# Attentional Discounting in Gains, Attentional Amplification in Losses

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## Introduction

**Visual attention causally influences choices.**

- An increase in the relative attention received by a desireable option increases the frequency with which it is chosen [1–3].

**We do not know if visual attention influences choices between losses in the same way that it influences choices between gains.**

- Attention to appetitive snacks increases the tendency to overweight the value of fixated options [4–7].
- Attention to the positive outcome of a gamble increases with its probability and amount [8].

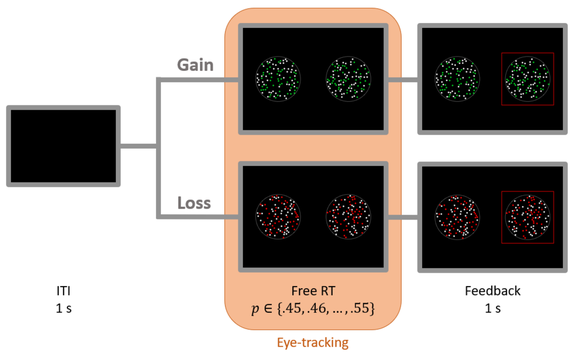
**How does visual attention impact choices between negative-outcome lotteries?**

**H0:** ↑ relative attention to option ⇒ ↓ choice frequency, due to attentional discounting.

**H1:** ↑ relative attention ⇒ ↑ choice frequency, due to attentional amplification.

## Eye-Tracking Task

- $N = 25, 400$ binary choices between lotteries.
- 2 blocks, 2 conditions:
  - Gain: positive-outcome lotteries.
  - Loss: negative-outcome lotteries.

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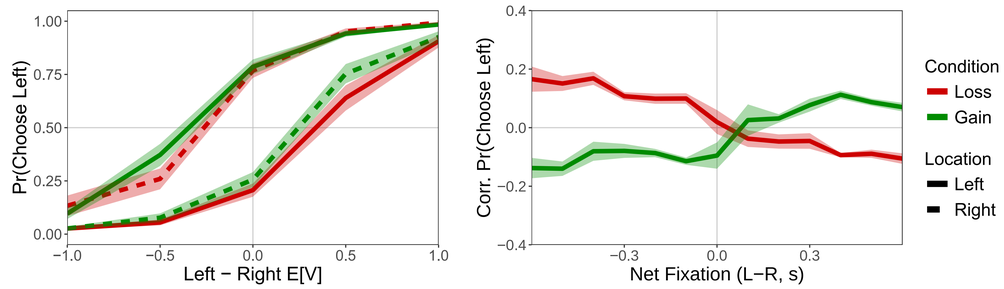
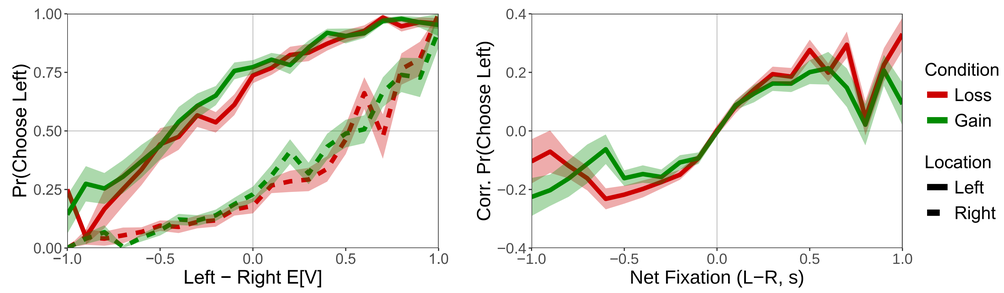
## Results

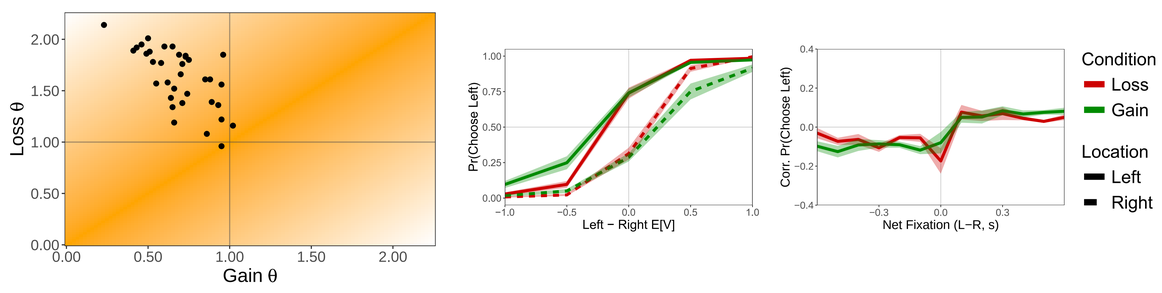
**Model Predictions** If there is attentional discounting in loss choices ($\theta_{loss} \in (0, 1)$), then an increase in the relative attention received by an option should decrease the frequency with which it is chosen.




**Observed Data** Instead, we find that an increase in the relative attention received by an option still increases the frequency with which it is chosen, just as in gains.




**aDDM** Observed data is explained by attentional amplification in the aDDM ($\theta > 1$) in choices between losses and attentional discounting ($\theta \in (0, 1)$) in choices between gains.




### Hypotheses

| | |
|---|---|
| H0: ↑ relative attention ⇒ ↓ choice frequency, discounting. (Results, Observed Data) | UNSUPPORTED |
| H1: ↑ relative attention ⇒ ↑ choice frequency, amplification. (Results, aDDM) | SUPPORTED |

## Model

**Attentional Drift-Diffusion-Model (aDDM)**

$$\text{Evidence}_t = \text{Evidence}_{t-1} + \mu_t + \epsilon_t$$

- Fixated left: $\mu_t = d(V_L - \theta V_R)$.
- Fixated right: $\mu_t = d(\theta V_L - V_R)$.
- Drift rate: $d$.
- Noise: $\epsilon_t \sim N(0, \sigma^2)$.
- Attentional discounting: $\theta \in (0, 1)$.
- Attentional amplification: $\theta > 1$.
- Evidence accumulation to decision bounds fixed at $\pm 1$.

## Discussion

Choices and response times can be captured by an aDDM using a non-constant attentional bias parameter that discounts the value of the nonfixated option in gains ($\theta \in (0, 1)$) and amplifies this value in losses ($\theta > 1$). Potential explanations:

- There is a fundamental difference in the role of attention in gains versus losses.
- Subjects may be solving the task by counting the number of green dots in gain trials, switching to counting the white dots in loss trials, and making value comparisons based on these counts.

Next steps:


## References

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