

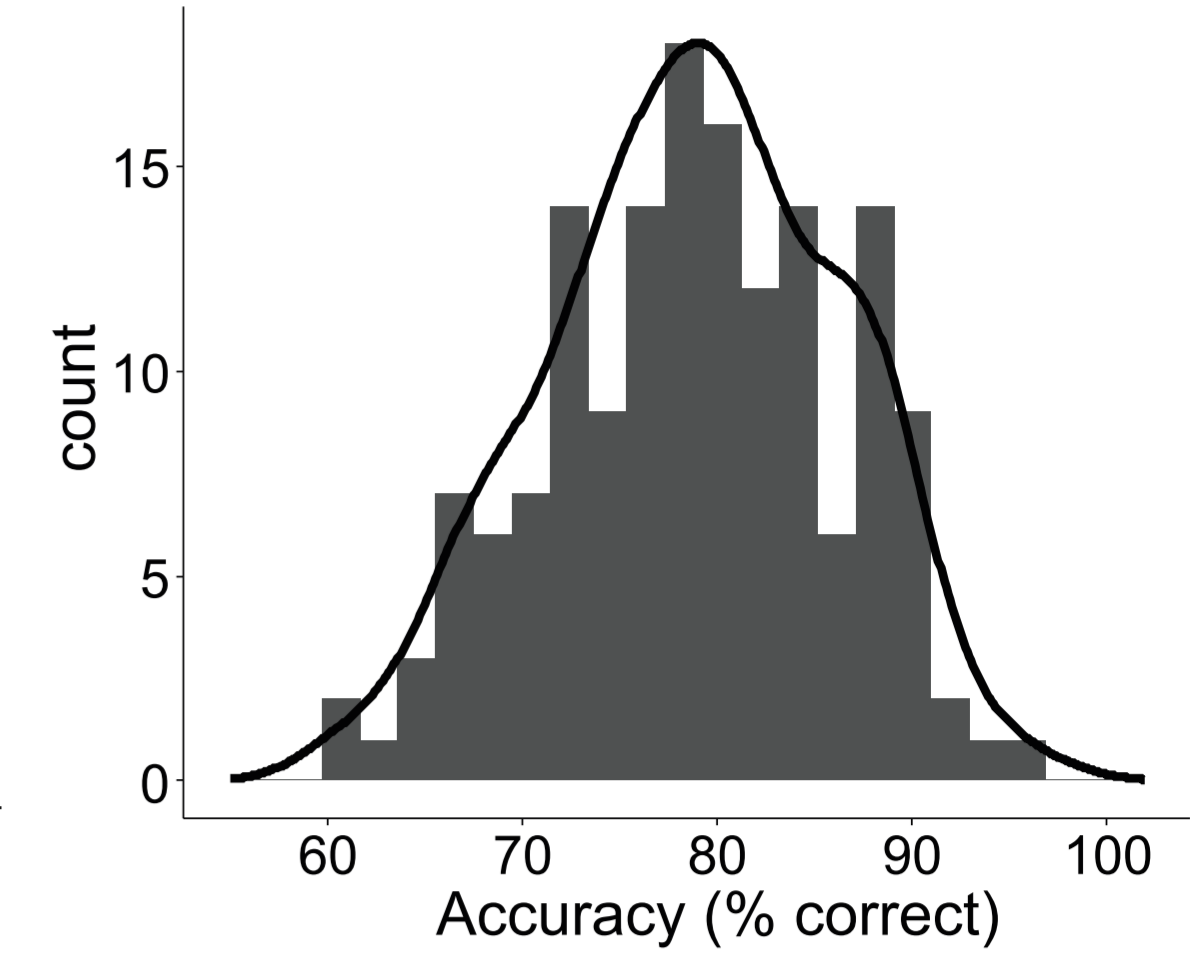
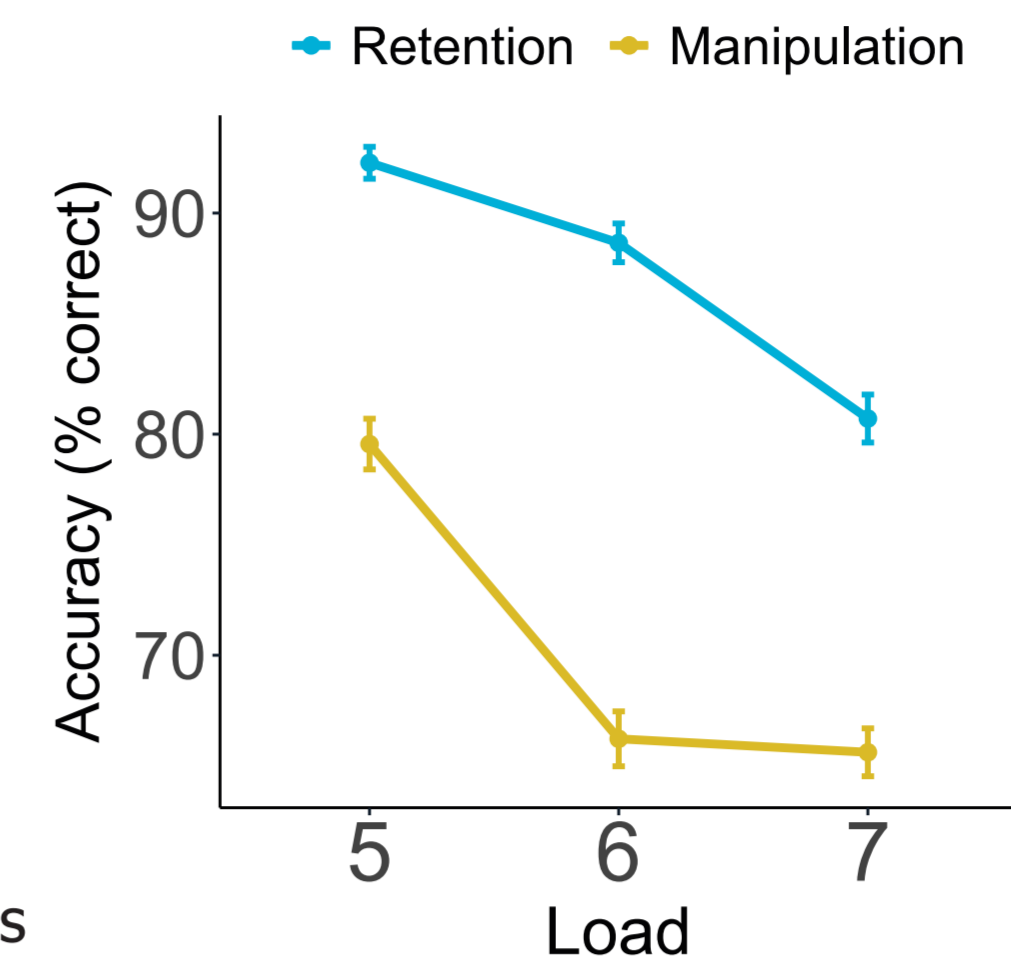
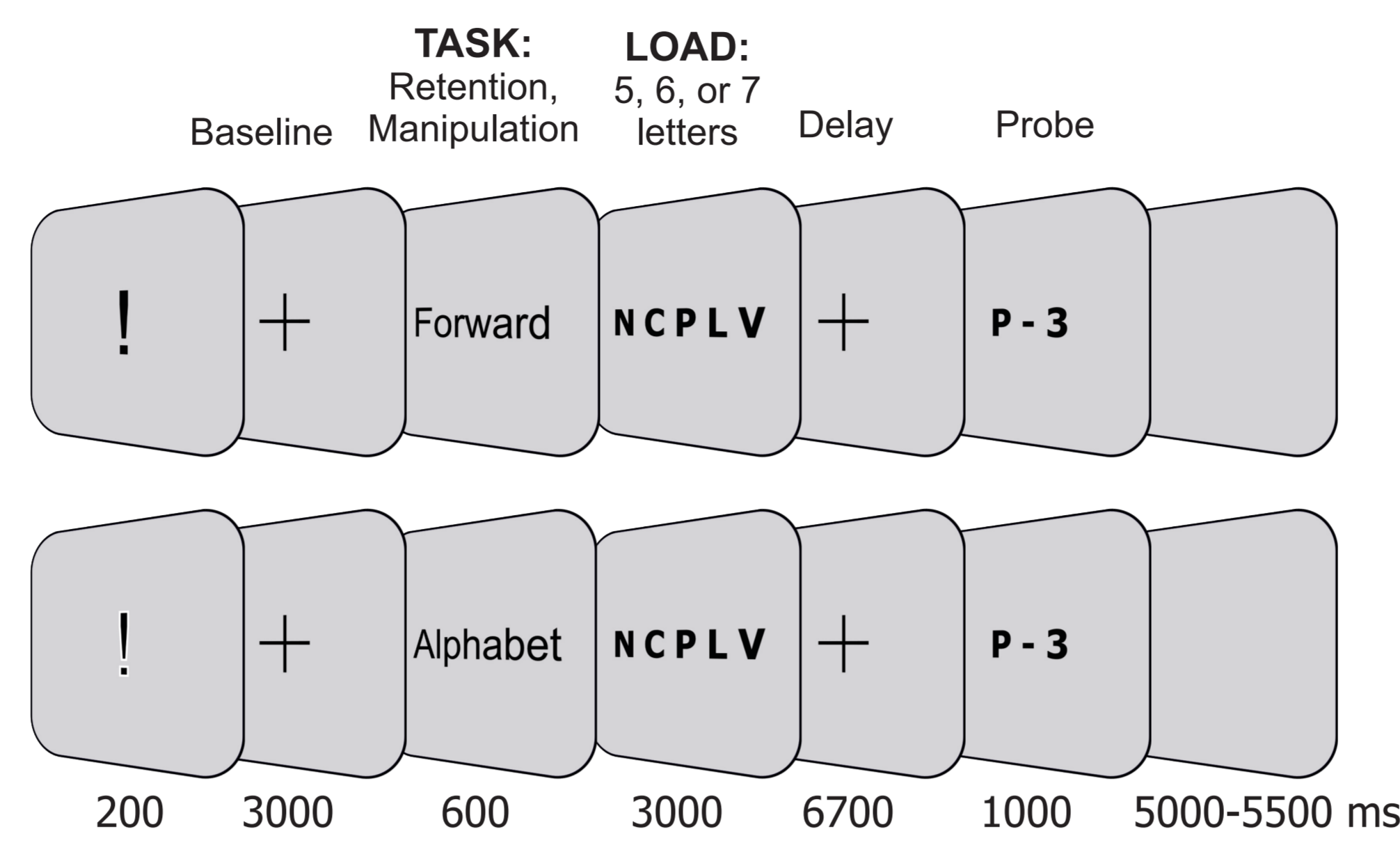
An EEG study of the role of executive control in individual differences in working memory

METHODS

N = 156
 (82 females, mean age = 21.23, SD=3.22)

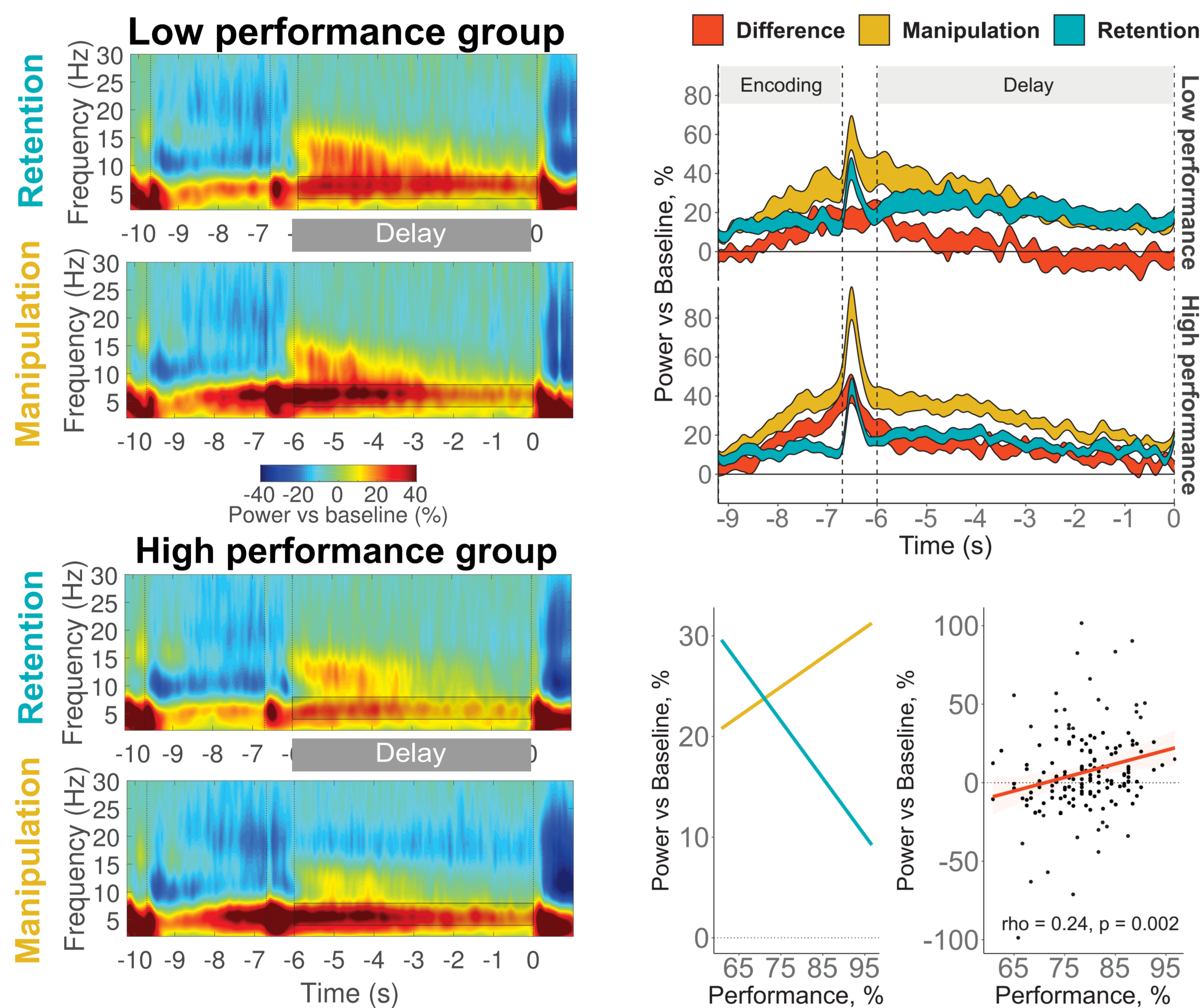
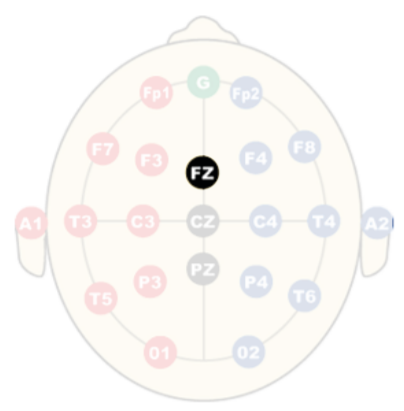
Six different conditions: memorizing 5, 6 or 7 letters in the alphabetical or forward order (Manipulation and Retention conditions).

The difference between the relative spectral power in the retention and the manipulation conditions was regarded as an EEG index of the executive components of WM.



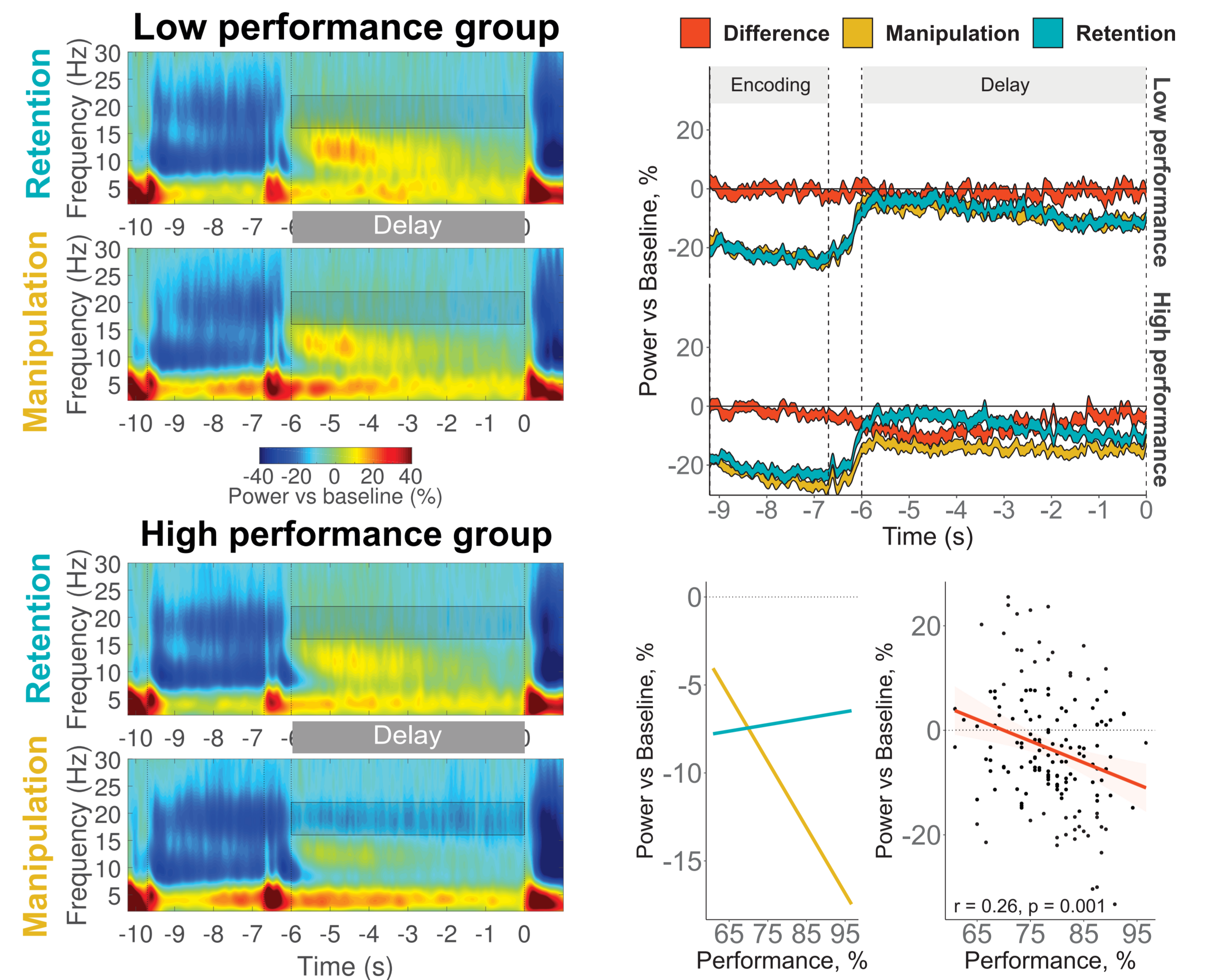
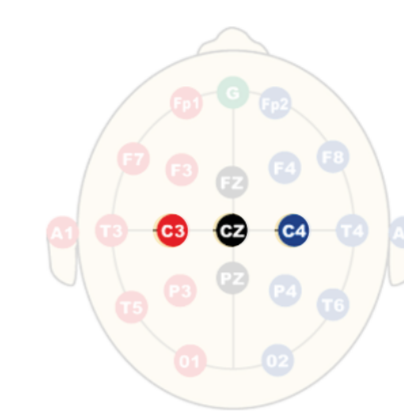
RESULTS

Theta



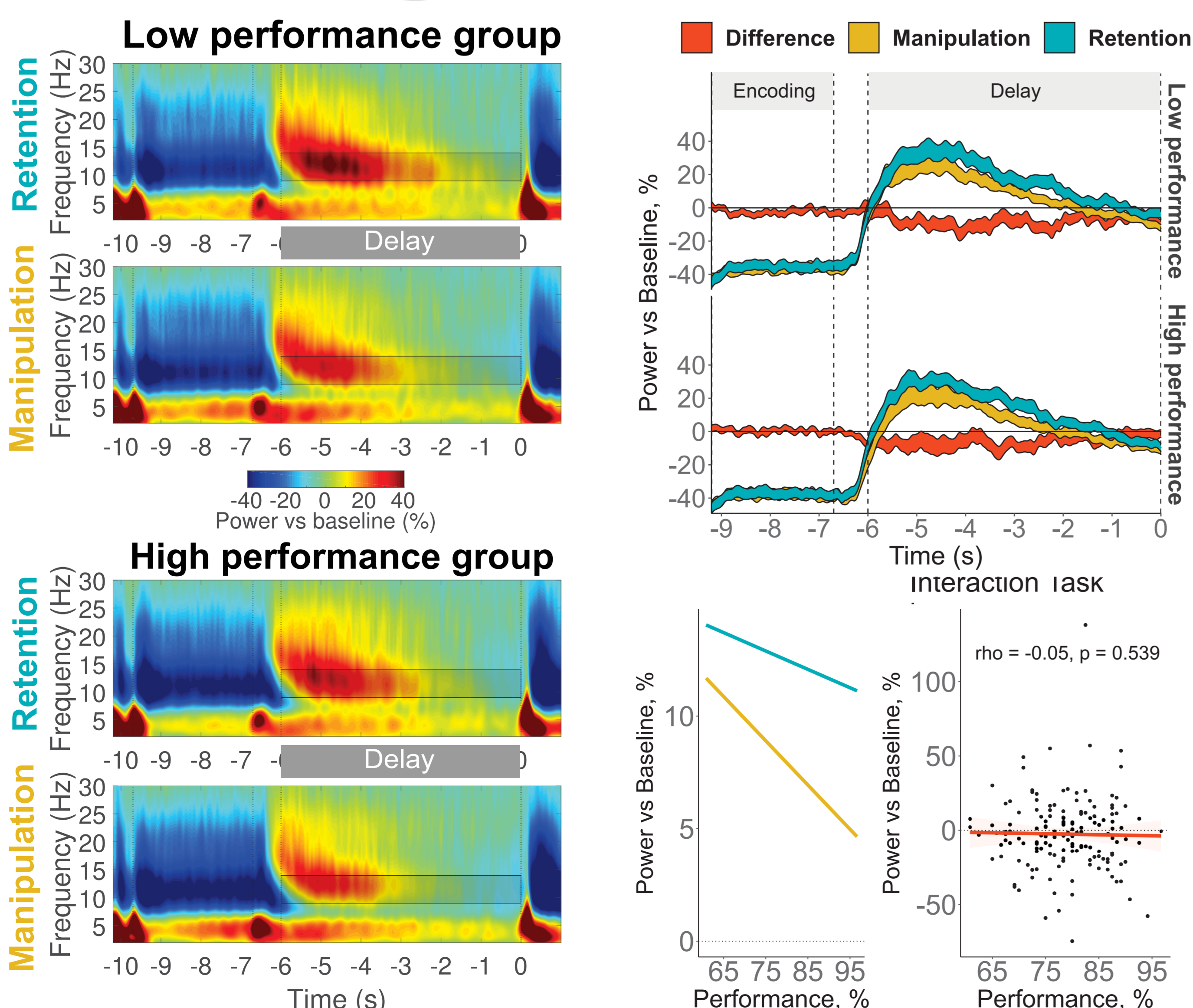
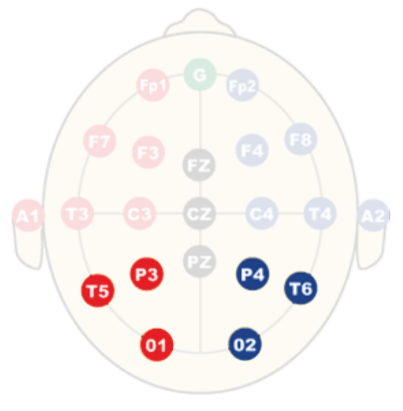
Theta (4-8 Hz, Fz channel) power positively associated with behavioral performance in the Manipulation task and a negatively in Retention task (*Task by Performance interaction* ($p = 0.004$)). The theta central executive index (the difference between baseline normalized theta power in Manipulation and Retention conditions) positively correlated with the individual WM performance (*Spearman's rho* = 0.24, $p = 0.002$).

Beta



Beta (16-22 Hz, average over C4,Cz,C4 channels) power negatively related to WM performance in the Manipulation task but not in the Retention task (*Task by Performance interaction*: $p < 0.001$). Like it has been done with the theta activity, a subtraction of Retention beta from Manipulation beta was taken as an index of executive WM components. The correlation between this index and WM performance had similar magnitude as yielded in the analysis of theta ($\rho = -0.26$, $p = 0.001$).

Alpha



No significant main effect or interactions with Performance

SUMMARY

Working memory (WM) consists of two main components: sensory storage and central executive. We studied cortical oscillatory correlates of these two components in a large sample of 156 participants to assess separately the contribution of them to individual differences in WM.

The participants were presented with WM tasks of above-average to high complexity. Some of the tasks required only storage in WM, others required storage and mental manipulations.

Our data indicate a close relationship between frontal midline theta, central beta activity and the central executive component of WM. The oscillatory counterparts of the central executive determined individual differences in verbal WM performance. In contrast, alpha activity was not related to the individual differences. The results demonstrate that central executive component of WM, rather than sensory storage capacity, play the decisive role in individual WM capacity limits.