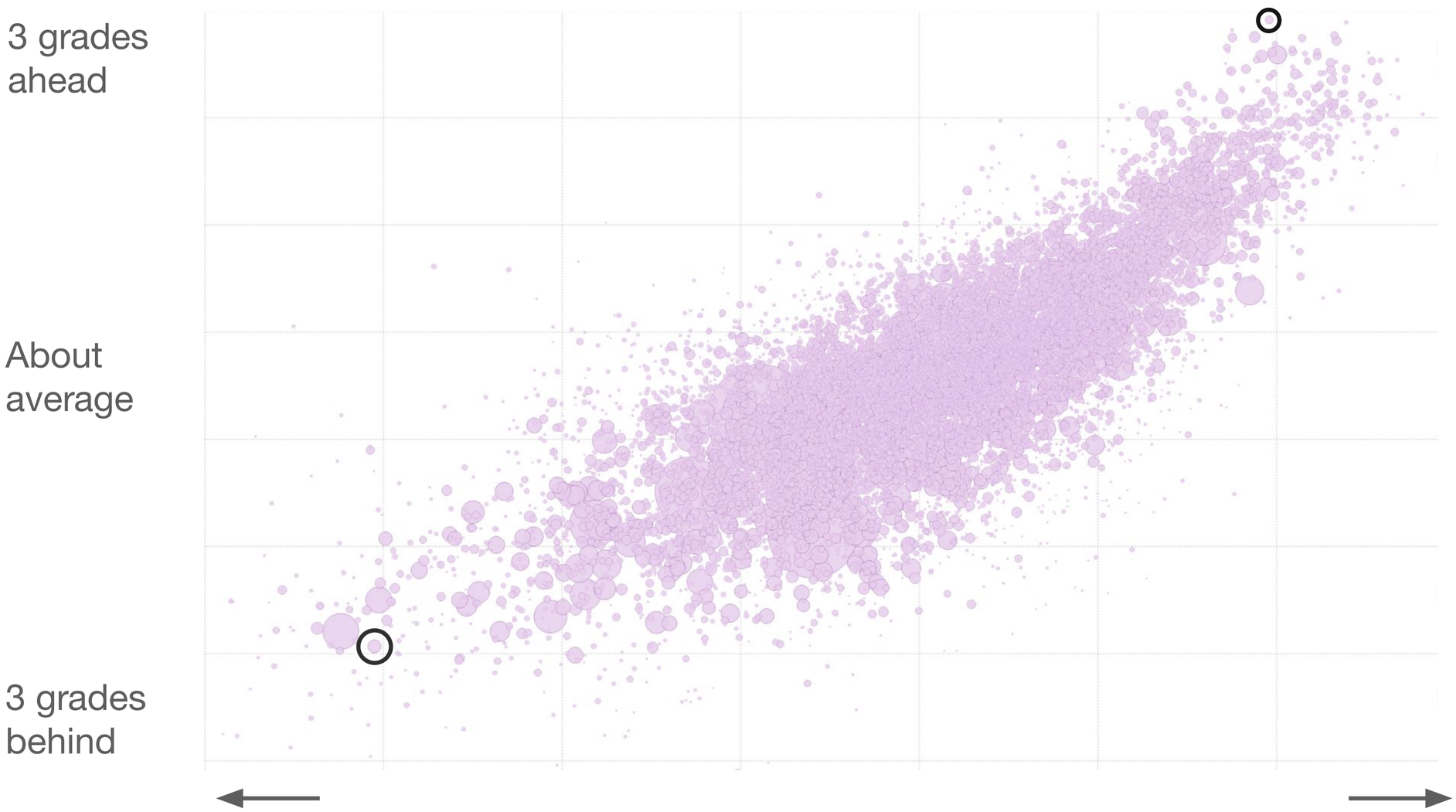
Socioeconomic status in childhood influences exploratory risk-taking and learning

Alexandra Decker

Massachusetts Institute of Technology

2024 Psychology and Economics of Poverty Meeting

Sixth grade academic achievement



Source: “The Geography of Racial/Ethnic Test Score Gaps”, by Sean F. Reardon, Demetra Kalogrides and Kenneth Shores of Stanford

What children learn

How children learn

How children learn

Exploration and risk-taking

Tymula et al., 2012; Lucas et al., 2014; van den Bos & Hertwig, 2017; Gopnik et al., 2017; Plebanek & Sloutsky, 2019; Sumner et al., 2019; Blanco & Sloutsky, 2021; Liquin & Gopnik, 2022; Blanco et al., 2023

Exploiting (secure known rewards)

e.g., taking a familiar class

Exploring

e.g., taking a new class

Exploiting (secure known rewards)

e.g., taking a familiar class

✓

✗ Less learning

Exploring

e.g., taking a new class

✓ New Learning

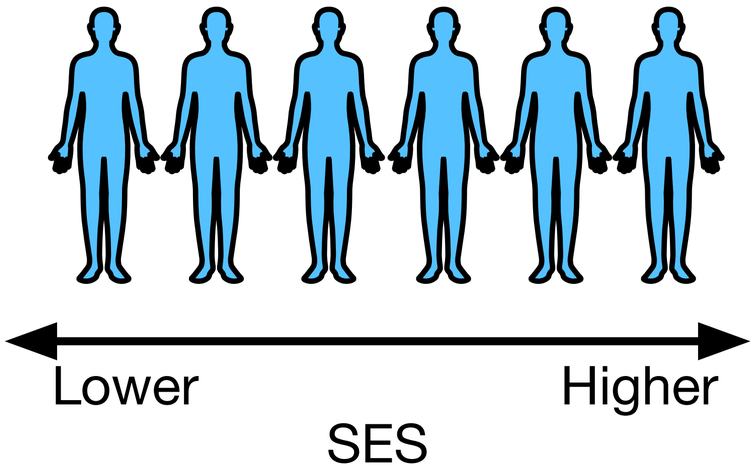
✗ Immediate costs & uncertain rewards

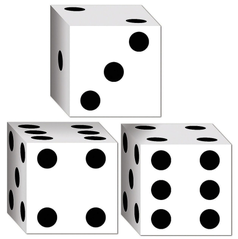
Fewer resources means less protection from the costs of exploring (e.g., car trouble taking time of work etc) (Amir, Jordan, & Rand, 2018).

Uncontrollability might make deferred rewards feel unattainable

Do poorer children **take fewer exploratory risks?**

How does this impact **learning?**





Exploratory risk-taking
and learning task

Participants (*N* = 125; 12-14 years old)

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Measured SES using parental income and education

Combined into a composite score

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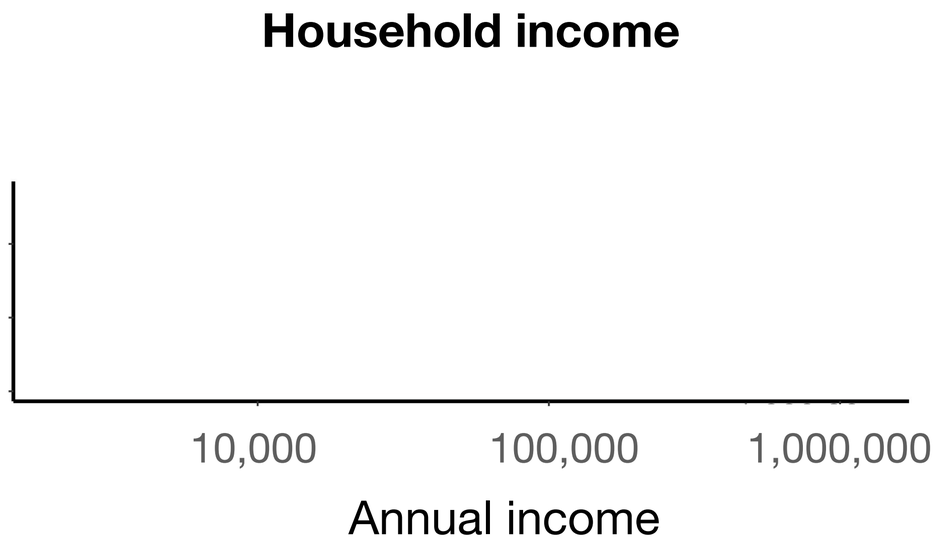

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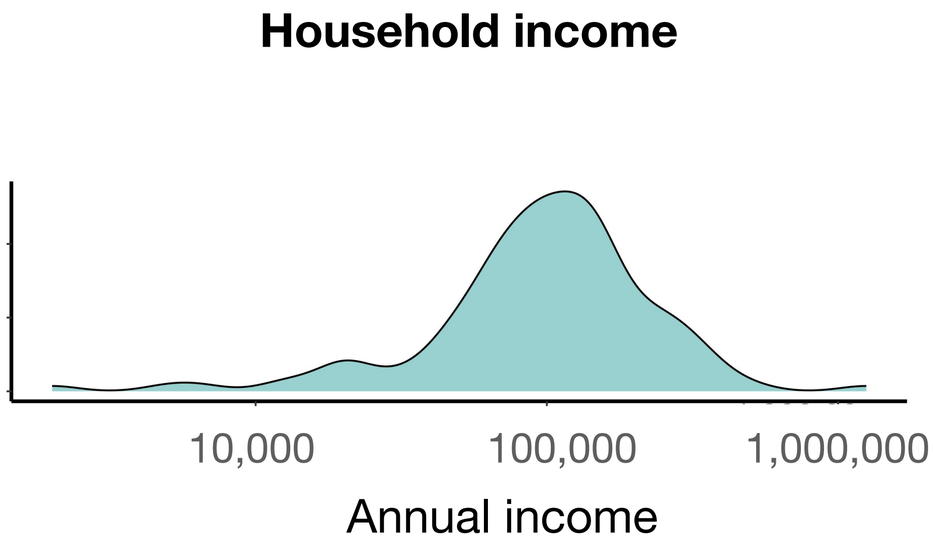
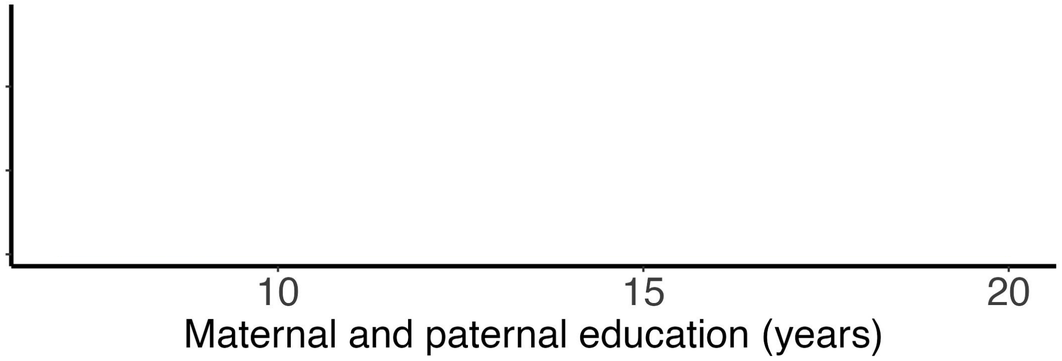
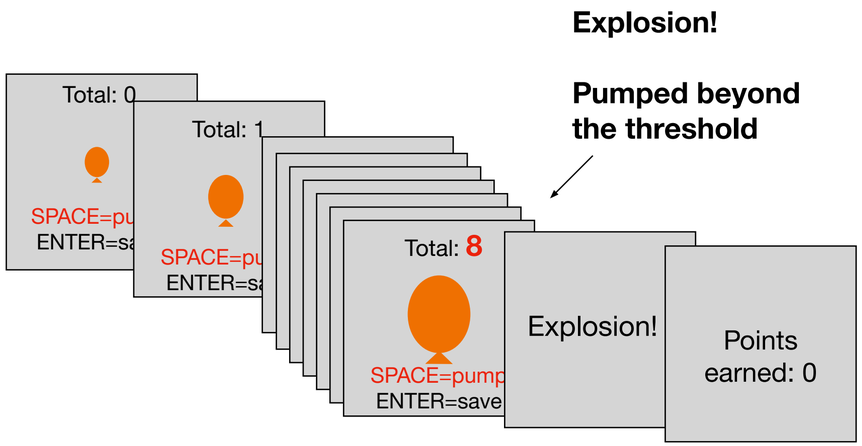
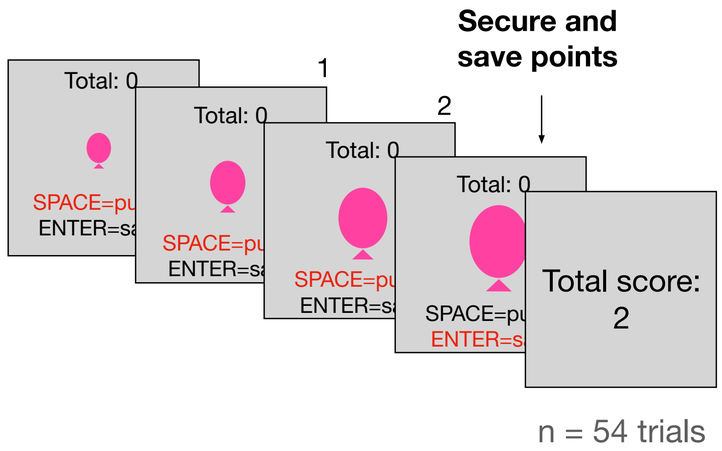




Exploratory risk-taking task





n = 54 trials

Long balloon = explodes after 19 pumps

Short balloon = explodes after 7 pumps

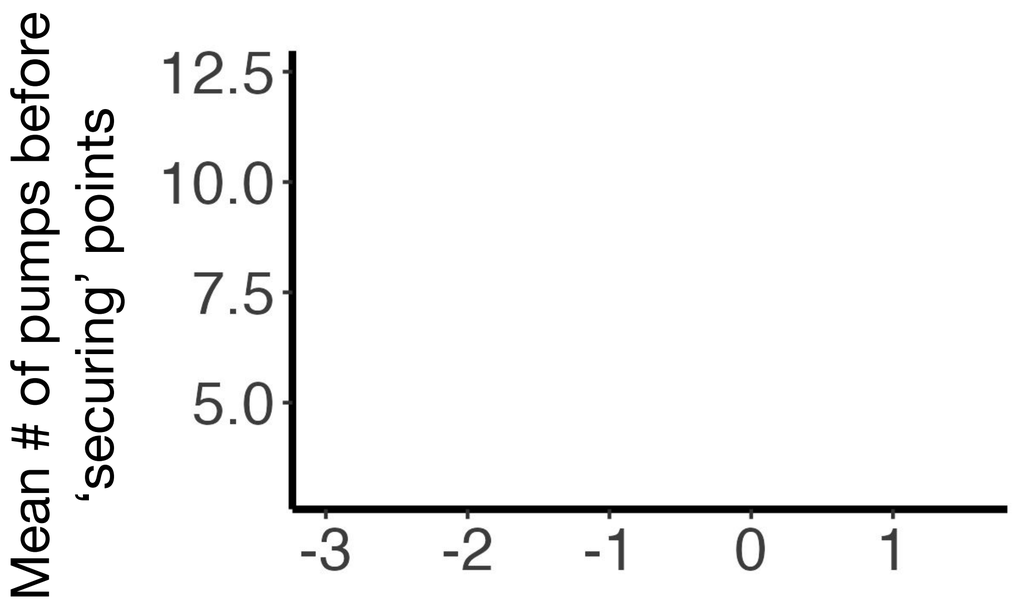
Unreliable balloon = explodes after variable number of pumps

Exploratory risk taking = More pumping and explosions

Learning = points earned in the last phase of the task

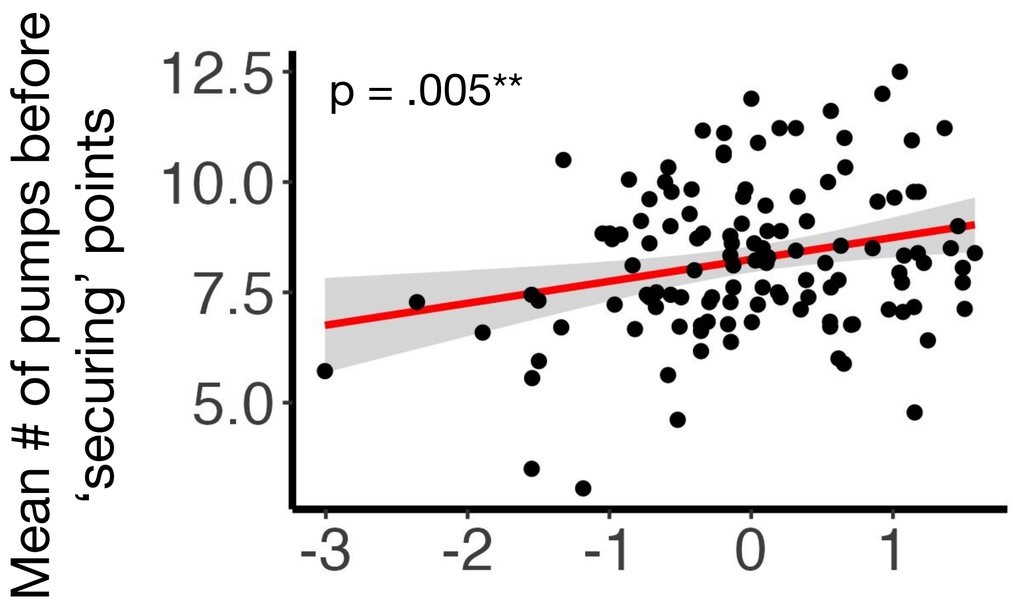
Is socioeconomic status associated with **exploratory risk-taking**?

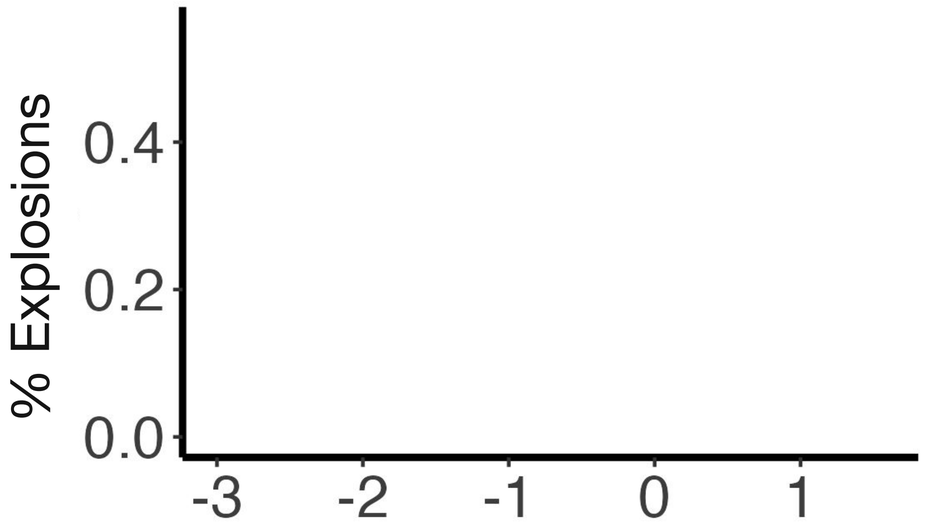
Socioeconomic status and risk taking



Poorer children **sampled less** to the balloon explosion limits

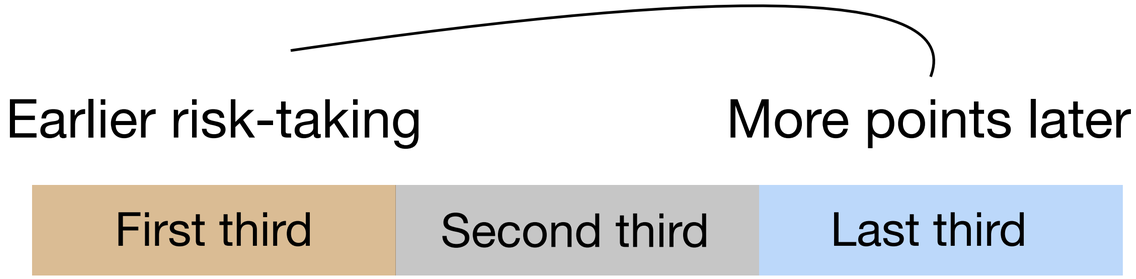
Socioeconomic status and risk taking





Poorer children **sampled less** to the balloon explosion limits

Does exploratory risk-taking benefit later performance?



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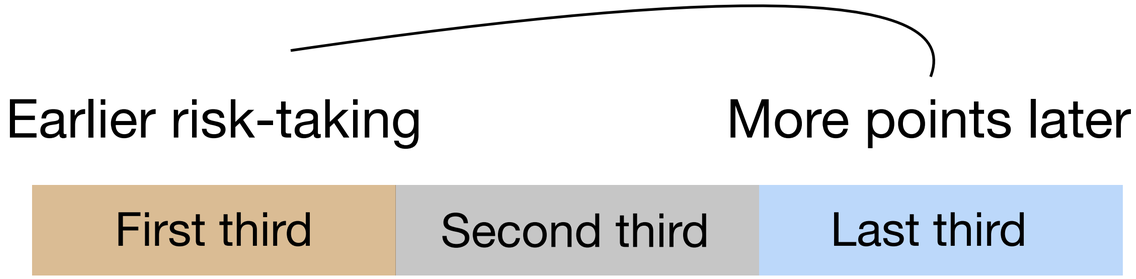
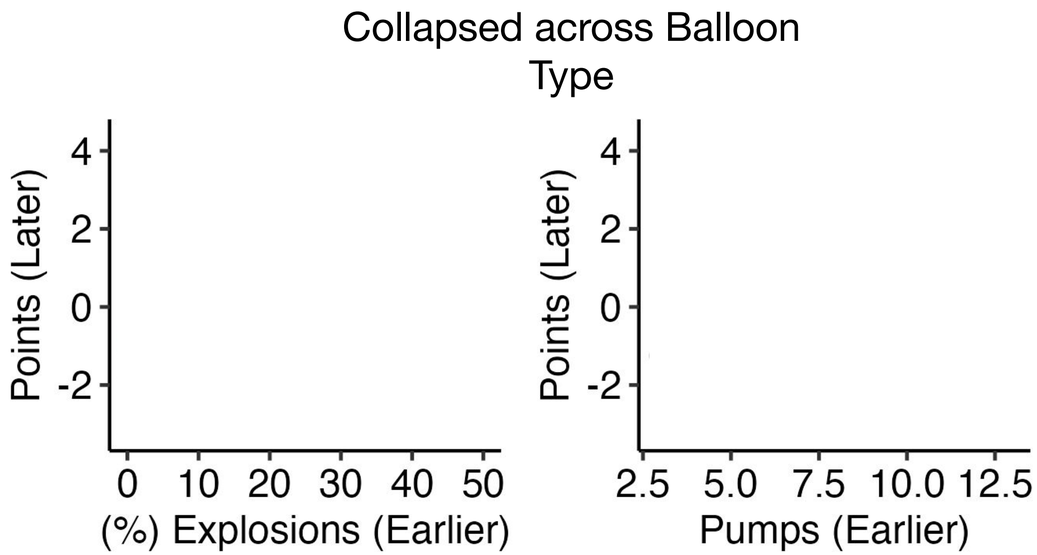
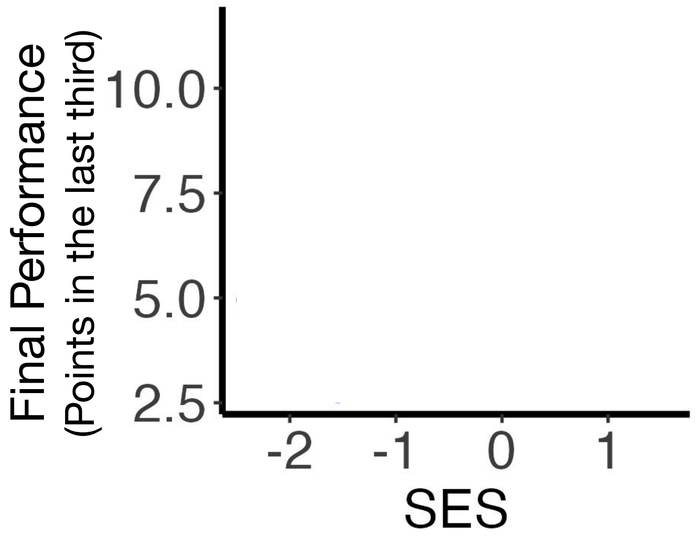


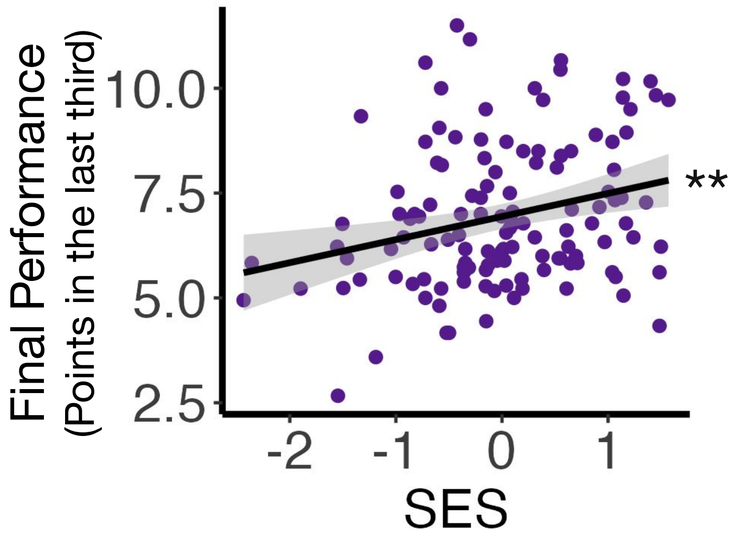


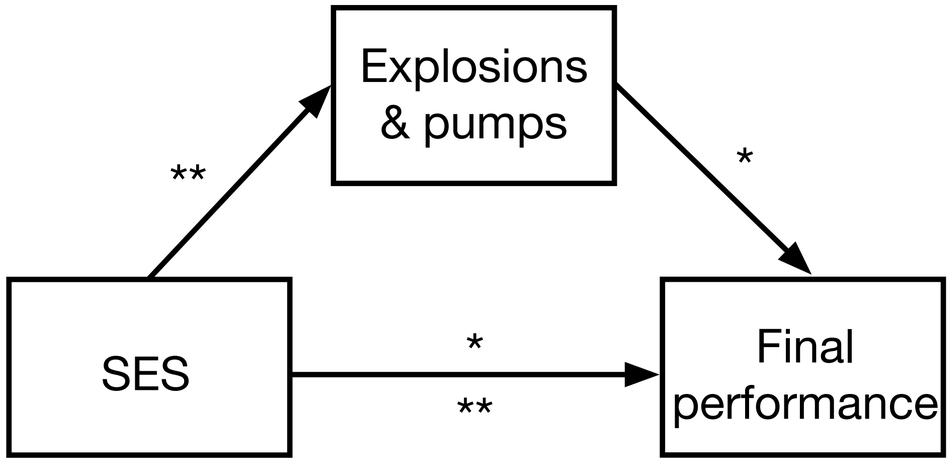
Is socioeconomic status related to performance in the last task phase?

Socioeconomic status and final performance outcomes

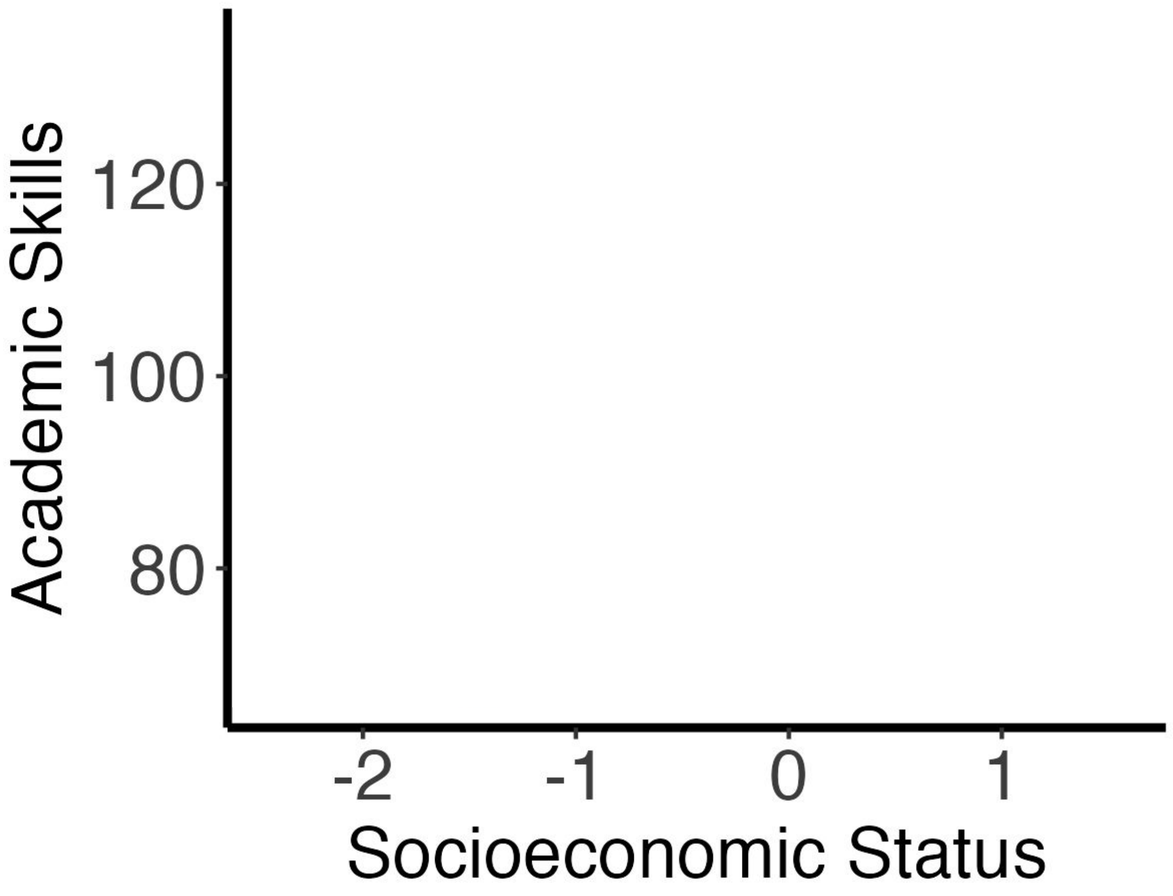


Exploration explained SES differences in performance

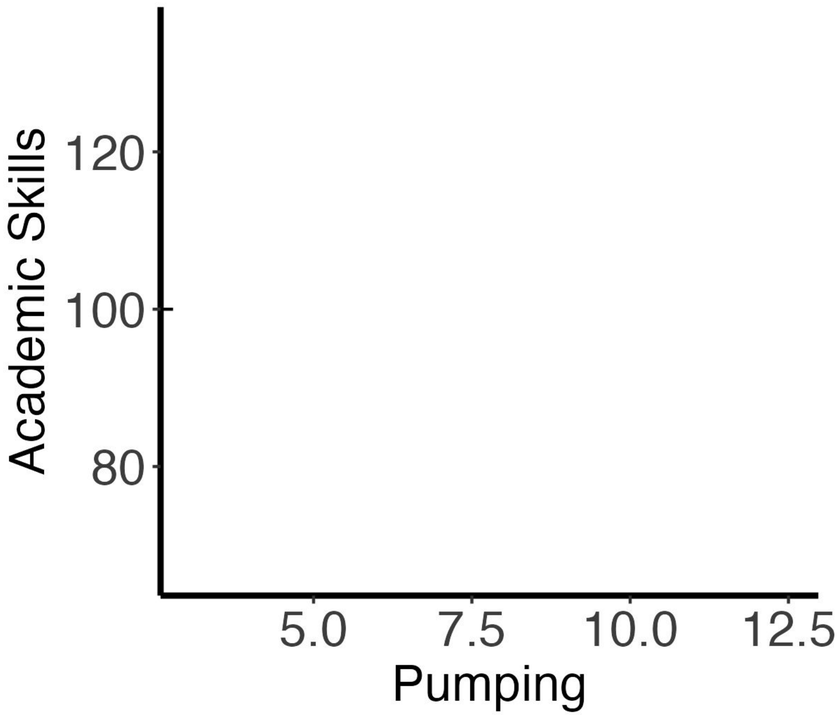




Socioeconomic status and academic skills



In-task risk-taking and academic skills



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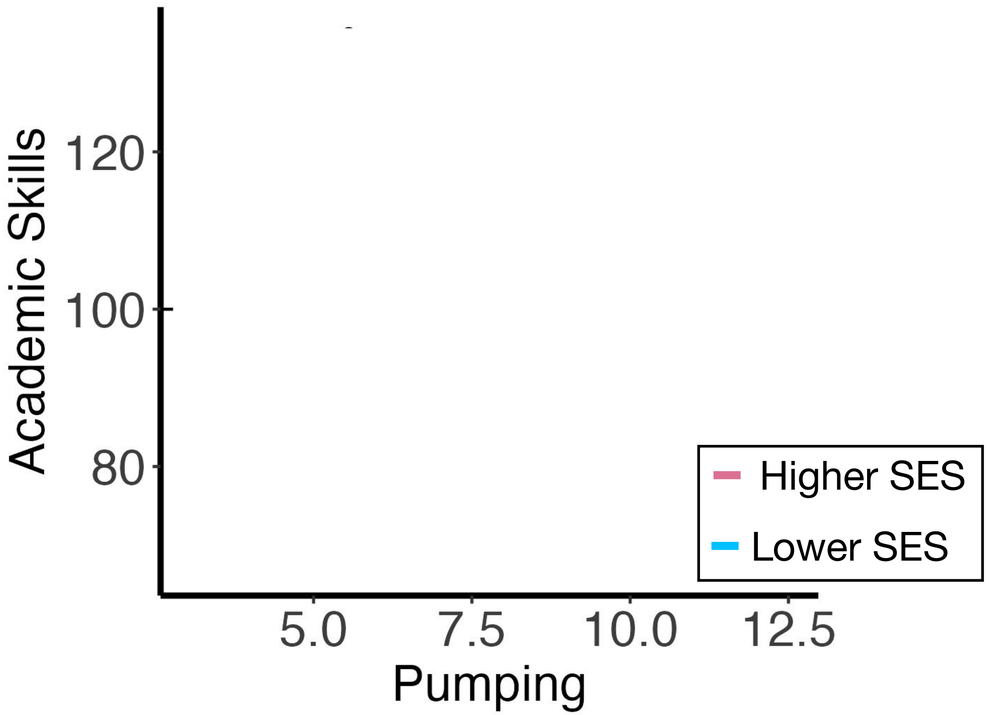

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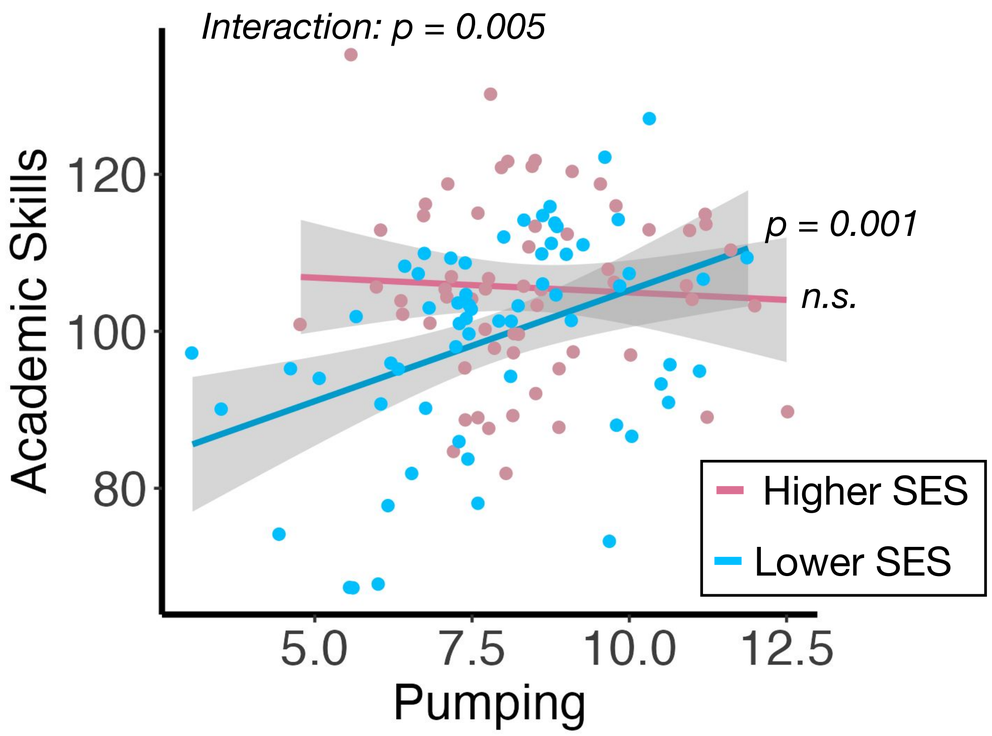


How children are learning

Having less might mean **exploring** less

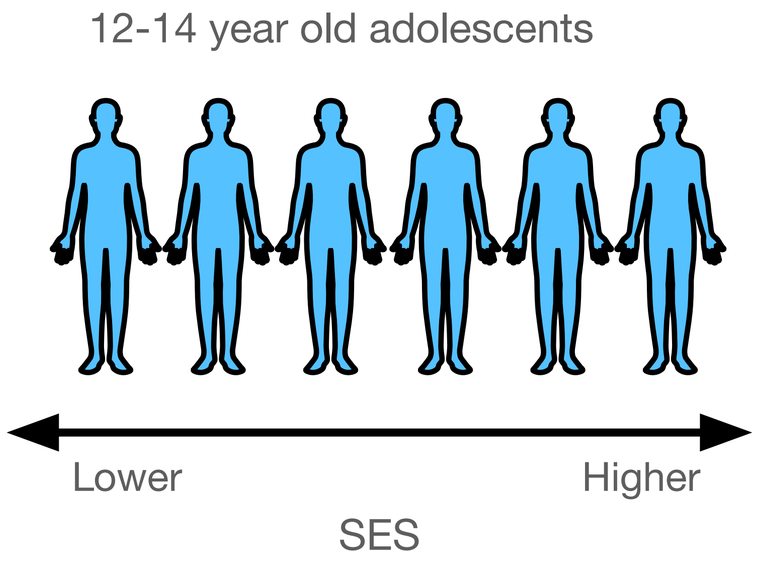
Might be **adaptive** for ensuring welfare when resources are scarce

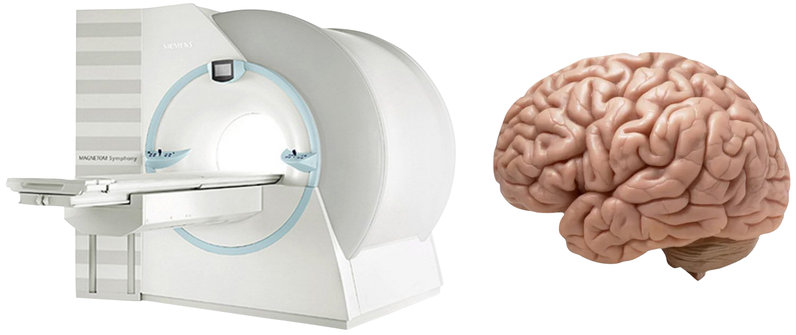
Exploiting secures immediate rewards

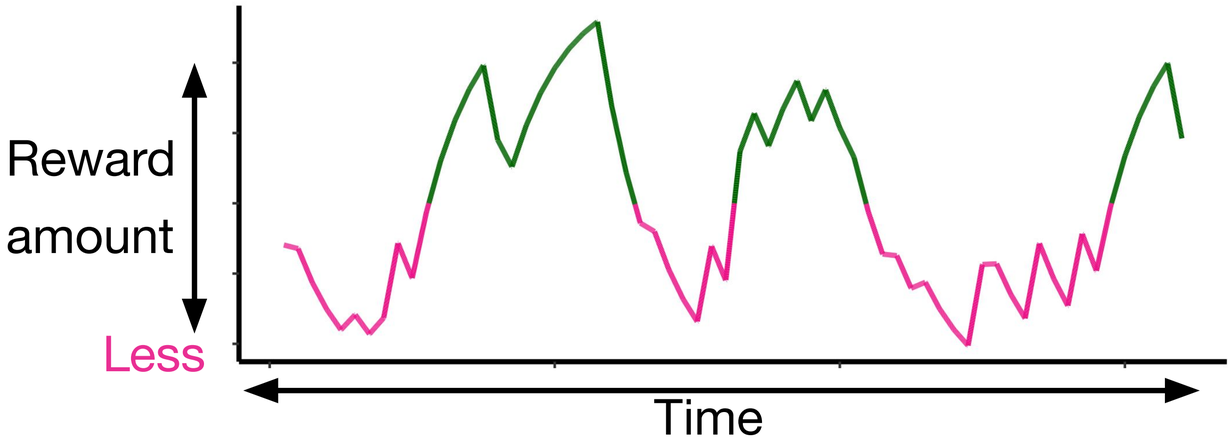
Does exploratory behavior fluctuate based on reward availability in our changing environments?

… **Does the brain track reward availability** in the environment?

More





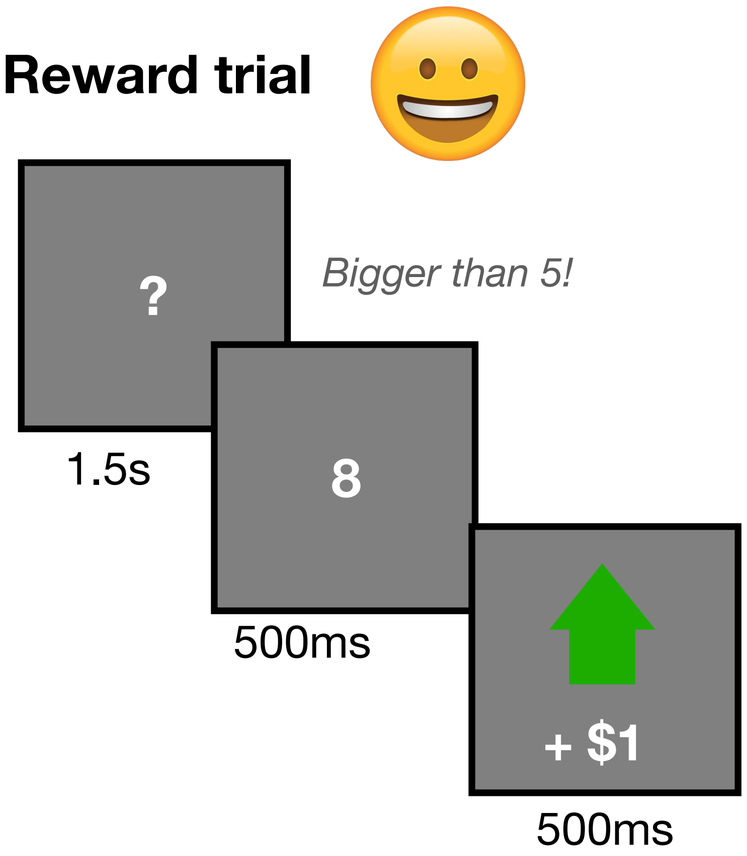


Decker et al., 2024

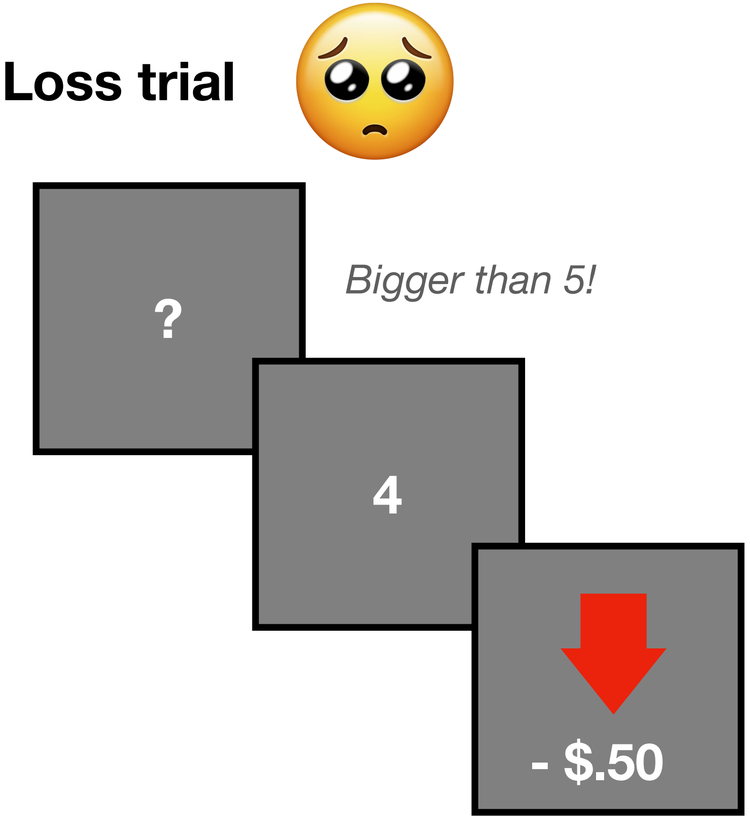
SIEMENS
MAGNETOM Trio
A Tim System

Gambling task

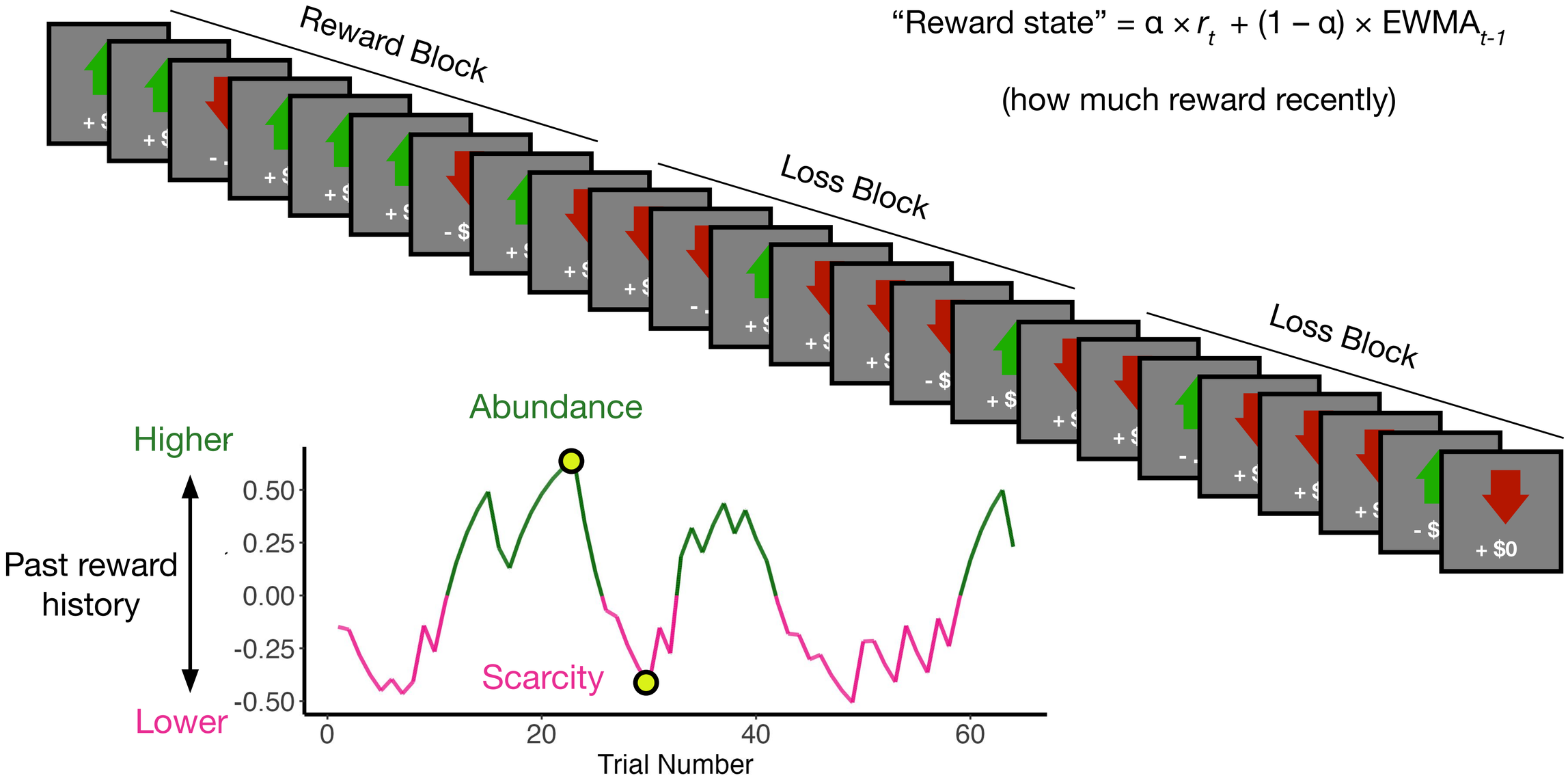
Reward trial



Loss trial



Decker et al., 2024

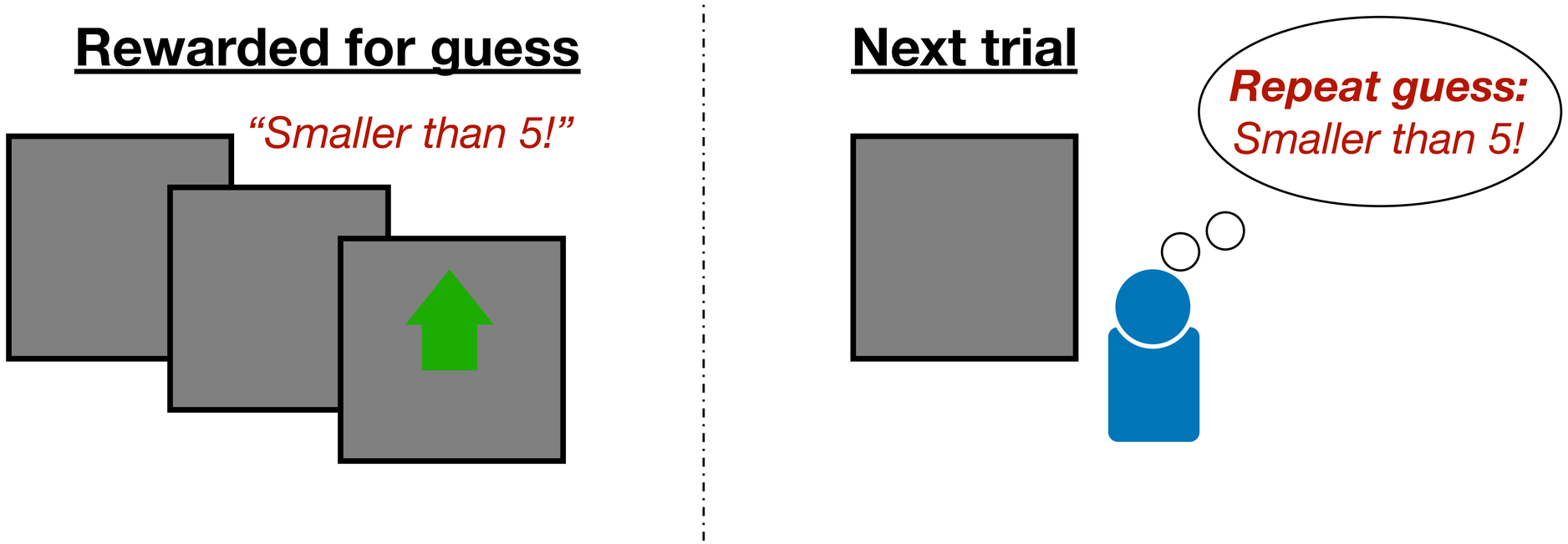


"Reward state" = $\alpha \times r_t + (1 - \alpha) \times \mathrm{EWMA}_{t-1}$

(how much reward recently)

Decker et al., 2024

People exploit by repeating previously rewarded actions



Are people **more likely to exploit** (repeat previously rewarded action) when **rewards** are **scarce**?

Decker et al., 2024

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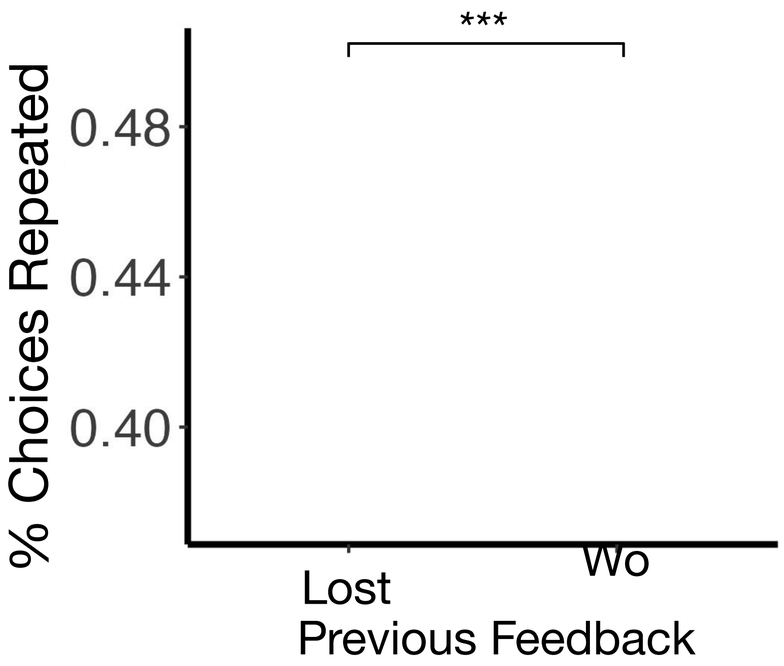
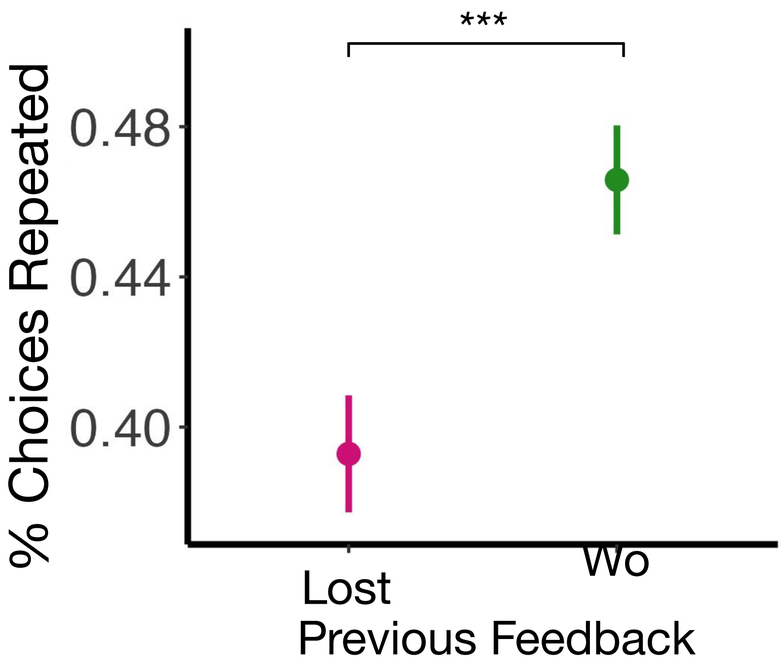
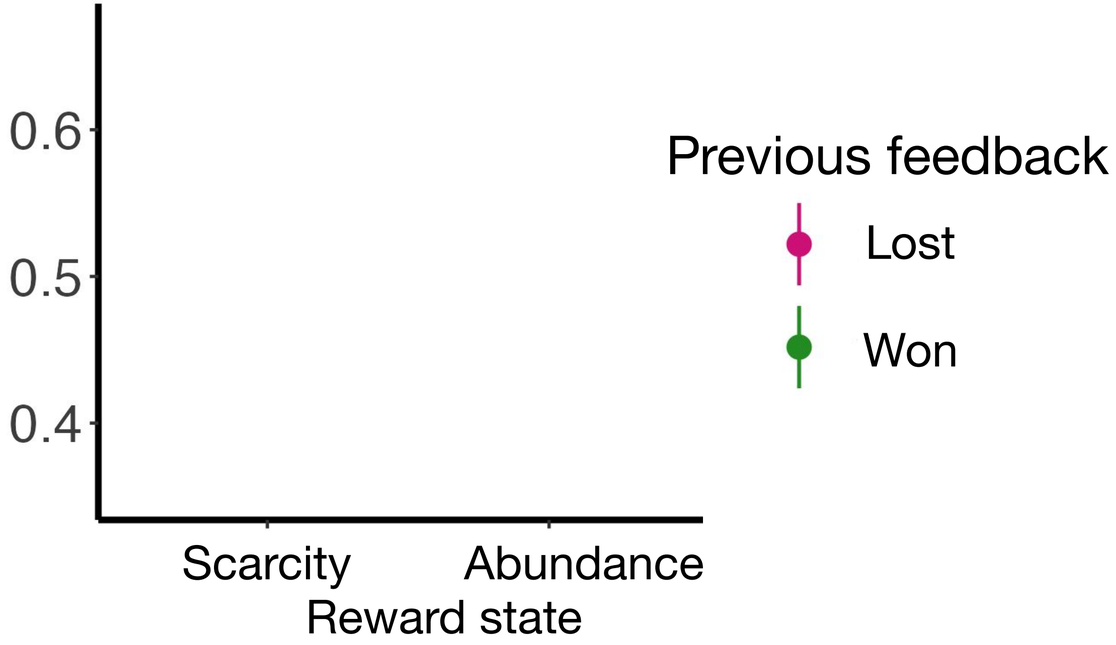


Decker et al., 2024

More exploitation in states of scarcity





Decker et al., 2024

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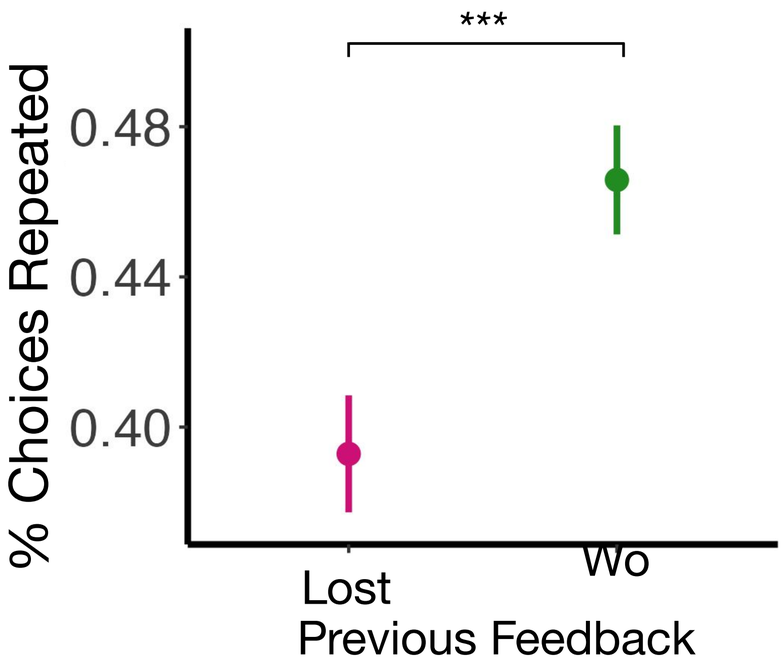

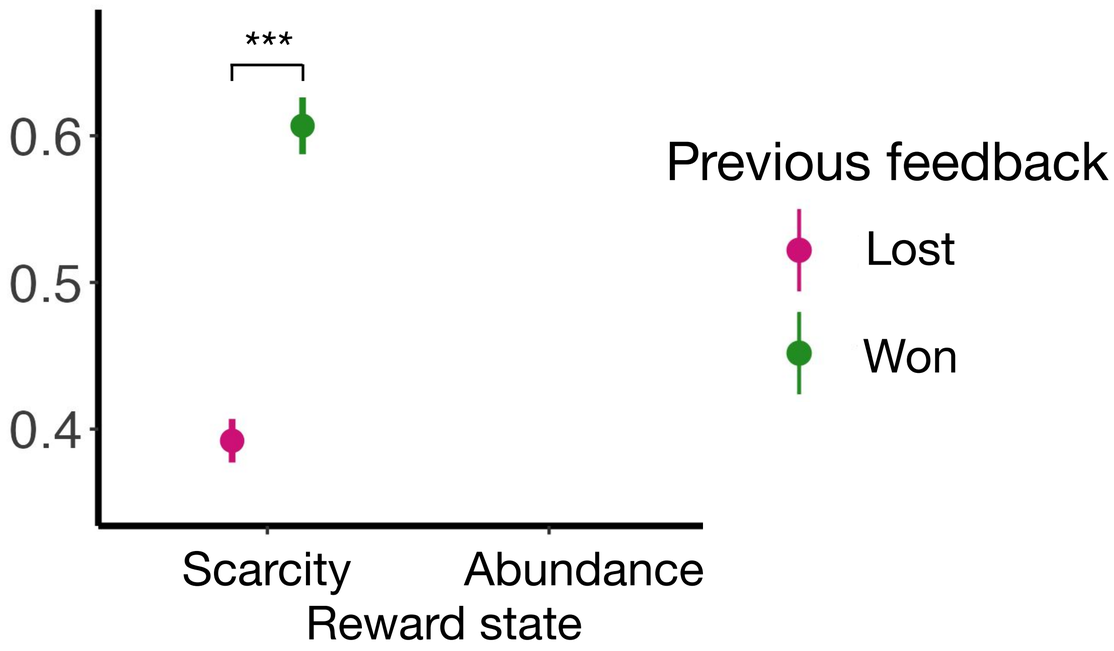

Decker et al., 2024

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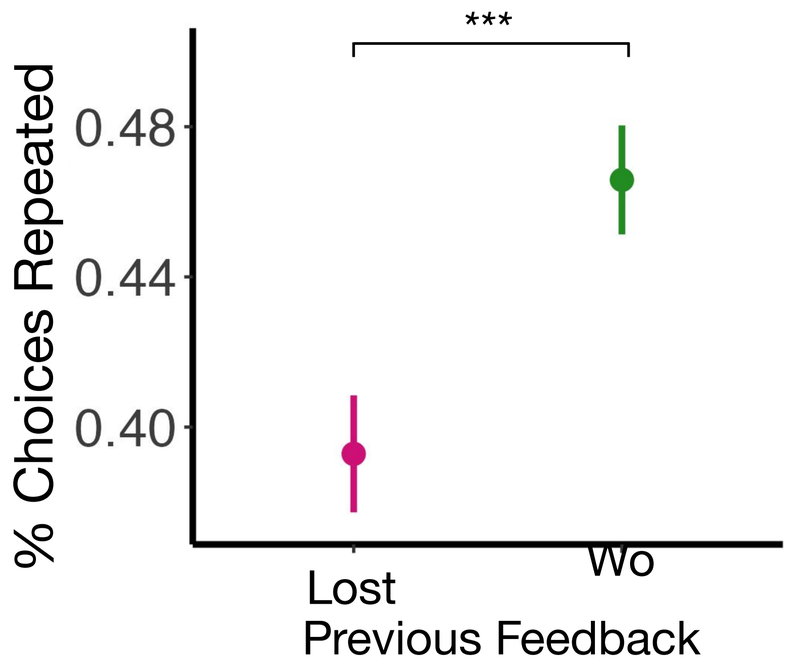
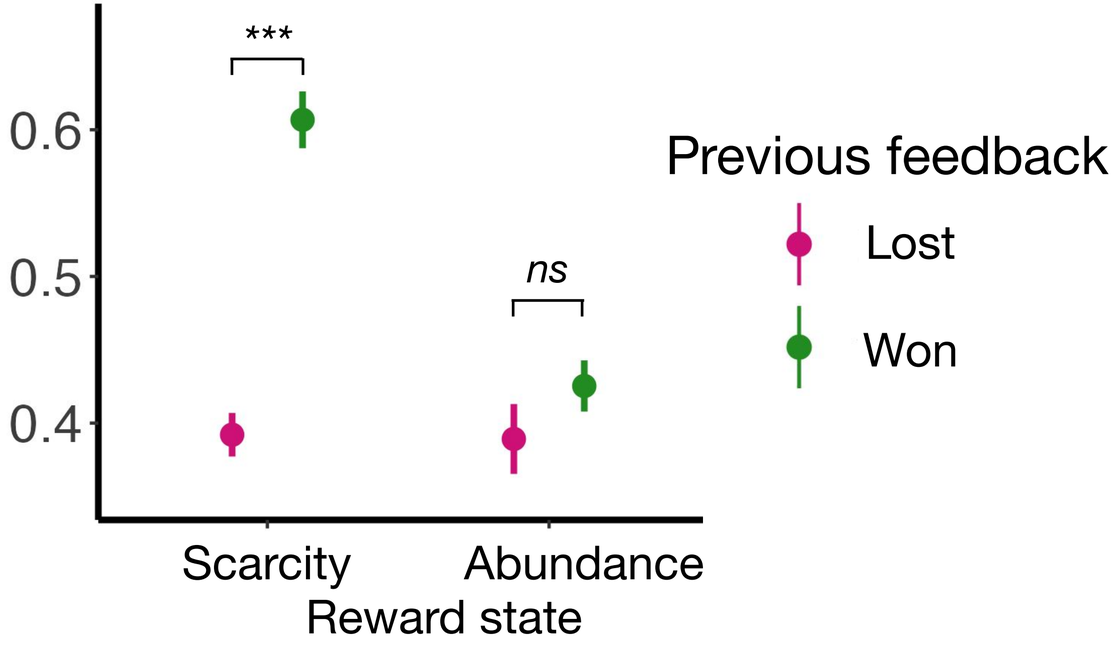




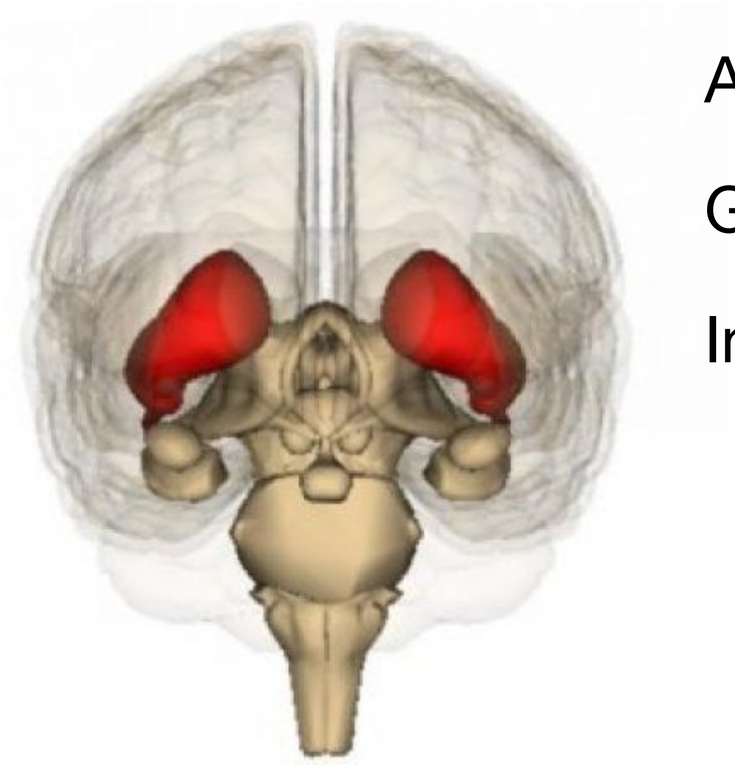
People track environmental rewards across time and **adapt behavior**

Decker et al., 2024

Is the **brain tracking** fluctuations in the reward state across time?

… differently by SES?

The striatum



Activates to reward

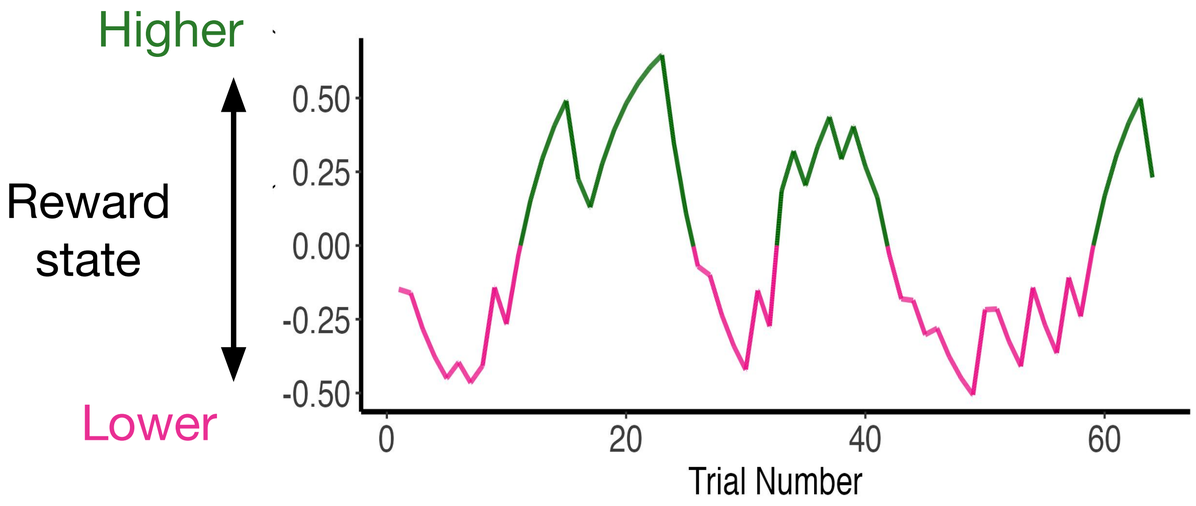
Goal-driven motivation, exploration, risk-taking

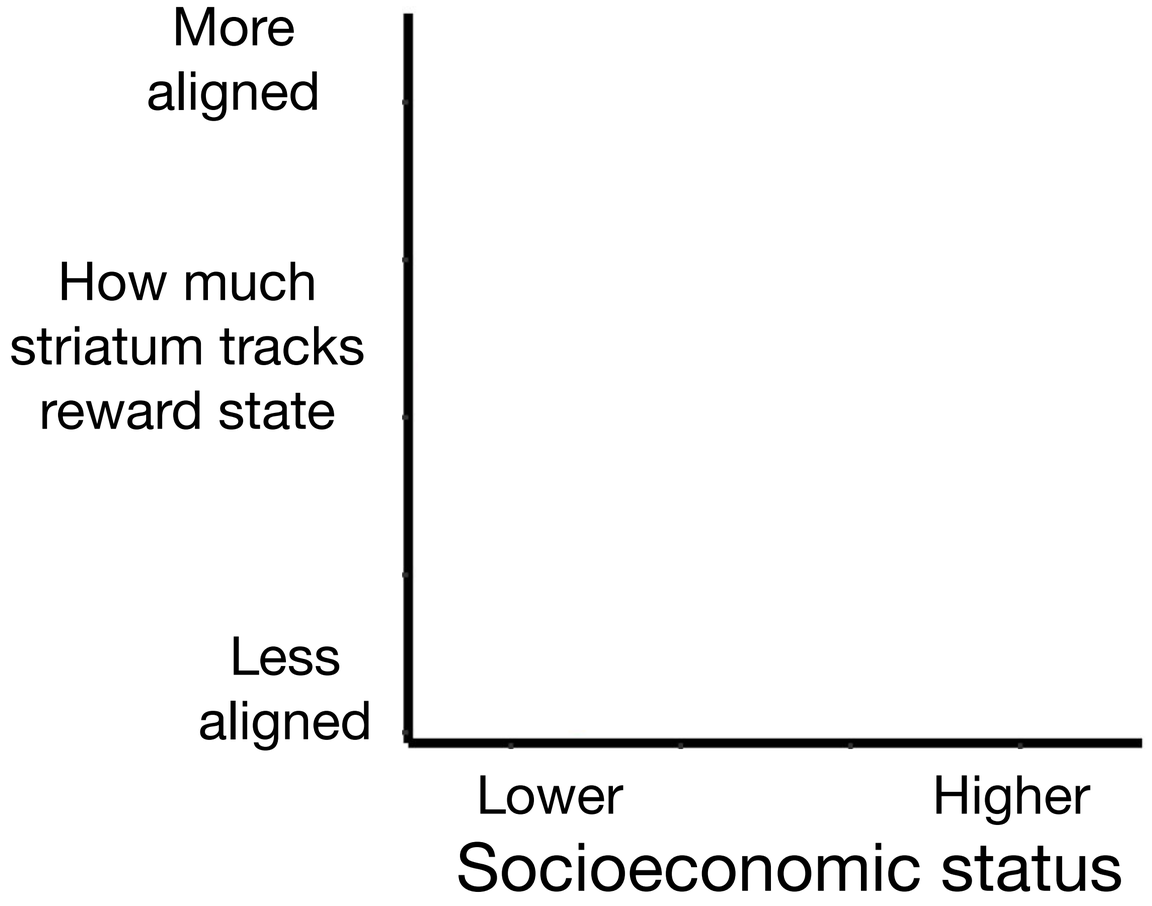
In animals, tracks reward fluctuations

Having less might mean ***greater*** responses to rewards

Having less might mean ***reduced*** responses to rewards

SES and how well striatum tracks reward state





Decker et al., 2024

Poorer children took **fewer exploratory risks** and **secured points earlier**

Task manipulation: **Reward availability** influences **explore/exploit behavior**

Being **poorer** was linked to **less reward tracking** in the striatum

QR code to paper

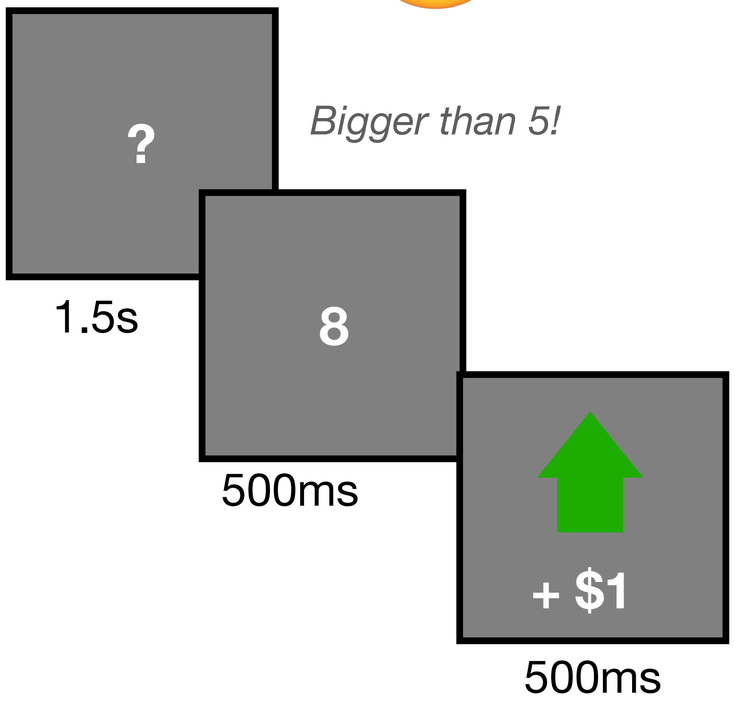
John Gabrieli

Julia Leonard

Rachel Romeo

Gambling task

Reward trial



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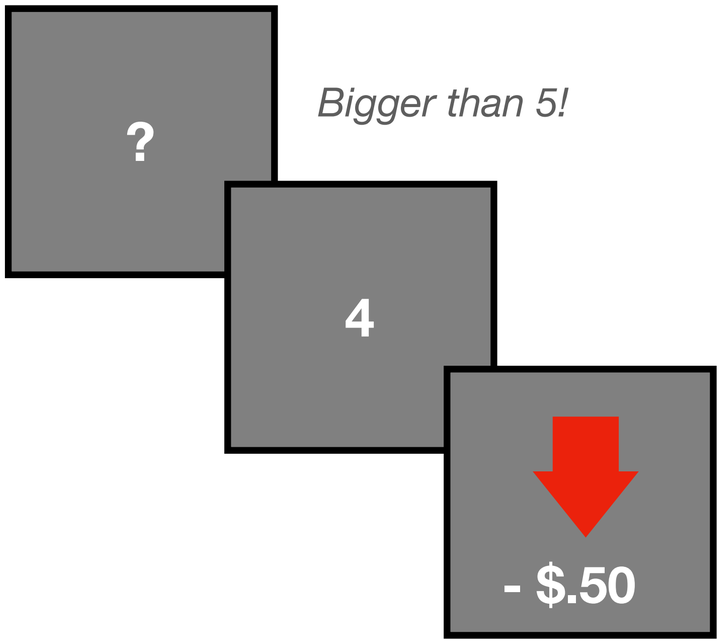
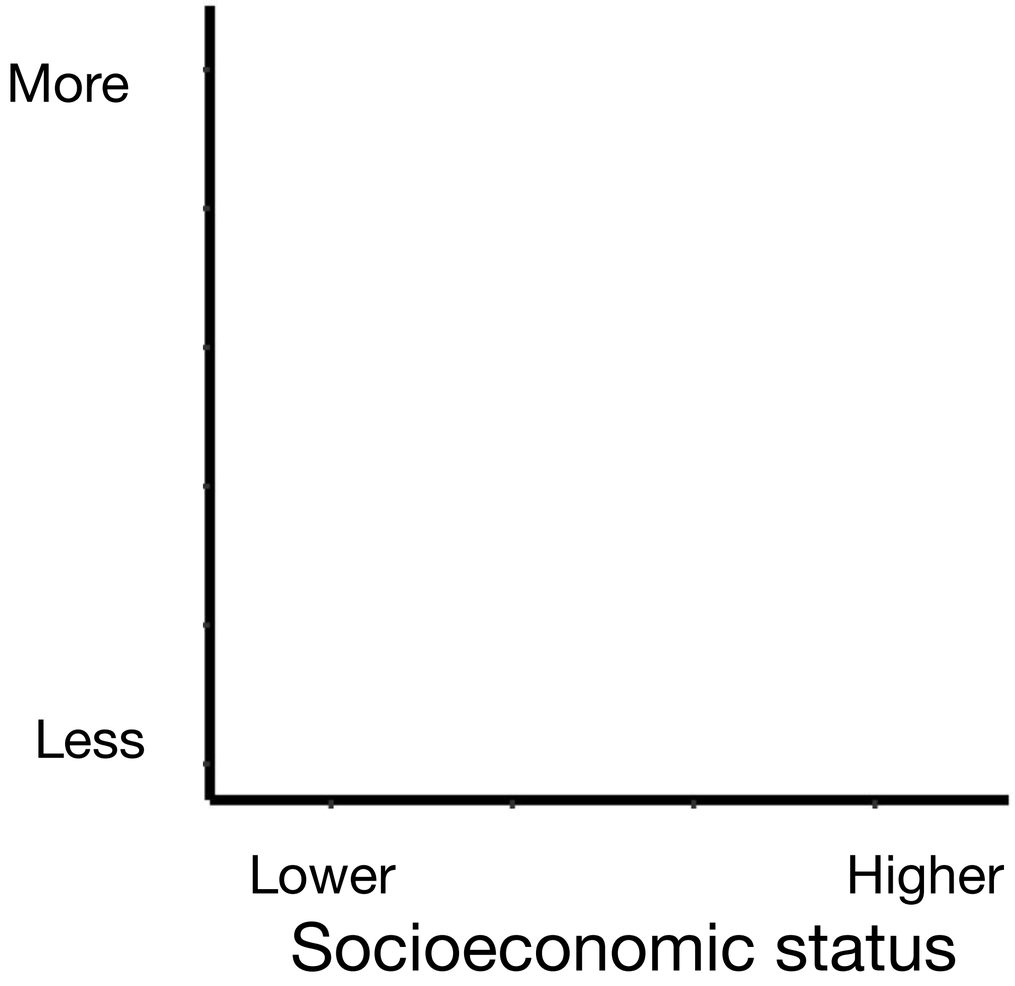
Loss trial



SES and reward responses



Decker et al., 2024