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## Supplementary Information for

# Unlocking Adults' Implicit Statistical Learning by Cognitive Depletion

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**This PDF file includes:**

**Table S1. Cohen's d effect sizes for independent t-tests**

| | Cohen's d effect size | Interpretation |
|---|---|---|
| **Word recognition (behavioral data)** | | |
| Experiment 1 (DLPFC > control) | | |
| Overall | .8 | Large |
| Unconfident responses | .8 | Large |
| Confident responses | .3 | Small |
| Experiment 2 (HCL/LCL > control) | | |
| Overall | .8/.7 | Large/Medium |
| Unconfident responses | .6/.3 | Medium/Small |
| Confident responses | -.1/.2 | Trivial |
| **Word-learning index (neural data)** | | |
| Experiment 1 (DLPFC > control) | .9 | Large |
| Experiment 2 (HCL/LCL > control) | -.2/-.1 | Trivial |

**The effect of cognitive depletion on the power of brain oscillations (Exploratory EEG data analyses)**

Total power ($\mu V^2$) was calculated for the Delta δ (1–4 Hz), Theta θ (4–8 Hz), Alpha α (8–12 Hz), and Beta β (12–30 Hz) bands using Matlab's *fft* function and was $\log_{10}$-transformed for normalization. We looked at power spectra across three regions (i.e., frontal, central and parietal-occipital) as a function of cognitive depletion (TMS for experiment 1 and cognitive fatigue for experiment 2). This is visualized in the figures below.

**Experiment 1.** TMS induced an overall marginally significant *increase* in Theta θ oscillations (i.e., TMS: $F$ (1, 30) = 3.91, $p$ = .057; TMS x Region: $F$ < 1) and Alpha α oscillations (i.e., TMS: $F$ (1, 30) = 3.93, $p$ = .057), and a significant increase in Alpha α oscillations in the parietal-occipital area specifically (i.e., $X^2$ (1) = 6.1, $p$ = 0.04, TMS x Region: $F$ (2, 700) = 5.26, $p$ < .01). There were no effects on Delta oscillations (i.e., TMS: $F$ (1, 30) = 1.17, $p$ = .29; TMS x Region: $F$ < 1) or Beta oscillations (i.e., TMS: $F$ (1, 30) = 3.69, $p$ = .064; TMS x Region: $F$(2,30) = 1.49, $p$ = .24).

**Experiment 2.** Cognitive load induced an overall significant *decrease* in Delta δ oscillations (Load: High vs Control: $\beta$ = -5.69e-02, SE = 2.52e-02, $t$ = -2.37, $p$ = .021; Low vs. Control: $\beta$ = -6.028e-02, SE = 2.56e-02, $t$ = -2.36, $p$ = .022; $F$ (2, 55) = 3.7, $p$ = .032; Load x Region, $F$(4, 1248) = 1.34, $p$ = .25). There were no effects on the higher frequency bands (i.e., all $F$'s < 1).

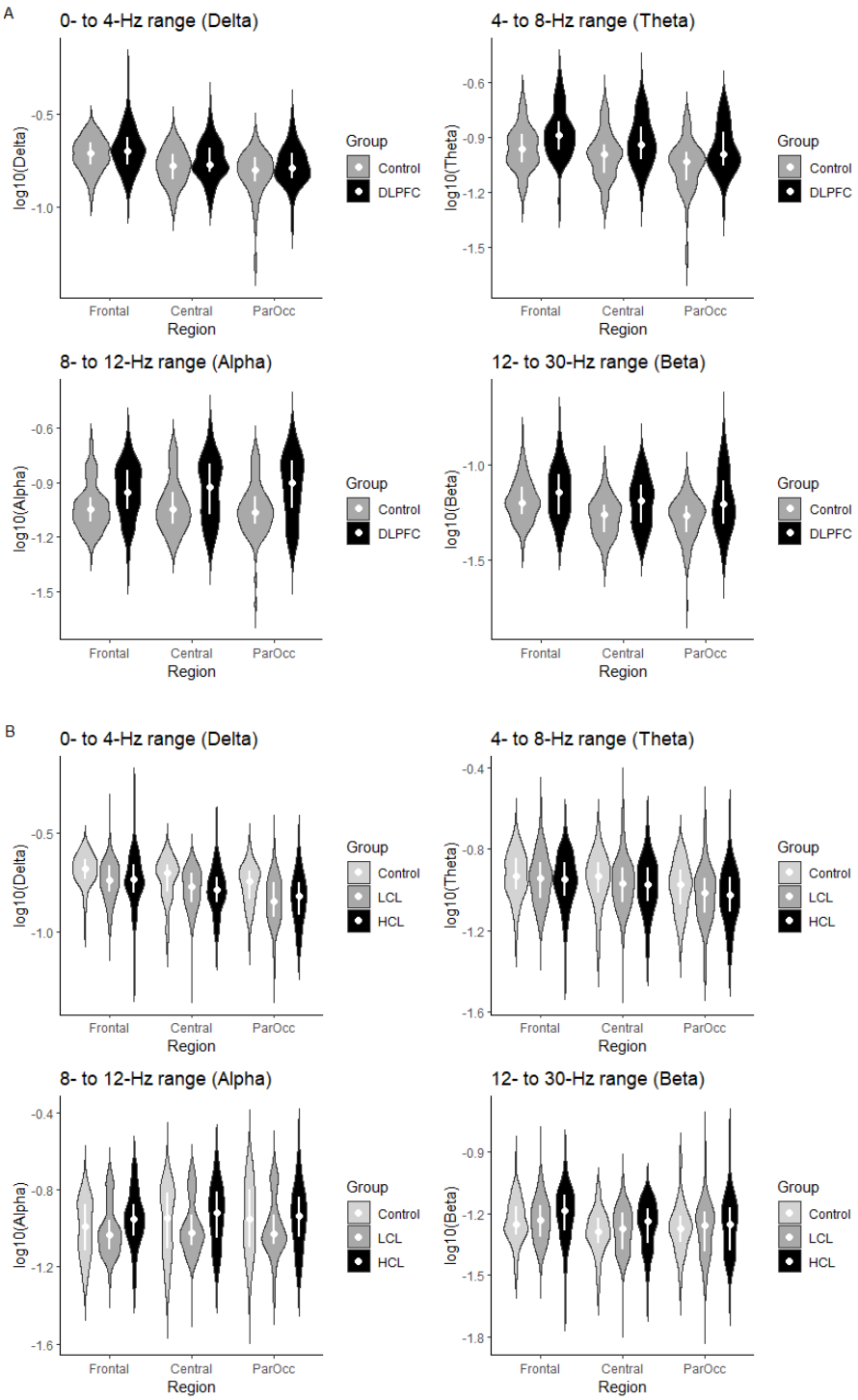


**Fig. S1.** Log10-transformed EEG power in four frequency ranges in the cognitive-disrupted (A, Experiment 1: TMS in black; B, Experiment 2: High and Low load in black and dark grey, respectively) and control participants (light grey), shown in the form of violin plots. Filled white circles represent the median, and the first and third quartiles are identified by the bottom and top of the bold vertical lines, respectively.

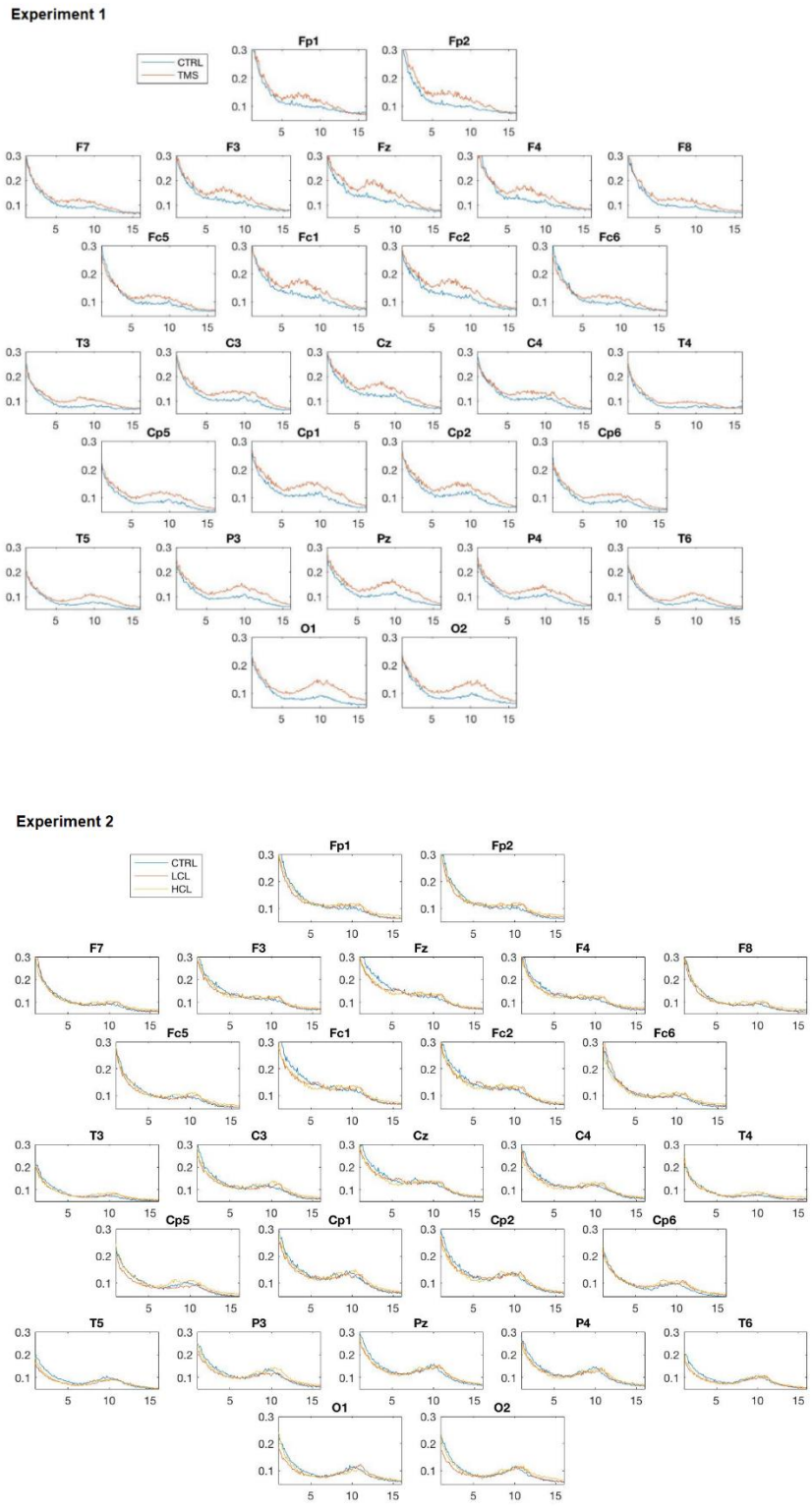


**Fig. S2**. EEG power spectra ($\mu V^2$, 0-16 Hz) at each electrode in Experiments 1 and 2. Note that the values are not normalized as in Figure 1.

**Relationship between online and offline measures of statistical learning (exploratory correlation analyses)**

Each participant's structured word-learning index and overall recognition accuracy was entered into a Pearson correlation analysis. No significant correlations were found.

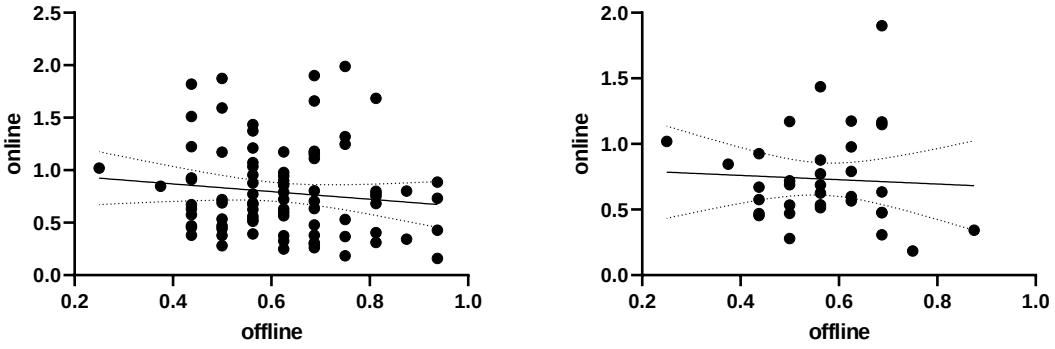


**Fig. S3.** Correlation between the online learning measure (i.e., the word learning index measured using EEG during structured exposure) and the offline learning measure (i.e., recognition accuracy measured 15-min after exposure). Left: All groups in both experiments (n = 90, r = -..12, *p* = .3, ns). Right: Control groups in both experiments (n = 35, r = -.06, *p* = .7, ns).