

# Parsing the role of dopamine in reward discounting and subjective value Jaime J. Castrellon<sup>1</sup>, Gregory R. Samanez-Larkin<sup>1,2</sup> <sup>1</sup>Department of Psychology, Duke University, <sup>2</sup>Center for Cognitive Neuroscience, Duke University

### Introduction

Some people are more willing to make impulsive, risky, or costly choices than others, which is assumed to be strongly associated with individual differences in dopamine (DA) function. However, there are inconsistencies in findings relating DA to discounting. Across three studies, we sought to better clarify the role of DA function in discounting behavior and subjective value neural representations.

## Methods



[11C]FLB 457 18F Itallypride [18F]fallypride Adult Lifespan Sample Adult Lifespan Sample Young Adult Sample Options RT<10s \$10.00 \$16.00 1 Month 2 Months Choice \$16.00 \$10.00 2 Months Month ITI 10s - RT Cortical BP<sub>ND</sub> 5+ Striatal BP<sub>ND</sub> 25+

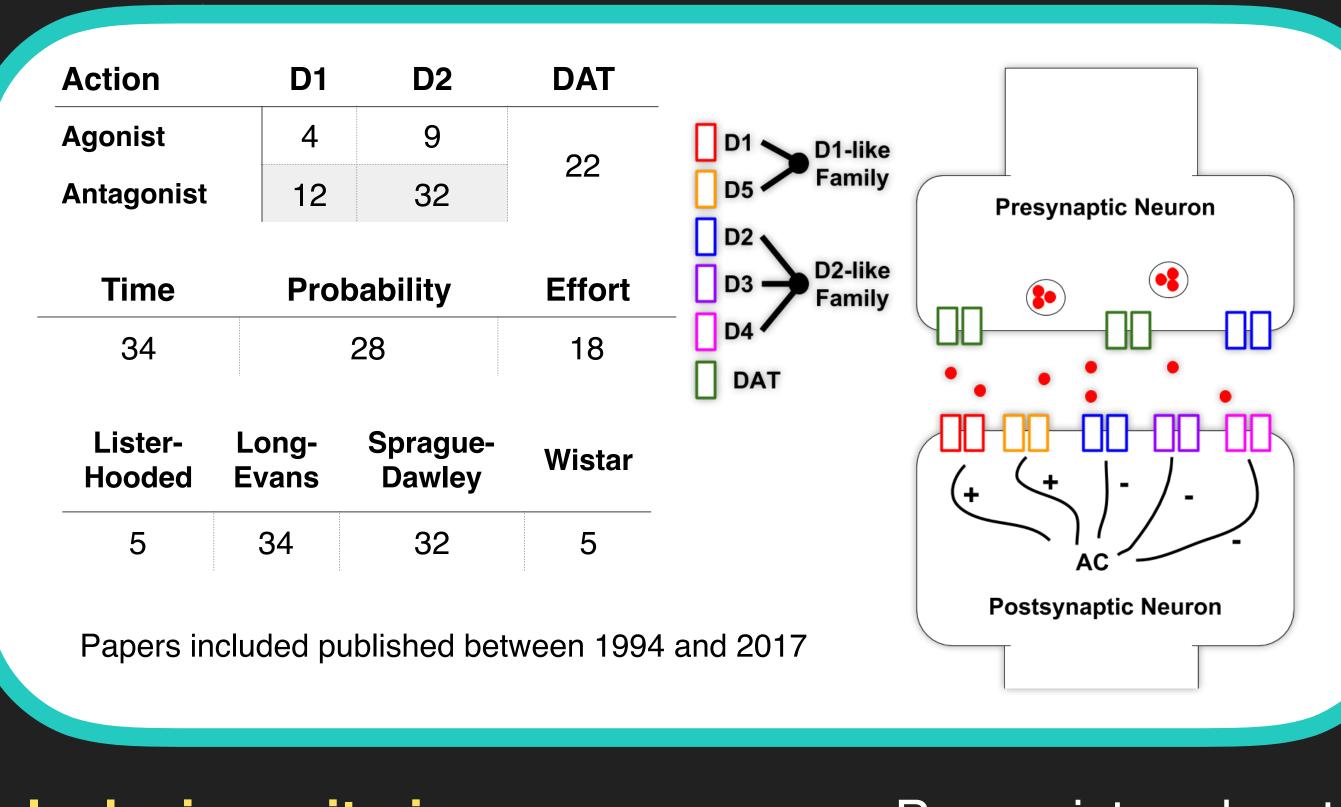


Left: Average D2 BPND across 3 study samples and 2 radiotracers. **Right**: Delay discounting task setup

Study 2

Left: Average D2 BPND in the striatum **Right:** ROI from which BP was extracted in the ventral striatum; ROIs in the vmPFC and midbrain from which SV fMRI signal was extracted

30 **BP**ND Mmmmhh 2.0 SV across task time



Inclusion criteria

Study 3

- Discounting task
- Healthy mammals
- DA drug that binds to D1, D2, or DAT
- Placebo-controlled studies

• Pre-registered meta-analysis Initial library of 34 studies PubMed search expanded to 1,309 papers

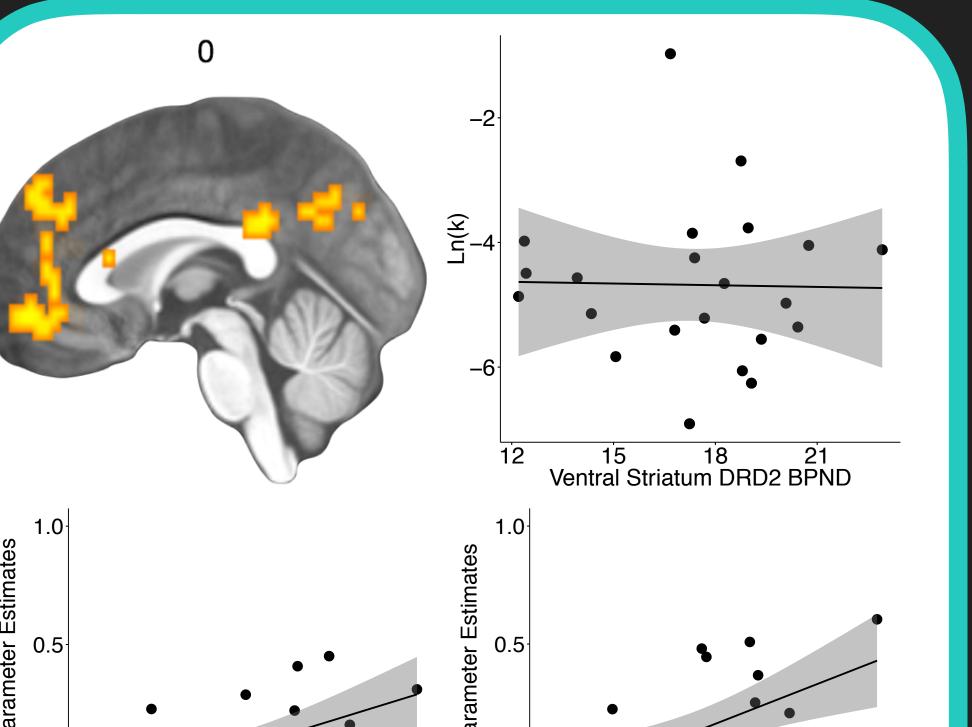
### Results

#### Study 1 No correlation between DA D2 receptors and discounting in healthy adults.

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VS D2 receptor availability correlates with SV but not discounting.



#### Amygdala BP Hippocampus BP Insula BP<sub>ND</sub> ACC BP Putamen BP<sub>ND</sub> Thalamus BP Caudate BP<sub>ND</sub> Midbrain BP Ventral Striatum BP<sub>ND</sub>

#### **Dopamine and Discounting**

Joutsa 2015 (HC, D2R)

present study (HC, D2R)

Crunelle 2004 (ADHD, DAT)

Eisenstein 2015 (OB, D2R)

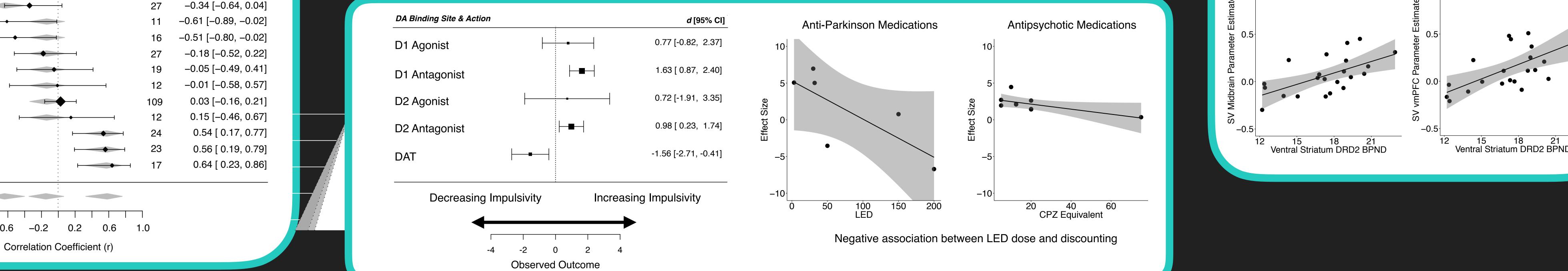
Joutsa 2015 (HC, DR)

Joutsa 2015 (PD, SC)

Source	Ν	Correlation [95% CI]
Joutsa 2015 (PG, DR) →	12	–0.89 [–0.97, –0.65]
Joutsa 2015 (PG, D2R)	12	-0.70 [-0.91, -0.21]
Oberlin 2015 (NTSA, D2R)	10	–0.65 [–0.91, –0.03]
Ballard 2015 (MA, D2R)	27	-0.34 [-0.64, 0.04]
Oberlin 2015 (HC, D2R) →	11	-0.61 [-0.89, -0.02]
Smith 2016 (HC, SC)	16	-0.51 [-0.80, -0.02]
Ballard 2015 (HC, D2R)	27	-0.18 [-0.52, 0.22]
Eisenstein 2015 (HC, D2R)	19	-0.05 [-0.49, 0.41]

### Study 3

### Not all DA drugs impact discounting behavior. DAT blockers reduce impulsive choice. No distinction between agonist and antagonist drugs that bind to D1R or D2R.



### Conclusions

These findings suggest that some long-held assumptions about individual differences in dopamine function and reward discounting may be more nuanced than previously believed. This work was supported by the following grants: NIDA R21-DA033611, NIA R00-AG042596, NIA R01-AG044838, and an NSF Graduate Research Fellowship We thank all those who contributed to the OpenNeuro platform, which facilitated this analysis.