

Supplementary material

S1. Time course of a trial during the Stroop task

Each trial lasted 2 seconds. At the beginning of each trial, a fixation cross was presented for 400 ms. This fixation cross was enclosed by a circle or a square for 50 ms, and then the cross alone remained on the screen. After this preparatory signal, a color word (e.g., GREEN, BLUE, RED, or YELLOW), shown in a different color than the meaning of the word (e.g., the word GREEN shown in blue), appeared on the screen until the participant's response. Participants were instructed to read the word itself when a square was presented on the screen (reading trials) or name the color of the word when a circle appeared (naming trials) for a maximum of 1250 ms. An omission was defined as participants not responding at all or responding after 1250 ms (Too long RT).

S2. Assessment of maximal voluntary contraction (MVC)

At the beginning of each session, participants' MVC was measured using a hand dynamometer (TSD121C, BIOPAC) with the data acquisition unit (MP160) and the software acknowledge version 5.0 (BIOPAC Systems Inc, CA, USA). Data were recorded at 2000 Hz. Participants started by squeezing the dynamometer as strongly as possible with their dominant hand for 3 s. The MVC measurement was repeated with a 30-s rest period between trials until the peak force no longer increased. The highest peak force was used to calibrate the gauge for the TTE handgrip task. Participants sat on a chair with their forearm on their thigh, with the elbow forming an approximately 90° angle.

S3. Self-reported measures

At the beginning of each session, participant's state was assessed by questions on their sleep duration the previous night, consumption of psychostimulant substances 6 hours before or engagement in intense physical activity 12 hours before. Before the cognitive task

(Stroop task or documentary viewing task), participants had to report their level of fatigue using visual analog scales displayed on a screen, ranging from 0% to 100%. After the completion of the cognitive task, participants reported their level of fatigue, perceived difficulty in the cognitive task, feelings of boredom during the cognitive task and motivation to perform the TTE handgrip task. Following the TTE handgrip task, participants reported their level of fatigue.

During the TTE handgrip endurance task, perceptions of effort and pain were measured every 30 seconds. Perception of effort was measured with the CR100 scale (Borg & Kaijser, 2006) and pain with the Cook Scale (O'Connor & Cook, 2001). Effort and pain were analyzed using the "individual isotime" (Nicolò et al., 2019). We used the shortest performance during the TTE for each participant between the two experimental conditions. This performance represents 100% of their individual isotime. Then, three other time points were used corresponding to 0%, 33% and 66% of their 100% individual isotime for each participant and each session.

S4. Physiological measures analysis

ECG and ICG signals were processed with a MATLAB program developed by the SCOTE lab (Albi, France). In the ECG signal, R-peaks were identified by using a threshold peak detection algorithm. Heart rate variability (HRV) was calculated based on the detected R-peaks. For the ICG signal, the B point was estimated based on the RZ interval according to the recommendation of Lozano et al. (2007). The R onset and the B point were automatically scored for each cycle. The preejection period (PEP) was determined as the time interval (in ms) between R-onset and B point and averaged over 1-min periods (Berntson et al., 2004). All PEP < 40 ms or > 200 ms were excluded from the 1 min average. Additionally, PEP data that were ± 2 standard deviations of the mean for each minute were visually inspected.

S5. MVC results

The MVC was measured at the beginning of each session, both after the mental task and after the physical task to measure the effect of each task on maximal strength. We expected a decrease in MVC after the TTE handgrip task. We conducted an ANOVA with time (before the mental task, after the mental task and after the handgrip task) and session (Stroop and control) as repeated-measures factors. The interaction between Time and Session did not reach significance: $F(1.787, 87.577) = 2.677, p = .080, \eta_p^2 = .052$. The main effect of session was also not significant: $F(1, 49) = 2.302, p = .136, \eta_p^2 = .045$. We found a significant main effect of time on MVC: $F(1.259, 61.675) = 132.064, p < .001, \eta_p^2 = .729$. Participants had a lower peak force after the handgrip task ($M = 20.086, SD = 6.026$) than before ($M = 27.435, SD = 8.302, p < .001$) suggesting that they really performed the TTE handgrip task until exhaustion.

S6. Cardiovascular results

Cardiovascular baseline

We used one-way ANOVA on the baseline cardiovascular indices to examine differences in baseline scores. No differences in scores between the two baselines were found (all $p > .05$). The mean and standard deviation of baseline scores are reported in Table 1.

For HRV measures (RMSSD), heart rate (HR) and breathing rate, an ANOVA was conducted with Session (Stroop and control) and Time (baseline, periods 1, 2, 3 and 4 of the mental task) as repeated-measures factors.

| | Means (standard deviation) of cardiovascular baseline scores | | |
|----------------|--|-------------------------|----------------|
| | Baseline control session | Baseline Stroop session | <i>p</i> value |
| PEP (ms) | 138.049 (15.069) | 140.113 (15.378) | .576 |
| HF power (log) | 6.303 (1.296) | 6.115 (1.476) | .217 |
| RMSSD (ms) | 41.056 (21.435) | 41.651 (24.695) | .801 |
| HR (bpm) | 74.561 (10.047) | 74.741 (10.703) | .366 |
| SBP (mmHg) | 119.347 (12.891) | 120.551 (10.6752) | .361 |
| DBP (mmHg) | 76.082 (11.595) | 79.673 (13.757) | .055 |

Table 1: Means and standard deviations of psychophysiological baseline measures.

Note: PEP = preejection period, HF = high frequency, RMSSD = root mean square of successive differences, HR = heart rate, SBP = systolic blood pressure, DBP = diastolic blood pressure.

Breathing rate

The interaction between Session and Time was significant: $F(2.739, 131.450) = 5.126$, $p = .003$, $\eta_p^2 = .096$. The breathing rates during the two baselines were not significantly different ($p = 1.000$). Breathing rate did not change between the 4 periods of the control task ($M = 11.602$, $SD = 3.306$, all $p > .05$) or during the Stroop task ($M = 12.867$, $SD = 2.908$, all $p > .05$). The only significant difference in breathing rate was observed during the second period; the breathing rate was lower in the control task ($M = 11.204$, $SD = 2.944$) than in the Stroop task ($M = 12.776$, $SD = 3.210$, $p = .034$).

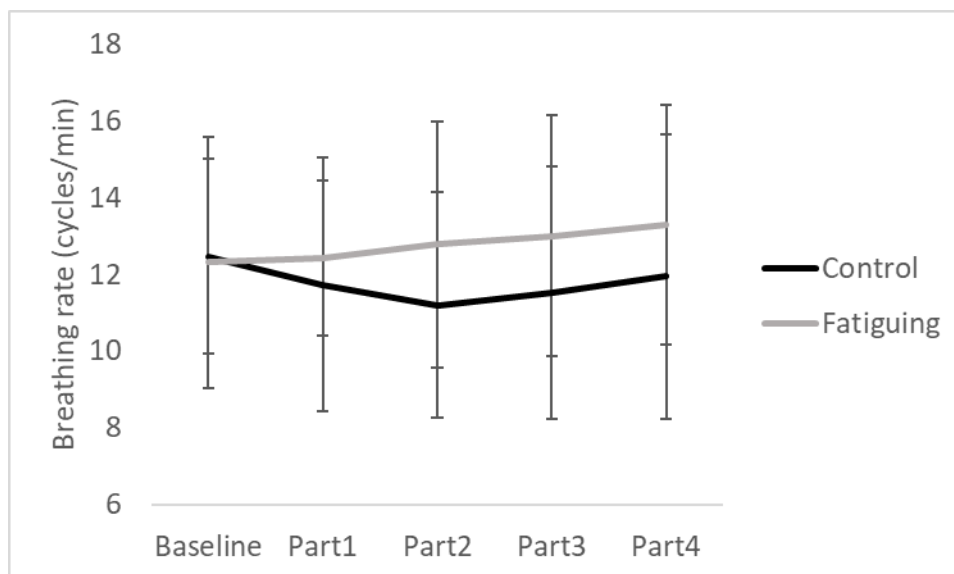


Figure 1: breathing rate in cycles/min. Errors bars represent the standard deviation.

Heart rate

The interaction between Session and Time reached significance: $F(2.260, 108.497) = 27.504$, $p < .001$, $\eta_p^2 = .364$. The heart rates measured during the two baseline periods were not different ($p = 1.000$). During the 4 periods of the mental task, the heart rate in the control task was significantly lower in the control task than that in the Stroop task (all $p < .05$). During the control task, the heart rate was higher during the first period ($M = 70.551$, $SD = 9.695$) compared to the third ($M = 72.918$, $SD = 9.602$, $p < .001$) and fourth periods ($M = 72.388$, $SD = 9.101$, $p = .018$). During the Stroop task, the HR rate did not change between any of the 4 periods (all $p = 1.000$). These results suggest a higher sympathetic activity in the Stroop task compared to the control task.

RMSSD

The interaction between Session and Time was significant: $F(2.349, 112.738) = 14.730$, $p < .001$, $\eta_p^2 = .235$. A post hoc test showed that RMSSD values were not significantly different between the control and Stroop baseline ($p = 1.000$). RMSSD values were lower in the Stroop task (period 1: $M = 30.053$, $SD = 14.708$; period 2: $M = 30.763$, $SD = 14.942$;

period 3: $M = 31.737$, $SD = 15.597$; period 4: $M = 34.439$, $SD = 19.681$) than during the control task (period 1: $M = 44.638$, $SD = 24.366$; period 2: $M = 42.438$, $SD = 24.440$; period 3: $M = 40.860$, $SD = 22.724$; period 4: $M = 42.706$, $SD = 24.695$) for the first, second and third periods (all $p < .05$) but not for the fourth period ($p = .113$). RMSSD values did not change significantly as time-on-task increased during the control (all $p = 1.000$) and the Stroop tasks (all $p > .05$). These results are similar with those obtained for HF index.

Systolic blood pressure

We conducted an ANOVA with Session (control, Stroop) and Time (after the baseline period and after the mental task) on systolic blood pressure. The interaction between Session and Time did not reach significance: $F(1, 48) = 2.909$, $p = .095$, $\eta_p^2 = .057$. The main effect of Session was significant: $F(1, 48) = 5.571$, $p = .020$, $\eta_p^2 = .107$. However, the main effect of Time was not significant: $F(1, 48) = .018$, $p = .893$, $\eta_p^2 < .001$. These results indicate that systolic blood pressure was lower during the control session ($M = 118.500$, $SD = 11.990$) than during the Stroop session ($M = 121.296$, $SD = 11.627$).

Diastolic blood pressure

Diastolic blood pressure was analyzed by conducting a repeated-measures ANOVA with Session and Time as within-subjects factors. The interaction between Session and Time was not significant: $F(1, 48) = .060$, $p = .807$, $\eta_p^2 = .001$. The effect of Session was significant: $F(1, 48) = 5.786$, $p = .020$, $\eta_p^2 = .108$. However, the effect of Time did not reach significance: $F(1, 48) = .001$, $p = .972$, $\eta_p^2 < .001$. As for systolic blood pressure, diastolic blood pressure was lower in the control ($M = 76.245$, $SD = 10.637$) than in the Stroop session ($M = 79.551$, $SD = 13.256$).

S7. Self-reported measures

Boredom

Participants did not feel more bored in the control ($M = 29.120$, $SD = 24.399$) than in the Stroop task ($M = 33.820$, $SD = 25.536$): $t(49) = -1.105$, $p = .275$, $d = -.156$. It is also interesting to note that the level of boredom was low in both sessions ($< 34/100$).

Motivation

We conducted a paired sample t test with Session as a repeated-measures factor (control and Stroop) on the motivation to perform the TTE handgrip task. Participants reported to be less motivated to perform the handgrip task after the Stroop task ($M = 61.204$, $SD = 24.590$) than after the control task ($M = 69.571$, $SD = 20.300$): $t(48) = 2.557$, $p = .014$, $d = .365$.

Perceptions of effort and muscle pain during the subsequent handgrip endurance task

An ANOVA was conducted between session (control and Stroop) and time (0%, 33%, 66% and 100%) as repeated measures on perceived effort. The interaction between session and time was not significant: $F(1.274, 62.419) = 2.488$, $p = .112$, $\eta_p^2 = .048$. The main effect of session did not reach significance: $F(1, 49) = 3.053$, $p = .087$, $\eta_p^2 = .059$. The effect of time was significant: $F(1.415, 69.350) = 187.597$, $p < .001$, $\eta_p^2 = .793$. The perception of effort increased throughout the TTE handgrip task (all $p < .001$).

The same ANOVA was conducted on perception of pain. The interaction between session and time did not reach significance: $F(1.762, 86.314) = .1169$, $p = .311$, $\eta_p^2 = .023$. The main effect of session was not significant: $F(1, 49) = 3.411$, $p = .071$, $\eta_p^2 = .065$. The effect of time reached significance: $F(1.372, 67.207) = 197.000$, $p < .001$, $\eta_p^2 = .801$. As for the perception of effort, the pain increased throughout the TTE handgrip task (all $p < .001$).

Performance during the control task

A one-sample t test was conducted on the percentage of correct responses compared to chance (50%). The participant's responses were higher than chance level ($M = 8.000$, $SD =$

| Variable | Task difficulty | Subjective fatigue | Motivation | Boredom | Stroop performance (RT naming trials) | Stroop performance (omissions) | TTE Handgrip performance |
|---------------------------------------|-----------------|--------------------|------------|---------|---------------------------------------|--------------------------------|--------------------------|
| Subjective fatigue | .359* | | | | | | |
| Motivation | .108 | -.173 | | | | | |
| Boredom | .084 | .152 | -.111 | | | | |
| Stroop performance (RT naming trials) | .065 | .252 | .102 | .001 | | | |
| Stroop performance (omissions) | .215 | .076 | -.182 | .038 | .527** | | |
| TTE Handgrip performance | -.444** | -.167 | -.007 | -.039 | .124 | .281* | |
| PEP reactivity | -.194 | .023 | .078 | -.089 | -.134 | -.336* | .129 |

.904): $t(49) = 3.320$, $p < .001$, $d = 3.320$, indicating that the participant paid attention to the documentary.

S9. Correlational analysis

We conducted a correlational analysis to investigate the relationship between self-reported measures, behavioral performance, and physiological measures. The results are presented in Table S1.

Table S1: Pearson's correlational matrix of several dependent variables assessed during the experiment. Task difficulty = perceived difficulty of the Stroop task; Subjective fatigue = fatigue after the Stroop task – fatigue before the Stroop task; Motivation = motivation to perform the handgrip task after the Stroop task – motivation to perform the handgrip task after the control task. Boredom = boredom during the Stroop task. Stroop performance = performance in the fourth – performance in the first part; Handgrip performance = TTE during the control session – TTE during the Stroop session; PEP reactivity = mean reactivity during the fourth period of the Stroop task – mean reactivity during the first period of the Stroop task.

Note: * $p < .05$, ** $< .001$.

Perceived difficulty in the Stroop task significantly correlated with two other variables: the higher perceived difficulty was, the higher the subjective fatigue after the Stroop task, and the lower the performance in the TTE handgrip task. In addition, the increase in omission rate with time-on-task during the Stroop task significantly correlated with three variables: the greater the increase in omissions rate was, the higher the increase in mean RT during the Stroop task, the lower the increase in PEP reactivity during the Stroop task, and the larger the difference in performance in the TTE handgrip task between the control task and the Stroop session.

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