

EMOTIONS UNDER CONTROL? BETTER COGNITIVE CONTROL PREDICTS REDUCED NEGATIVE EMOTIONALITY BUT INCREASED NEGATIVE EMOTIONAL REACTIVITY WITHIN INDIVIDUALS

Supplementary Materials

Levente Rónai^{1,2*}, Flóra Hann¹, Szabolcs Kéri^{1,3}, Ulrich Ettinger⁴, Bertalan Polner⁵

¹Department of Cognitive Science, Faculty of Natural Sciences, University of Technology and Economics, Budapest, Hungary

²Institute of Psychology, University of Szeged, Szeged, Hungary

³National Institute of Mental Health, Neurology and Neurosurgery – Nyírő Gyula Hospital, Budapest, Hungary

⁴Department of Psychology, University of Bonn, Bonn, Germany

⁵Institute of Psychology, ELTE, Eötvös Loránd University, Budapest, Hungary

*ronai.levente@ttk.bme.hu

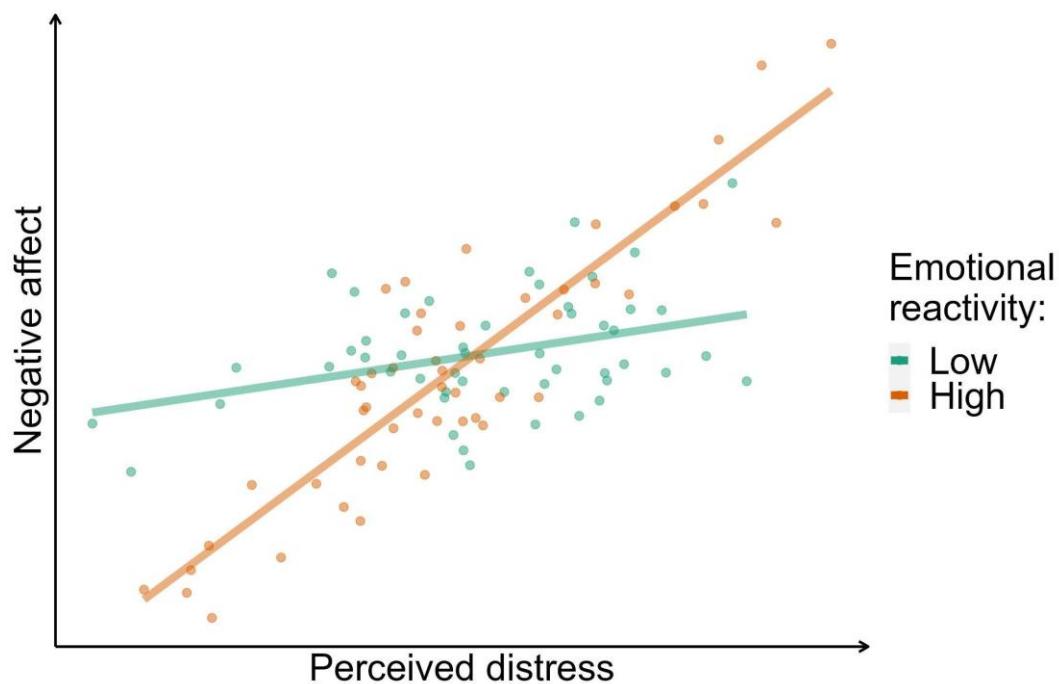


Fig. S1. Illustration of emotional reactivity on simulated data. Intensity of emotional reactivity can be captured by the slope's steepness regarding the statistical association of negative affect and perceived distress.

Additional information on ethical considerations

Participation in the study was voluntary, in return for which, if requested, we sent feedback figures to participants about their daily changes in emotional states and sleep. Study participation could be terminated at any time without justification. Data collection happened through a web application called formr.org, which collected responses during the study using links sent to participants' email addresses. Participants' email addresses were used solely for collecting responses and for contact and communication with the participants. Email addresses were deleted in all cases prior to data cleaning and processing to anonymize participants. Data of participants were only available to researchers on formr.org. For more information on formr.org security settings: <https://link.springer.com/article/10.3758/s13428-019-01236-y>

Baseline participant screening

Responses in the baseline assessment were screened based on relative completion speed (Leiner, 2019): we calculated relative speed factor i.e. the median speed of the sample ($\text{med}[\text{speed}] = 16 \text{ min.}$) divided by individual speed and excluded observations with a relative speed factor greater than two. This resulted in a cutoff speed of 8 minutes ($\text{med}[\text{speed}] \text{ after screening} = 16.24 \text{ min.}$).

Dataset comparison

To evaluate any potential sampling bias introduced by the analysis of two separate (but overlapping) datasets, we compared participants of the Go/no-go and 2-back datasets with the participants not included in the analyses. Participants in the Go/no-go sample significantly differed from those not included with respect to median age and sex, with the former being higher in the Go/no-go sample, which also contained more females. The 2-back sample also

had significantly more females, higher median age, and a different distribution of education levels compared to the participants we excluded.

Cognitive control task screening

A multi-stage screening protocol was applied to keep valid and evaluable data for momentary 2-back and Go/No-go tasks: first, prior to the screening procedure, we also attempted to find delayed, but not invalid responses (xth trial was 'go' with missing response and xth + 1 trial with single fast [< 0.2 seconds] response). Second, we attempted to identify and screen invalid sessions. We conceptualized invalid sessions with over 50% rate of invalid trials (no-concept or completely effortless responses that hold multiple, typically unlikely fast clicks or taps given regardless of the stimulus). Third, we screened all invalid and fast (< 0.2 seconds) trial-responses. Fourth, we discarded complete sessions where participants did not respond to any of the trials. By the complete multi-stage screening process we retained 189416 Go/No-go and 200067 2-back trials in sum (trials within sessions: mean[Go/No-go] = 59.83, mean[2-back] = 59.86, sd[Go/No-go] = 0.59, sd[2-back] = 0.49).

Design

Upon entering the study, participants were asked to complete a survey containing trait-level questionnaires and assessing demographic information. At the end of this section, participants could decide whether they wanted to take part in the ESM phase of the study, starting the next morning. Participants received 8 two-hourly prompts (beeps) daily between 8:00 AM and 10:00 PM. These short, 5-minute sessions included the surveys mentioned above, related to momentary affective states and event pleasantness, besides other items not analyzed in the present study. Then, participants were automatically redirected to *pavlov.org* to complete the two short cognitive tasks described above, each taking approximately 1.5 minutes. The order of the tasks was randomized.

Every third day, participants also received a 5-minute survey exploring depressive symptoms, stressful events, support, and environmental resources in the past 3 days. This was received at 6:00 PM and could be completed until 10:00 PM. No other ESM prompt (beep) was sent later those days, with the next email sent at 8:00 AM the following morning. These surveys are not included in the present analysis.

Participants could take part in the ESM phase for up to 28 days, but had the option to quit at any point. After a minimum of 7 days of participation, they could choose to receive feedback containing figures about the daily fluctuation of their sleep quality and quantity, as well as their negative and positive affective states.

Compliance rates

In the Go/no-go sample, the compliance rate was acceptable for both the Go/no-go task and affective states surveys (mean = 33.1%, med = 31.2%, min = 1.25%, max = 65.4%) and the 2-back task (mean = 32.5%, med = 31.6%, min = 1.25%, max = 64.4%). The 2-back sample had similarly acceptable compliance rates for the 2-back task and affective states surveys (mean = 35.1%, med = 34.6%, min = 1.25%, max = 72.9%) and the Go/no-go task (mean = 32.4%, med = 31.6%, min = 1.25%, max = 64.4%). See Table S1 for descriptive statistics of the two samples.

Table S1. Descriptive statistics of measures in the ESM phase

	Go/No-go sample	N-back sample
Go/no-go d-prime score		
Mean	1.54	1.56
Median	1.54	1.56
SD	0.83	0.83
Range	-1.46 – 4.28	-1.46 – 4.28
2-back d-prime score		
Mean	2.21	2.11
Median	2.25	2.18
SD	1.12	1.14
Range	-1.27 – 4.16	-1.27 – 4.16
Event unpleasantness		
Mean	3.30	3.29
Median	3	3
SD	1.46	1.44
Range	1 – 7	1 – 7
Anger		
Mean	1.32	1.31
Median	1	1
SD	0.79	0.78
Range	1 – 6	1 – 6
Sadness		
Mean	1.69	1.71
Median	1	1
SD	1.15	1.19
Range	1 – 6	1 – 6
Calmness		
Mean	4.18	4.20
Median	4	4
SD	1.49	1.49
Range	1 – 6	1 – 6

Cheerfulness

Mean	3.35	3.34
Median	3	3
SD	1.37	1.38
Range	1 – 6	1 – 6