

Differential Neural Responses During Moral and Economic Value-Based Decision-Making

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Introduction

- Evidence shows that valuation of moral situations involve similar neural processes as economic situations across different probabilities and magnitudes.¹
- However, a person's utilitarian or non-utilitarian decision preferences should involve differential neural circuits when arbitrating between monetary and human life forfeiture.
- We investigated these neurobehavioral processes underlying value-based decisions regarding variable amounts of money or human life tradeoffs. We hypothesized that decisions involving monetary and human life forfeiture would reflect utilitarian and non-utilitarian strategies involving different brain regional engagement.

Methods

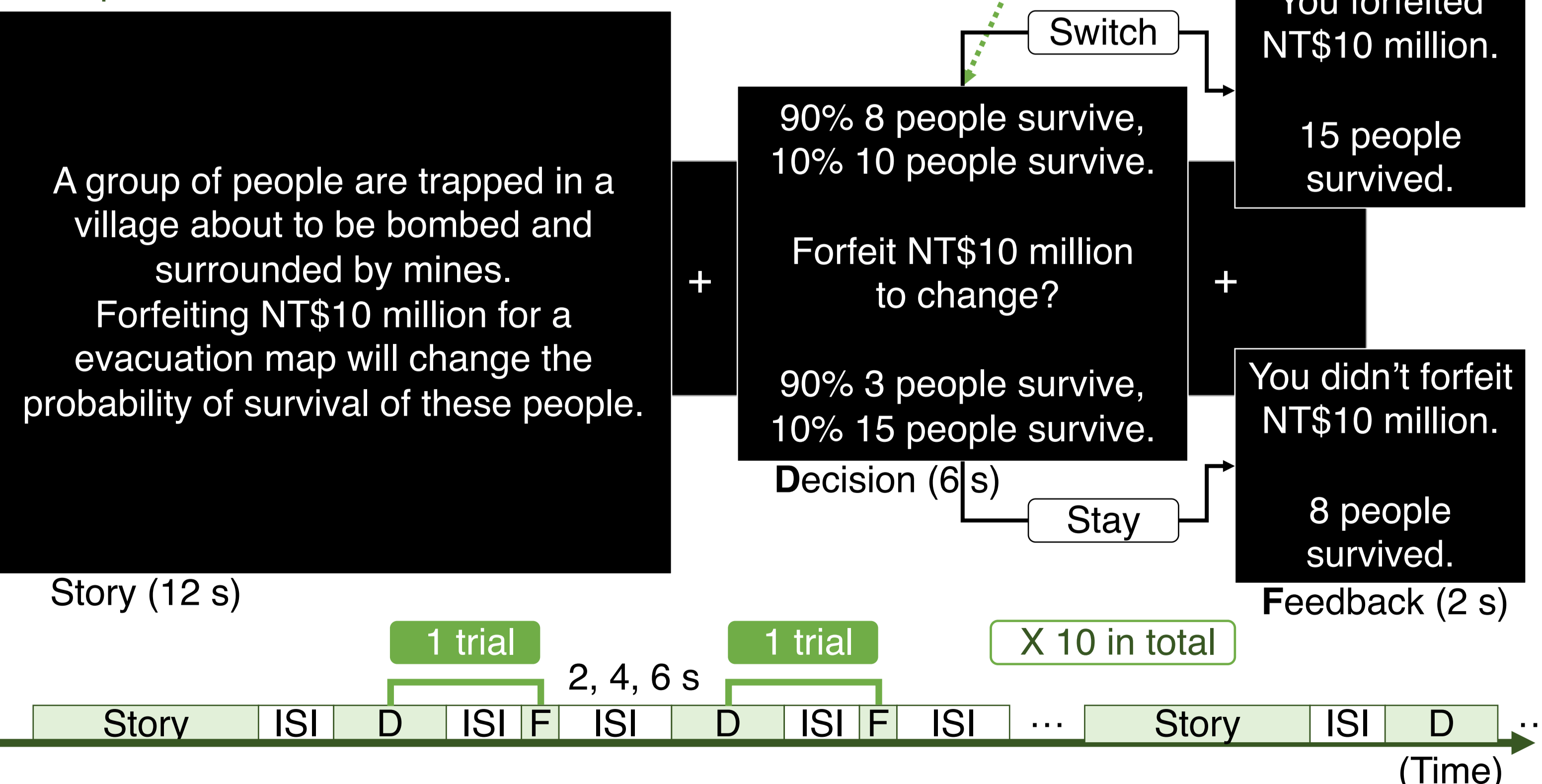
- Parameters of functional MRI** 8 echo planner imaging runs, 169 volumes per run. TR = 2 s, TE = 24 ms, 38 axial slices, 3.4 x 3.4 x 4mm resolution, 64 x 64 matrix.
- Participants:** 36 healthy young adults, mean age (SD) = 23.5 (3.1) years, 21 females, 15 males.

- Moral Choice Task:** Participants first read a story indicating a hypothetical scenario, and then saw an initial life/cash expected value (EV) and an alternative EV described by varying probabilities and amounts under the scenario. Participants either accepted the initial EV (Stay) or forfeited life/cash in exchange for the alternative EV (Switch).

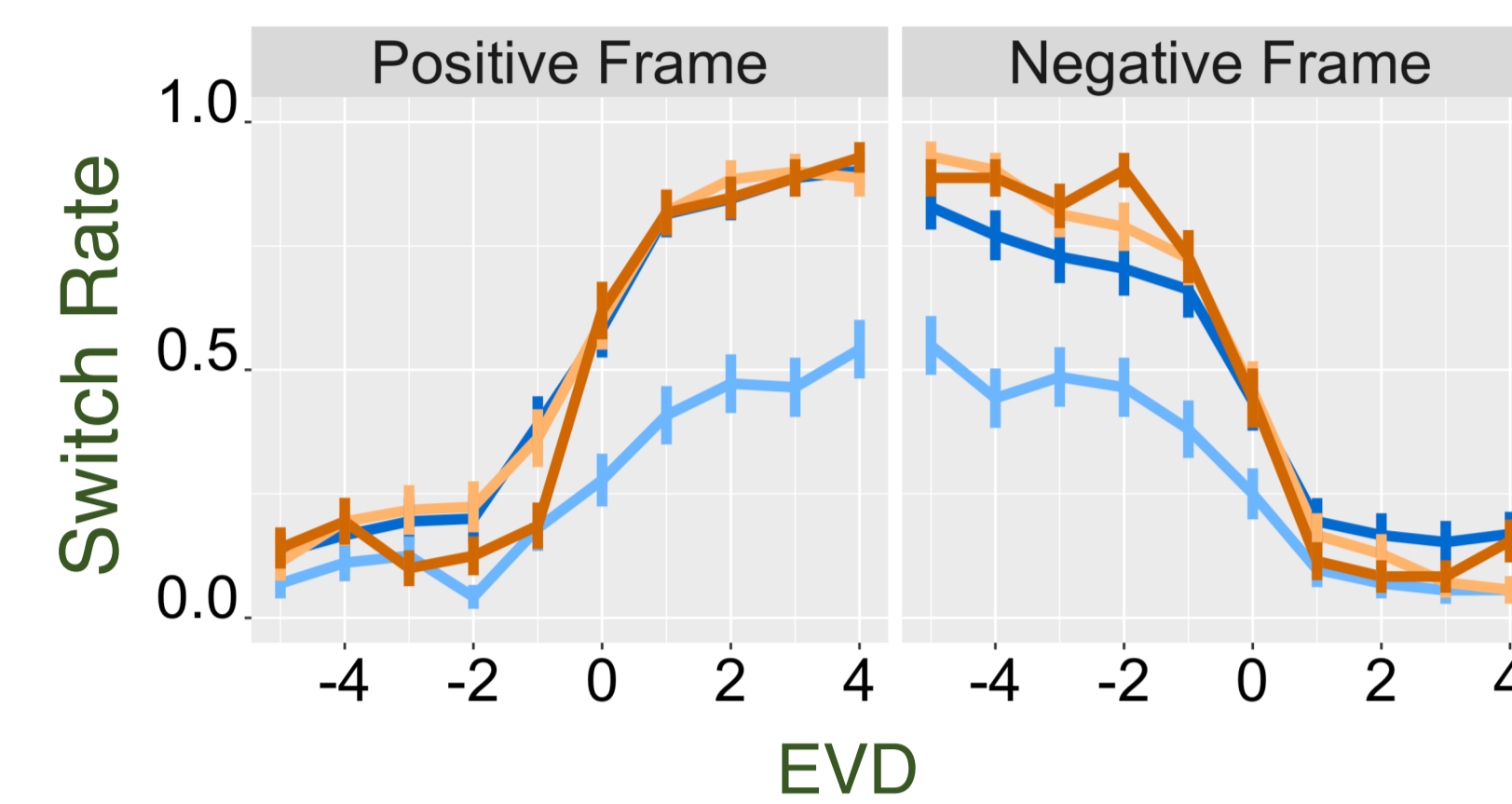
		Price	
		Life	Cash
Outcome	Life	Life-Life (LL)	Cash-Life (CL)
	Cash	Life-Cash (LC)	Cash-Cash (CC)

Initial EV = 0.9 x 8 + 0.1 x 10
Alter EV = 0.9 x 3 + 0.1 x 15
EVD = initial EV - alter EV

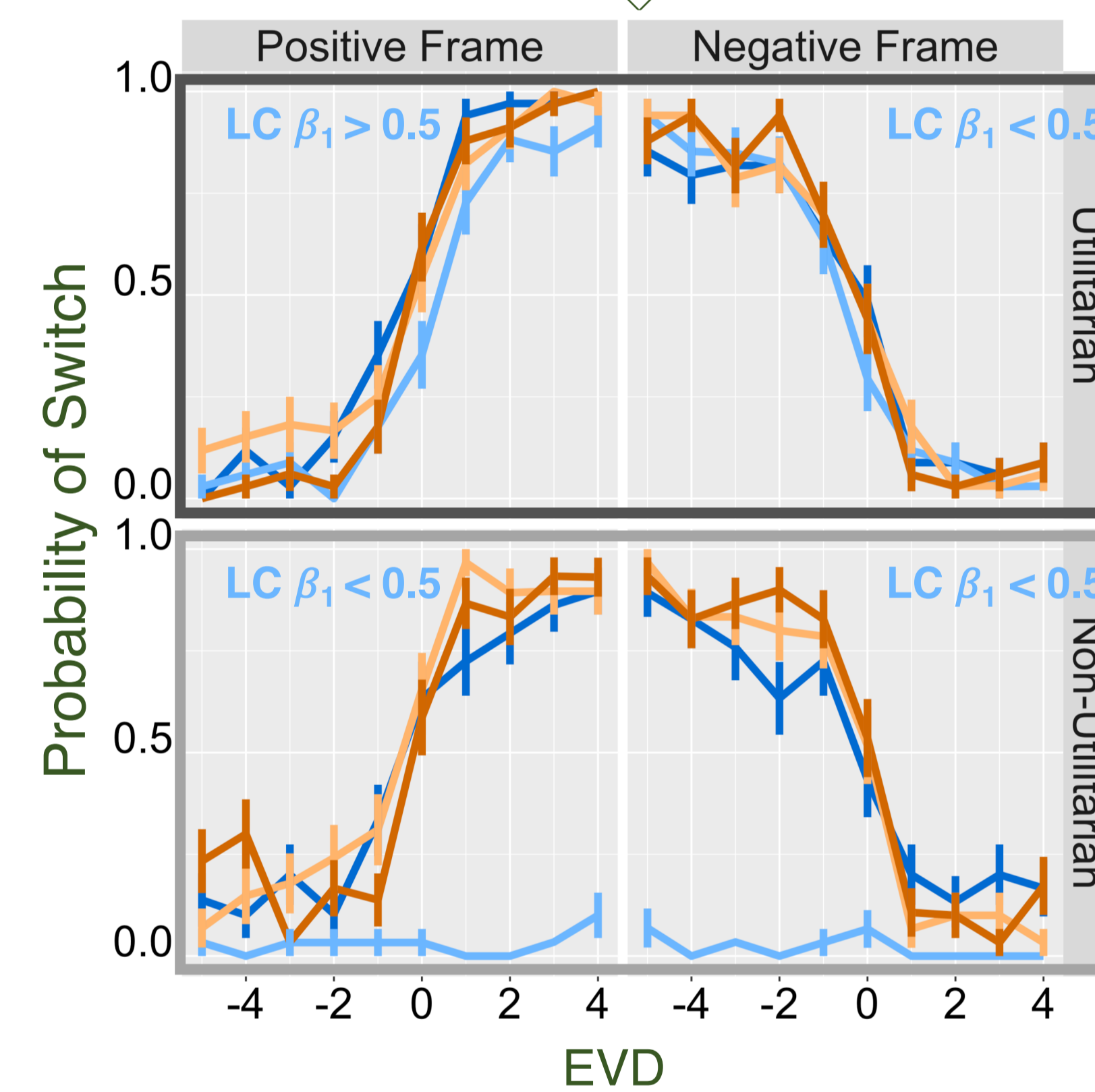
Example of CL condition:



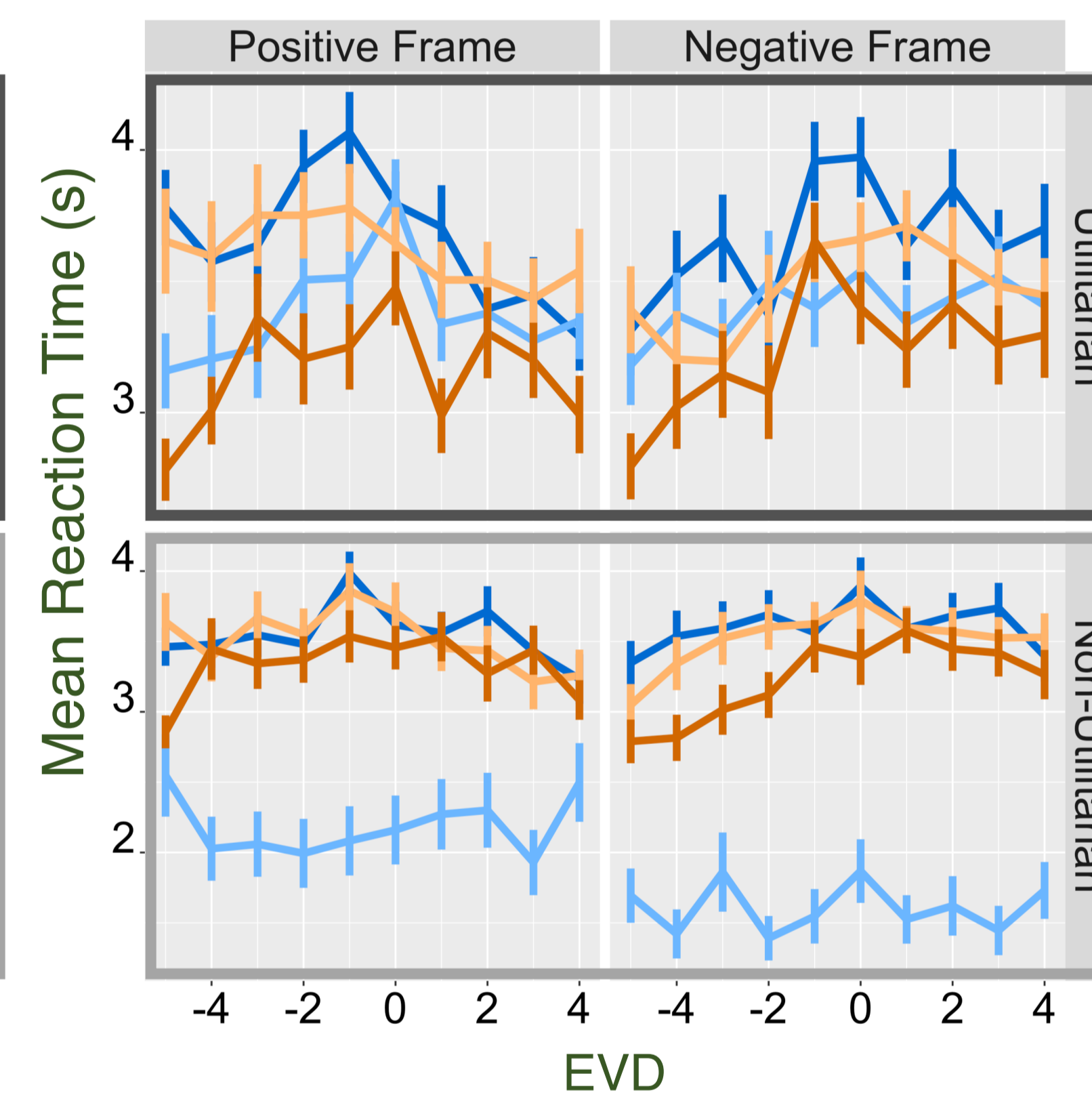
Distinct Utilitarian and Non-Utilitarian Behaviors



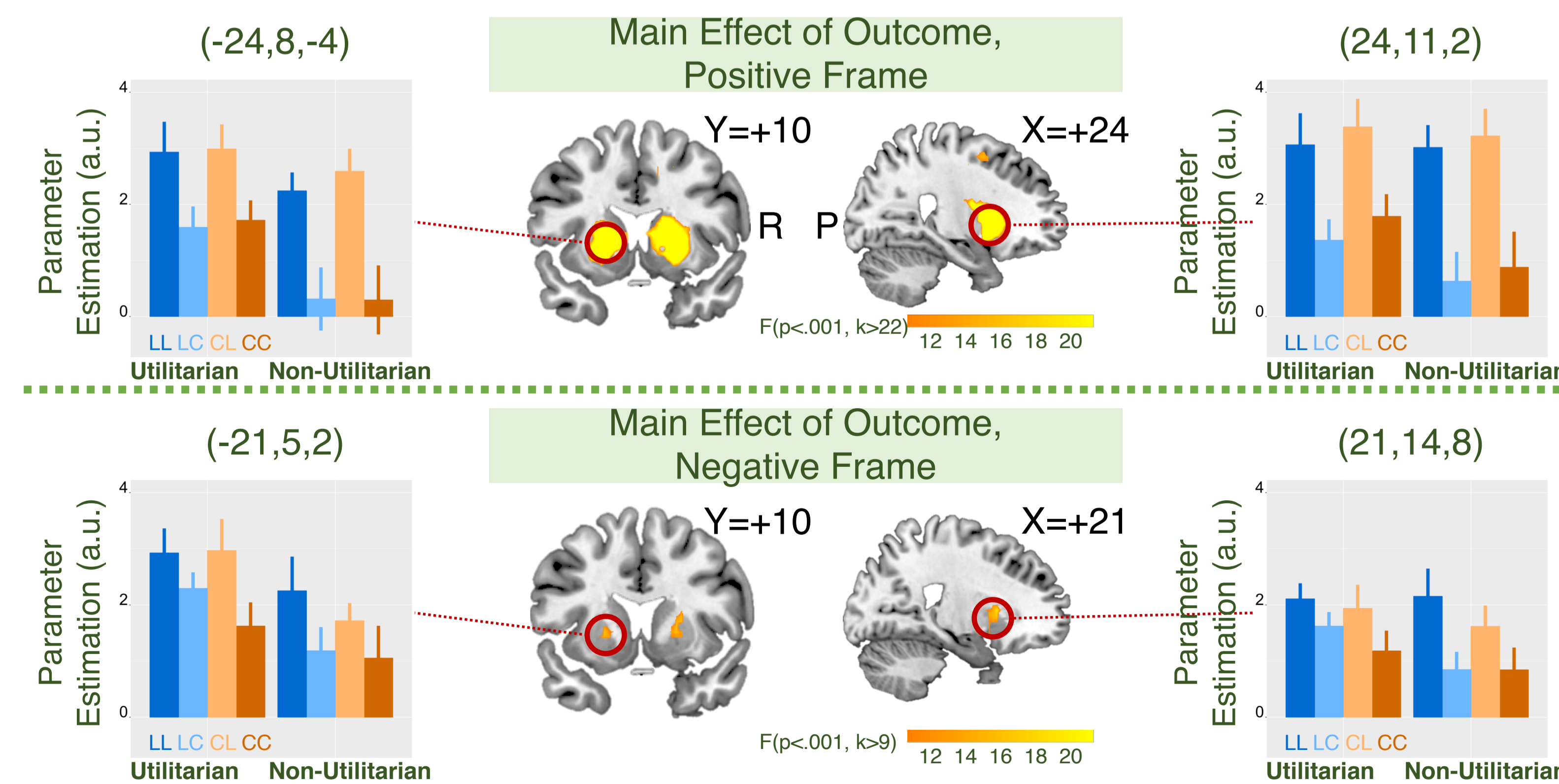
$$\log(\text{Switch}) = \beta_0 + \beta_1 \cdot \text{EVD} + \beta_2 \cdot \text{Condition} + \beta_3 \cdot \text{EVD} \cdot \text{Condition} + \epsilon$$



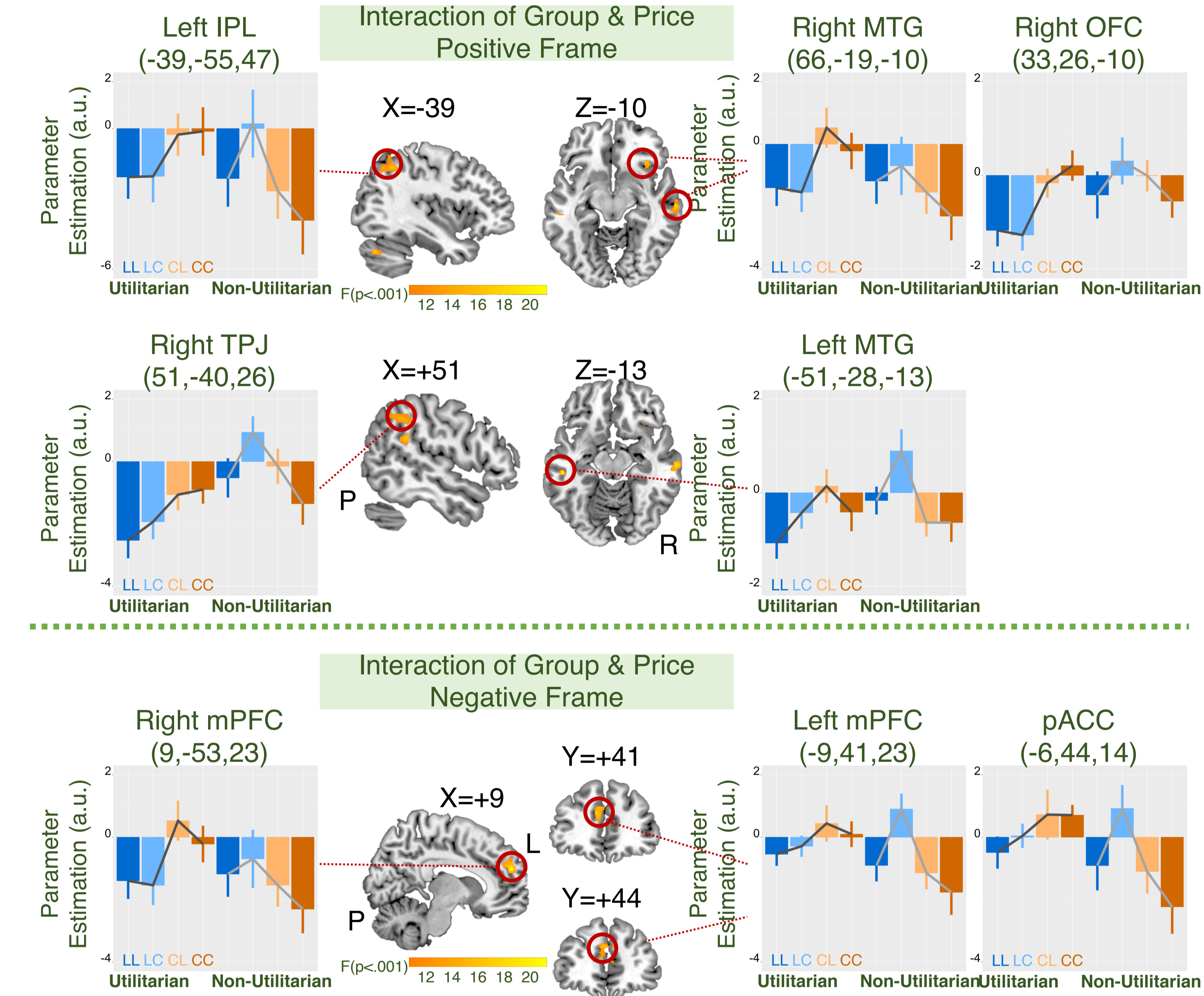
Distinct Reaction Time Between Groups



Common Striatal Responses across Conditions



Whole Brain Differential Response Patterns



Conclusions

- Neurobehavioral responses to arbitrate life and monetary value reflect **utilitarian** and **non-utilitarian** decision strategies.
- Utilitarian decisions monotonically track expected value for life and monetary outcomes whereas non-utilitarian decisions maintain status quo for life-for-cash options regardless of expected value.
- Cortical processing distinguished these two strategies in bilateral temporoparietal, middle temporal, and right orbitofrontal areas in positive framed trials, and medial prefrontal areas in negative framed trials.
- Striatal responses dissociated life from monetary outcomes regardless of forfeit price.
- Differential engagement of the above neural loci might influence the degree of utilitarian use of stimuli vs. endogenous conceptual ideals.

Reference

¹ Shenhav, A., & Greene, J. D. (2010). Moral judgments recruit domain-general valuation mechanisms to integrate representations of probability and magnitude. *Neuron*, 67(4), 667-677.

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