



Exploring Cognitive Control and Self-Regulation: The Moderating Effect of Negative Affectivity on Effortful Control

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Introduction

Temperamental self-regulation, generally referred as effortful control (EC), is mainly composed of inhibitory control and attention shifting (Eisenberg, 2017; Rothbart & Bates, 2006; Rothbart et al., 2003). Self-regulation maintains an inherent bidirectional connection with bottom-up, emotional and appetitive processes. These processes both impose challenges on self-regulation and/or are moderated by it (Nigg, 2017). Kindergarten is a critical age period for the development of EC and top-down regulation; hence, it is important to study what determines the ability of children to regulate when they are required to cope with negative emotional challenges, such as the moderating effect their temperamental tendency to experience negative emotions (NA) has on their EC.

Sample:

134 Kindergarten children (45% female)
Regular schools (normative development)
 $M_{age} = 4y.6m \pm 6m$

Main reported measures

Temperament

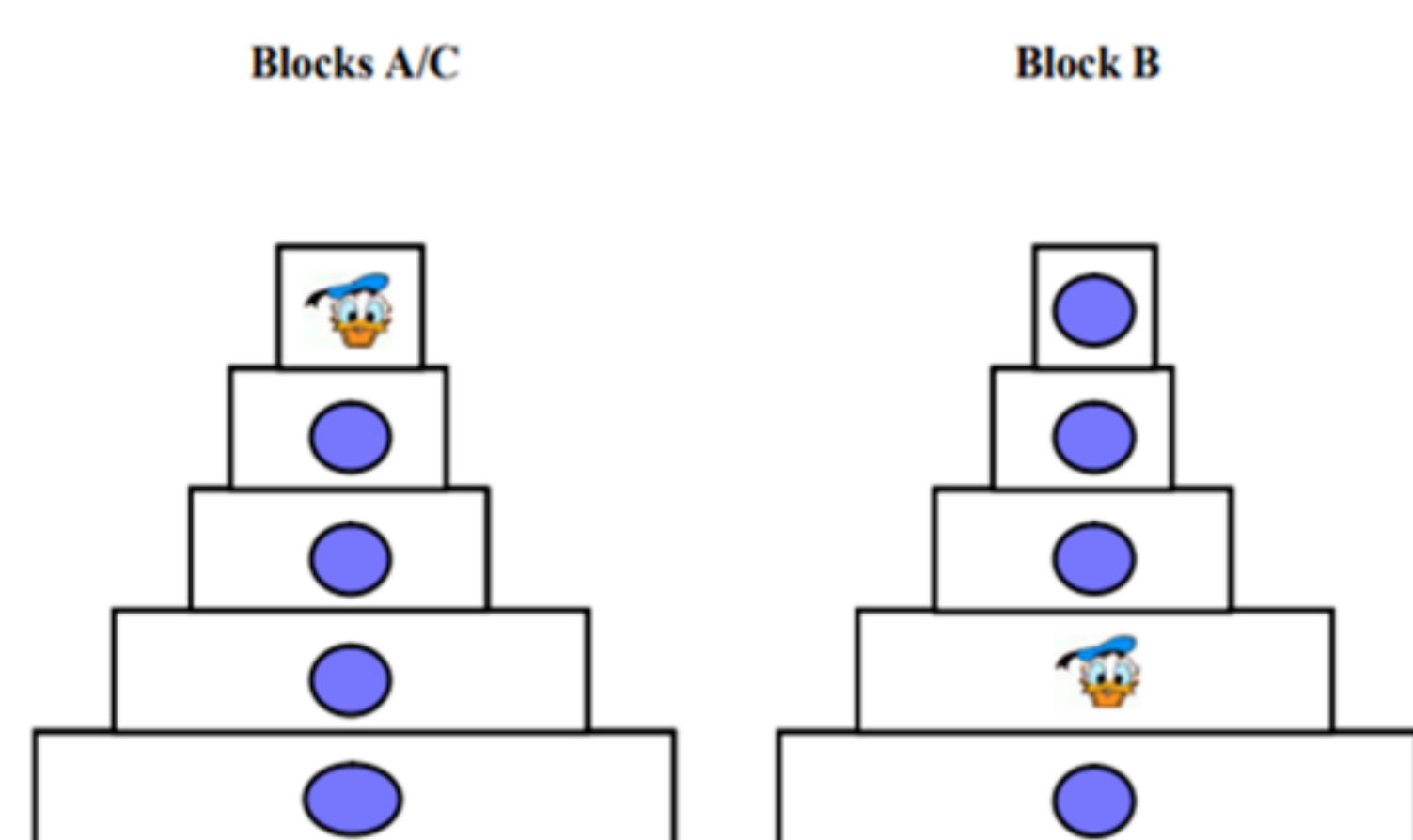
Negative Affectivity and Effortful Control (CBQ-SF; Putnam & Rothbart, 2006); mother's report; Reliability: $\alpha = .84$ & $.83$

Emotional and behavioral difficulties

Pediatric Symptoms Checklist (PSC; Jellinek & Murphy, 1988); mother's report; Reliability: $\alpha = .93$

Procedure: Challenging self-regulation

- The Emotional Go/No Go task (Farbiash & Berger, 2016): performed while brain activity was measured.
- Three blocks with a fake competition, several times in each block the children received visual feedback about their ranking:



Manipulation check:

For each block, the children rated their feelings of motivation, success, frustration and joy, on a 6-point scale



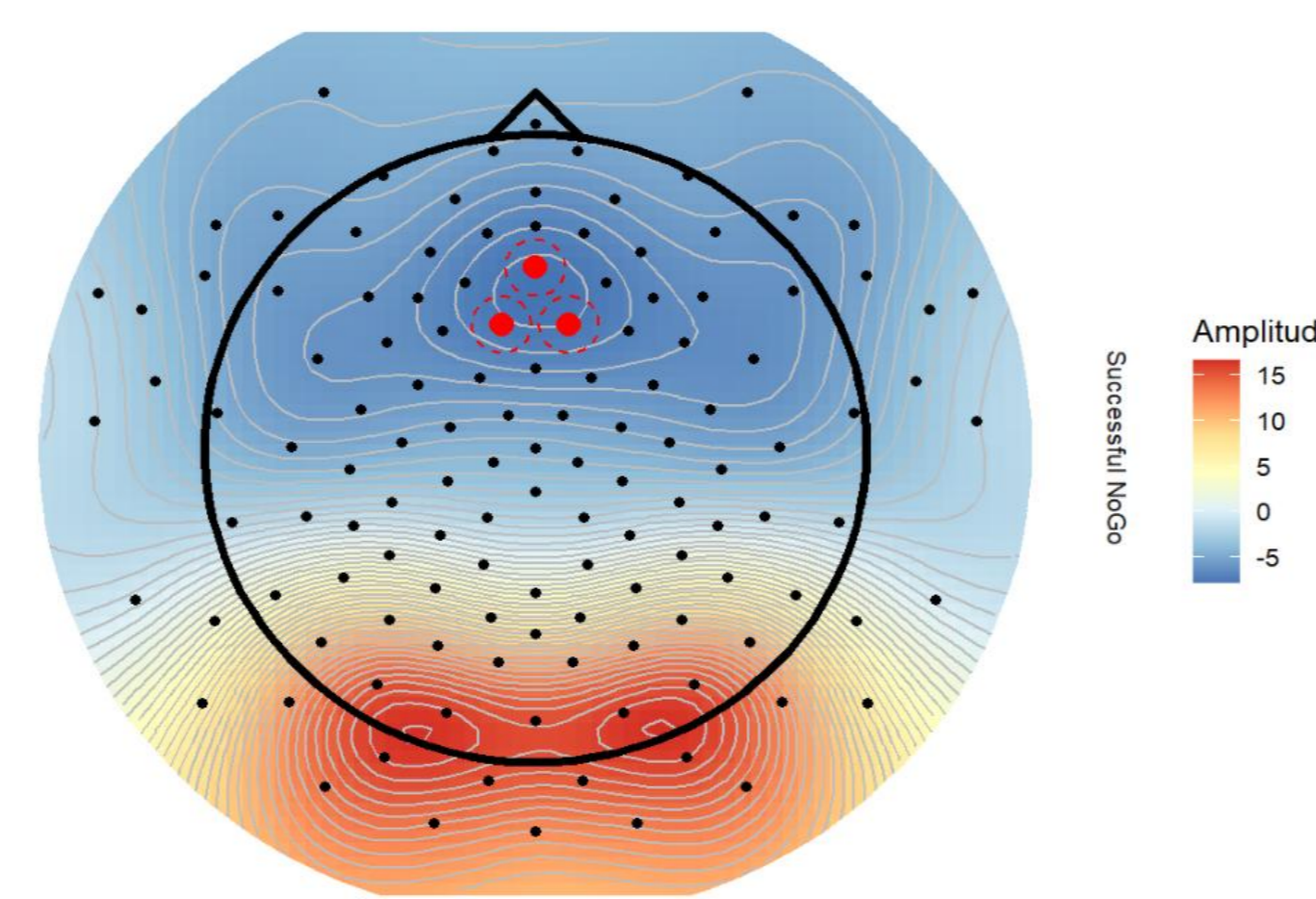
For Block B:
Motivation – no difference
Success ▼
Frustration ▲
Fun ▼

Brain activity measures

EEG recorded from 128 scalp sites using the EGI Geodesic Sensor net and system (250 Hz sampling rate).

Three measures were calculated in successful No-go trials at midcentral electrodes, within the 300-400 ms after stimulus window, in the frustrating block (Block B):

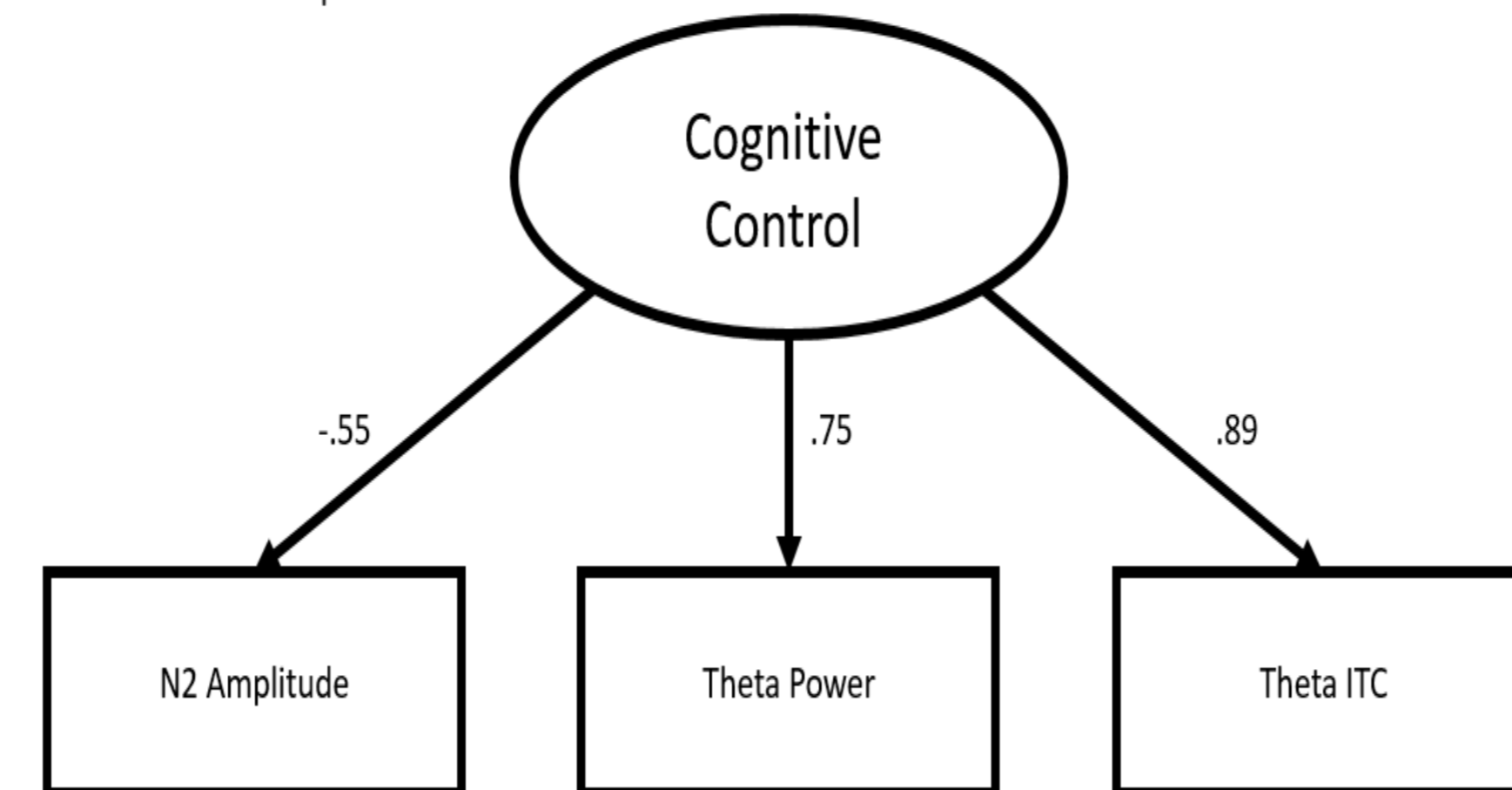
- Mean peak N2 amplitudes;
- Power of theta frequency band (4-8 Hz)
- Intertrial phase coherence (ITC) of the theta



Voltage topo-map at 350 ms

Then a **Regulatory Resources Factor (cognitive control)** was calculated:

Explained variance = 55.22%



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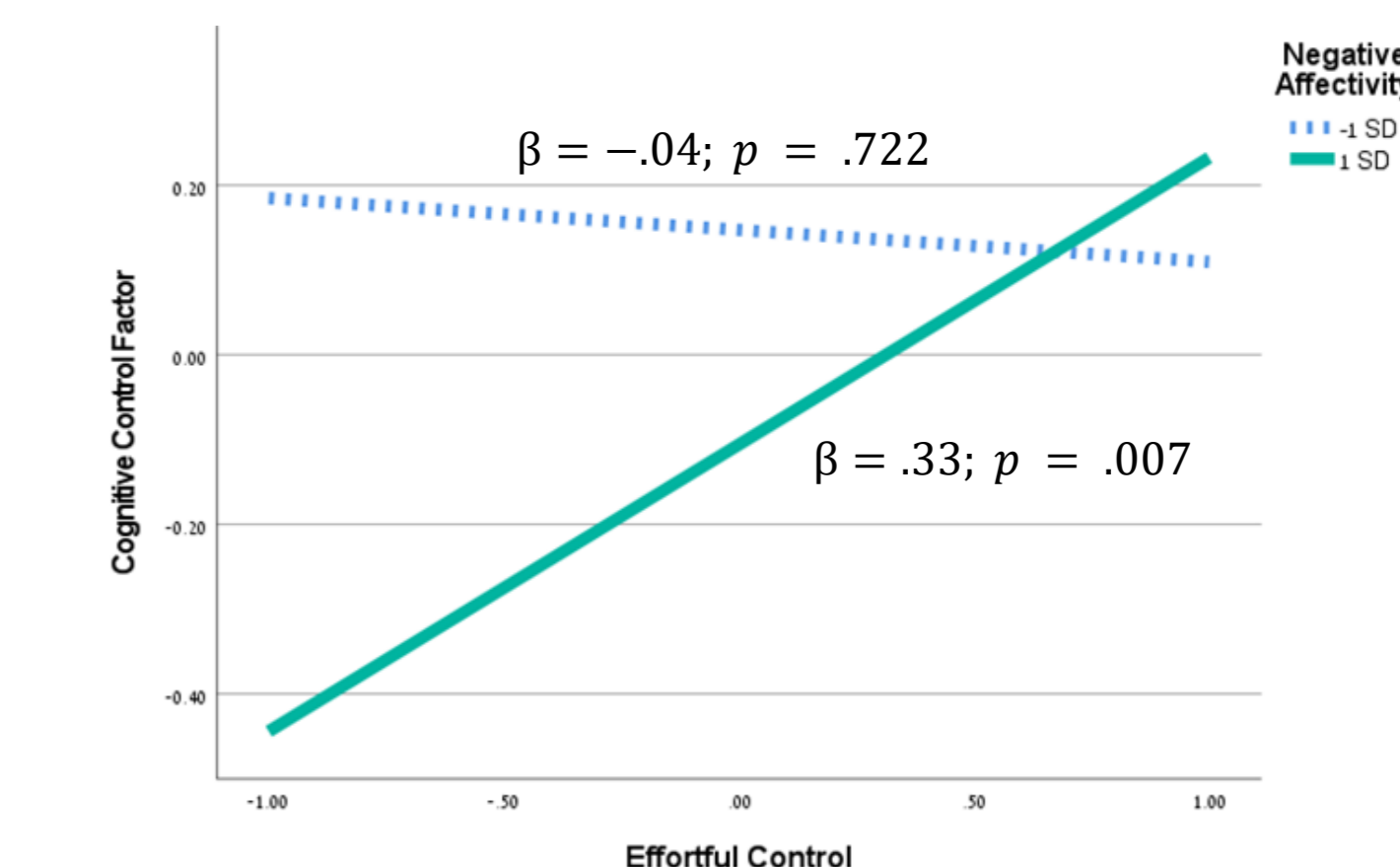
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Results

I. Explaining Children's electrophysiological cognitive control factor by reported temperament Indexes

Variables	Cognitive Control		
	β (SE)	p value	95% CI
Effortful Control	.15 (.08)	.071	[-.01 .32]
Negative Affectivity	-.13 (.08)	.125	[-.29 .04]
Interaction	.18 (.07)	.015	[.03 .32]
F	3.78	.012	
R ²	.082		

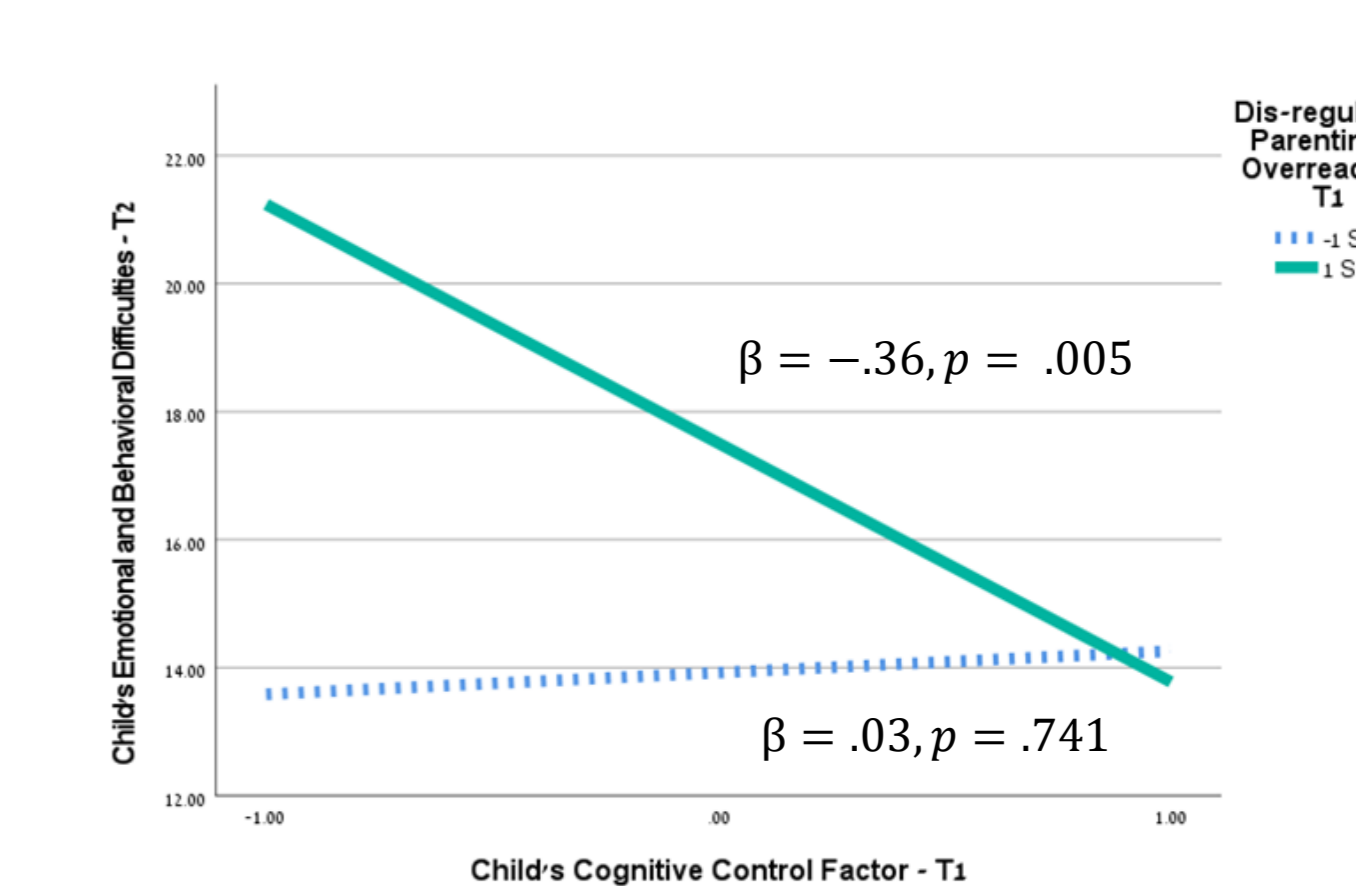


II. Does the electrophysiological cognitive control factor explain self-regulation of the children *in real life*? **YES, but moderated by mother's self-regulation**

Full model predicting child's socioemotional problems a year after the lab assessment: Interaction between dis-regulated parenting (overreactive scale) and the cognitive control factor is significant beyond the effect of

- T1 variables: NA, EC, NA x EC, emotional and behavioral difficulties
- T2 variables: mothers' PTSD symptoms, objective exposure to traumatic events

Variables	Child's behavioral-emotional problems		
	β (SE)	p value	95% CI
Child's socio-emotional difficulties – T1	.28 (.08)	< .001	[.13 .43]
Mother's PTSD symptoms – T2	-.54 (.07)	< .001	[-.40 .68]
Objective exposure to trauma – T2	.18 (.07)	.010	[.05 .32]
Child's cognitive control – T1	-.15 (.07)	.051	[-.29 .00]
Mother's dis-regulation (overreactive) – T1	.14 (.07)	.043	[.00 .28]
Mother's dis-regulation (laxness) – T1	.01 (.08)	.908	[-.14 .16]
Laxness X cognitive control	.19 (.09)	.041	[.01 .37]
Overreactive X cognitive control	-.18 (.08)	.019	[-.34 -.03]
F	21.38	< .001	
R ²	.719		



Discussion

This study explored the underlying mechanisms of children's self-regulation in situations that elicit emotional distress. In line with Rothbart's Temperament Theory (Rothbart et al., 1994, 2000), our findings further support that in situations eliciting negative emotions, children with a greater tendency toward such emotions can allocate more resources for conflict monitoring—but only when they exhibit higher effortful control. This brain-activity cognitive control measure is relevant for explaining child's self-regulation in real life stressful situations - moderated by the mother's own self-regulation in her parenting practices.

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