

## Background

- o Everyday choices involve weighing effort against reward (e.g., whether to exercise)
- o Different incentives motivate behavior differently<sup>1</sup> (e.g. high vs. low; positive vs. negative incentives).
- o People are both **gain pursuing** and **loss avoiding**. E.g., someone might choose to exercise to achieve long-term health (positive incentive) or to avoid being judged by others (negative incentive)
- o Previous task designs<sup>2</sup> have yet to fully capture how people choose to *persist* with their effort (vs. how they perform when they don't have that choice) and how those decisions are differently influenced by positive incentives versus negative incentives.

Here, we designed a novel task to:

- 1) Better capture persistence of physical effort
- 2) Look at how positive and negative incentives influence behavior

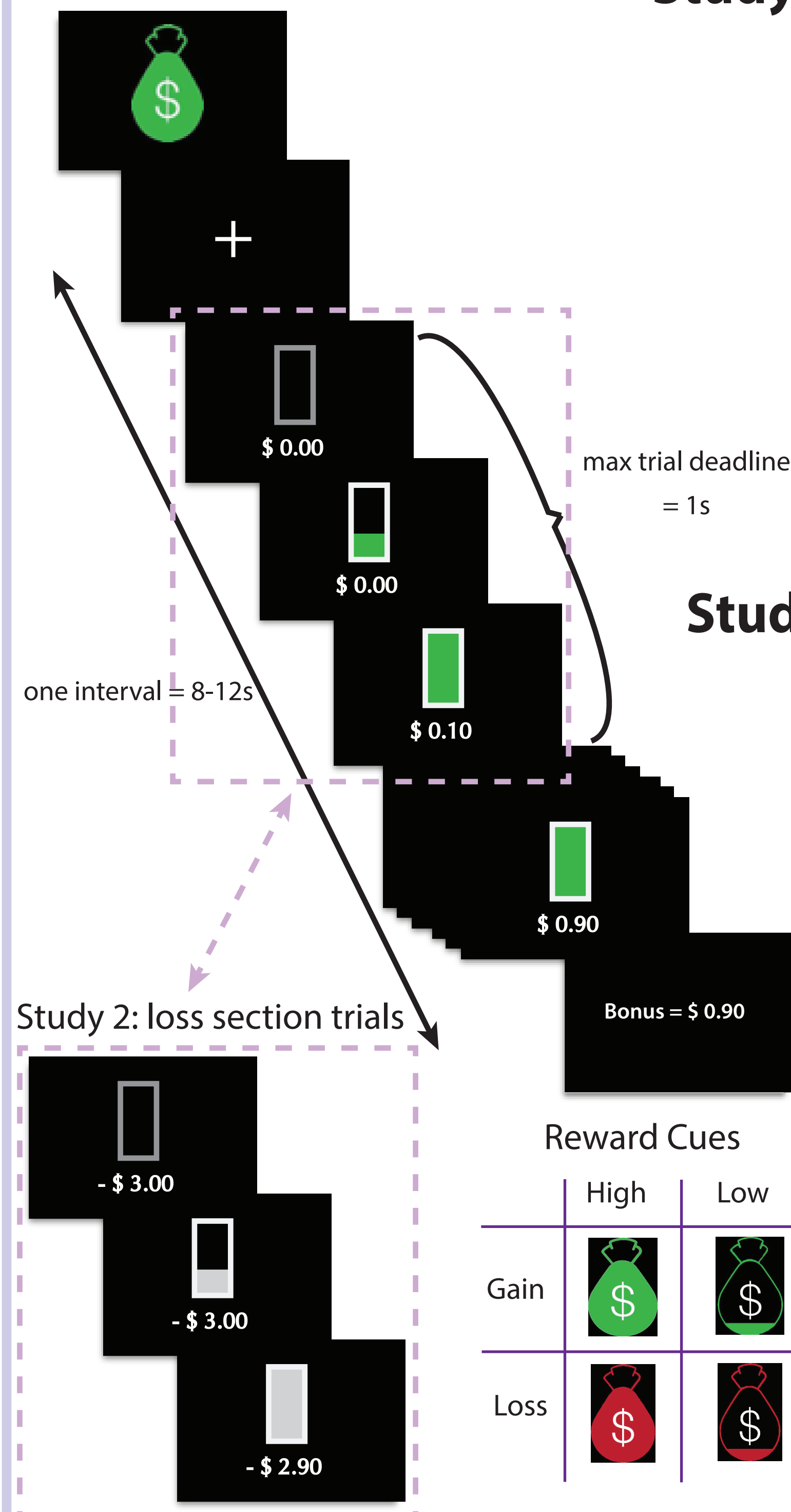
## Methods



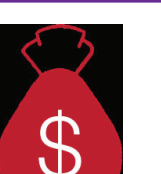
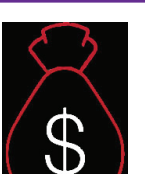
### Study 1: Varying rewards (N = 22)

- o Participants are given the freedom to complete as many trials as they want of a physical effort task.
- o Each trial is a button-pressing task that required 5 presses of the spacebar within 1s.
- o The task is interval based: each interval lasts 8 - 12 seconds, and reward cues are presented at the beginning. With 45 intervals/block \* 4 blocks

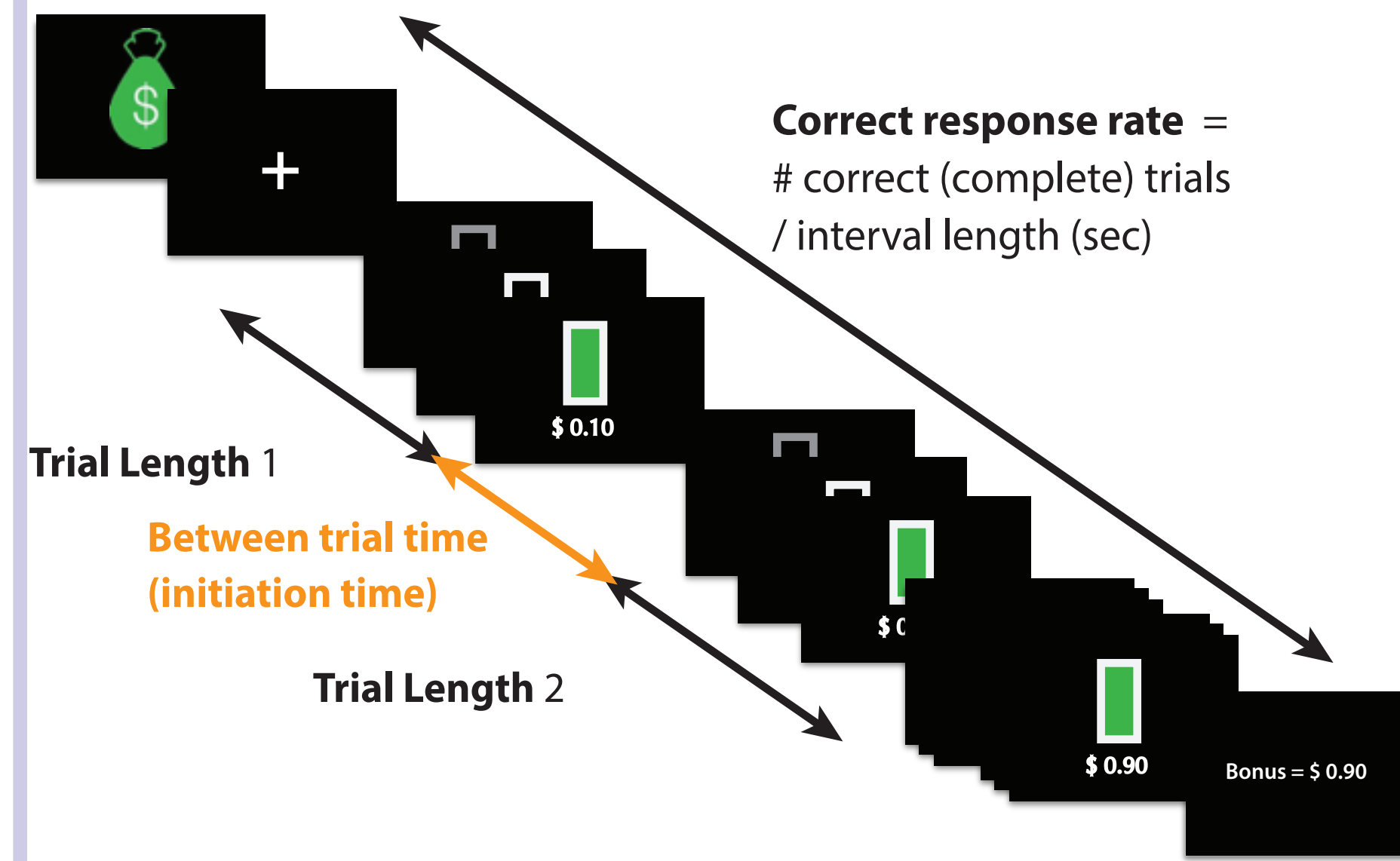
### Study 2: Varying rewards vs losses (N = 30)

- o In addition to incentive magnitude variations, study 2 set up two sections: **gain vs. loss sections** (gain always before loss sections), with different framing of the same bonus calculations.
- o Section 1 (gain) has the same structure as study 1.
- o In the loss section, participants are first given a certain amount of bonus. Every trial they complete eliminates some portion of that potential loss.
- o Each section has 40 intervals/block \* 2 blocks



	High	Low
Gain		
Loss		

## Results: Dependent Variables



Performance on each task interval could be decomposed into three measures:

- o **Correct Response Rate** serves as an overall evaluation of speed.
- o **Trial Length** is the time it takes to complete a trial
- o **Between Trial Time (Initiation time)** is the time it takes to initiate the next trial.

## Conclusions

- o Higher and more negative incentives motivate increased physical effort.
- o Increase effort was observed both in faster button-pressing within a trial and faster initiation of each subsequent trial.

## Future Directions

- o Effects on cognitive vs. physical effort tasks (see poster C124)
- o Underlying neural mechanisms (e.g., fMRI)
- o Apply task to patient populations (e.g., anhedonia leads to reduction in reward wanting and less willingness to spend effort<sup>3</sup>)

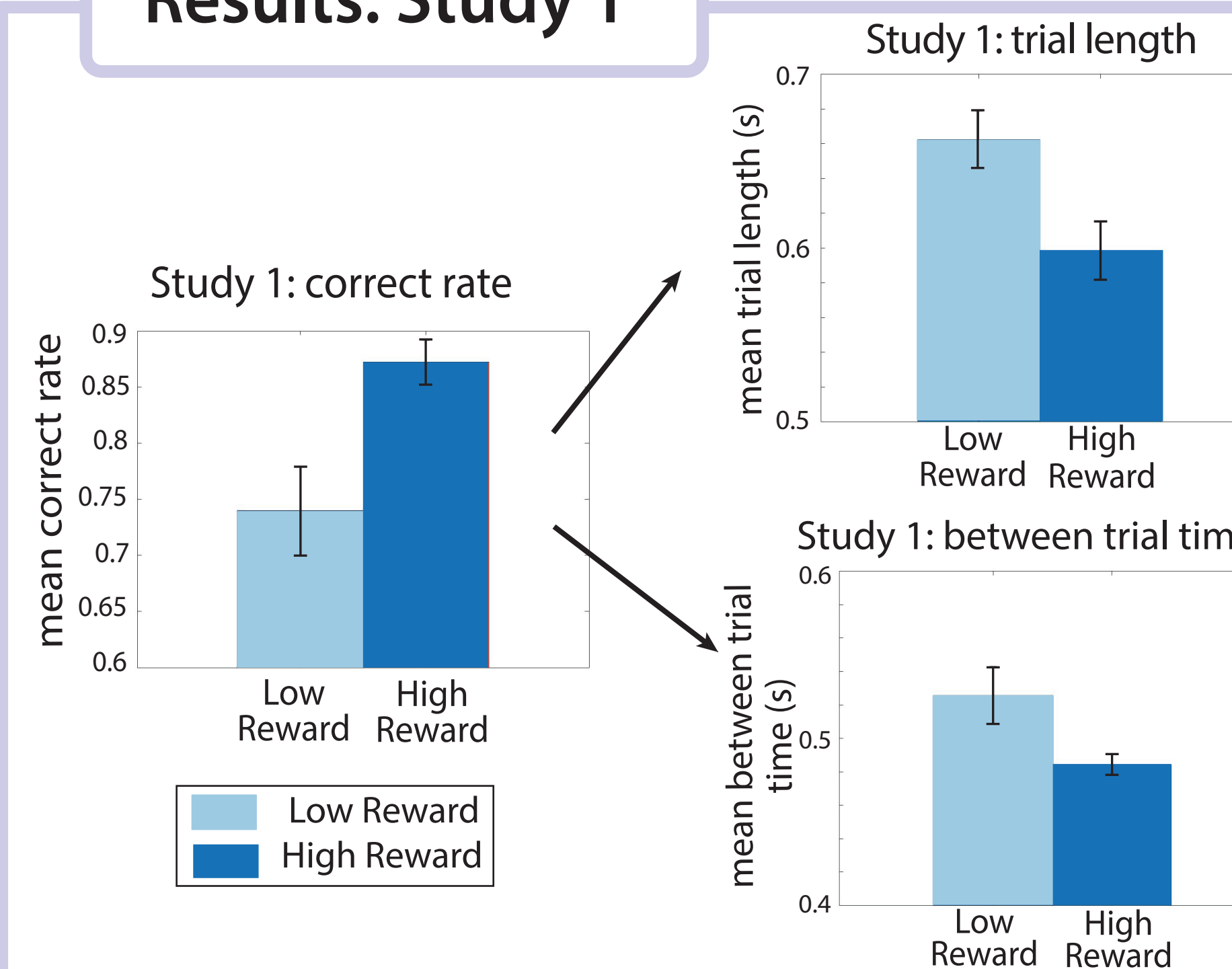
## References

1. Chong, T.T.-J., Bonnelle, V., Husain, M. (2016). Quantifying motivation with effort-based decision-making paradigms in health and disease. *Progress in Brain Research*. 299, 71-100.
2. Atkinson, J. (1957). Motivational determinants of risk-taking behavior. *Psychological Review* 64(6p1), 359.
3. Treadway, M.T., Buckholtz, J.W., Schwartzman, A.N., Lambert, W.E., Zald, D.H. (2009). Worth the 'EEFRT'? The Effort Expenditure for Rewards Task as an Objective Measure of Motivation and Anhedonia. *PLoS One*. 4(8): e6598.

## Acknowledgement

Special thanks to Carolyn Dean Wolf for assistance in developing the task.

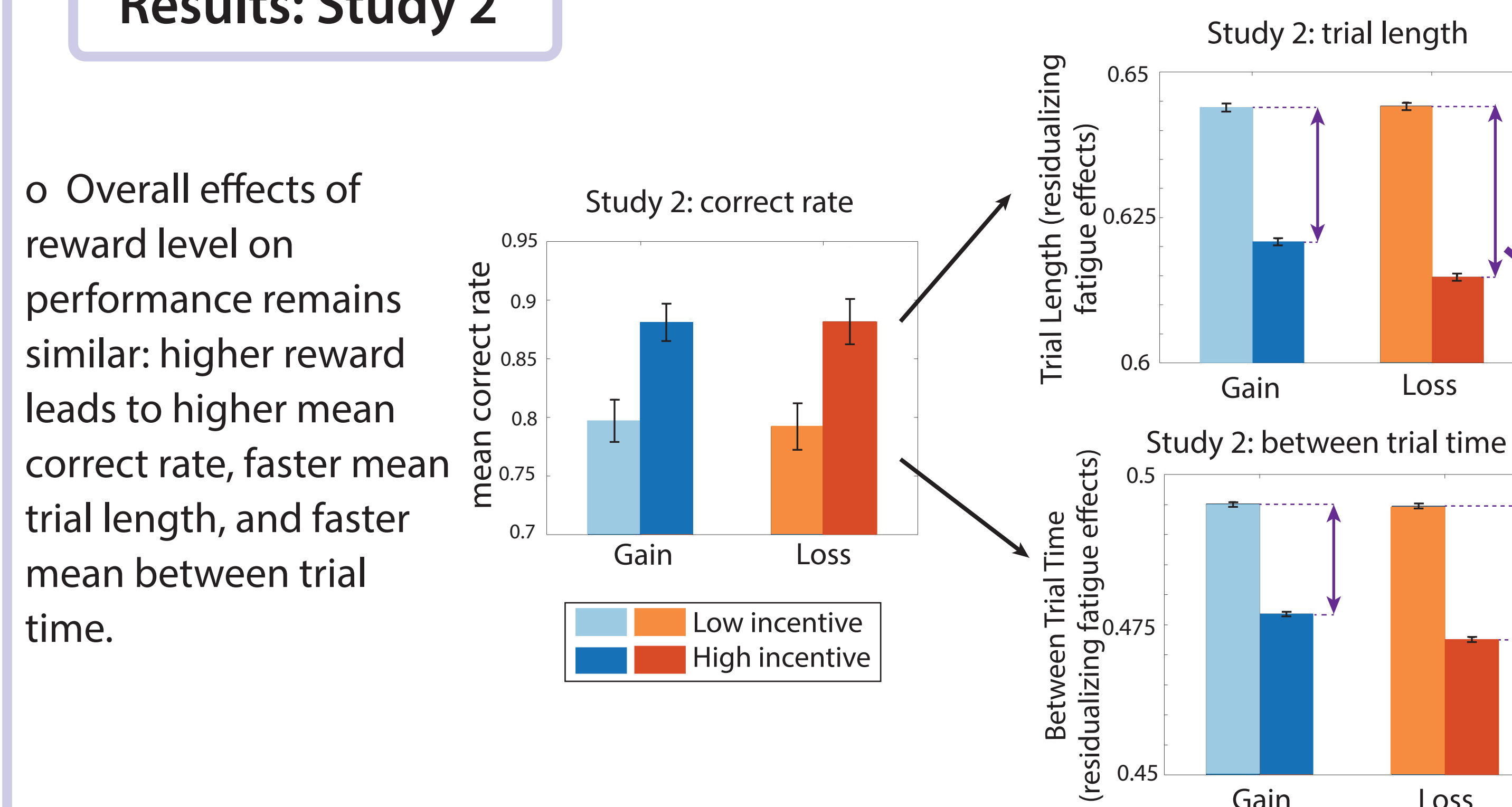
## Results: Study 1



o Participants show better performance when rewards are high: complete more trials per interval ( $p < 0.01$ ).

o This is reflected in both shorter trial lengths ( $p < 0.005$ ) and between trial times ( $p < 0.05$ ) when reward levels are high.

## Results: Study 2



o Overall effects of reward level on performance remains similar: higher reward leads to higher mean correct rate, faster mean trial length, and faster mean between trial time.

o **Loss condition leads to better performance:** higher mean correct rate, shorter mean actual trial length (faster trial performance) and shorter mean between trial time (faster initiation of the next trial).

o **Significant Interaction between reward levels and positive/negative incentives:** in loss conditions, high incentives has a stronger effect on reaction time than low incentives, compared with gain conditions. (i.e., people are more loss avoiding than gain pursuing)

o All findings control for fatigue effects that were observed for all three measures.