

RacLab

nature human behaviour

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Human ventromedial prefrontal cortex is necessary for prosocial motivation

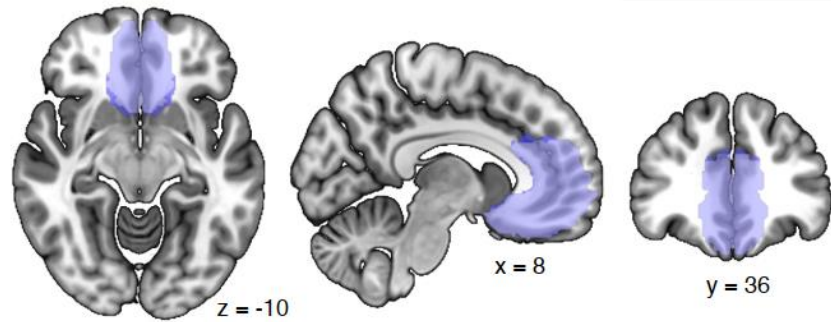
Patricia L. Lockwood^{1,2,3,4,8}✉, Jo Cutler^{1,2,3,4,8}✉, Daniel Drew^{3,4,5},
Ayat Abdurahman^{3,4,6}, Deva Sanjeeva Jeyaretna^{5,7}, Matthew A. J. Apps^{1,2,3,4},
Masud Husain^{3,4,5,7} & Sanjay G. Manohar^{3,5,7}

*Neurocognitive foundations of
social learning and decision-making*

Yang Ziyang

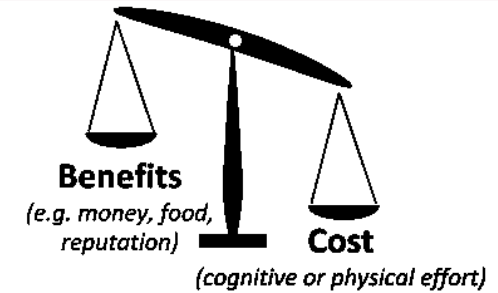
2024.06.28

Introduction



ventromedial prefrontal cortex

Processing costs

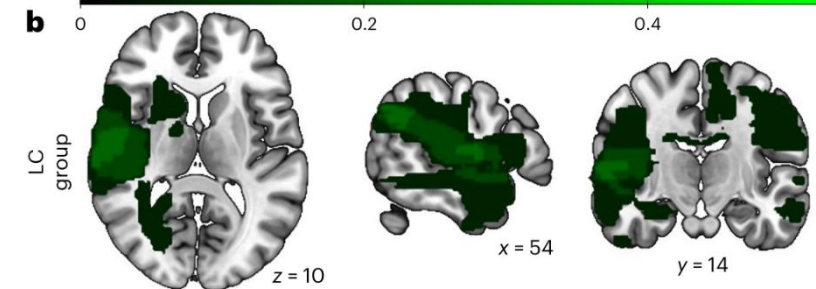
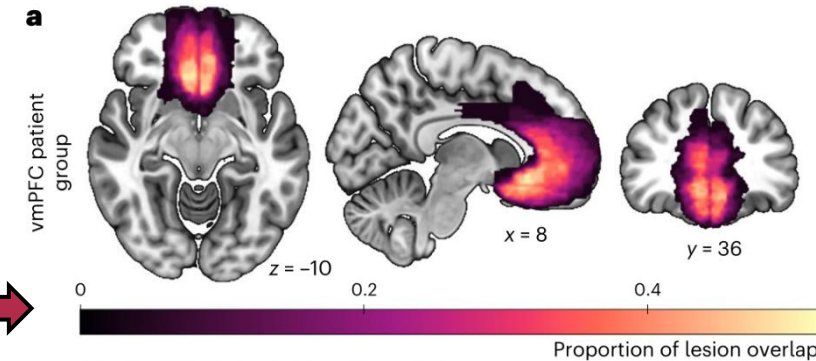


Decisions involving **other** people



cannot reveal **causal evidence**
for cognitive processes

lesion studies



larger samples

✓ effort

✓ social behaviour

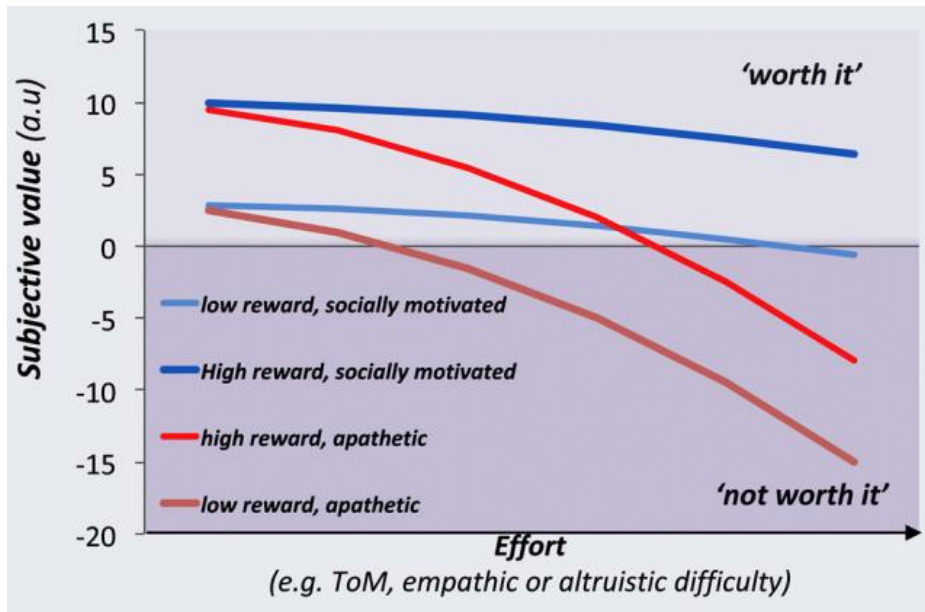
✓ reward

} typical individual
variability

Introduction

Prosocial behavior

- Voluntary behavior that **benefits another** but involves **sacrificing personal benefits**
- Mostly **correlational** studies and **dispositional** measures
- **Effort** behavior as a better proxy?



Effort is aversive



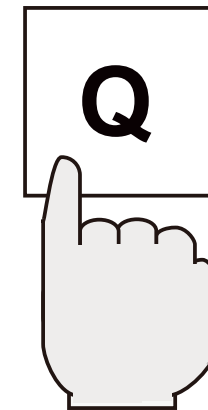
FINANCIAL



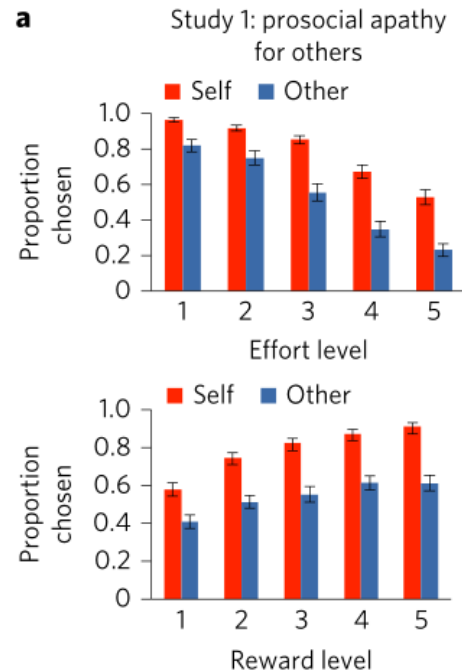
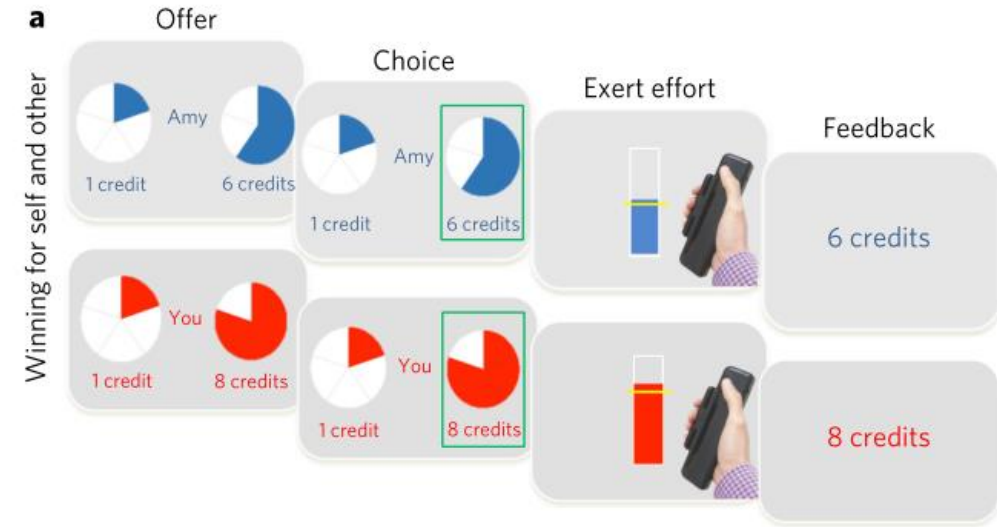
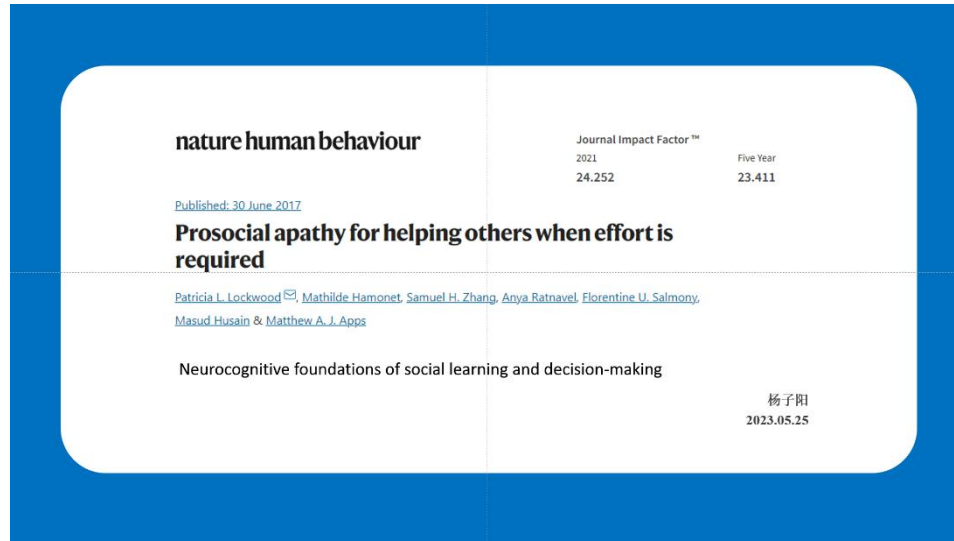
MORAL



EFFORT



Introduction

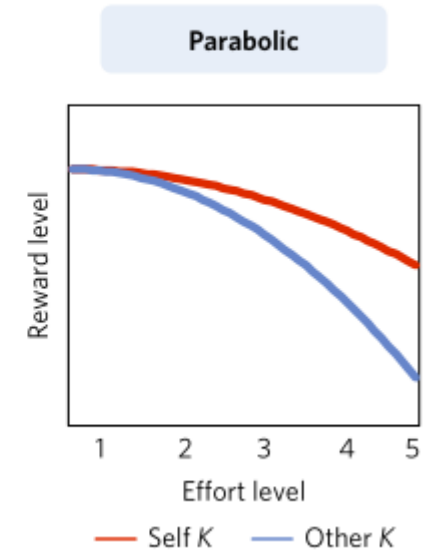


Winning model

$$SV = R - KE^2$$

Value = Reward - (Discount × Effort²)

$K = \begin{cases} K_{\text{self}} & \text{if self trial} \\ K_{\text{other}} & \text{if other trial} \end{cases}$





Introduction

Psychological Science

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Aging Increases Prosocial Motivation for Effort

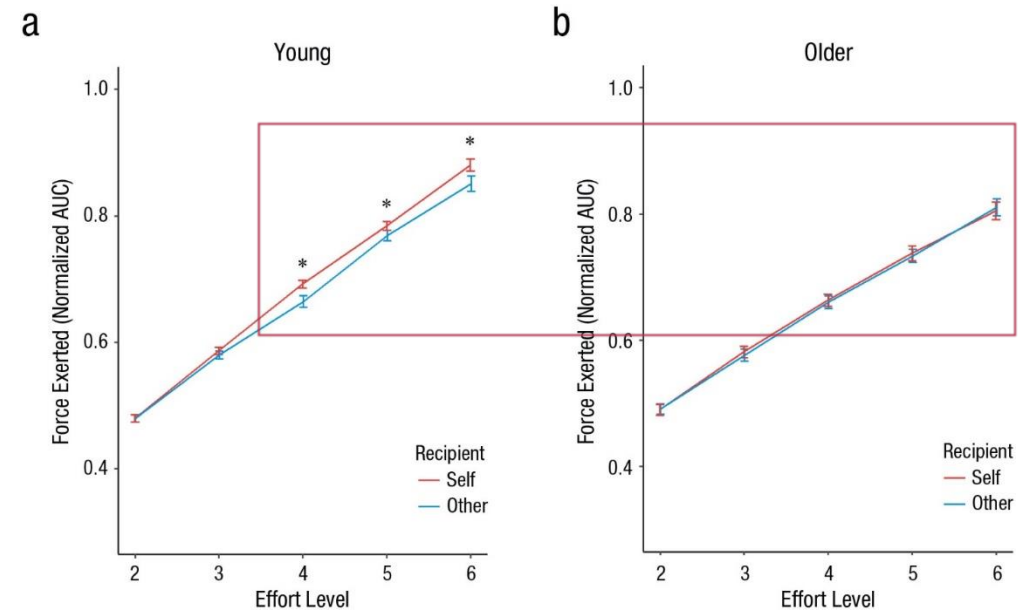
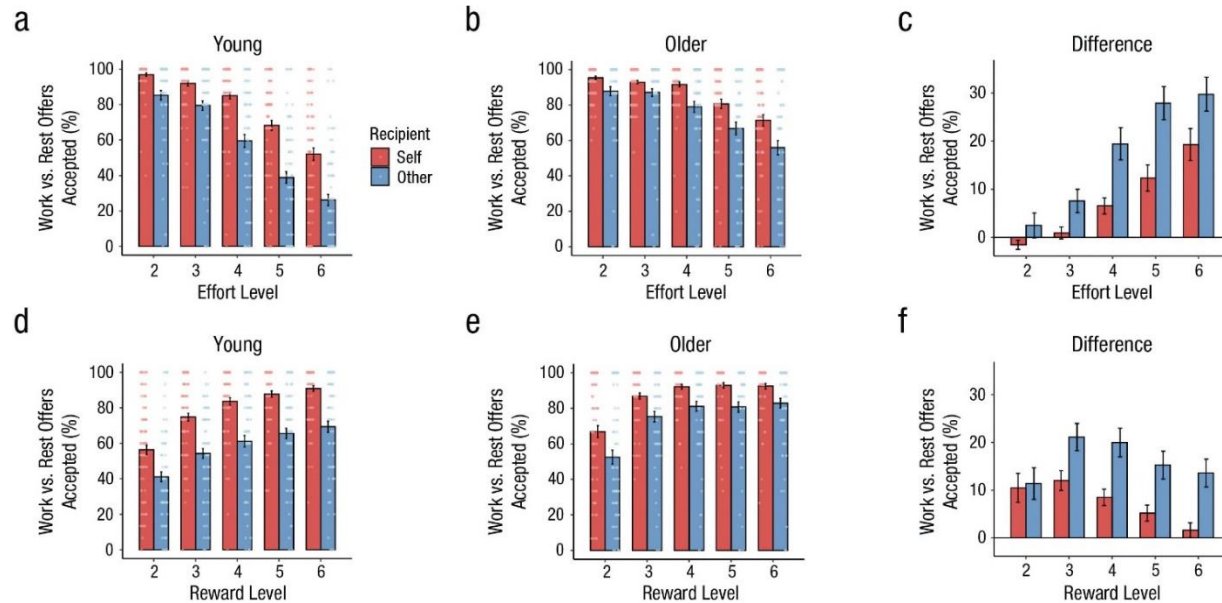
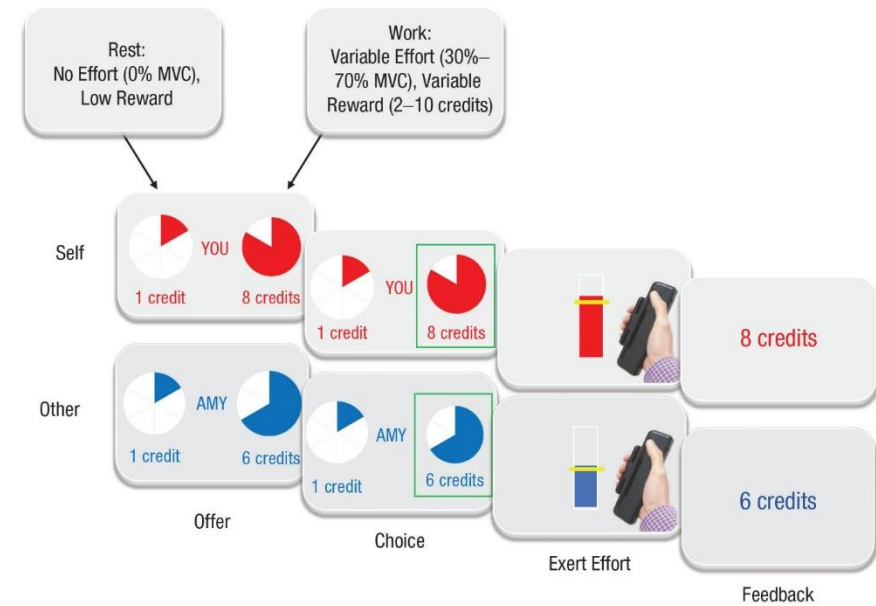
[Patricia L. Lockwood](#) , [Ayat Abdurahman](#) [...], and [Matthew A. J. Apps](#)  [View all authors and affiliations](#)

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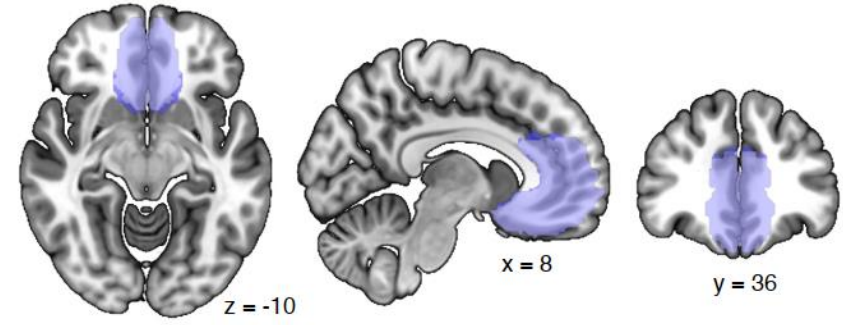
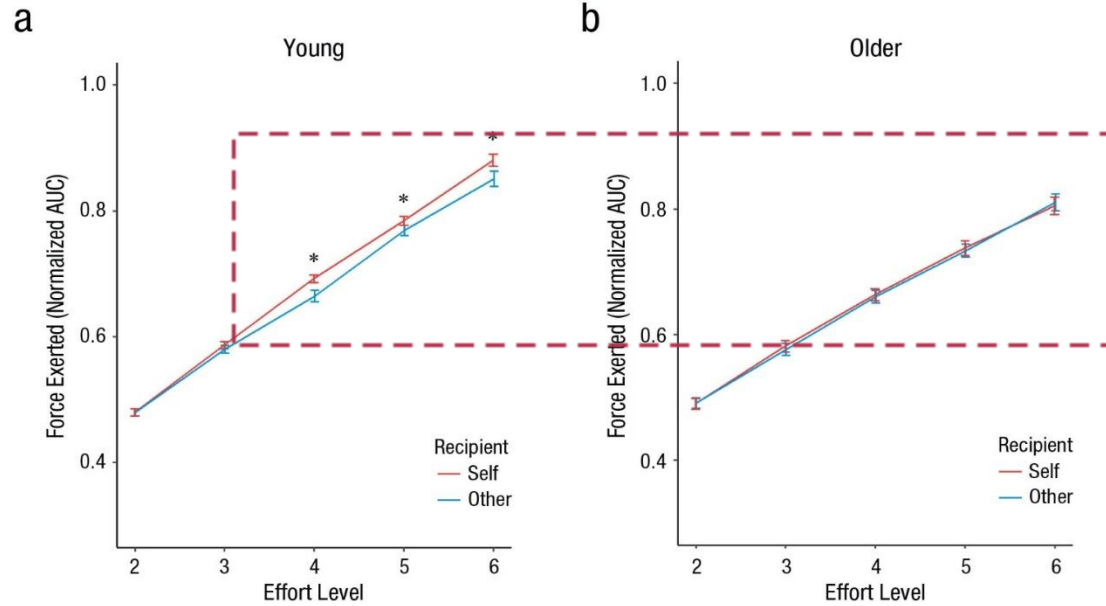
Neurocognitive foundations of social learning and decision-making

杨子阳

2023.06.08



Introduction

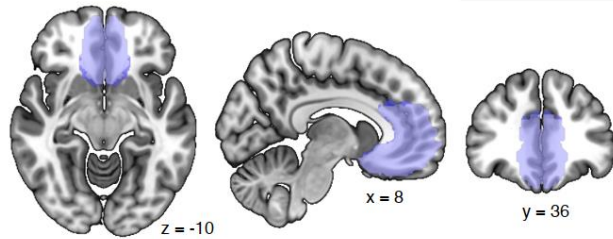


vmPFC maturation

vmPFC as a crucial region for prosocial behaviour

vmPFC activity when participants observe
another person receiving rewards

Introduction



Patients with vmPFC damage :

- disrupts social behaviour
- less generous and less trustworthy
- experience less guilt
- reject more unfair offers in economic games



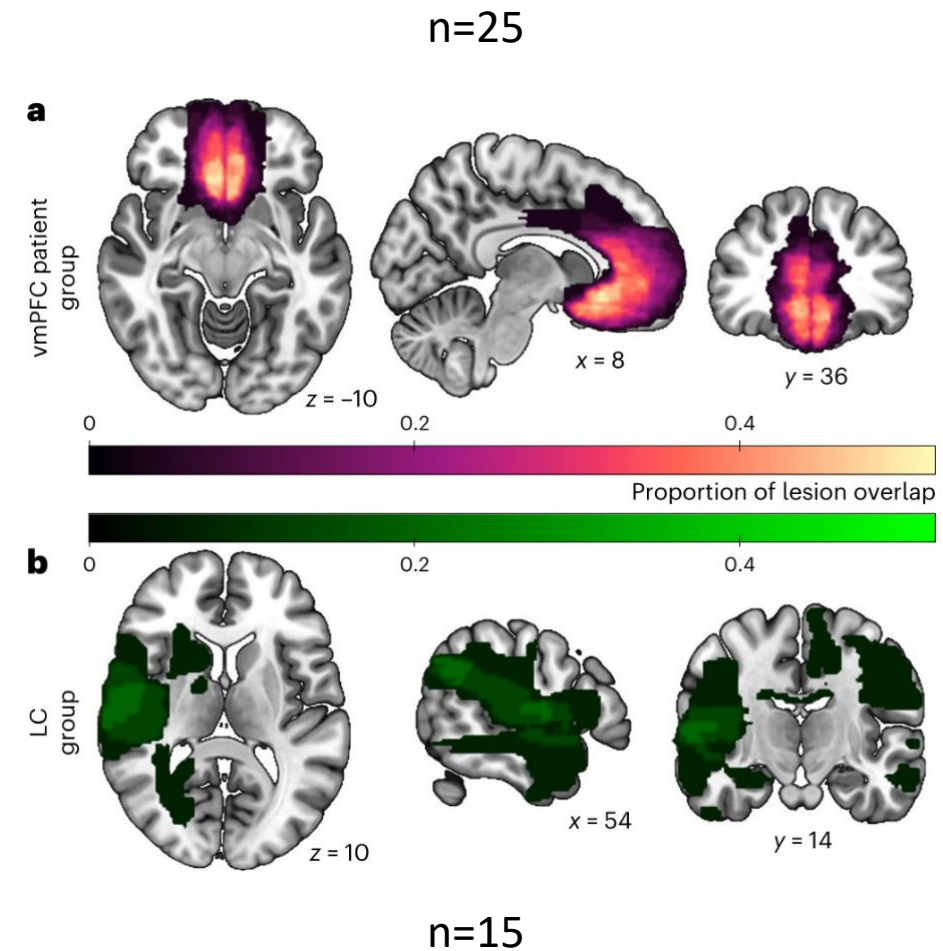
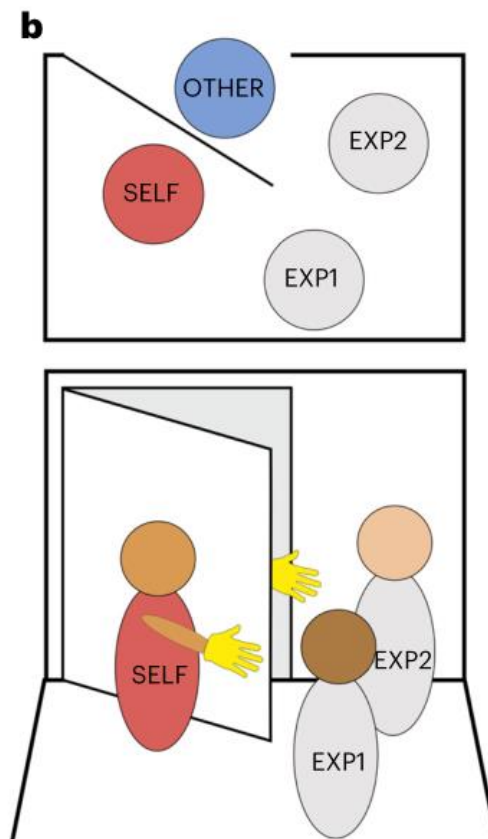
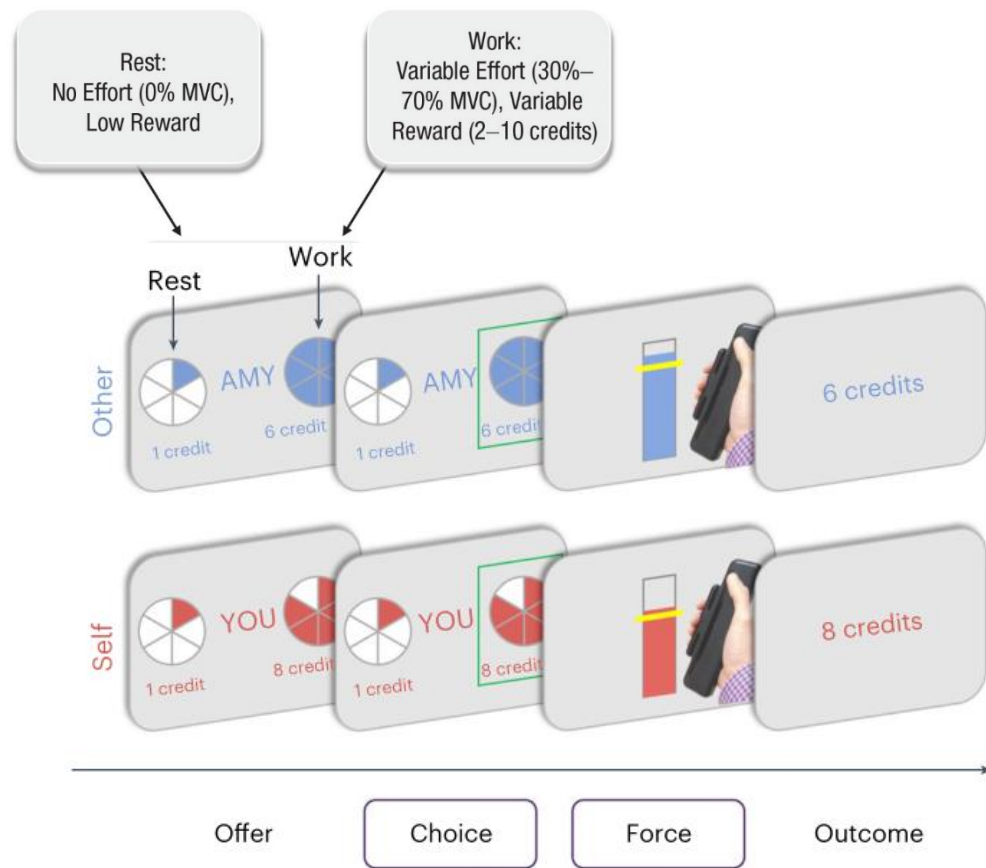
- increased willingness to cooperate with a group



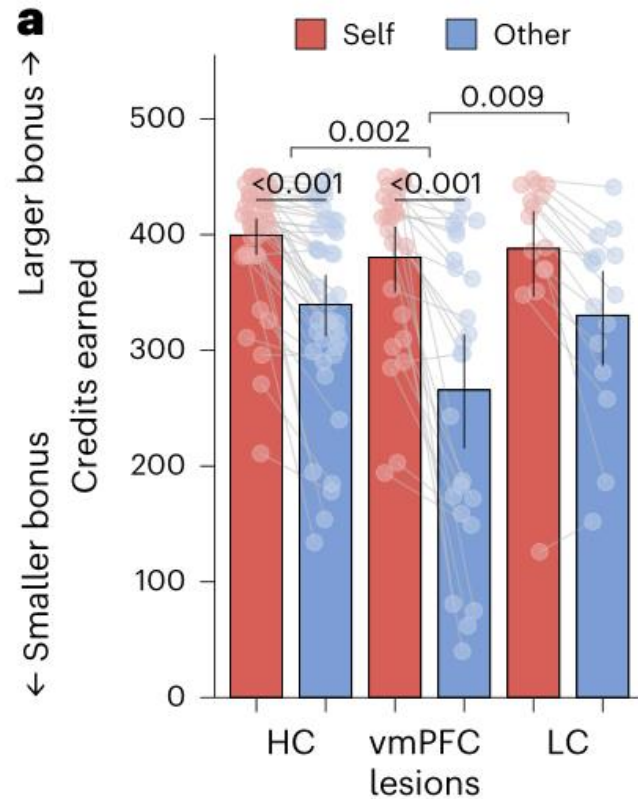
✓ whether studies use real weather than hypothetical social situations

✓ economic games cannot dissociate whether any differences in prosocial behaviour

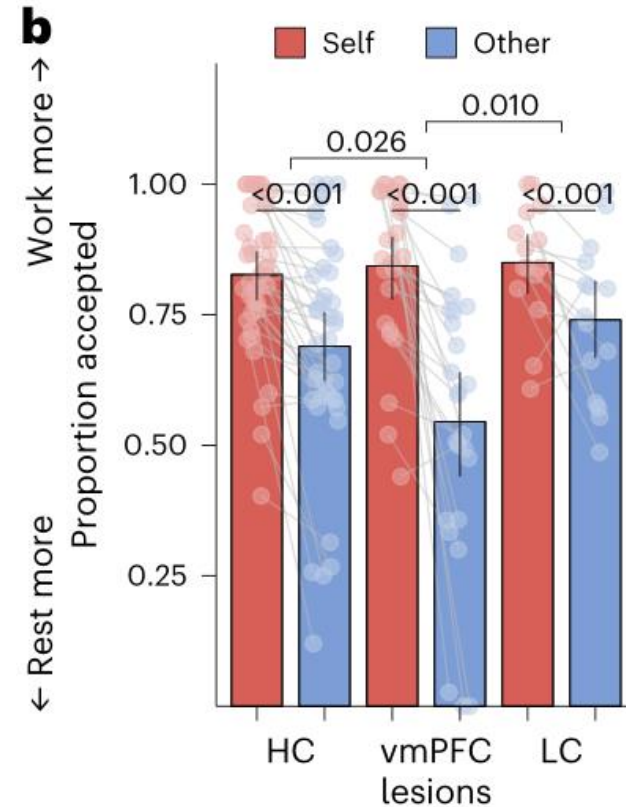
Design



Result

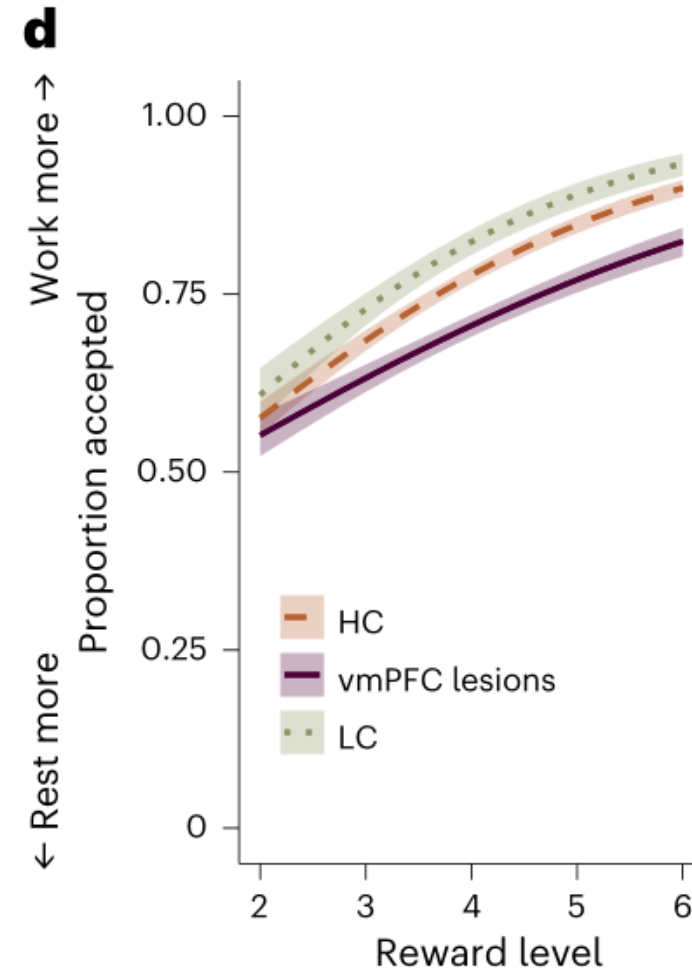
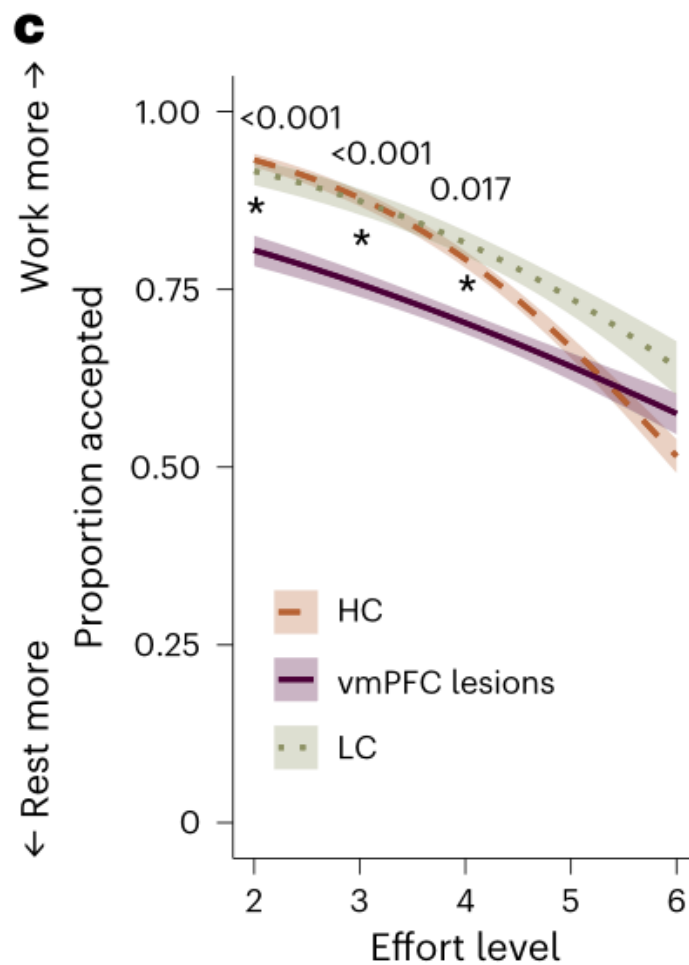


Patients with vmPFC damage earn less for the **other** person



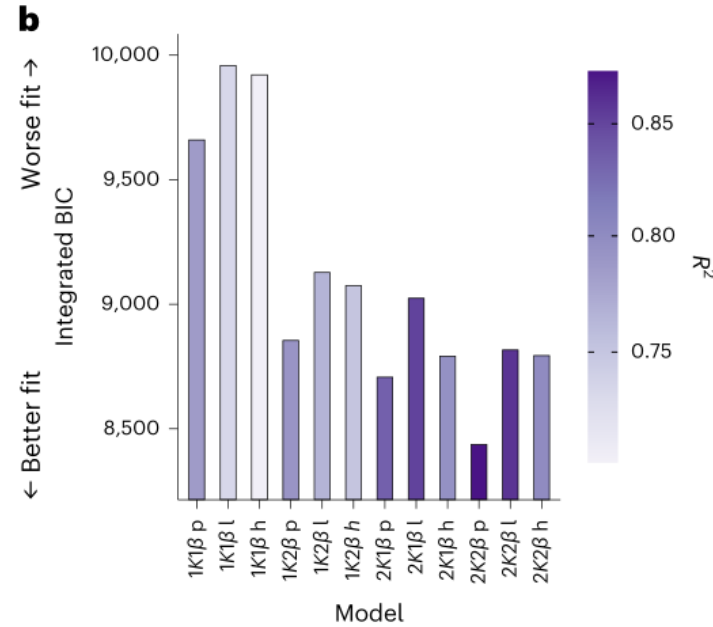
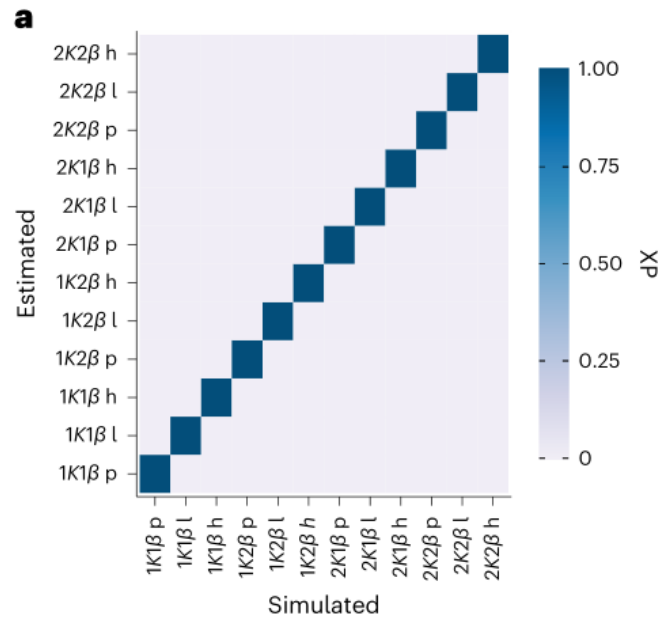
Damage to vmPFC **decreases prosocial behaviour**

Result



vmPFC lesions **decrease EFFORT** sensitivity (but no REWARD)

Result

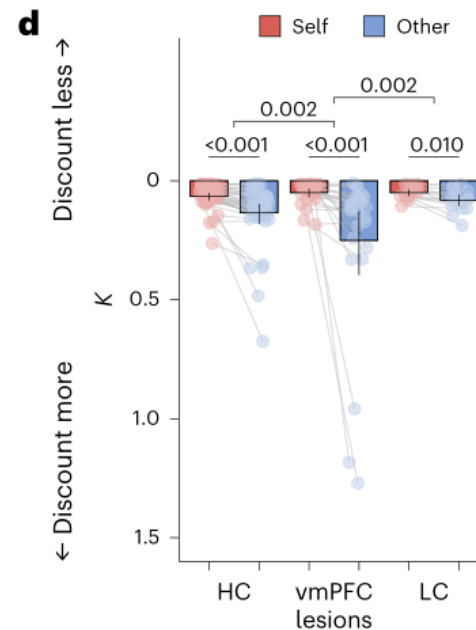
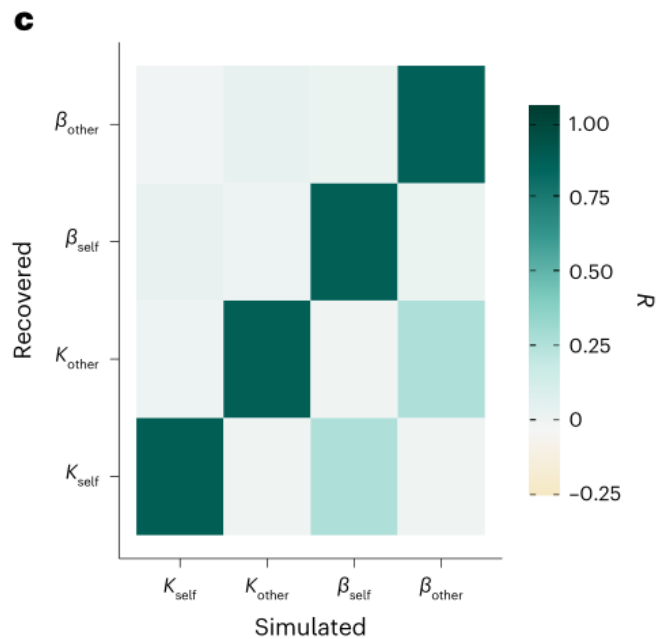


effort devalues the reward \rightarrow K parameter

choice consistency \rightarrow β parameter

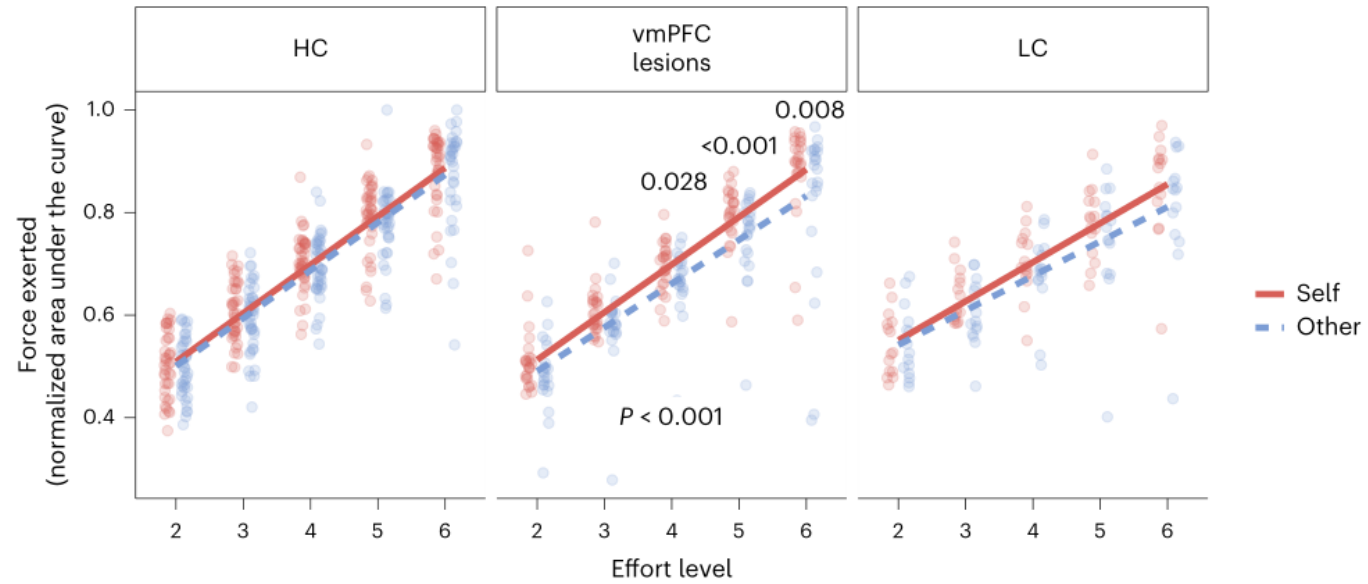
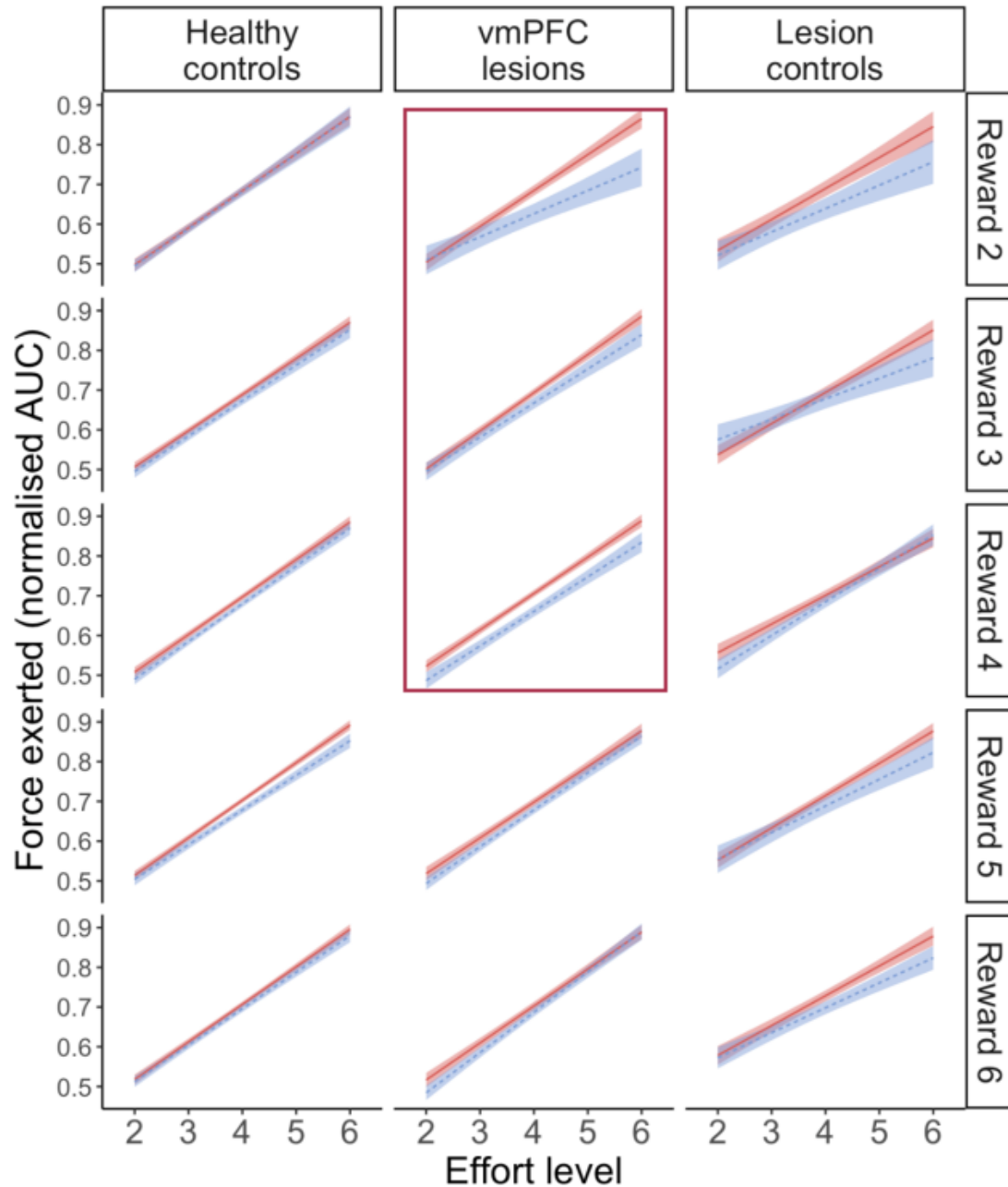
Uniqueness of Parameter Estimation

Reliability of Inferences



vmPFC lesions increase the discounting of prosocial rewards

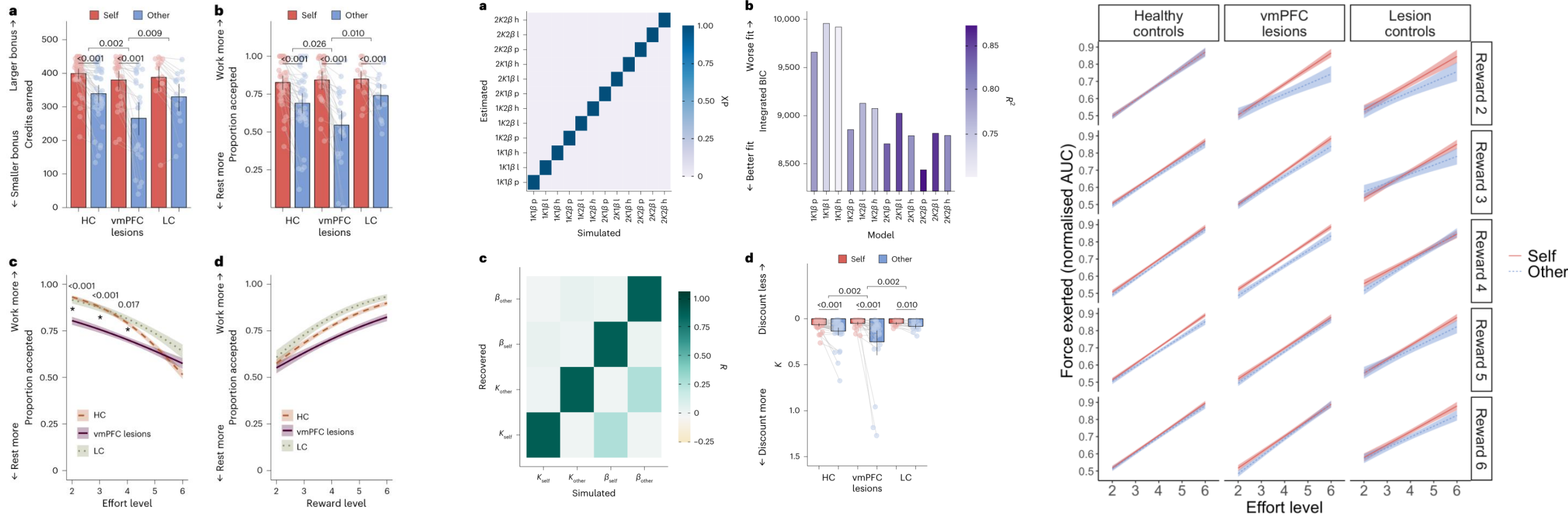
Result



Patients with vmPFC damage
exert less force to help others

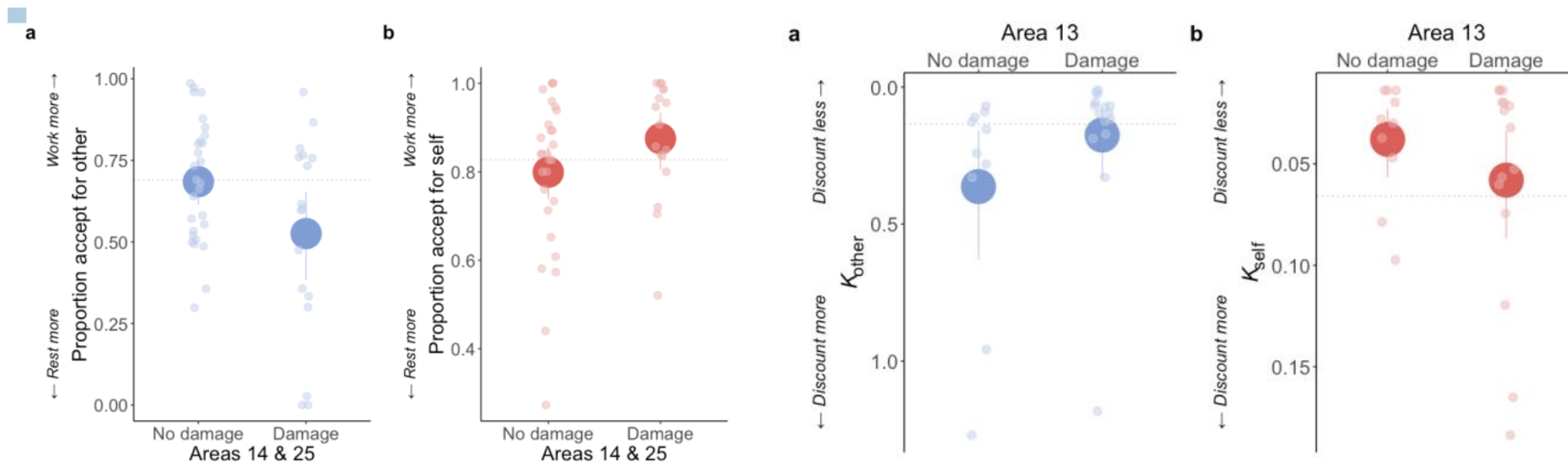
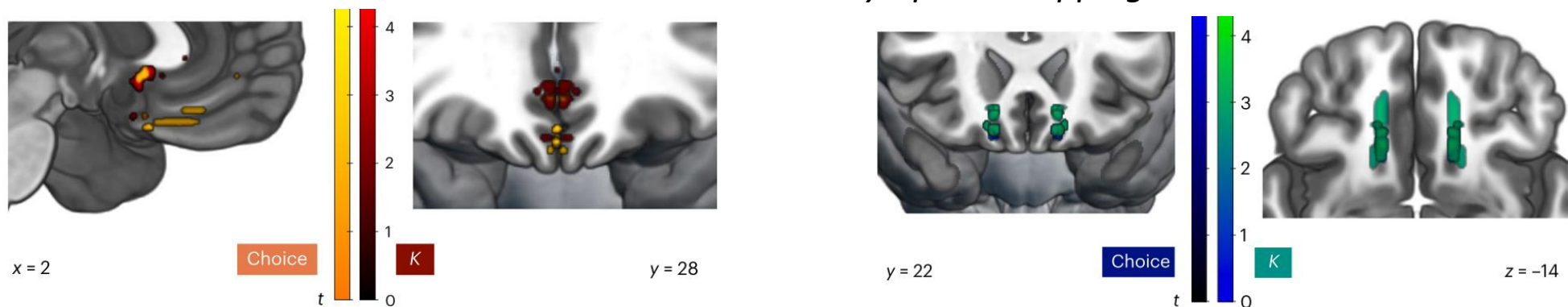
particularly for the smallest
rewards (in high effort)

Result



➤ Lesions in vmPFC also led to a lower willingness to energize actions, even after deciding to help others.

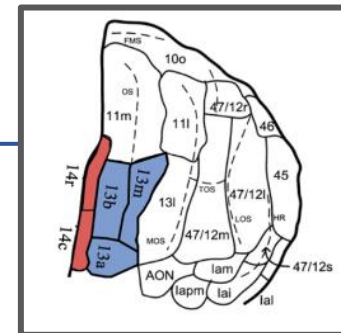
Dissociable effects of medial versus lateral vmPFC damage

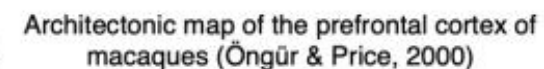
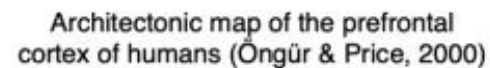


Result

Dissociable effects of medial versus lateral vmPFC damage

*VLSM (Voxel-Based Lesion Symptom Mapping, 基于体素的损伤症状映射)





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