

# The effect of value-conflict and volatility on decision-making processes



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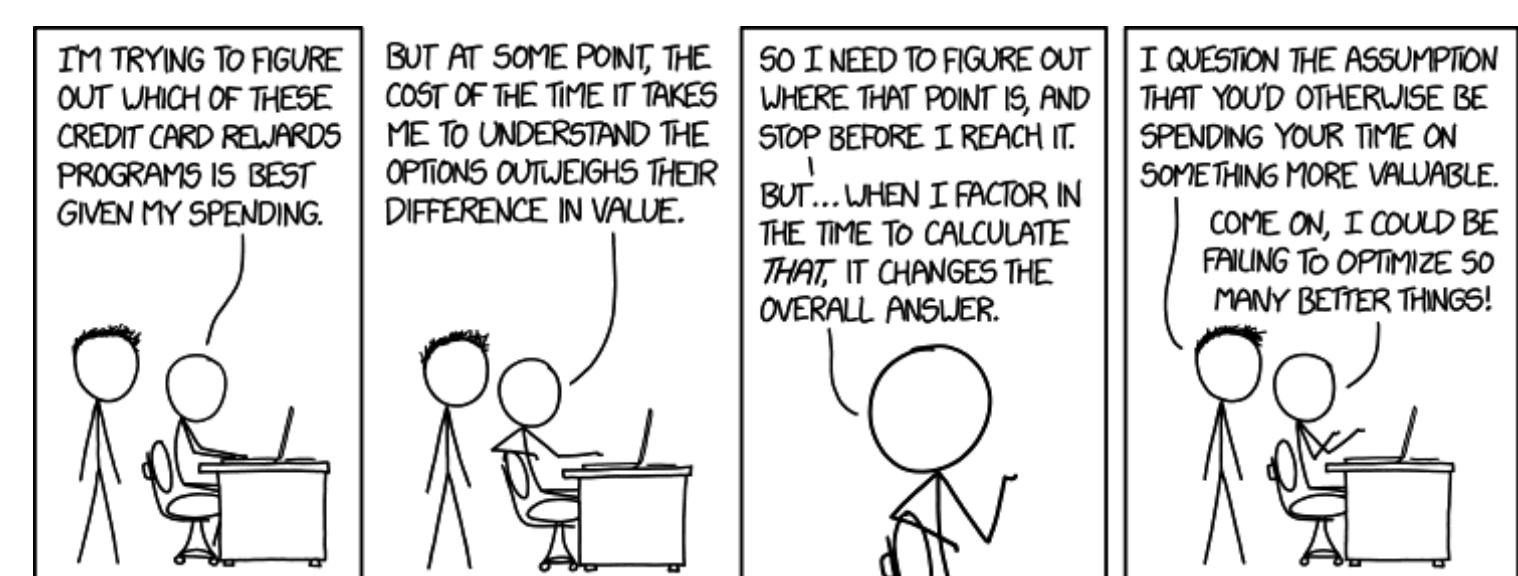
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## Introduction

### How do we make good decisions under multiple forms of uncertainty?

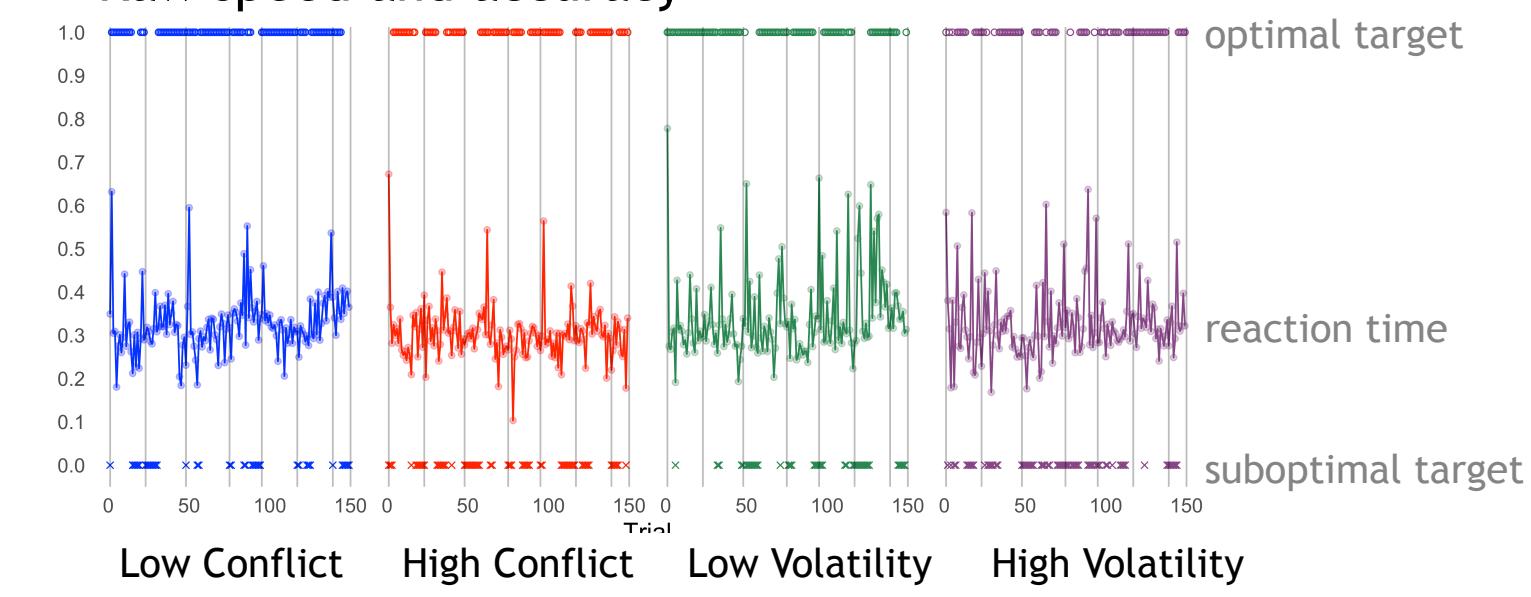
**conflict:** a state of uncertainty in the relative estimate of action-value

**volatility:** sudden shifts in action-value associations over time



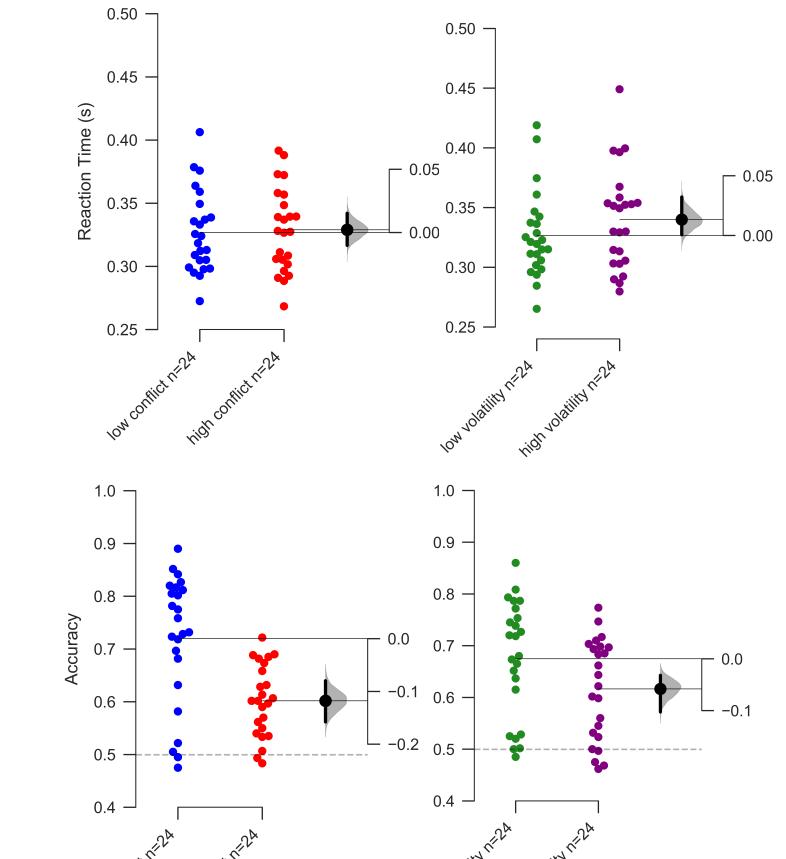
## Observed Behavior

### Raw speed and accuracy

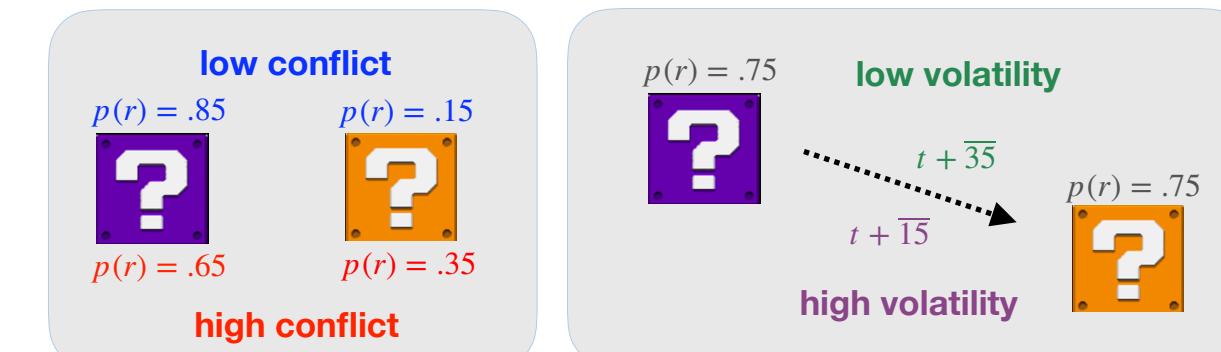
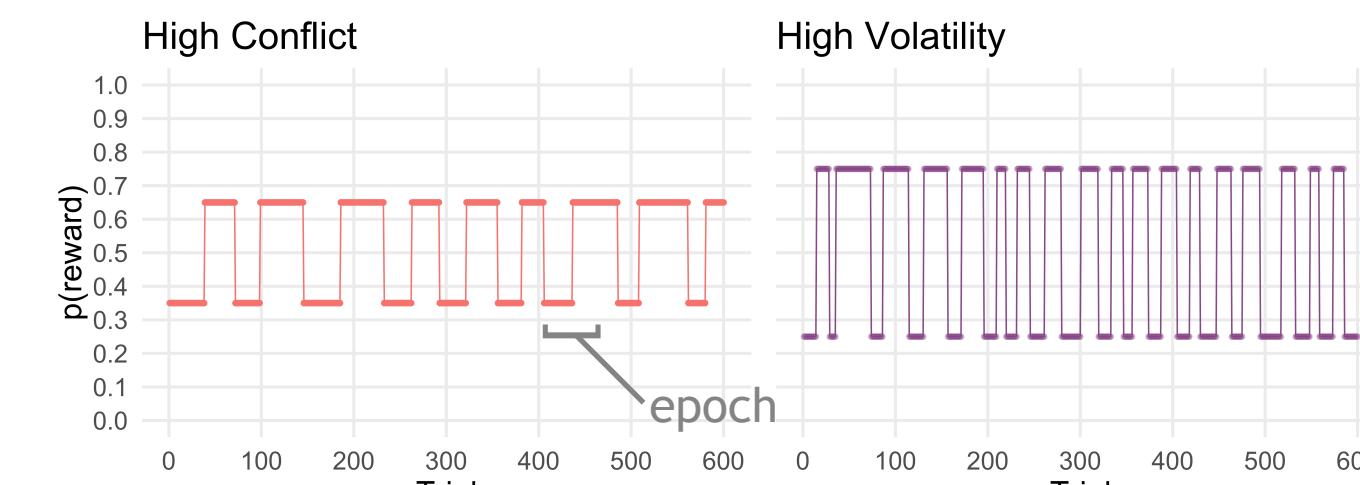
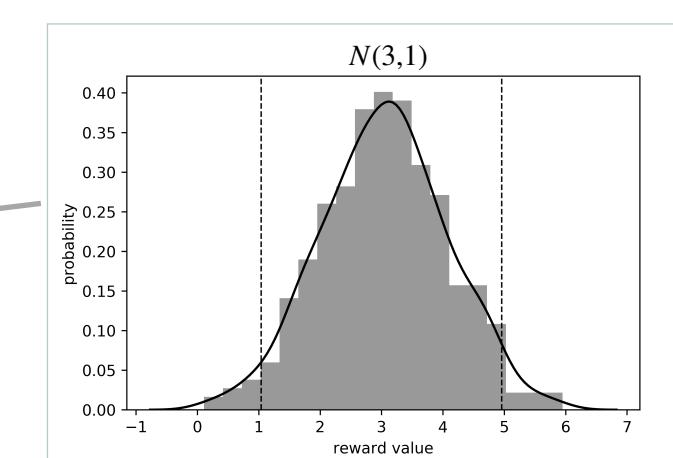
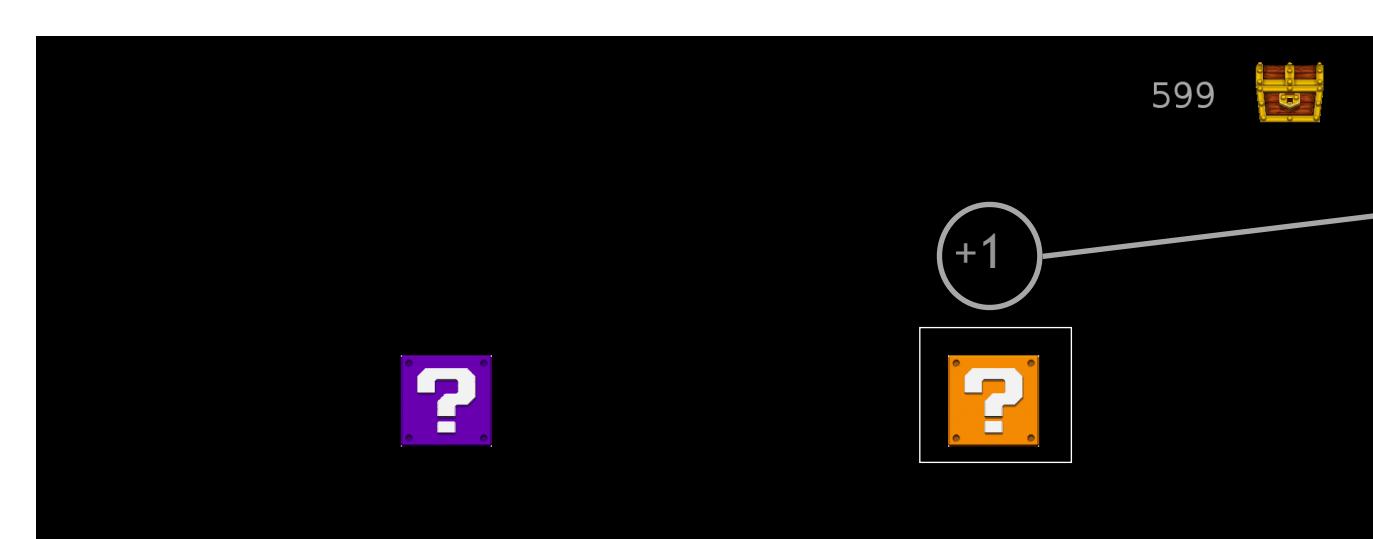


Feedback volatility affects reaction time and value-conflict affects accuracy.

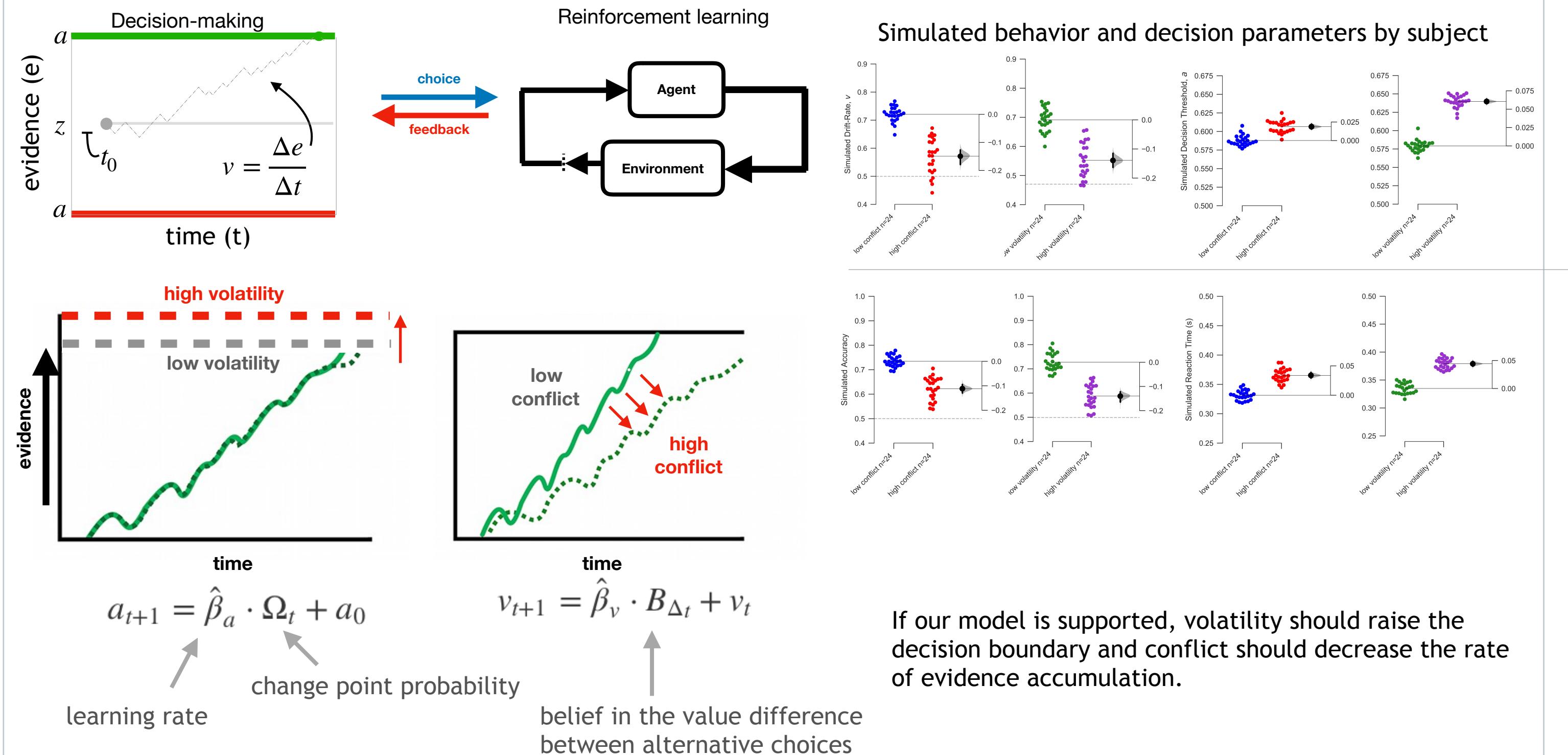
### Average speed and accuracy



## Task

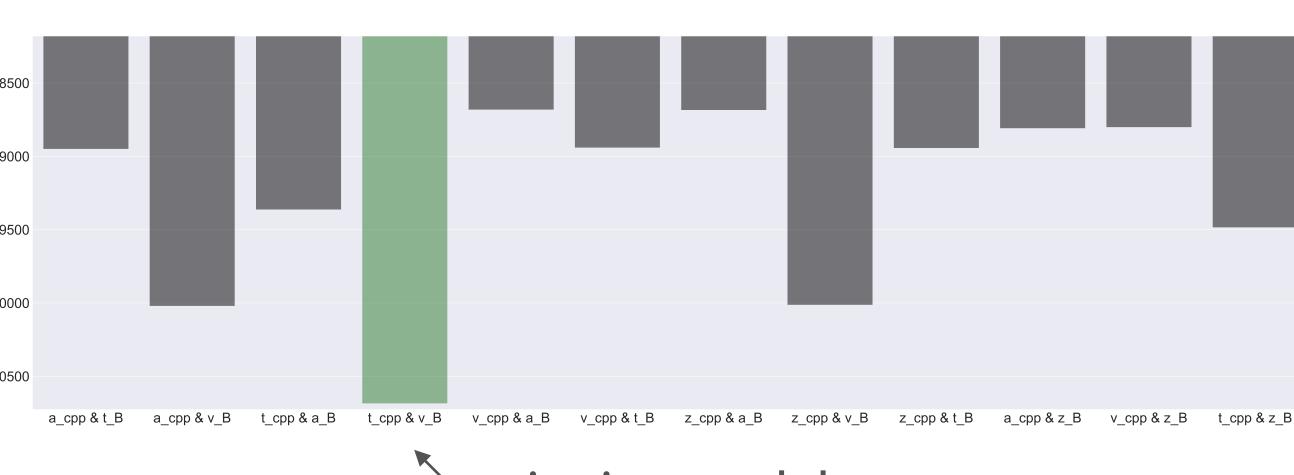


## Computational Model

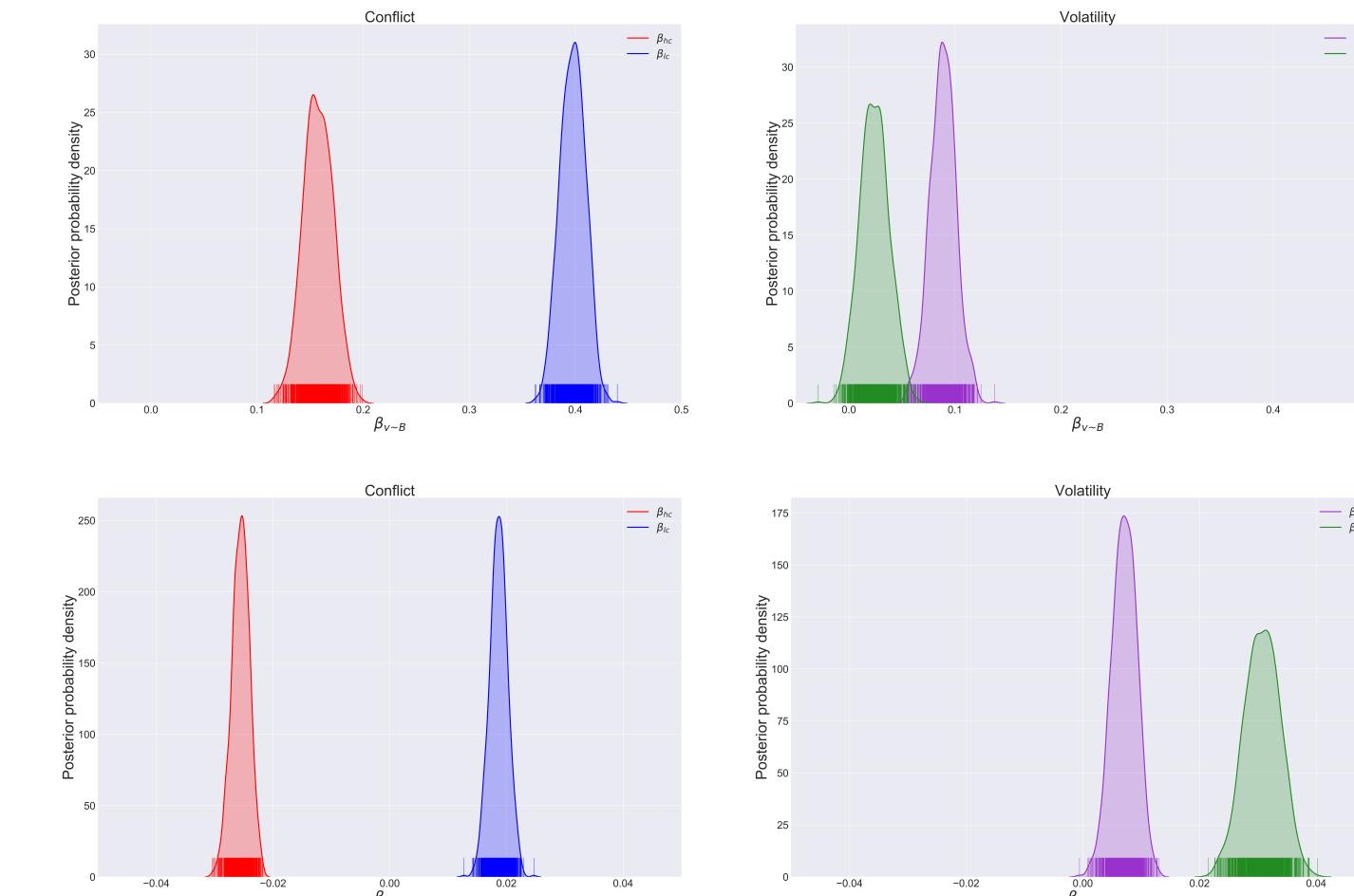


## HDDM Regressions

### Model Fit



### Regression parameters for winning model



Drift-rate increases with belief in all conditions, with the strongest relationship between belief and drift-rate when conflict is low.

Non-decision time increases with change point probability in low volatility and low conflict conditions, with the strongest relationship between change point probability and non-decision time when volatility is low.

## Conclusions

### Where we were right

Value-conflict decreases the speed of evidence accumulation, and covaries with belief in the value difference between choices.

### And where we were wrong

The stability of action-reward contingencies affects non-decision time, not the amount of evidence needed to make a decision.

Wiecki, T. V., Sofer, I., & Frank, M. J. (2013). HDDM: hierarchical bayesian estimation of the drift-diffusion model in python. *Frontiers in neuroinformatics*, 7, 14.

Kim, T. D., Kabir, M., & Gold, J. I. (2017). Coupled decision processes update and maintain saccadic priors in a dynamic environment. *Journal of Neuroscience*, 37, 3078-3086.

Humphries, M. D., Khamassi, M., & Gurney, K. (2012). Dopaminergic control of the exploration-exploitation trade-off via the basal ganglia. *Frontiers in neuroscience*, 6, 9.

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