

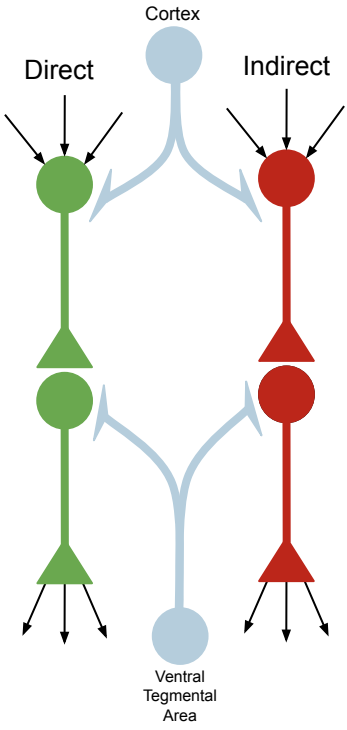
D2 dopamine receptor density, sensitivity to rewards, and learning in a complex value-based decision-making task

Cristina Bañuelos

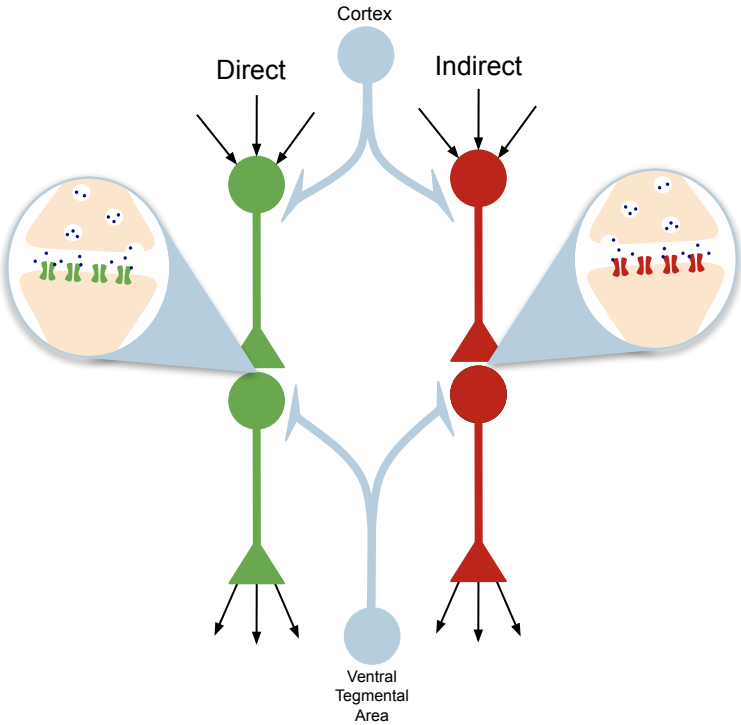


NMC4
December 2021

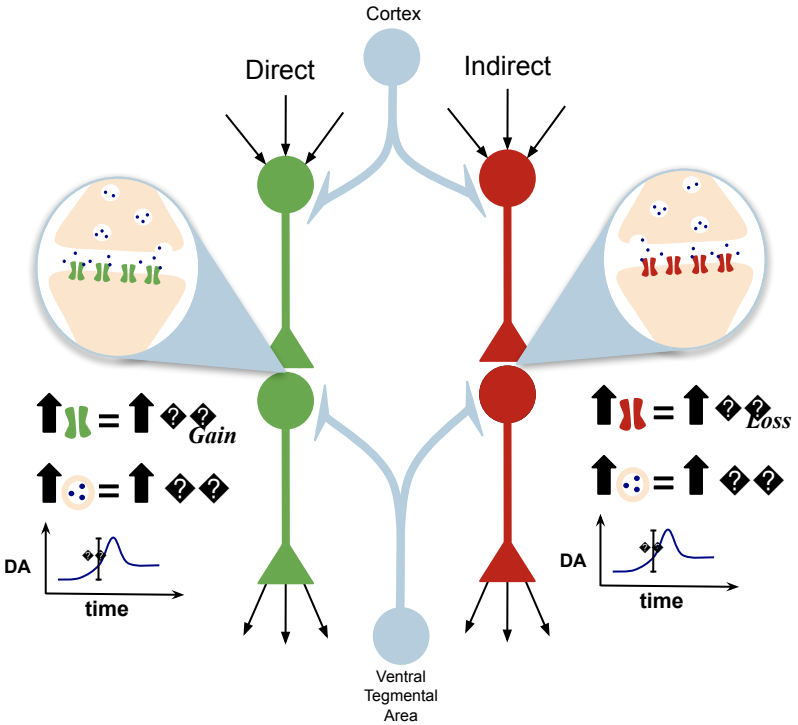
A



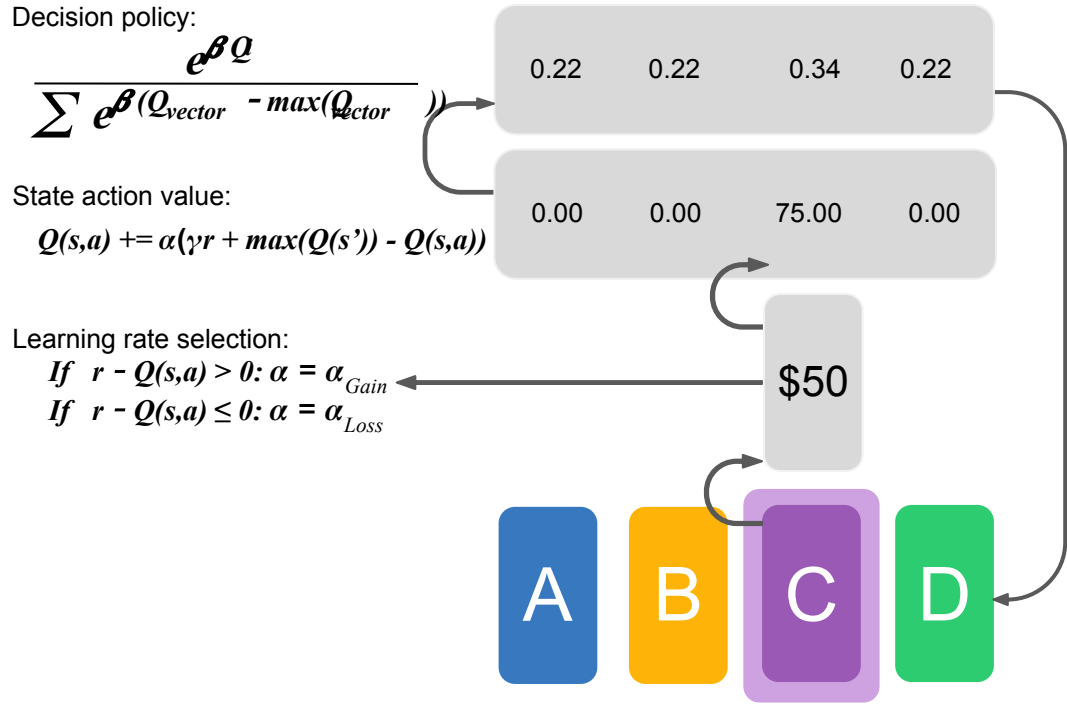
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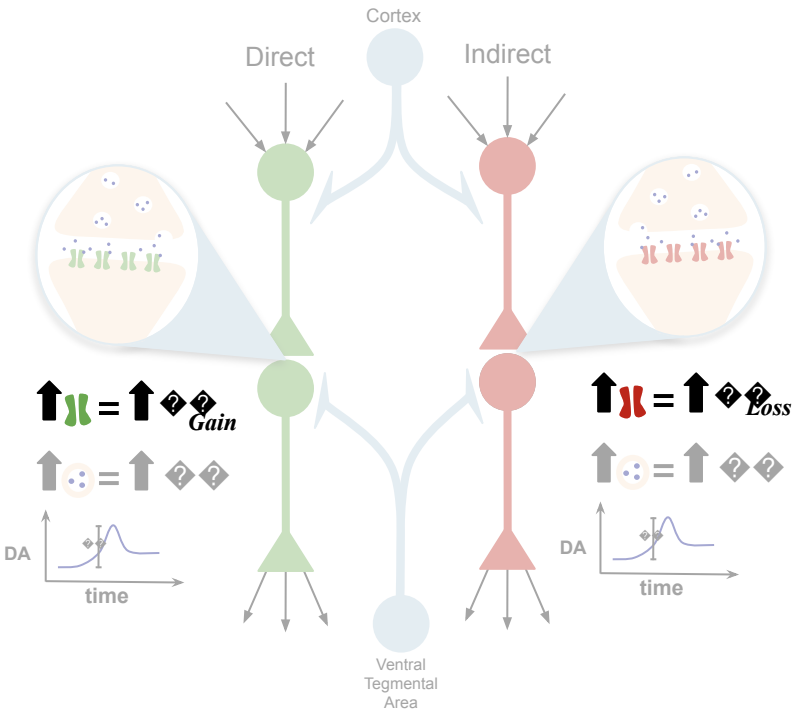
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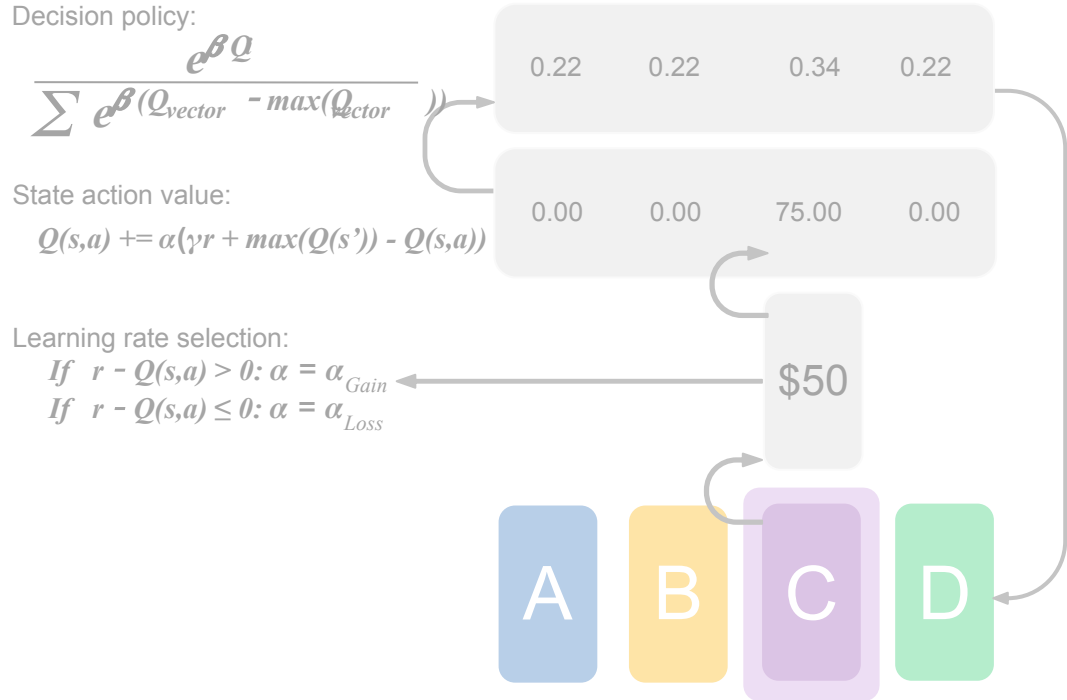
B



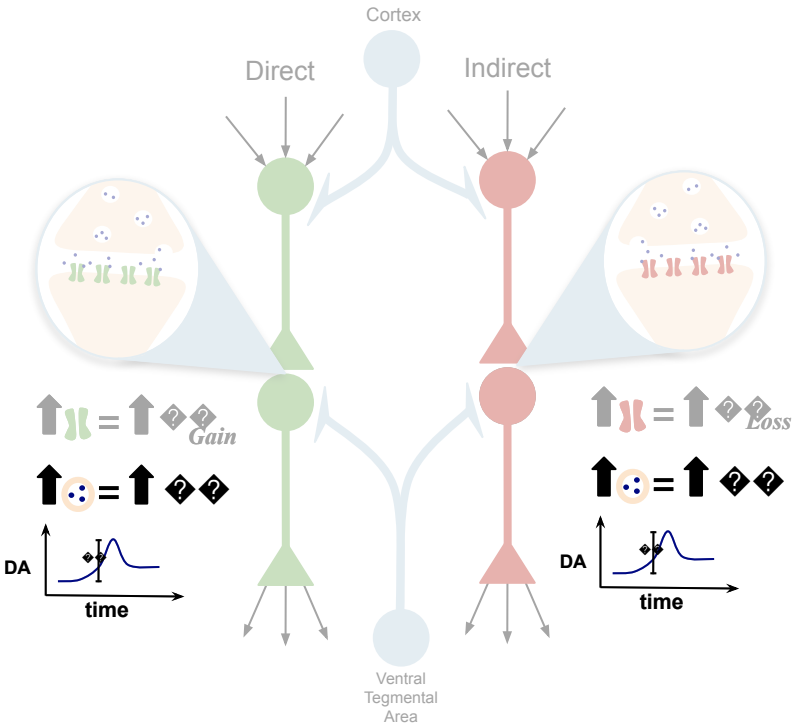
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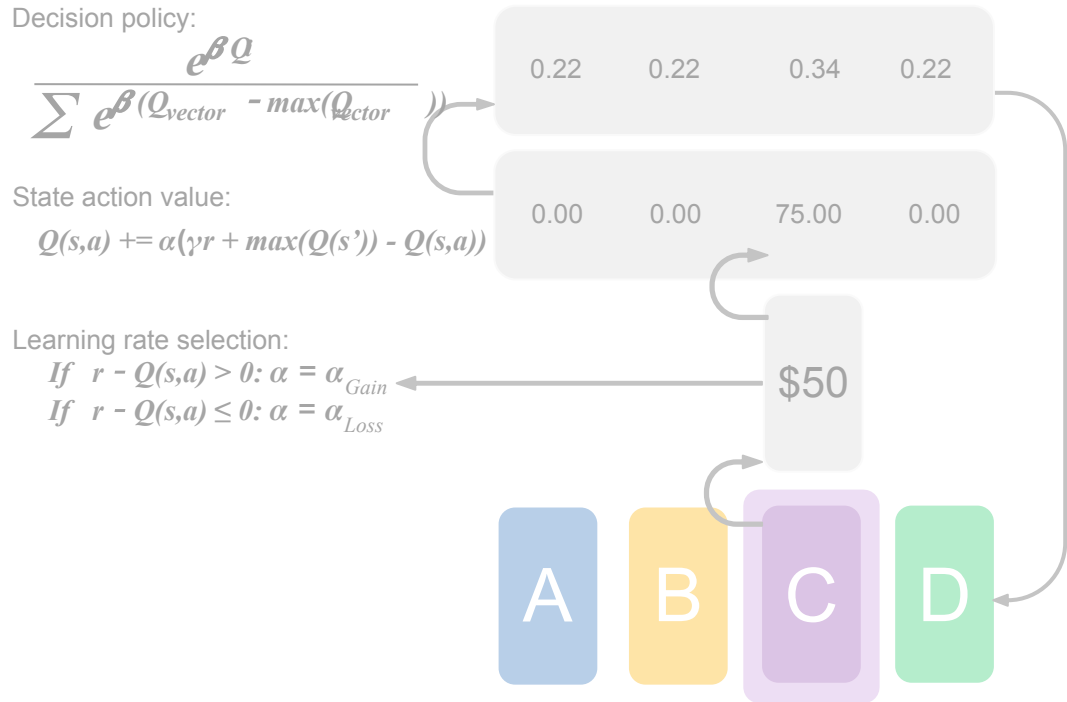
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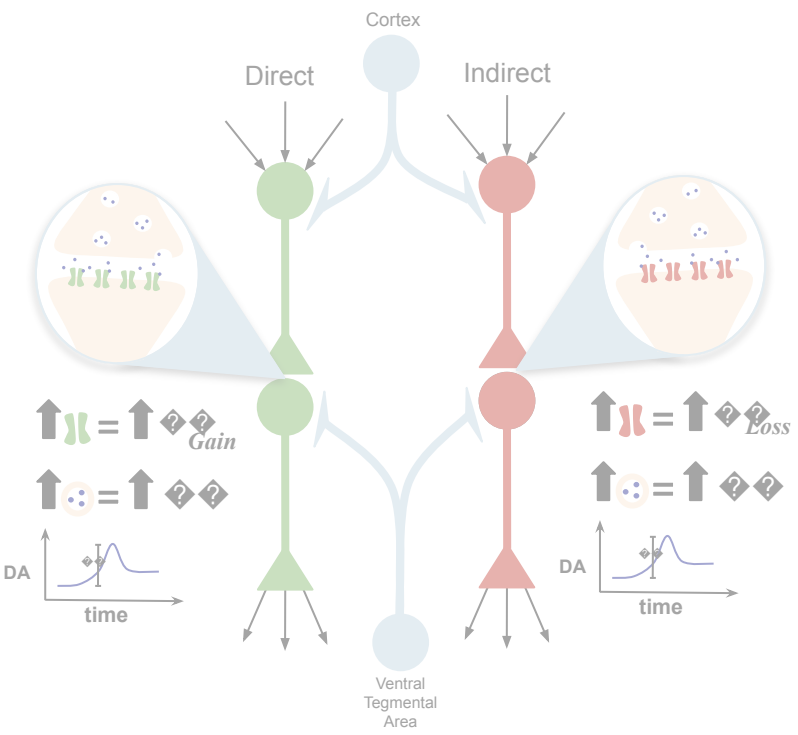
A



B



A



B

Decision policy:

$$\frac{e^{\beta Q}}{\sum e^{\beta(Q_{vector} - \max(Q_{vector}))}}$$

State action value:

$$Q(s,a) += \alpha(\gamma r + \max(Q(s')) - Q(s,a))$$

Learning rate selection:

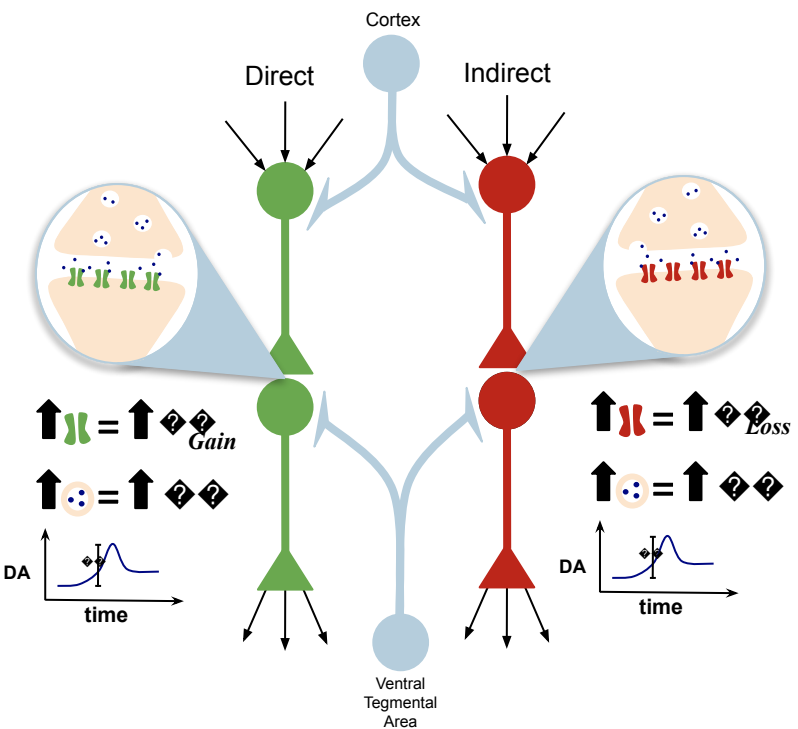
If $r - Q(s,a) > 0$: $\alpha = \alpha_{Gain}$
 If $r - Q(s,a) \leq 0$: $\alpha = \alpha_{Loss}$

	0.22	0.22	0.34	0.22
State action value:	0.00	0.00	75.00	0.00
Frequency of Reward:	Low	High	Low	High
Net Yield:	Loss	Loss	Gain	Gain

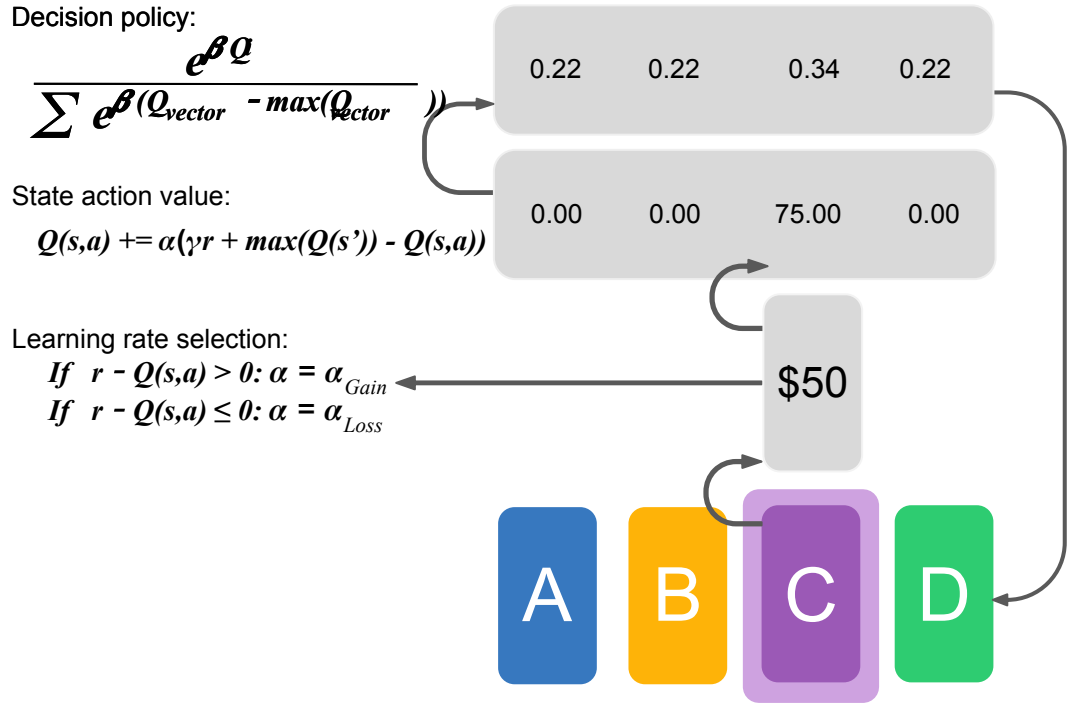
\$50

A B C D

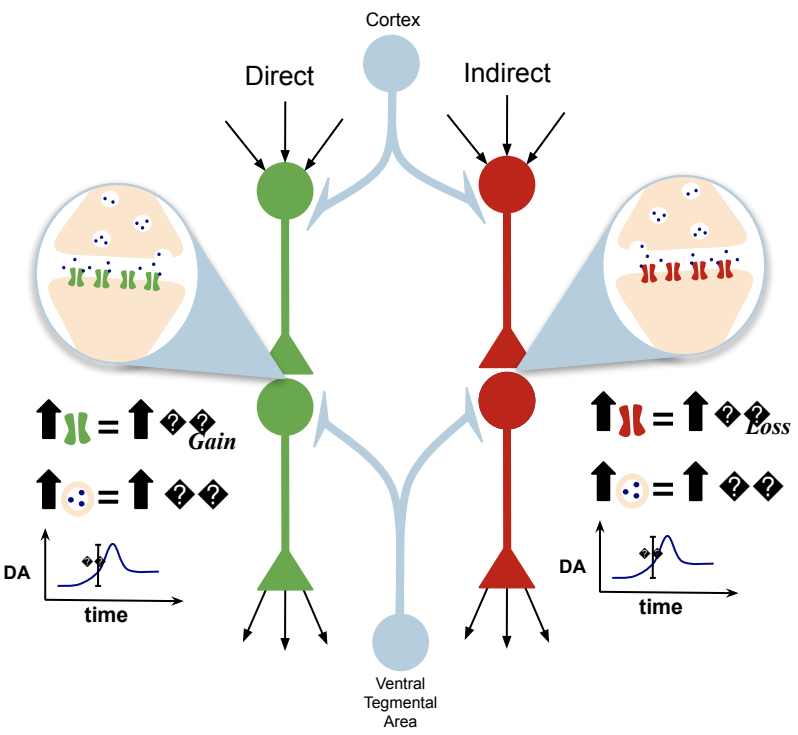
A



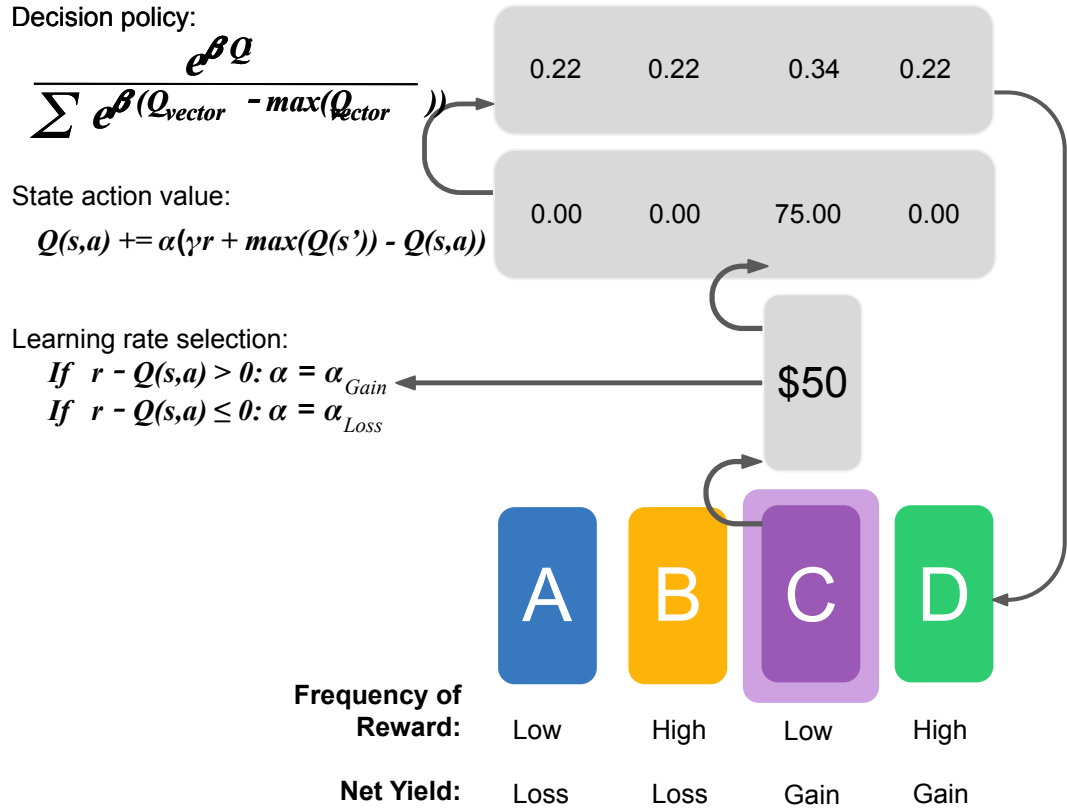
B



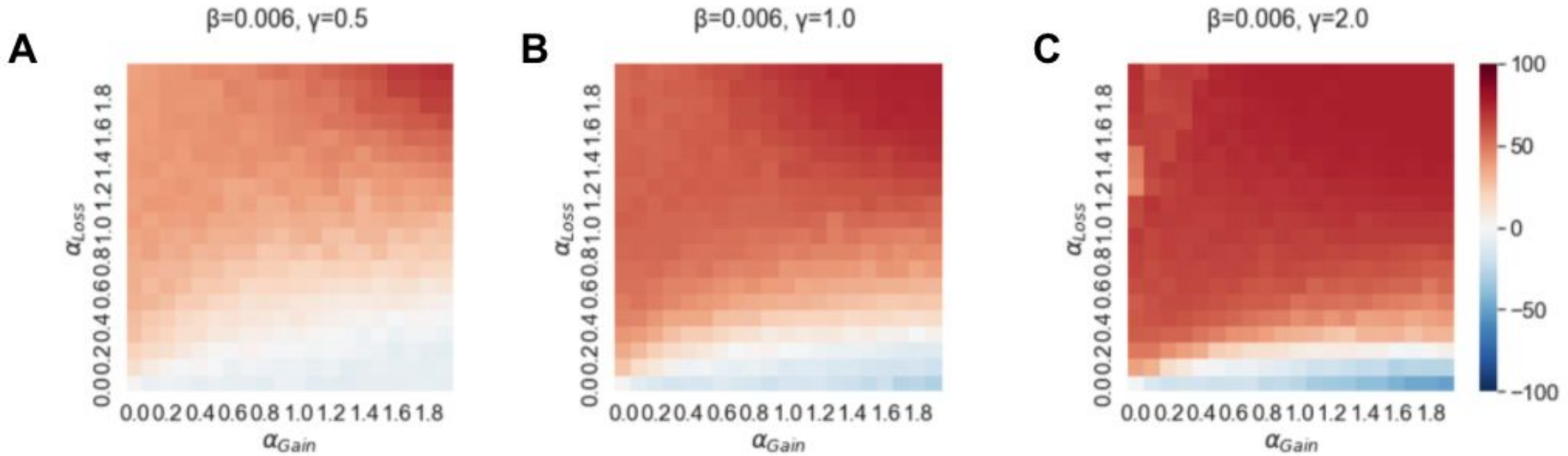
A



B



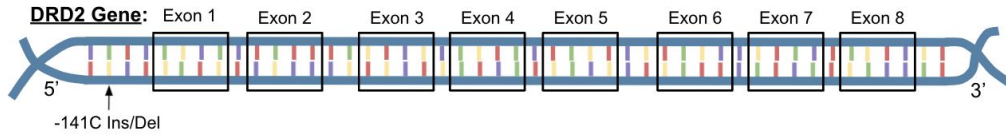
Payoff Heat Maps



Hypothesis

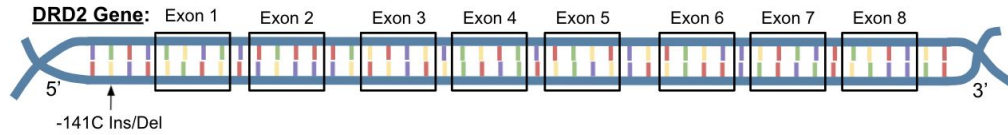
- This simple model predicts that asymmetries in **learning on gains versus losses**, due to asymmetries in D1 versus D2 receptors, can interact with **reward reactivities**, or phasic dopamine signals, to determine the efficacy of value-based decision-making.

Methods

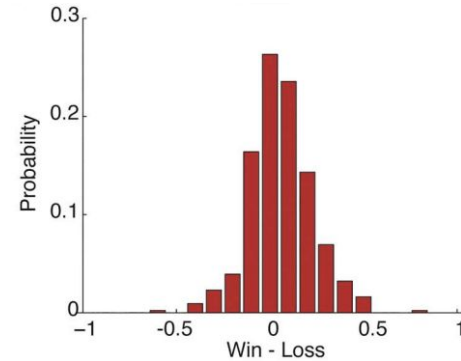
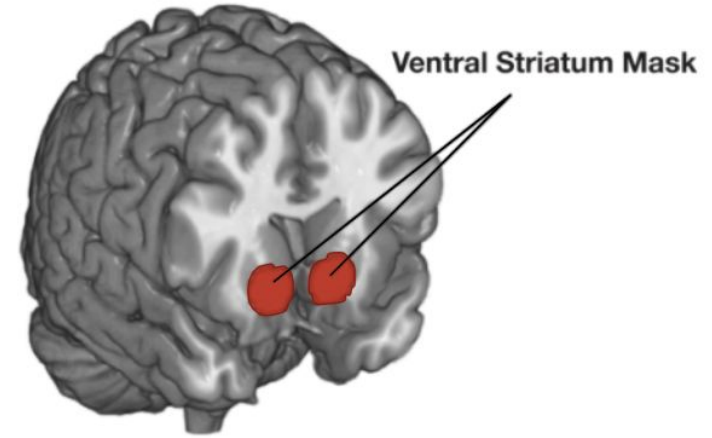


438 participants (119 carriers and 319 non-carriers)

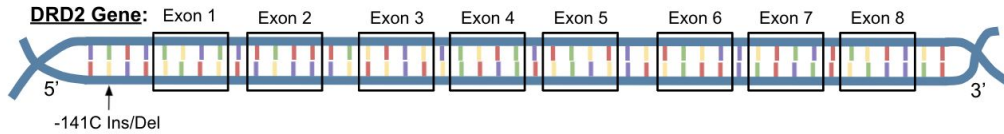
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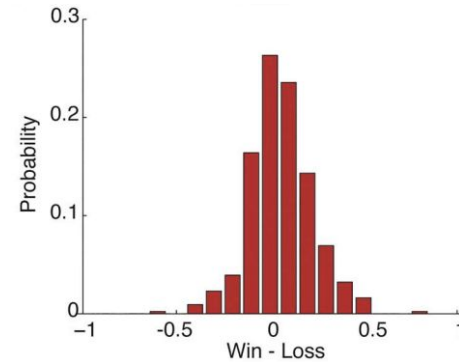
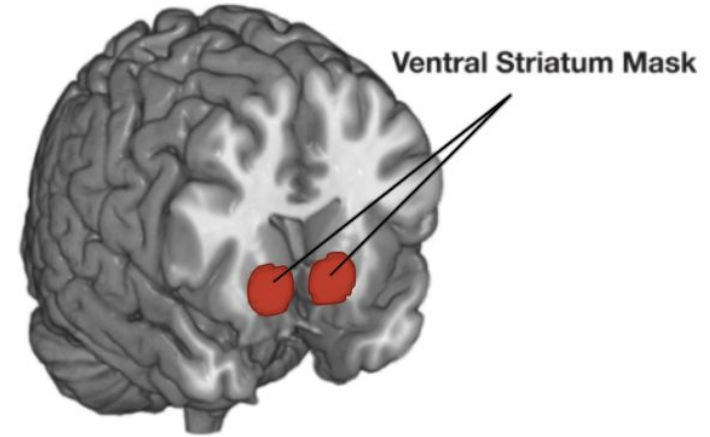
Methods



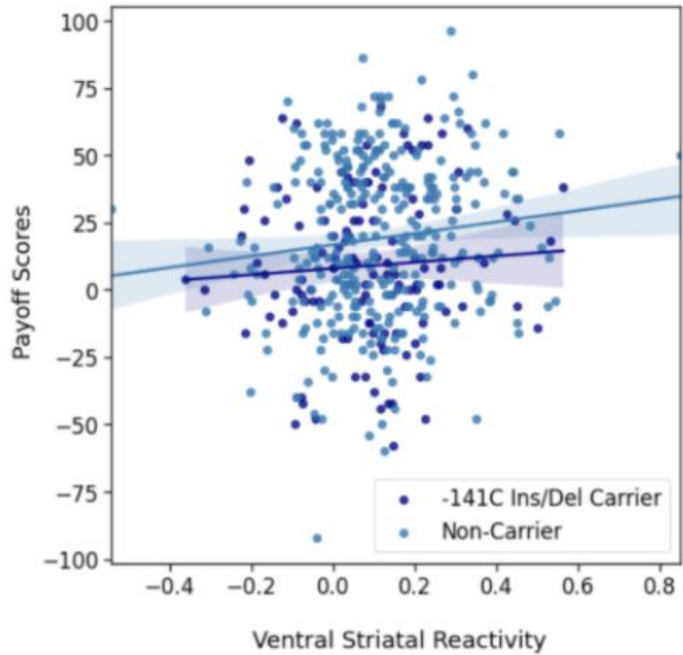
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	A	B	C	D
Frequency of Reward:	Low	High	Low	High
Net Yield:	Loss	Loss	Gain	Gain

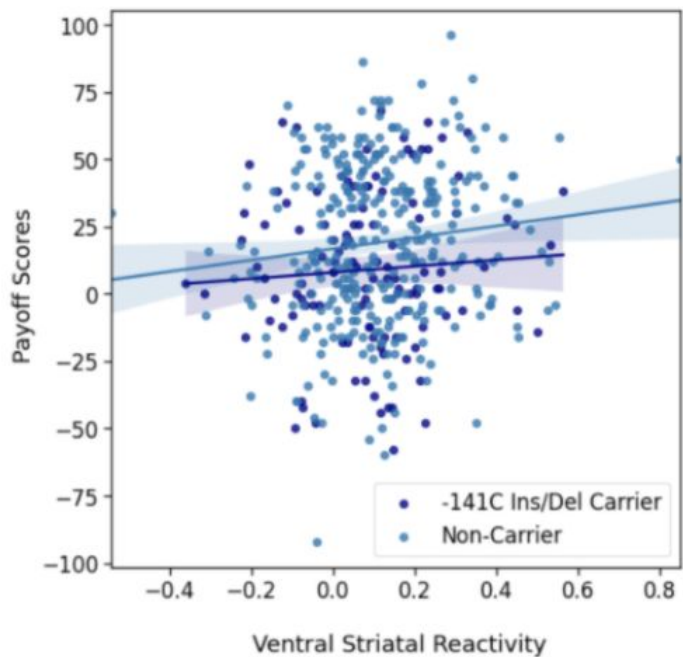
$$\text{Payoff} = (C + D) - (A + B)$$



Payoff vs Ventral Striatal Reactivity between DRD2 groups

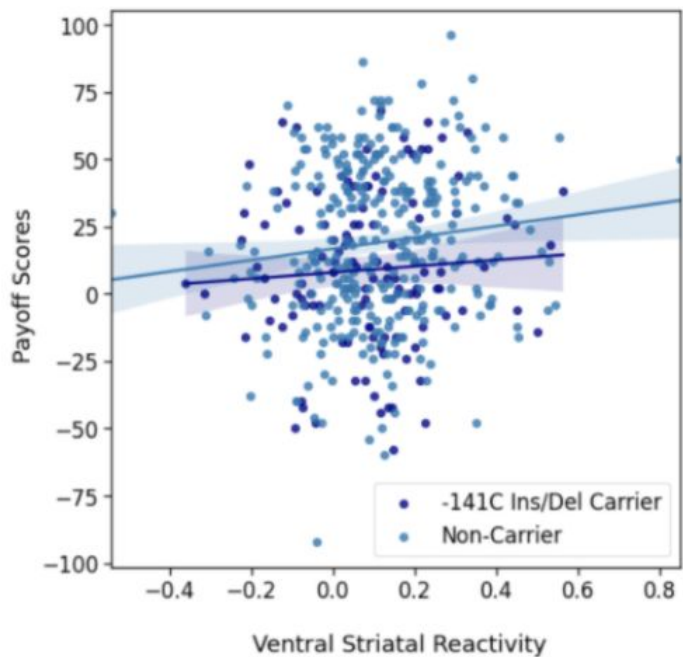


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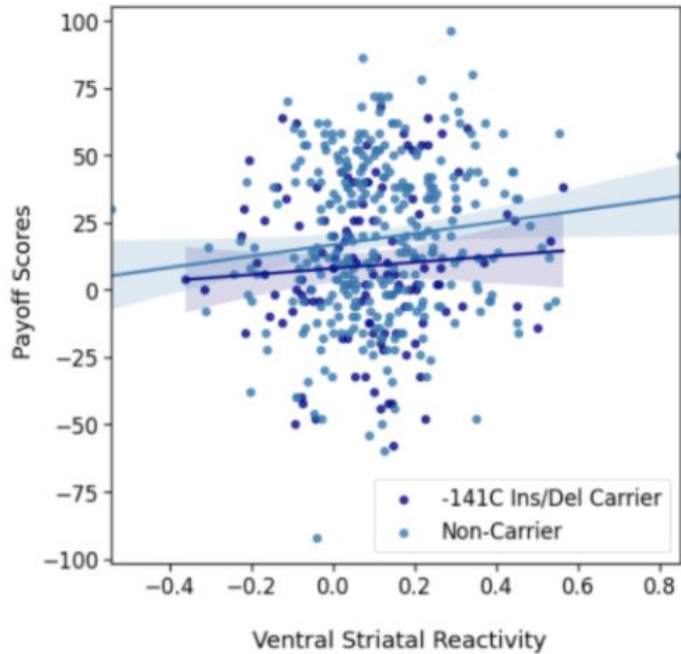
	Coef.	Std. Err.	t	P> t	[0.025	0.975]
Intercept	16.704	2.020	8.269	0.000	12.733	20.674
DRD2	-8.790	3.634	-2.419	0.016	-15.932	-1.649
VS	21.140	10.020	2.110	0.035	1.447	40.833
DRD2:VS	-9.573	18.830	-0.508	0.611	-46.582	27.436

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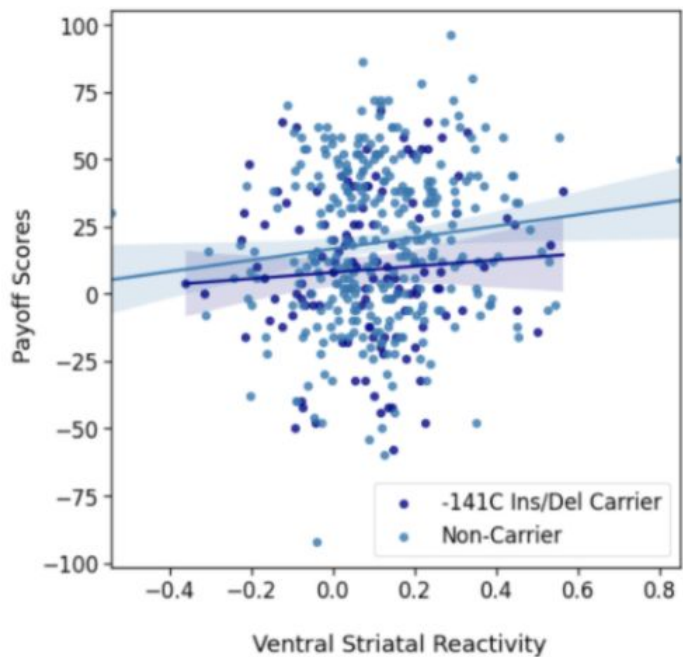
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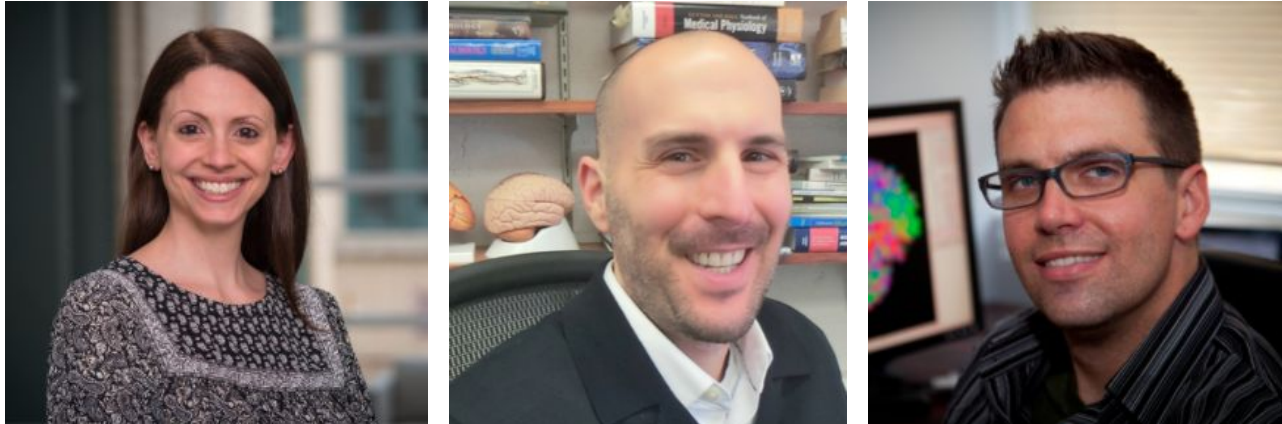


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Take home message

- Having lower D2 receptor density or lower reactivity to reward feedback leads to an overall lower ability for value-based decision-making
- Contrary to our primary hypothesis, we **did not** see an interaction between D2 receptor density and reactivity to reward feedback in the ability to perform value-based decision-making.
- There is **inconclusive evidence** that lower sensitivity to negative feedback signals in D2-sensitive pathways interacts with reward reactivity to determine the effectiveness of learning during value-based decision-making.

Acknowledgements



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