Delay Discounting and Neurobehavioral Trait Dimensions as Predictors of Externalizing Psychopathology in Children

Hanna Osborne, Isabella M. Palumbo, & Robert D. Latzman
Georgia State University

Introduction

- The RDoC initiative examines how neurobehavioral constructs can be valuable in assessing the development of psychopathology across multiple units of analysis (Cuthbert & Insel, 2013; Insel et al., 2010).
- Theory and research from developmental psychology can be integrated with RDoC to promote the understanding of ontology and mechanisms of mental illness.
- In particular, neurobehavioral trait constructs apparent in developmental literature may uniquely and interactively contribute to risk for psychopathology.
  - Threat-sensitivity is a continuum of fear/fearless, where low threat-sensitivity is associated with higher risk-taking (Kramer et al., 2019; Yancey et al., 2016).
  - Inhibitory control is expressed through the capacity to restrain behavioral impulses (Venables et al., 2018; Yancey et al., 2016).
  - Externalizing behaviors are characterized by poor self-regulation and actions or attitudes that violate societal norms
    - Divided into two specific, but related dimensions → aggression (AB) and rule-breaking (RBB).
  - Delay discounting is the measure of ability to wait for larger, delayed rewards compared to small, immediate ones (Mahalingam et al., 2014).
- Higher rates of delay discounting have previously been found to be associated with impulsivity, and disinhibited behaviors, as well as externalizing psychopathology in general (Mahalingam et al., 2014; Venables et al., 2018).
- As previous studies have been limited to adults, little research has investigated the unique contribution of neurobehavioral trait dimensions and the delay of gratification to the development of externalizing behaviors in young children.

Current Study

The current study assessed the unique and interactive contributions of threat sensitivity, inhibitory control, and delay discounting in efforts to explain levels of externalizing psychopathology in children.

Methods

Participants

- 1291 5-10 year-olds (*Mage*= 8±1.6 years; 34% female) from the Child Mind Institute Healthy Brain Network initiative (HBN; Alexander et al., 2017)

Measures

- *Delay Discounting (DD) Task (Koffarnus and Bickel, 2014)*
  - *e.g., "Would you prefer $50 now or $200 in 2 hours?"*
- *Parent Reported Trait Threat Sensitivity (THT+) (Palumbo et al., 2020)*
  - *e.g., "I am often afraid or nervous in unfamiliar situations"*
- *Parent Reported Trait Inhibitory Control (IC) (Palumbo et al., 2020)*
  - *e.g., "I often act without thinking."*
- *Parent Reported Externalizing Psychopathology*
  - Child Behavior Checklist (Achenbach and Rescorla, 2001)
    - Total Externalizing (EXT)
      - *Sum of AB and RBB*
    - Aggressive Behaviors (AB)
      - *e.g., "I like a lot of attention and often get in fights at school."*
    - Rule-Breaking Behaviors (RBB)
      - *e.g., "I like to steal candy from the store."*

Data Analysis

- Bivariate analyses were used to examine associations between delay discounting, neurobehavioral traits (i.e., threat-sensitivity and inhibitory control), and externalizing dimensions (i.e., total EXT, AB, RBB).
- Multivariate analyses were used to determine the unique and interactive contribution of delay discounting and neurobehavioral trait dimensions to predict dimensions of externalizing psychopathology in children.

Results

Bivariate Correlations

Table 1: Bivariate Correlations

	Age	Sex	DD	THT+	IC	Gen EXT	AB	RBB
Age	—							
Sex	0.002	—						
DD	-0.11***	0.04	—					
THT+	-0.03	-0.05*	-0.07*	—				
IC	-0.11***	-0.19***	-0.02	-0.15***	—			
Gen EXT	-0.09***	0.07**	-0.02	-0.24***	0.81***	—		
AB	-0.09***	0.07**	-0.01	-0.27***	0.77***	0.91***	—	
RBB	-0.06**	-0.02	-0.01	-0.13***	0.72***	0.82***	0.78***	—

*note: * p < .05, ** p < .01, *** p < .001*

- Threat-sensitivity was weakly negatively associated with all forms of externalizing
- Inhibitory control was strongly positively associated with all forms of externalizing
- Delay discounting was not associated with inhibitory control or any of the externalizing dimensions.
- Delay discounting was weakly negatively associated with threat-sensitivity.

Regression Analyses

Total Externalizing (EXT)

Table 2: THT+ * DD

	β	t	p	R	R^2
Step 1					
age	-0.09	-3.37	< .001	0.12	0.02
sex	-0.08	-2.7	0.01		
Step 2					
age	-0.11	-3.91	< .001	0.24	0.06
sex	-0.08	-3.03	0.002		
THT+	-0.21	-7.48	< .001		
DD	-0.04	-1.47	0.14		
Step 3					
age	-0.11	-3.91	< .001	0.24	0.06
sex	-0.08	-3.03	0.003		
THT+	-0.21	-6.62	< .001		
DD	-0.04	-1.47	0.14		
THT+ x DD	-0.004	-0.11	0.91		

Table 3: IC * DD

	β	t	p	R	R^2
Step 1					
age	-0.09	-3.37	< .001	0.12	0.02
sex	-0.08	-2.7	0.01		
Step 2					
age	-0.004	-0.21	0.83	0.81	0.66
sex	0.09	5	< .001		
IC	0.83	48.5	< .001		
DD	-3.285 e-4	-0.02	0.98		
Step 3					
age	-0.004	-0.21	0.83	0.81	0.66
sex	0.09	5	< .001		
IC	0.83	42.91	< .001		
DD	-2.572 e-4	-0.02	0.99		
IC x DD	0.002	0.09	0.93		

Aggressive Behavior (AB)

Table 4: THT+ * DD

	β	t	p	R	R^2
Step 1					
age	-0.1	-3.53	< .001	0.13	0.02
sex	-0.08	-2.67	0.008		
Step 2					
age	-0.11	-4.07	< .001	0.24	0.06
sex	-0.08	-3.01	0.003		
THT+	-0.21	-7.46	< .001		
DD	-0.03	-1.12	0.26		
Step 3					
age	-0.11	-4.04	< .001	0.24	0.06
sex	-0.08	-3.01	0.003		
THT+	-0.22	-6.88	< .001		
DD	-0.04	-1.07	0.28		
THT+ x DD	-0.02	0.52	0.61		

Table 5: IC * DD

	β	t	p	R	R^2
Step 1					
age	-0.1	-3.53	< .001	0.13	0.02
sex	-0.08	-2.67	0.008		
Step 2					
age	-0.01	-0.66	0.51	0.78	0.61
sex	0.08	4.31	< .001		
IC	0.79	43.23	< .001		
DD	0.01	0.46	0.64		
Step 3					
age	-0.01	-0.67	0.504	0.78	0.61
sex	0.08	4.31	< .001		
IC	0.8	38.57	< .001		
DD	0.01	0.43	0.67		
IC x DD	-0.01	-0.6	0.55		

Rule-Breaking Behavior (RBB)

Table 6: THT+ * DD

	β	t	p	R	R^2
Step 1					
age	-0.06	-2.2	0.03	0.08	0.01
sex	-0.4	-1.51	0.13		
Step 2					
age	-0.07	-2.49	0.01	0.14	0.02
sex	-0.05	-1.67	0.1		
THT+	-0.17	-4.08	< .001		
DD	-0.02	-0.8	0.43		
Step 3					
age	-0.07	-2.47	0.01	0.14	0.02
sex	-0.05	-1.67	0.1		
THT+	-0.12	-3.81	< .001		
DD	-0.02	-0.76	0.45		
THT+ x DD	0.01	0.38	0.71		

Table 7: IC * DD

	β	t	p	R	R^2
Step 1					
age	-0.06	-2.2	0.03	0.08	0.01
sex	-0.4	-1.51	0.13		
Step 2					
age	0.02	0.98	0.33	0.72	0.52
sex	0.1	5	< .001		
IC	0.74	36.42	< .001		
DD	0.01	0.44	0.66		
Step 3					
age	0.02	0.97	0.33	0.72	0.52
sex	0.1	5	< .001		
IC	0.74	32.35	< .001		
DD	0.01	0.43	0.67		
IC x DD	-0.01	-0.2	0.84		

Regression Analyses: Main Effects

- Low threat-sensitivity and high inhibitory control emerged as independent predictors of all three externalizing dimensions.

Regression Analyses: Interaction Effects

- Threat-sensitivity appears to have a strong predictive effect on externalizing dimensions, regardless of delayed discount rate, and this observation was even more prominent for inhibitory control.

Discussion

- At the bivariate level, results suggest that children who display high levels of inhibitory control and low threat sensitivity are more likely to be at risk for aggressive and rule-breaking forms of externalizing psychopathology.
- Delay discounting was not associated with any of the externalizing dimensions.
- Results of the current study illustrate that delay discounting did not have a significant influence on the relationship between threat sensitivity and any of the observed dimensions of parent-reported externalizing, nor between inhibitory control and dimensions of externalizing.

Potential explanations

- Nonsignificant findings with effect sizes approaching zero are oftentimes seen as undesirable outcomes of research.
  - Ultimately, they are just as valuable and can bear important insight into the validity of theories or methods.
- Results of this study are in line with robust associations found in developmental literature, which suggest that low threat sensitivity and high inhibitory control are risk factors for externalizing psychopathology.
  - In general, children exhibiting low effortful control are more prone to avoidant and aggressive behaviors (Lengua & Long, 2002).

Limitations

- This study mainly used parent-reports (CBCL), and correlations between parent reports and child reports often seem to be low to moderate (Barker et al., 2007).
  - Child reports may better assess their personality traits.
- Additionally, traditional task-based measures that are robust in adults may not be as suitable for children.
  - Due to the very young age of HBN participants, it is important to consider developmental appropriateness, or the capacity to understand a given construct within children of a similar developmental level.

Future Directions

- Operationalizing trait-dispositional constructs using biobehavioral indicators provides much more stability and accuracy than task-based measures.
  - These measures may contain poor reliability and validity, as they are hindered by small sample sizes and the belief that only significant findings are important.
- The utilization of more appropriate task-based measures in future studies could also be useful.
- Examining these relationships in samples of other youth groups (i.e., adolescents) would provide further insight.

Hanna Osborne
hosborne3@student.gsu.edu