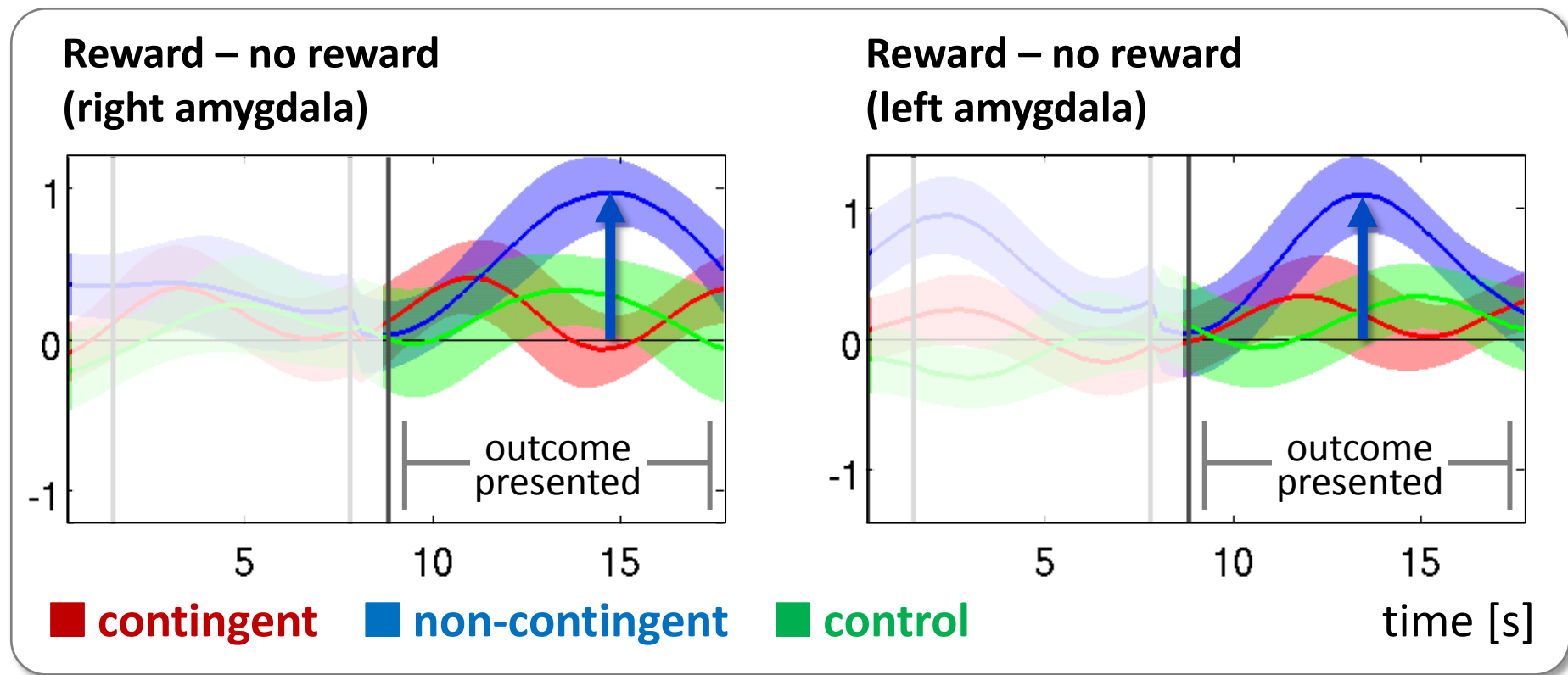
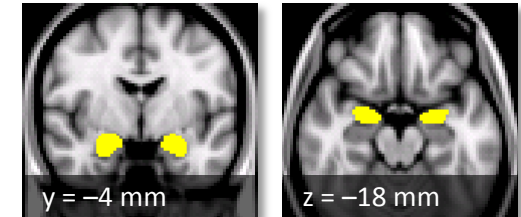
Reward sensitivity throughout the brain

Many regions are equally sensitive to reward, irrespective of the way in which outcomes should be linked to previous choices.



Reward sensitivity in the amygdala

The amygdala becomes reward-sensitive when contingencies are ambiguous.



Summary

- 1 Behavioural results.** Contingent and non-contingent reversal learning can be robustly induced in humans purely by using different experimental instructions.
- 2 Imaging results.** When contingencies are available, lateral OFC distributes reward to the underlying decision. When the LOFC cannot do this, a circuit involving the amygdala becomes central to learning.
- 3 Conclusions.** The simpler reward-processing system of the amygdala might account for the reversal deficit observed when a lesion is made to the OFC.