

Impaired model-free decision-making is associated with aberrant striatal presynaptic dopamine in patients with schizophrenia during psychotic remission



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Background:

- Human **decision-making** = selection of behaviors
- Model-free** (i.e., relying only on previous outcomes) vs. **model-based** decision-making (i.e., applying cognitive models)
- Balance between model-free and model-based decision-making is associated with **ventral striatal dopamine** (Deserno, 2015)
- In **schizophrenia**:
 - aberrant striatal dopamine function**, particularly presynaptic dopamine **synthesis** capacity (Howes, 2012)
 - findings of impaired model-based (Culbreth, 2016) and model-free behavior (Gold, 2012)

→ Hypothesis:

Impaired balance of model-free/model-based decision-making is associated with aberrant striatal dopamine synthesis in schizophrenia during psychotic remission

Participants:

27 patients with chronic schizophrenia in psychotic remission and 25 healthy controls

Methods:

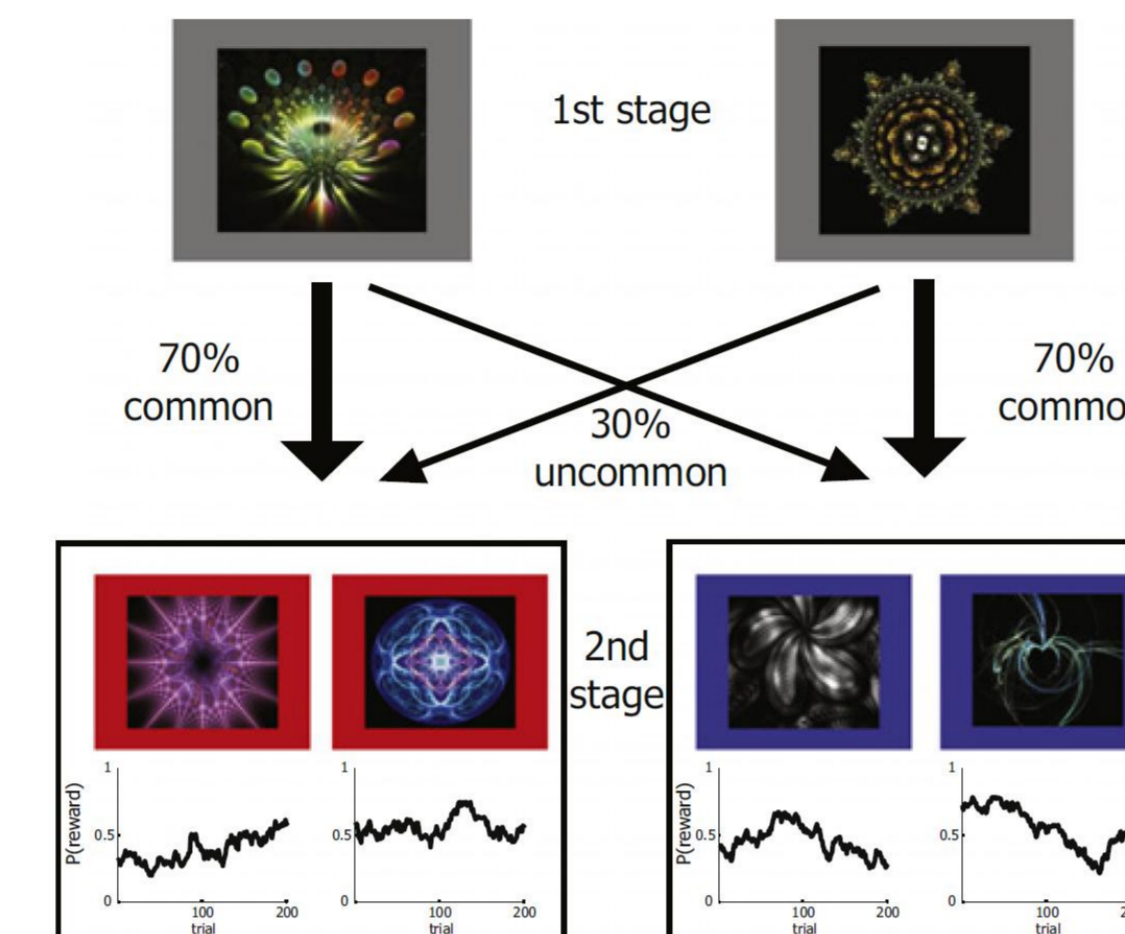
1. Model-based/model-free decision-making (DM):

- Sequential DM task

(Daw, 2011; Wunderlich, 2012)

- Computational model

-> **performance** parameters for model-free and model-based behavior



2. Presynaptic striatal dopamine synthesis capacity:

- ¹⁸FDOPA positron emission tomography (PET)

- Voxelwise graphical Patlak analysis for striatal subdivisions

-> k_i^{cer} (= influx constant of ¹⁸FDOPA with reference to cerebellum) averaged over each striatal subdivision

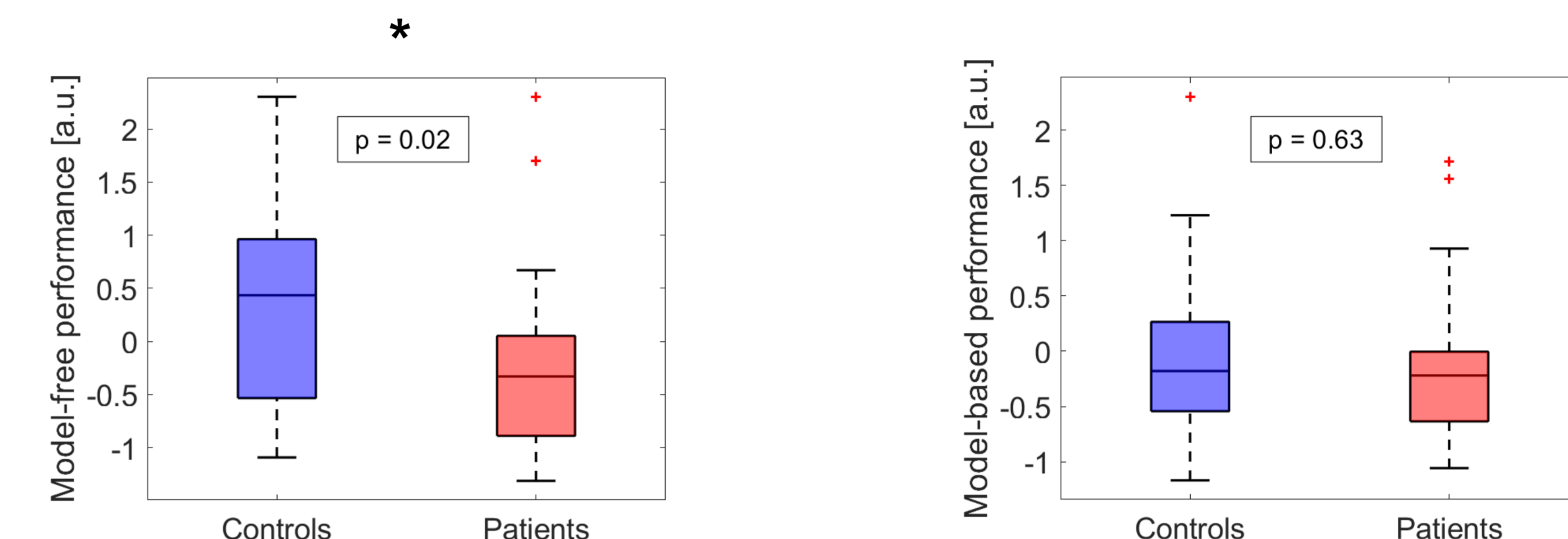
3. Association between model-free decision-making and dopamine:

ANCOVA:

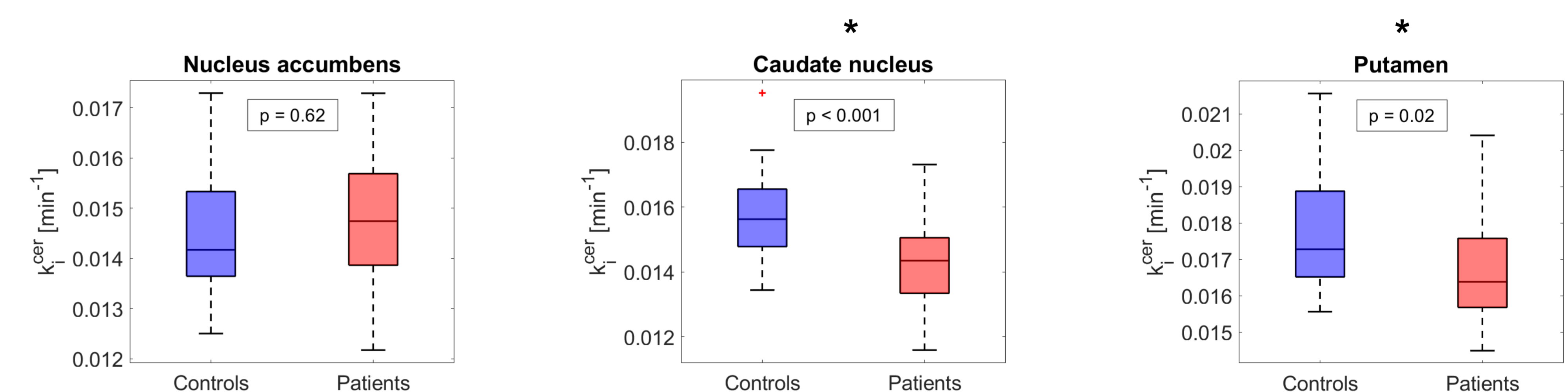
- dependent variable: model-free performance
- factors: Group and k_i^{cer} of striatal subdivisions
- > outcome of interest: **interaction Group x k_i^{cer}**

Results:

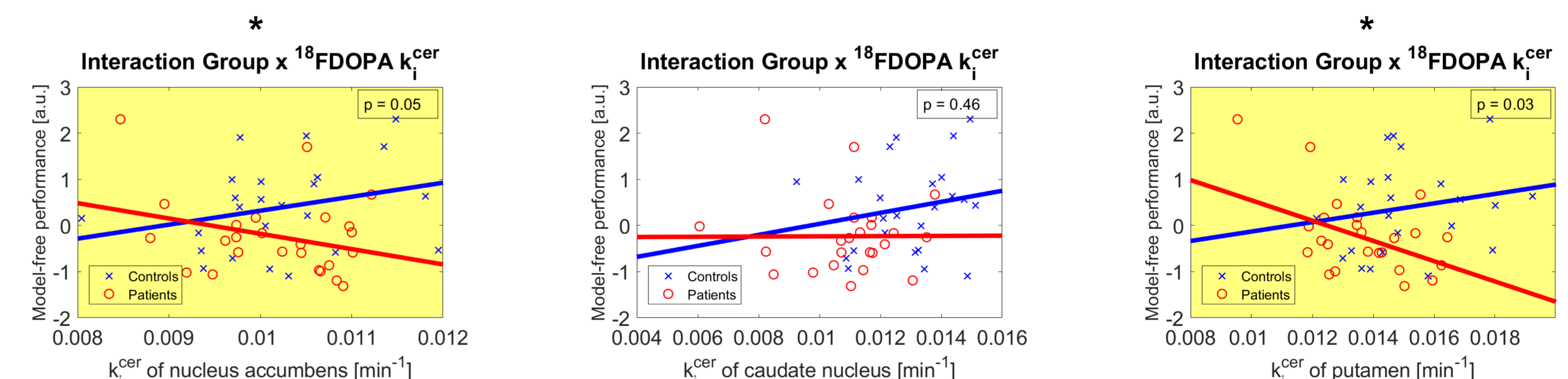
1. Patients with schizophrenia show selectively reduced model-free performance parameter:



2. Striatal dopamine synthesis is significantly reduced in patients with schizophrenia during psychotic remission in caudate nucleus and putamen:



3. The association between model-free performance and striatal dopamine synthesis in nucleus accumbens and putamen differs across groups:



Conclusions:

- In patients with **schizophrenia during psychotic remission**, **model-free but not model-based** decision-making is **impaired**
- The **association** between **model-free behavior** and **dopamine** synthesis in nucleus accumbens and putamen is **reversed in patients**

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