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CRIME, SECURITY AND LAW

Modeling cognitive deficits and enhancements in adversity-exposed youth using Drift Diffusion Modeling

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Developmental Science

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Cognitive deficits and enhancements in youth from adverse conditions: An integrative assessment using Drift Diffusion Modeling in the ABCD study

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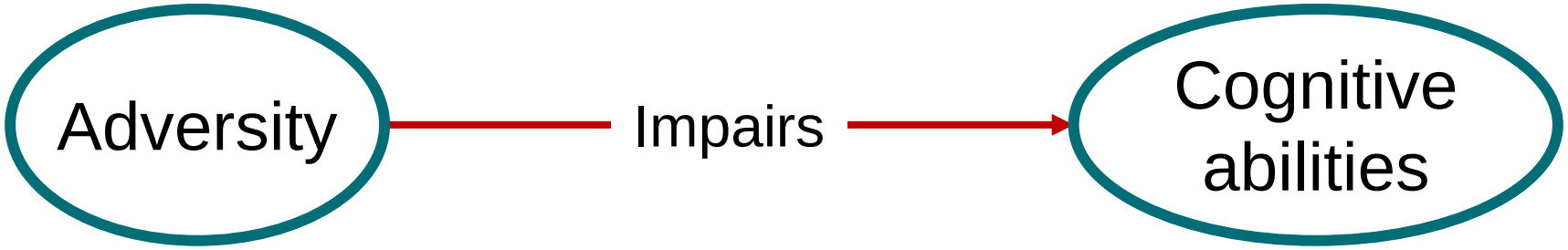
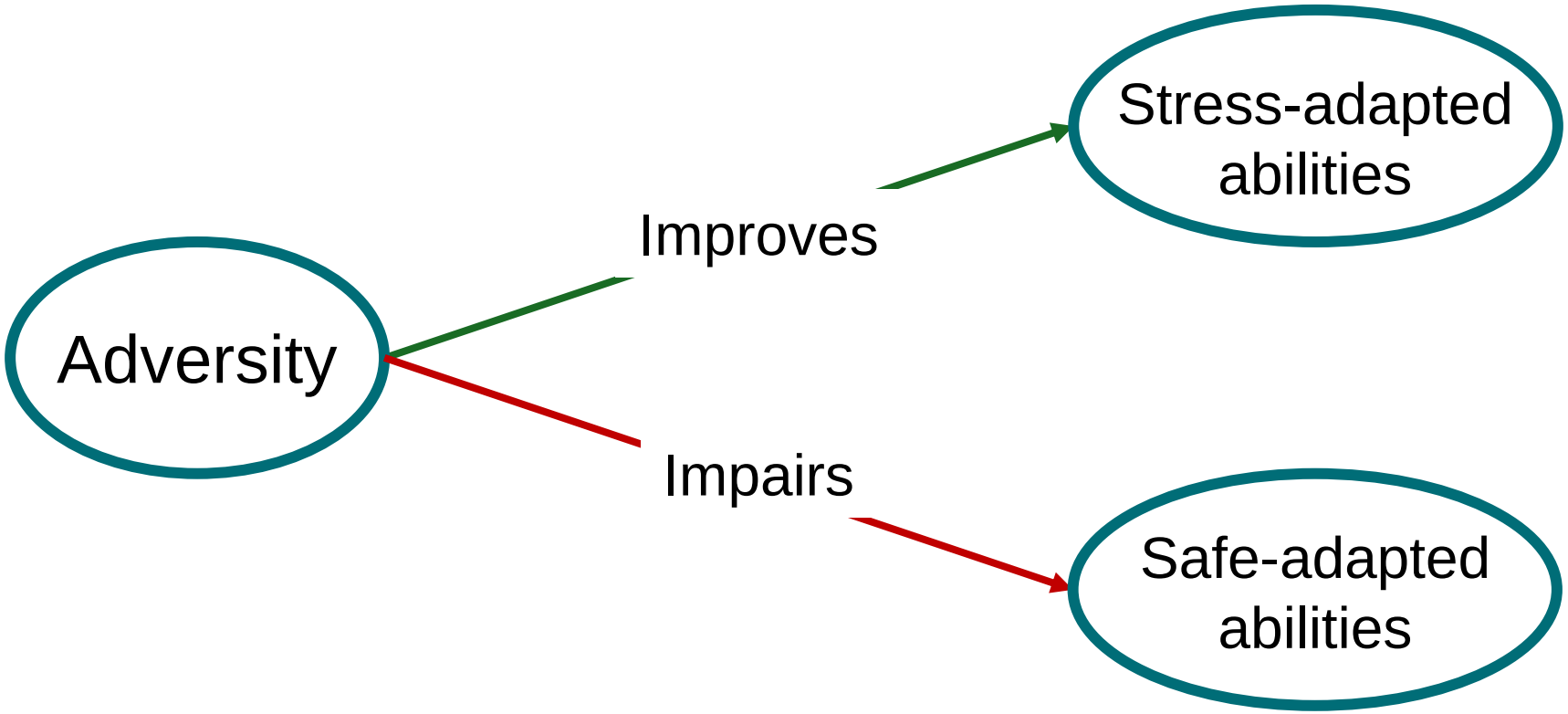
Cognitive deficits



Cognitive adaptations



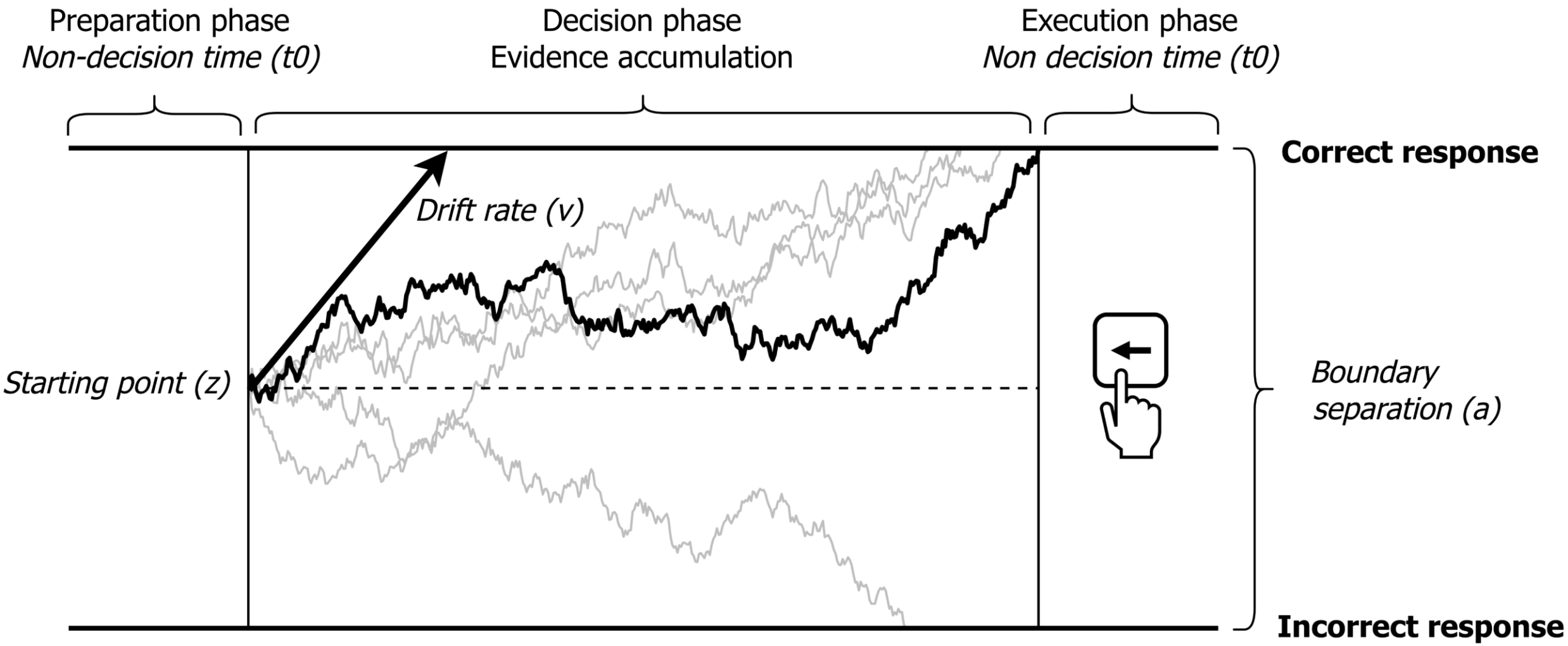
Performance-ability gap

Why is this important?

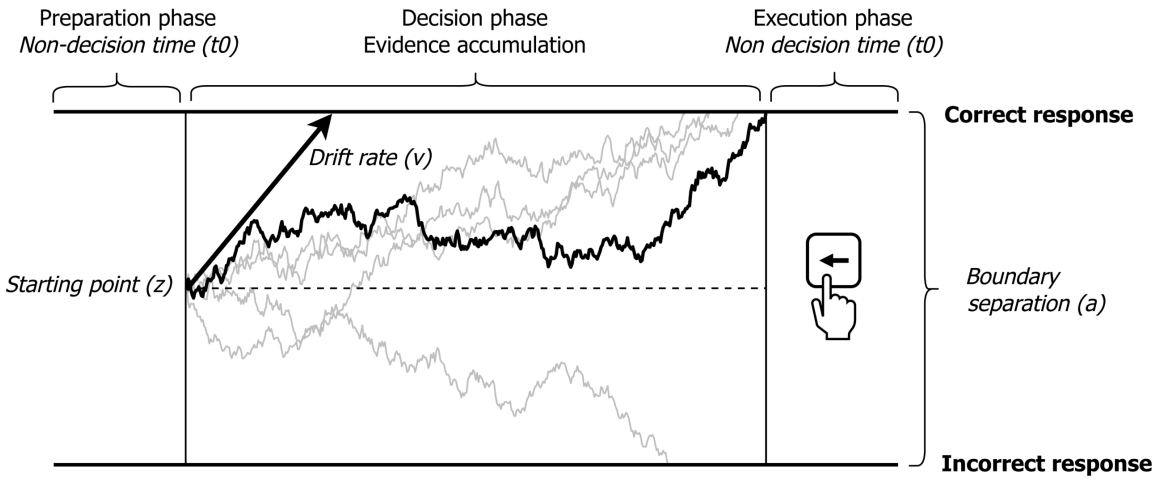
Theory development

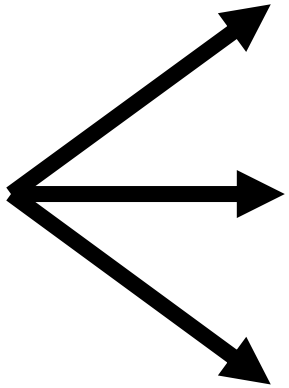
Interventions

Drift Diffusion Model

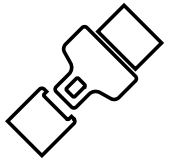


Drift Diffusion Model

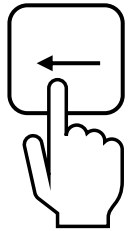




Drift rate
Information processing



Boundary separation
Response caution



Non-decision time
encoding/
response execution

Implementation

More trials needed / Less susceptible to outliers

Option 1. Fit to *individual participants*

Maximum likelihood

Kolmogorov-Smirnov

Chi-square

Software/packages

Fast-dm

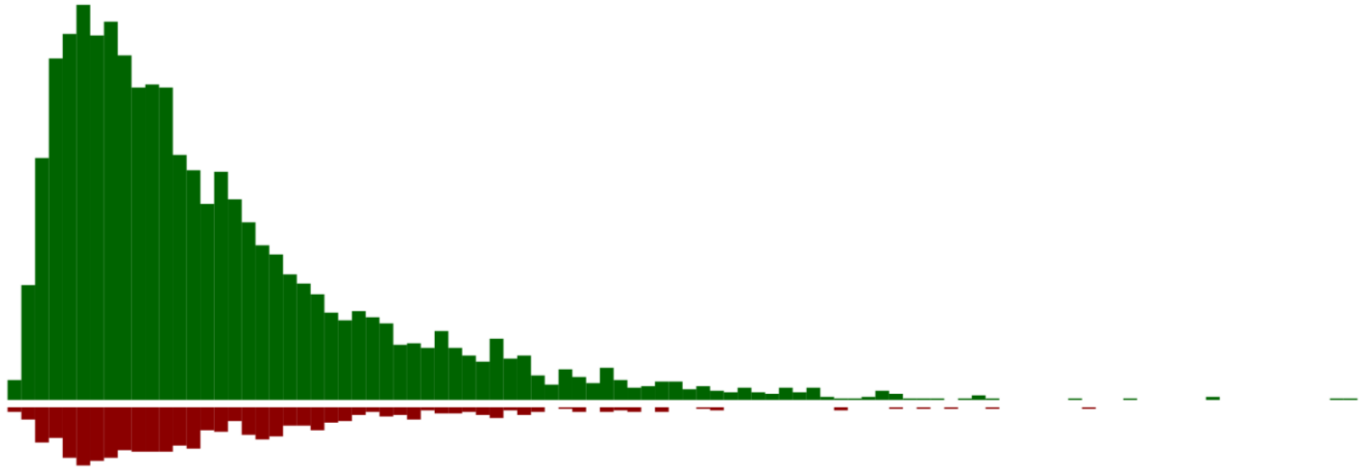
Option 2. Account for *group-level* effects

Hierarchical Bayesian

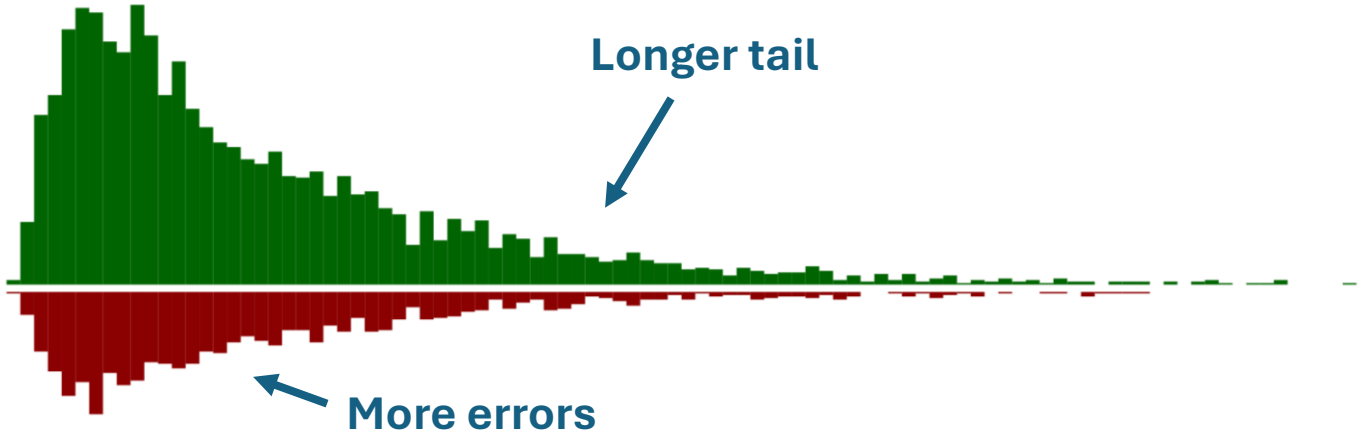
Software/packages

HDDM (python module)
hBayesDM (R package)
runjags (R package; with wiener module)

Lower rate of evidence accumulation

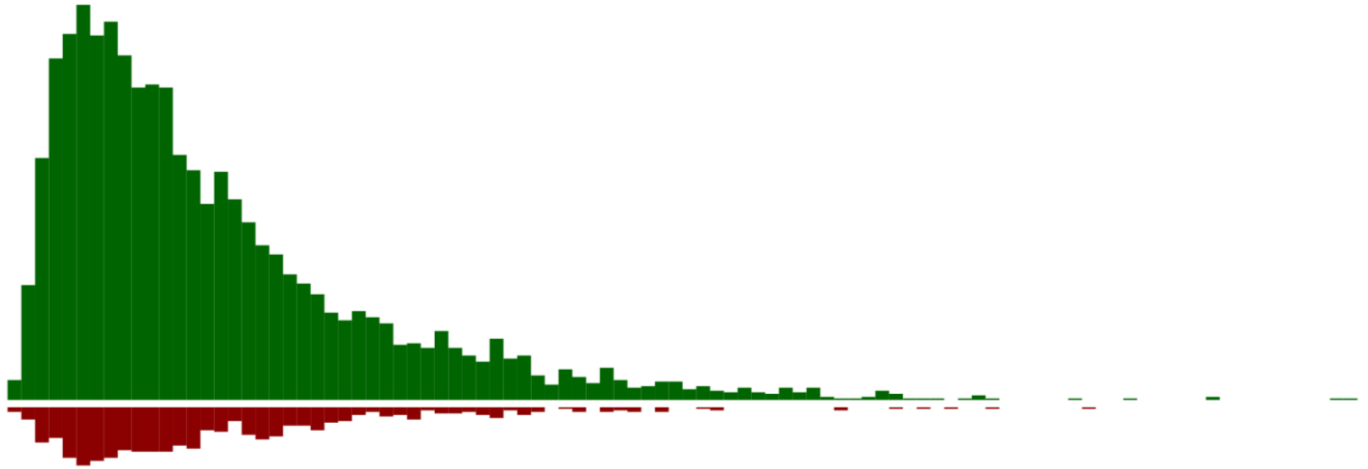


Drift rate: *2*
Boundary separation: 1
Non-decision time: 0.3
Bias: 0.5

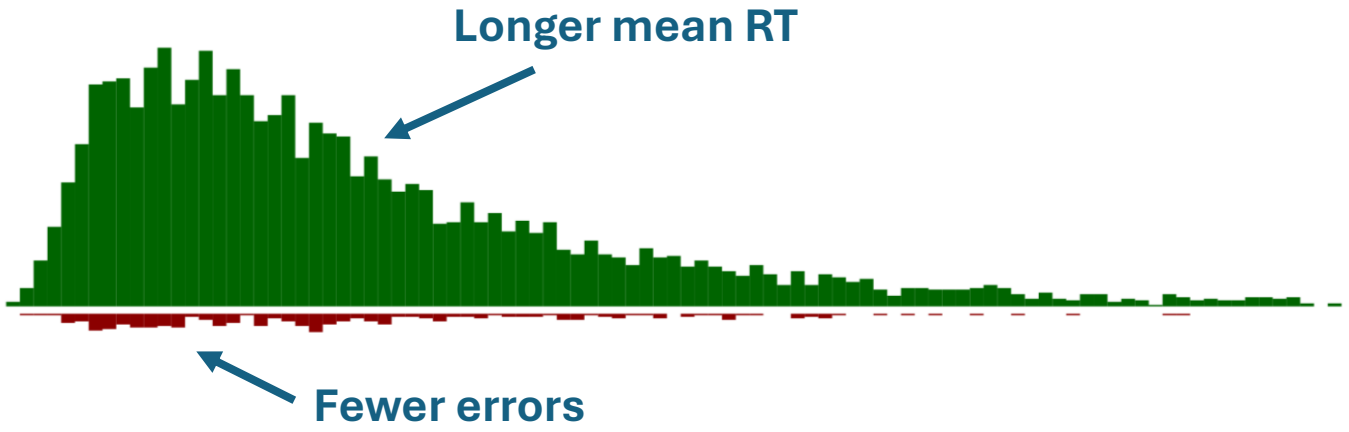


Drift rate: *1*
Boundary separation: 1
Non-decision time: 0.3
Bias: 0.5

Increased response caution

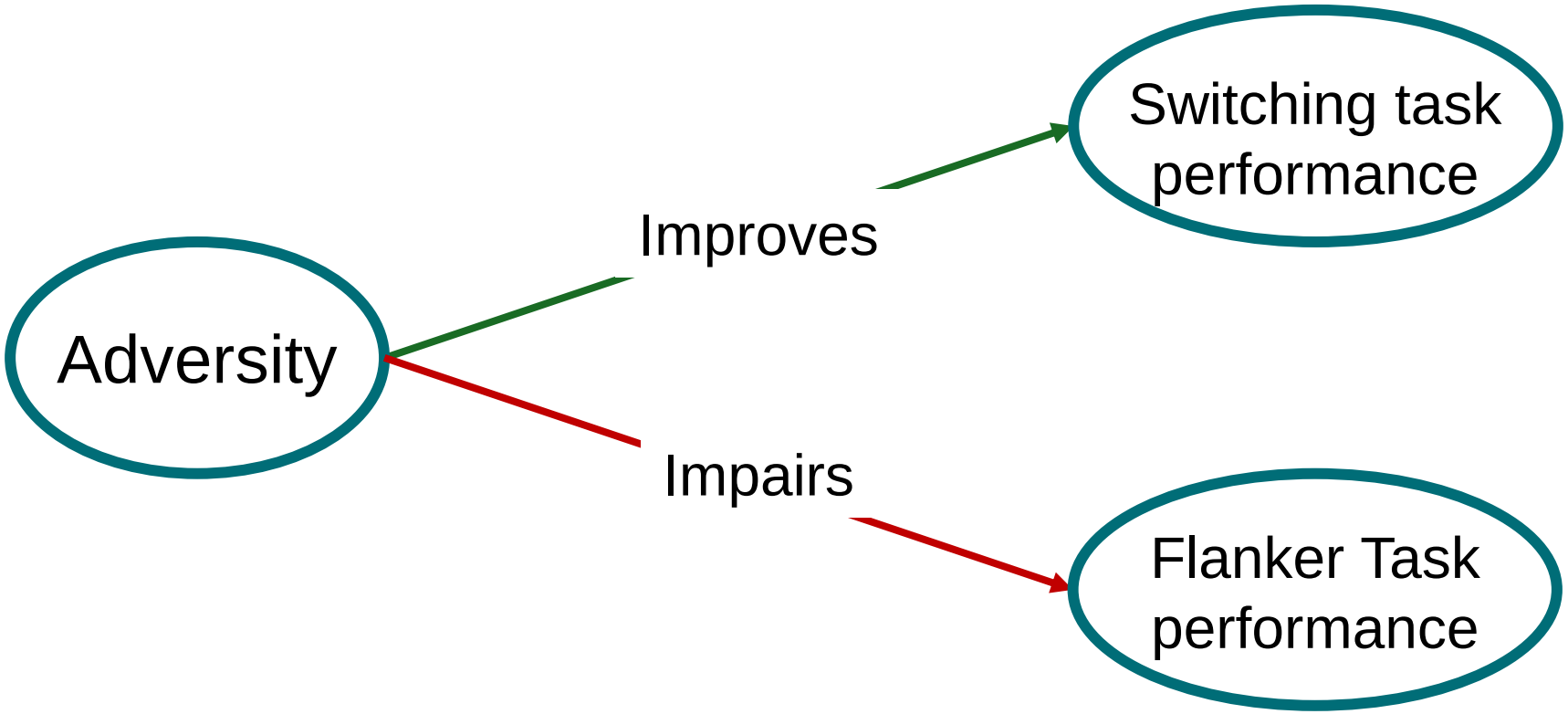


Drift rate: 2
Boundary separation: *1*
Non-decision time: 0.3
Bias: 0.5

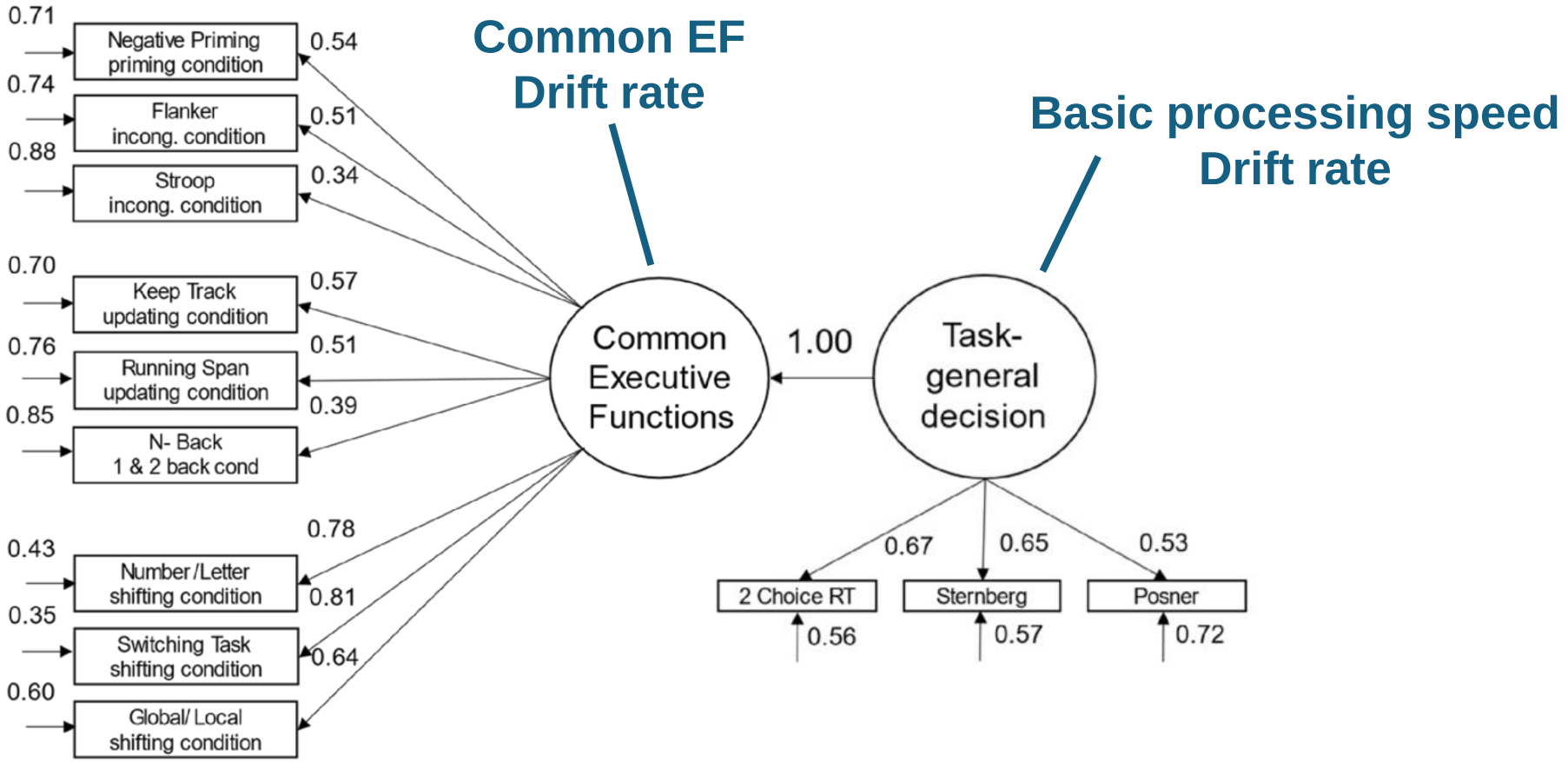


Drift rate: 2
Boundary separation: *1.5*
Non-decision time: 0.3
Bias: 0.5

Cognitive adaptations



Task-general factors



ABCD data

N = 10,563 US children aged 9-10

Household Threat (9 items)
"*We fight a lot in our family*"

Material deprivation (7 items)
"*Needed food but couldn't afford to buy it or couldn't afford to go out to get it*"

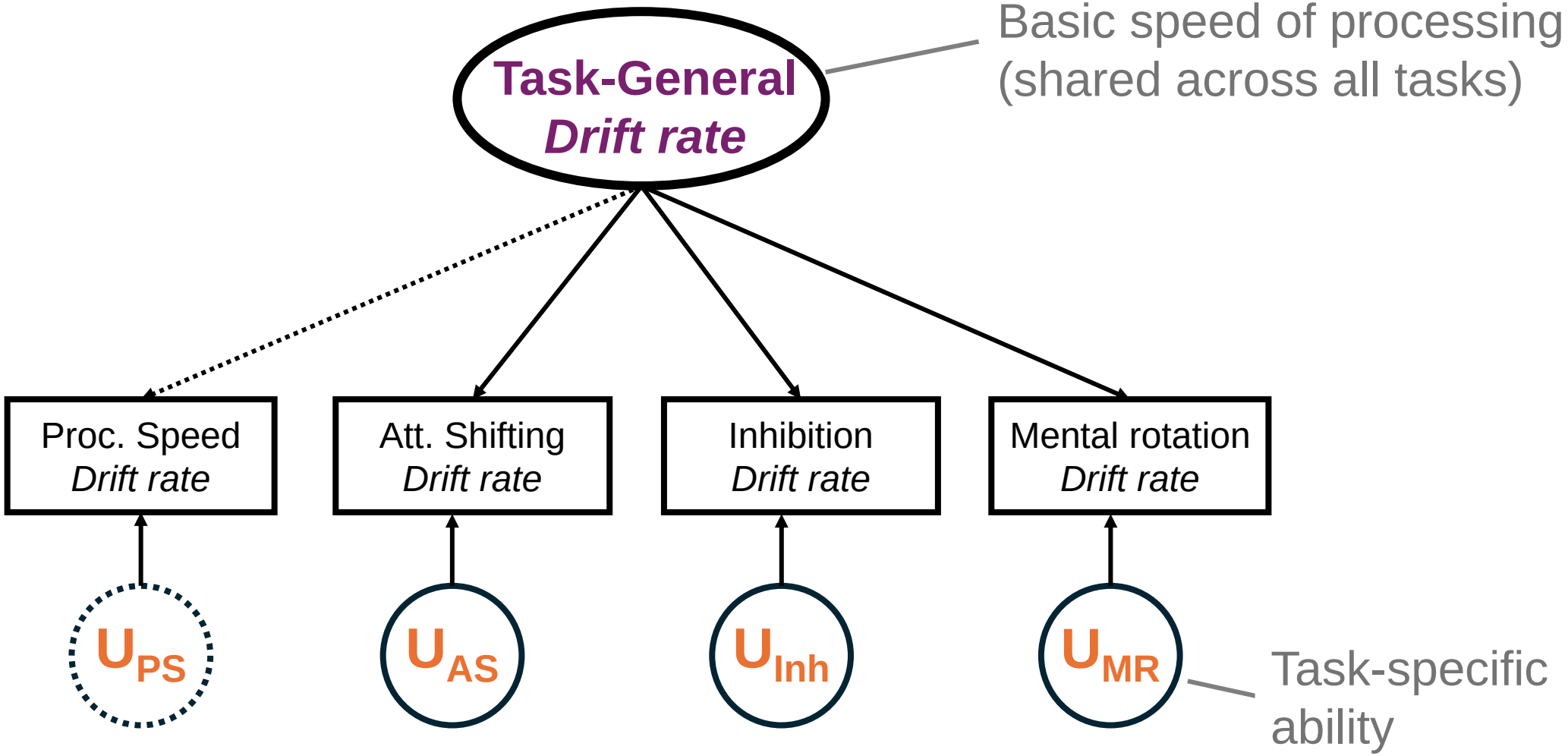
Processing Speed Task
Visual processing

Flanker Task
Inhibition / cognitive control

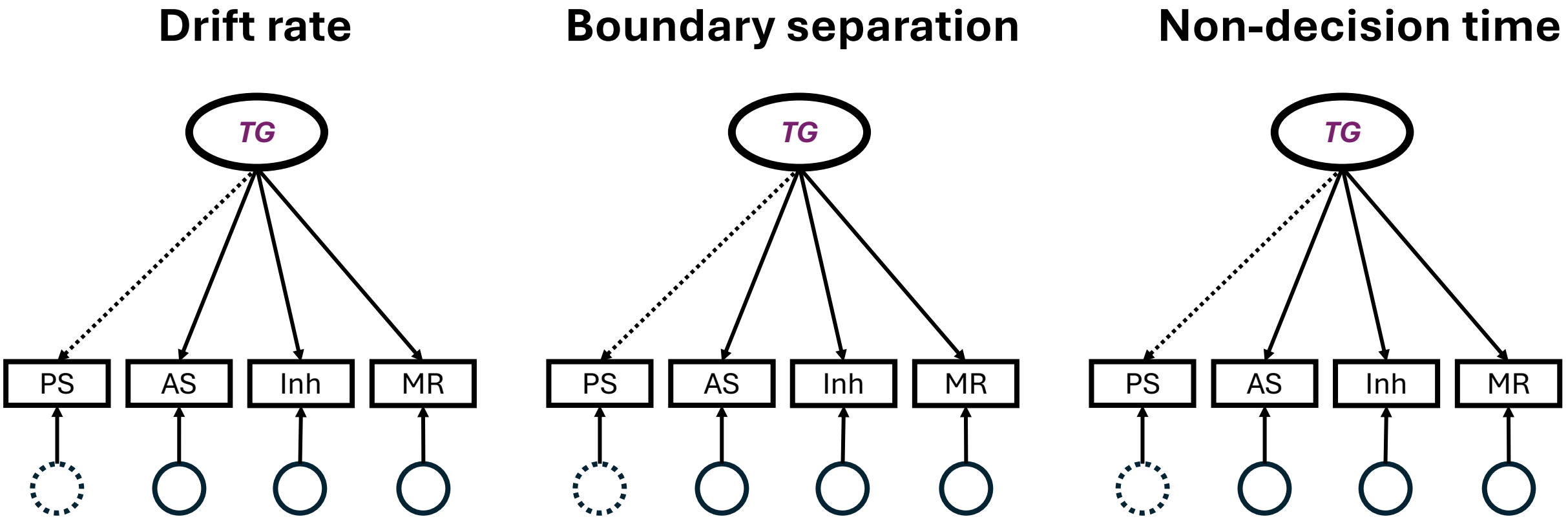
Dimensional Change Card Sort Task
Attention Shifting

Mental Rotation Task
Visual-spatial processing

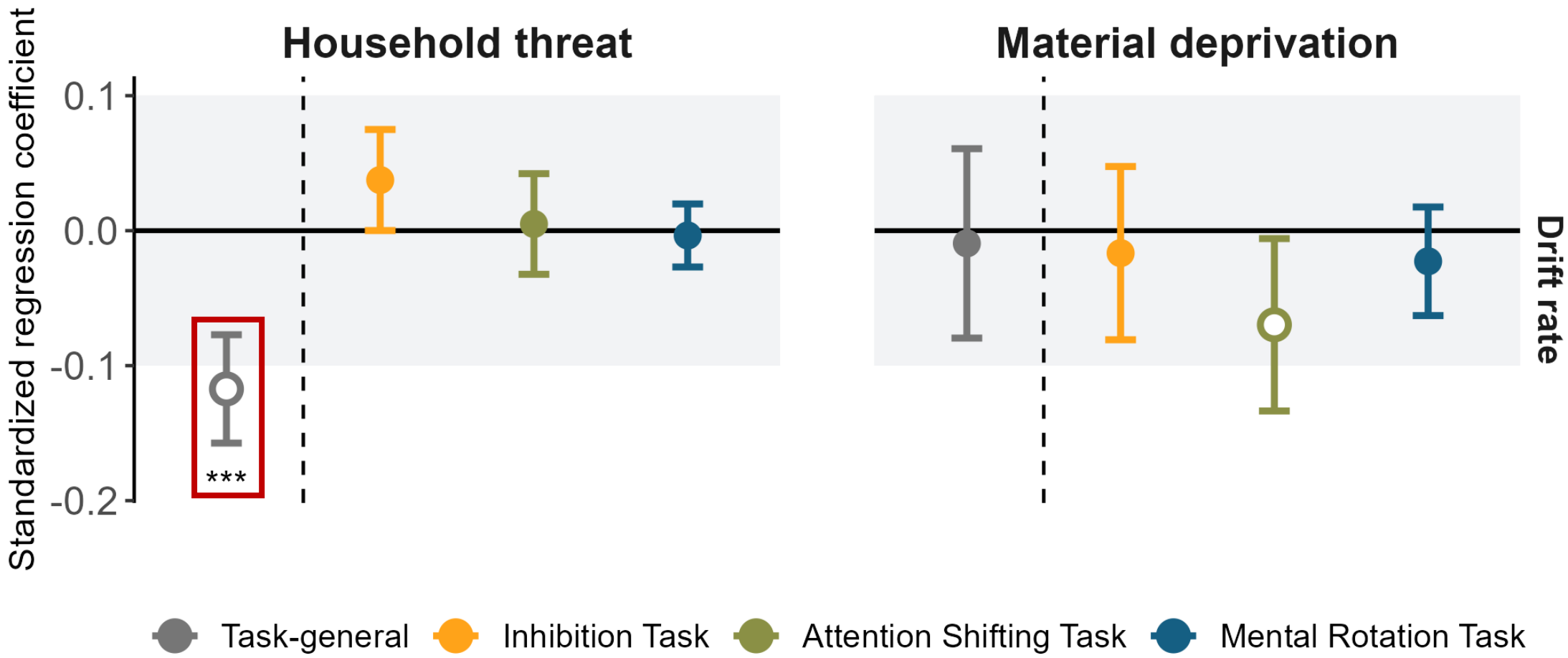
Structural Equation Modeling



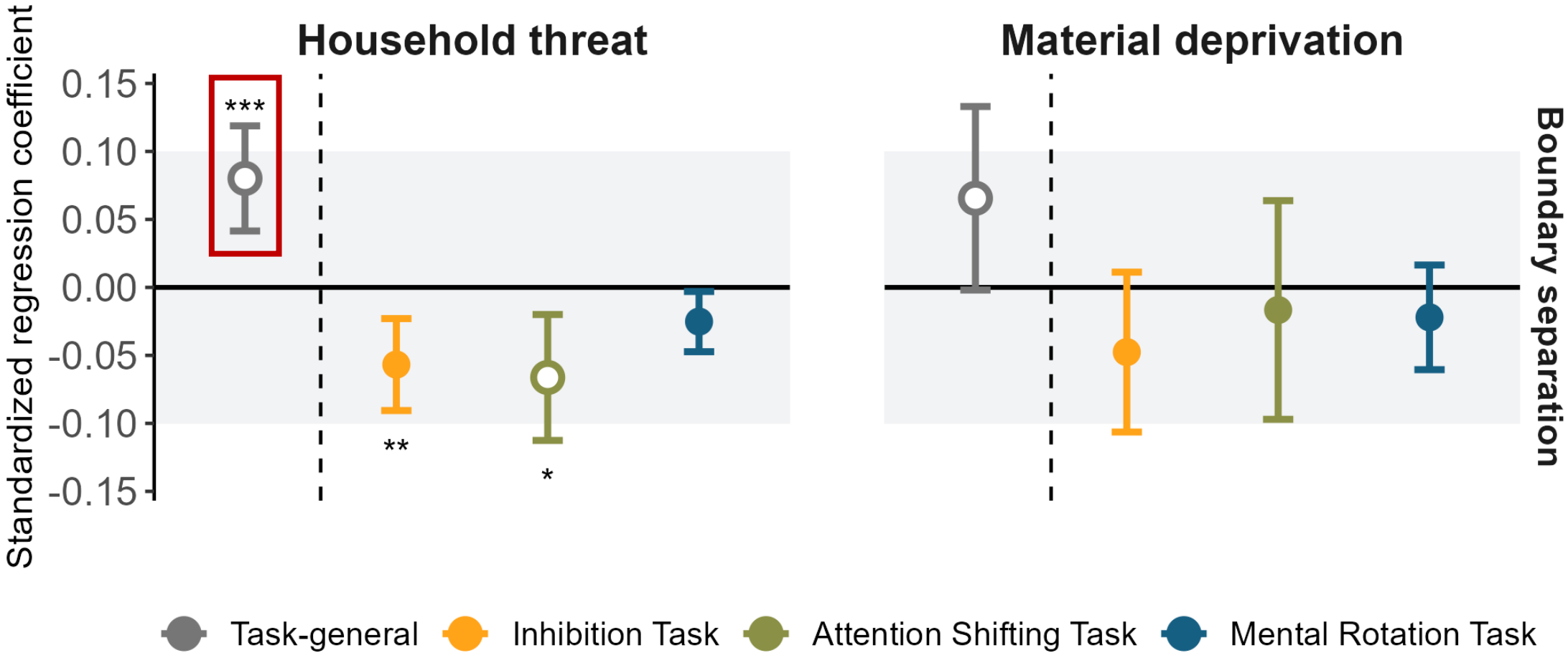
Structural Equation Modeling



** Not shown: covariances between task-general factors and task-specific factors within tasks*



Lowered performance due to task-general speed of processing



HIGHER task-general response caution,
But LOWER response caution for the shifting task

Conclusions

Drift Diffusion Modeling increases our understanding of how adversity shapes cognitive abilities

With implications for theory and interventions

Open question: what does the task-general drift rate factor represent, and why is it lowered in children from adverse conditions?

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Thank you!

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