Do Delay Discounting Patterns in ADHD Reflect Steeper Temporal Discounting or Reduced Consistency?

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Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental condition marked by persistent inattention and/or hyperactivity-impulsivity, often leading to social, academic, and occupational impairments.

A key cognitive feature of ADHD is impaired temporal decision-making, typically studied through delay discounting—the tendency to prefer smaller, immediate rewards over larger, delayed ones. Individuals with ADHD consistently show steeper delay discounting than neurotypical peers, a pattern central to several theoretical models of the disorder.

Objectives

The present study employed a computational modeling approach to investigate the mechanisms underlying temporal decision-making in individuals with ADHD.

Specifically, the model was used to examine whether inconsistency in choice behavior could explain the observed differences in delay discounting between individuals reporting high versus low levels of ADHD symptoms.

Methodology

Amazon Mechanical Turk (MTurk) workers participated in two experiments. Participants completed the Adult ADHD Self-Report Scale (ASRS-V1.1) and a modified Monetary Choice Questionnaire (MCQ), which involved selecting between smaller–immediate and larger–delayed rewards. Groups were defined using the ASRS clinical cutoff (ADHD: ASRS ≥ 51).

Decision-making was analyzed using the dd_cs Bayesian model from the hBayesDM R package, which estimated three hyper-parameters: discounting rate (r), impatience rate (s), and behavioral determinism (inverse temperature, β). Associations between these parameters and ADHD symptom severity were assessed using Bayesian linear regression.

Results

Experiment 1: Between-subject design

Immediate is Better condition:

Control group n = 228, ADHD group n = 60

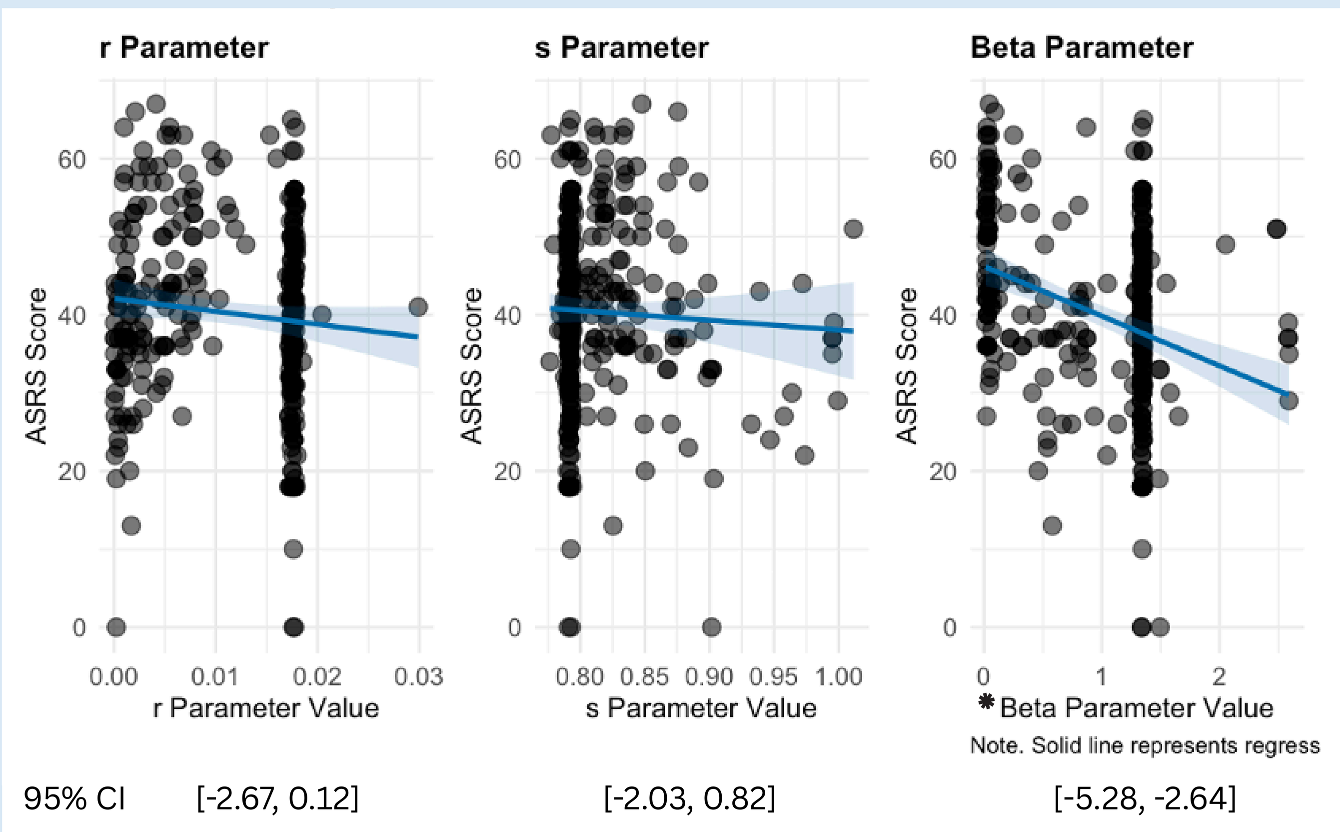
Table 1: $\hat{r}$ hyper-parameters mean

Group	Exp. Discounting rate (r)	Impatience (s)	Inverse temperature (β)
Control Group	1.0008555	1.0006206	1.0005973
ADHD Group	1.0003558	1.0004281	1.0004883

Table 2: HDI for group differences

	Exp. Discounting rate (r)	Impatience (s)	Inverse temperature (β)*
Lower Bound	-0.0073	-1.3352	0.4313
Upper Bound	0.0039	0.3378	0.7514

Figure 1: Immediate is better
Bayesian linear regression between the model parameters and ASRS scores



Delayed is better condition:

Control group n = 234, ADHD group n = 65

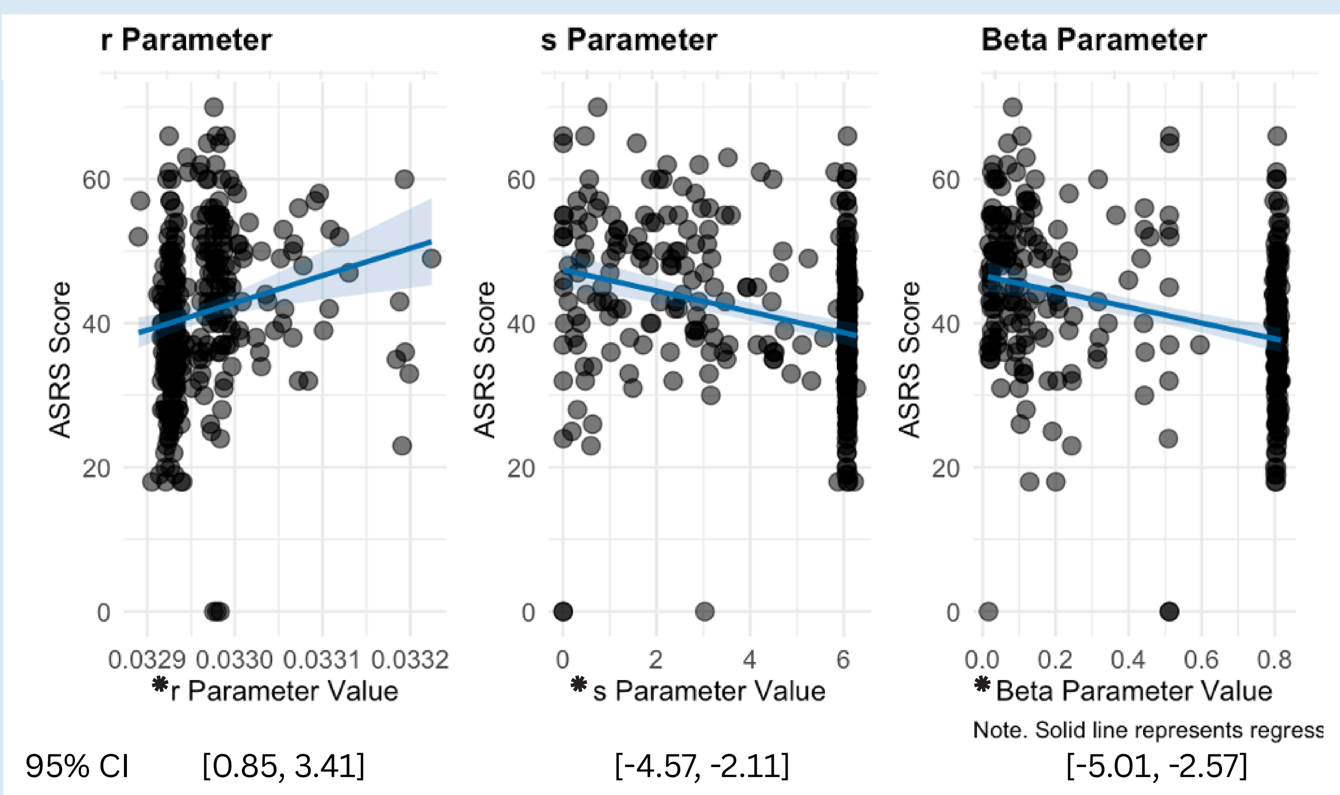
Table 3: $\hat{r}$ hyper-parameters mean

Group	Exp. Discounting rate (r)	Impatience (s)	Inverse temperature (β)
Control Group	1.0002	1.0000	1.0023
ADHD Group	1.0000	1.0000	1.0002

Table 4: HDI for group differences

	Exp. Discounting rate (r)	Impatience (s)	Inverse temperature (β)*
Lower Bound	-0.0653	-1.1081	0.1107
Upper Bound	0.0004	2.8803	0.4410

Figure 2: Delayed is better
Bayesian linear regression between the model parameters and ASRS scores



Experiment 2: Within-subject design

Control group n = 86 ADHD group n = 14

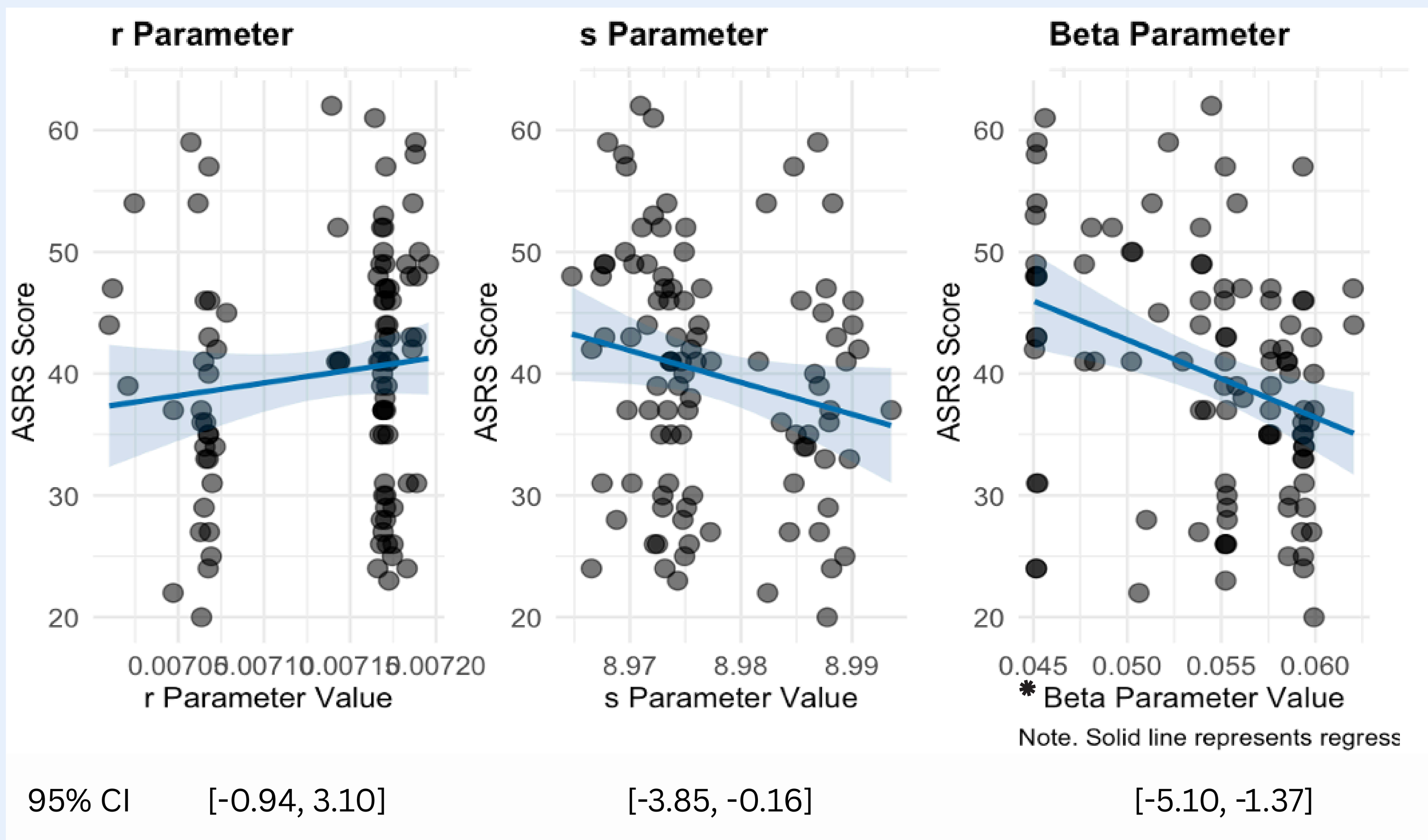
Table 5: $\hat{r}$ hyper-parameters mean

Group	Exp. Discounting rate (r)	Impatience (s)	Inverse temperature (β)
Control Group	0.9999	0.9999	0.9999
ADHD Group	1.0000	0.9999	1.0001

Table 6: HDI for group differences

	Exp. Discounting rate (r)	Impatience (s)	Inverse temperature (β)*
Lower Bound	-0.0001	-1.4522	0.0043
Upper Bound	0.0074	7.8202	0.0304

Figure 3: Within subject
Bayesian linear regression between the model parameters and ASRS scores



Conclusions

Across both experiments, only the inverse temperature parameter significantly differed between groups, indicating reduced choice consistency in individuals with elevated ADHD symptoms. No differences were found in discounting rate or impatience, suggesting that impulsivity was not heightened in the ADHD group. These findings align with prior research highlighting inconsistency as a potential cognitive marker in ADHD.

Bayesian regression in Experiment 1's "better delayed" condition, which used longer delays which is typical in delay discounting tasks, revealed significant associations between ASRS scores and all model parameters. Higher ADHD symptom severity was linked to stronger preferences for immediate rewards. However, even in this condition, when groups were defined categorically by the accepted clinical cutoff (as used for modelling) only consistency differences were significant. This suggests that inconsistency may be the most robust differentiator in ADHD-related decision-making.