

Supplementary Information

Adolescent Metacognitive Ability Predicts Spontaneous Task Strategy Adjustment

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CSI Quartile Analysis Approach

The analysis approach from Longman, Lavric and Monsell (2017) was followed to determine: (1) whether CSI on switch trials is longer than on repeat trials, (2) whether increased CSI duration decreases switch cost, and (3) if the effect of CSI can be attributed to preparation, not passive dissipation, by investigating the effect of two different response-to-fixation intervals (RFIs). CSI durations were broken into quartiles, separately for each participant.

An ANOVA on the CSI durations, with the factors CSI quartile, Trial Type (Switch or Repeat), Task (Parity or Magnitude) and RFI (0.7s or 1.7s), found a significant main effect of trial type, $F(1, 4315) = 8.89$, $p = .003$. The cue was viewed for significantly longer on switch ($M = 927\text{ms}$, $SE = 12.5$) than repeat ($M = 874\text{ms}$, $SE = 12.5$) trials. There was no significant interaction between trial type and CSI quartile, but CSI was longer for switch trials than for repeat trials across all four CSI quartiles (see Figure S4A and D). There were no other significant effects.

An ANOVA was then run on the reaction time variable, with the factors Trial Type (Switch or Repeat), CSI quartile, Task Type (Parity or Magnitude) and RFI (0.7s or 1.7s). Importantly, there was a significant switch cost as indicated by a main effect of trial type, $F(1, 4315) = 16.40$, $p < .001$, such that reaction time on switch trials ($M = 852$, $SE = 7.65$) was larger than reaction time on repeat trials ($M = 808$, $SE = 7.65$). There was also a significant main effect of CSI quartile, $F(3, 4315) = 7.53$, $p < .001$, (see Figure S1A), such that reaction time decreased across CSI quartile 1 ($M = 868\text{ms}$, $SE = 10.8$), CSI quartile 2 ($M = 815\text{ms}$, $SE = 10.8$) and CSI quartile 3 ($M = 799\text{ms}$, $SE = 10.8$), before increasing again in CSI quartile 4 ($M = 836\text{ms}$, $SE = 10.8$). There was no significant interaction between trial type and CSI quartile, but switch cost did decrease in longer CSI quartiles, with the exception of quartile 1 (see Figure SB). The reaction time increase in Quartile 4 was also found in Longman, Lavric and Monsell (2017), and attributed to fluctuations in processing efficiency.

However, Quartile 4 CSI did not increase substantially in the longer RFI trials, with CSI being comparable across RFI 0.7s and 1.7s in each quartile; Quartile 1 = 396ms and 388ms, Quartile 2 = 547ms and 555ms, Quartile 3 = 711ms and 718ms, Quartile 4 = 1282ms and 1278ms, respectively. Therefore, we carried Quartile 4 trials forward to a final ANOVA to check that the effects of CSI reflect preparation, not passive dissipation after the previous trial. Following the approach in Longman et al., 2017, a subset of trials was selected where RSI was within 1SD of the median RSI for the condition. A reaction time ANOVA with the factors RFI and Trial Type was run on this subset of trials. Neither the main effect of RFI nor its interaction with trial type approached significance (all $F_s < 1$), suggesting that the effects of preparation time on switch cost are due to active preparation, not passive dissipation.

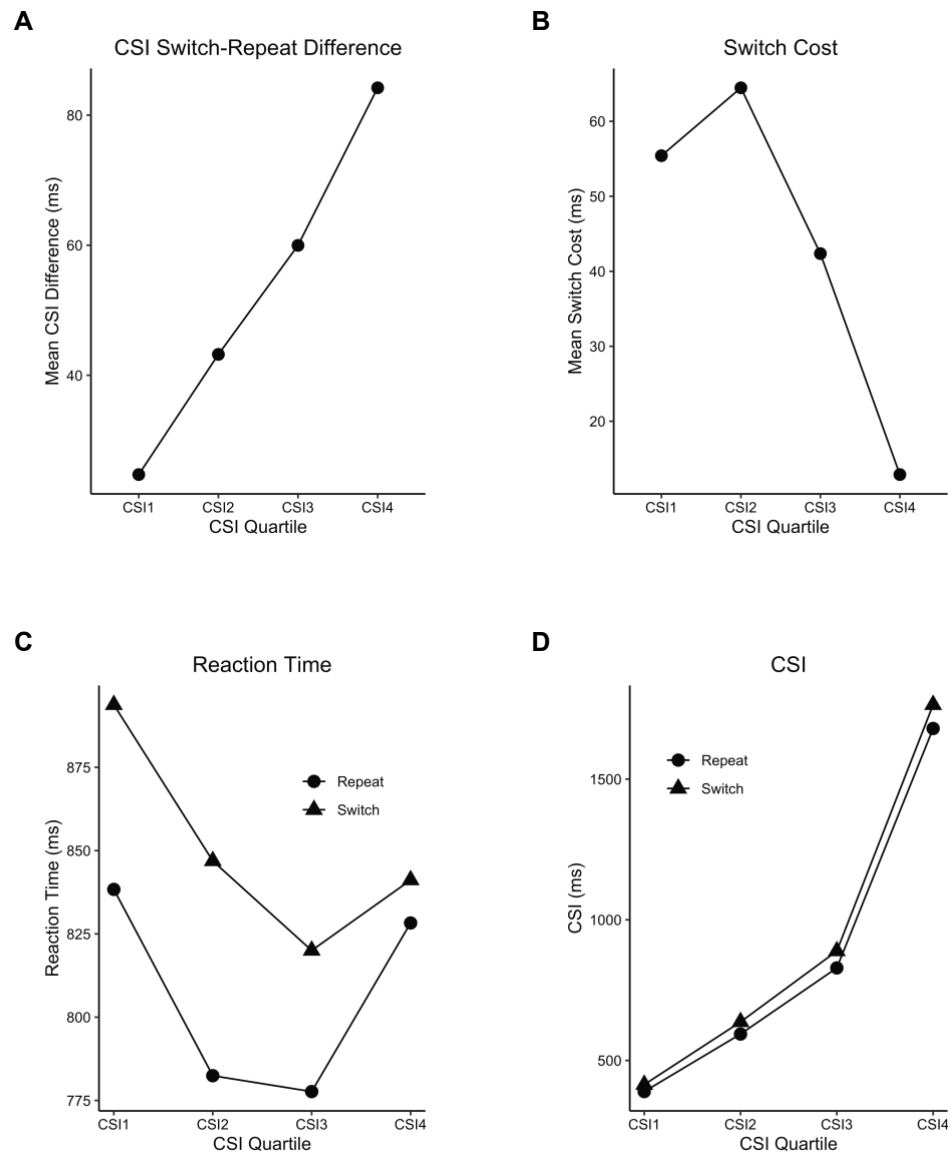


Figure S1. **A.** Average switch cost across CSI quartiles. **B.** Average CSI difference (switch – repeat) across CSI quartiles. **C.** Average reaction time across CSI quartiles. **D.** Average CSI across CSI quartiles.

Adolescent MAKQ Cluster Analysis

Non-hierarchical k-means clustering was used to investigate within-groups similarity across self-perceived meta-attention ability and objective strategy knowledge. The Monitoring, Control, and Total Strategy scales were standardised to ensure equal empirical weighting prior to conducting the cluster analysis. A convergence criterion of 0.00 was set, with a maximum of 10 iterations, and a 3-cluster solution was considered best fit (see Figure S2). Each cluster captures a distinct interaction between self-perceived meta-attention ability and objective strategy knowledge. The high knowledge group scored above average on self-perceived meta-attention ability and objective strategy knowledge, the low knowledge group scored below average on self-perceived meta-attention ability and objective strategy knowledge, and the overconfident group scored above average on self-perceived meta-attention ability, but below average on objective strategy knowledge.

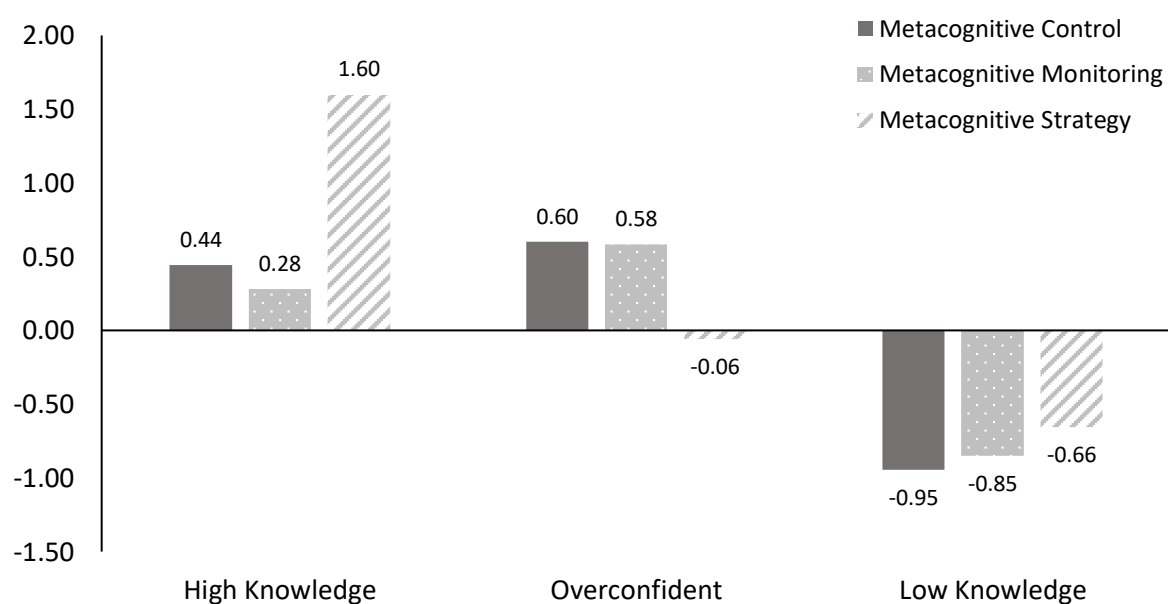


Figure S2. Metacognitive profiles revealed in the cluster analysis of MAKQ Monitoring, Control and Total Strategy scales.

Planned t-tests were run comparing switch trial preparation time for the High Knowledge cluster to the Low Knowledge and Overconfident clusters. Participants in the high knowledge group ($M = 851.85\text{ms}$, $SD = 369.61\text{ms}$) did not prepare for significantly longer than participants in either the Low Knowledge ($M = 717.98\text{ms}$, $SD = 291.82\text{ms}$) or Overconfident group $M = 723.82\text{ms}$, $SD = 286.90\text{ms}$, $t(67) = 1.65$, $p = .103$, $d = 0.42$ and $t(88) = 1.73$, $p = .087$, $d = 0.41$ respectively.

Response Distribution of Spontaneous Preparation Adjustment

The distribution of scores for spontaneous preparation adjustment allowed for individual variability in metacognitive skill to be captured (see Figure S3).

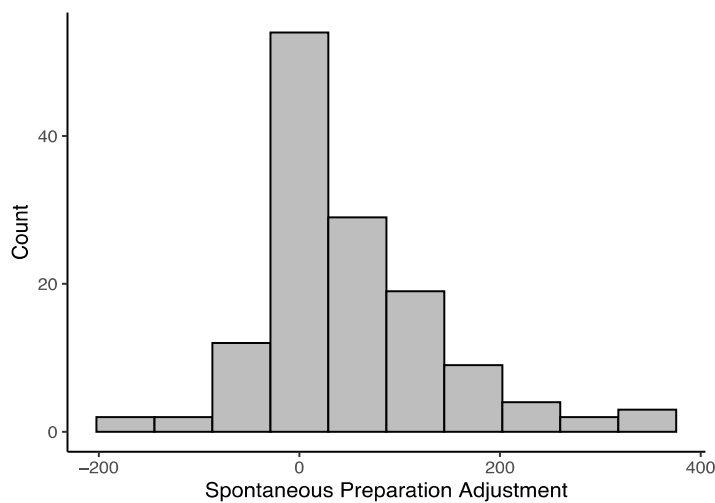


Figure S3. Distribution of spontaneous preparation adjustment scores.

Spontaneous preparation adjustment was not significantly positively correlated with switch cost, $r = -0.03$, $p = .704$. However, difference scores can be problematic in correlational research, and these reported correlations are between two sets of difference scores.