Supplementary Information

Cognitive and neural state dynamics of narrative comprehension

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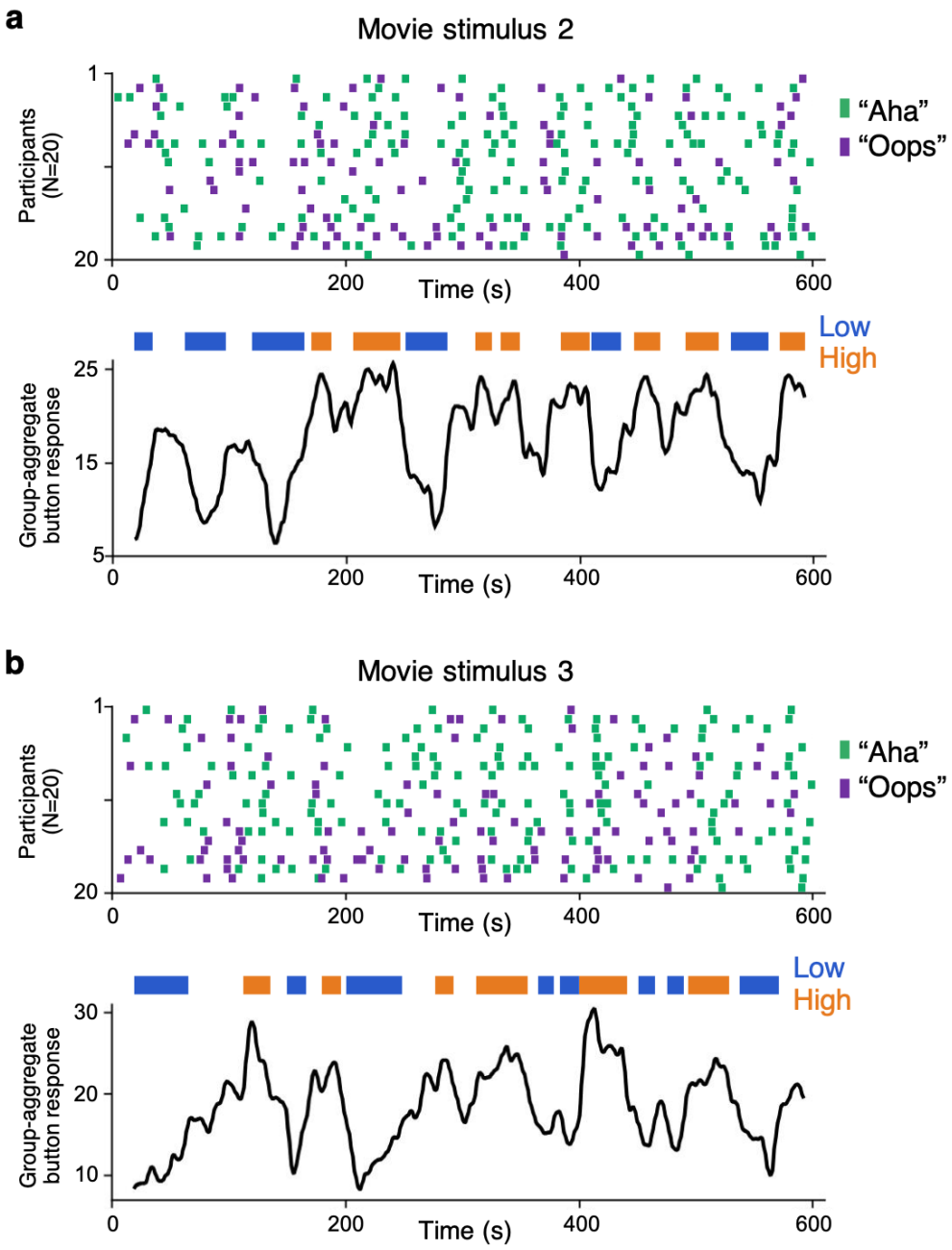
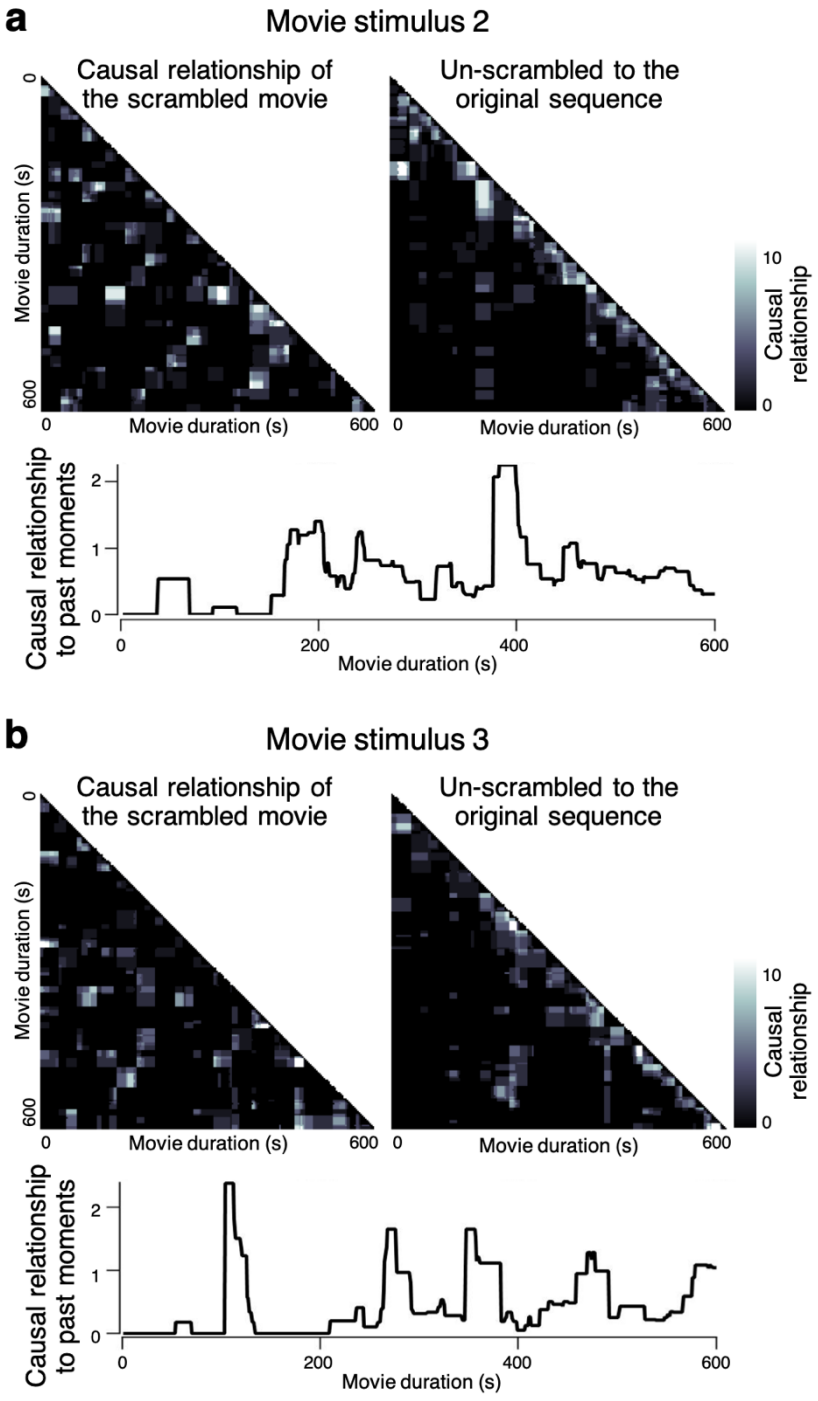
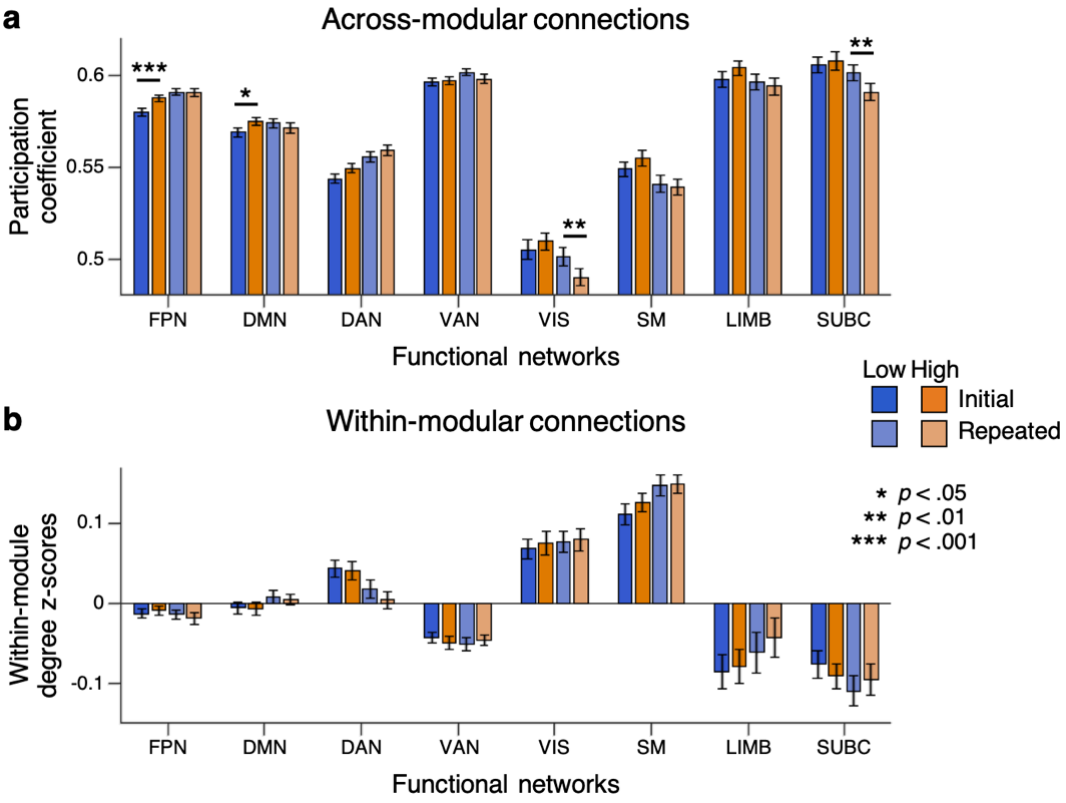
Supplementary Information S1. Results of behavioral experiment 1. (a) Behavioral results using *The Kid* (movie stimulus 2; N = 20), and **(b)** *Mr. Bean, the animated series* (movie stimulus 3; N = 20). The figure complements **Figure 2**.



Supplementary Information S2. Results of behavioral experiment 2. (a) Behavioral results using *The Kid* (movie stimulus 2; N = 12), and **(b)** *Mr. Bean, the animated series* (movie stimulus 3; N = 12). The figure complements **Figure 3**.



Supplementary Information S3. Regional network measures using a window size 36 s and Yeo atlas (122 ROIs). (a) Across-modular functional connectivity, represented by the participation coefficients. Participation coefficients were measured per ROI in every sliding window-applied functional connectivity matrix. The participation coefficient scores corresponding to high and low comprehension moments were averaged within a participant, summarized into pre-defined eight functional networks, and compared at the group level using paired Wilcoxon signed-rank tests and repeated-measures ANOVA. The participation coefficients of the FPN and the DMN increased when comprehension was high, only in the Initial but not in the Repeated Scrambled condition, with a significant interaction between the Scrambled conditions and comprehension states. The significance of the eight functional networks was FDR-corrected for multiple comparisons. **(b)** Within-modular functional connectivity, represented by the within-modular degree z-scores. Within-modular connections did not vary in any of the functional networks depending on comprehension states, for either the Initial or Repeated Scrambled conditions. FPN: frontoparietal control network, DMN: default mode network, DAN: dorsal attention network, VAN: ventral attention network, VIS: visual network, SM: somatosensory-motor network, LIMB: limbic network, SUBC: subcortical network.



Supplementary Information S4. Global network reconfiguration during narrative comprehension, robustness across different sliding window sizes and parcellation schemes. (a) Modularity and global efficiency were computed using the time-resolved functional connectivity that used sliding window sizes of 24, 30, 36, and 42 s (The results from a window size of 36 s were reported in the main text). Modularity showed consistent decrease during the high comprehension moments compared to low only in the Initial Scrambled condition (24 s: $z(66) = 1.85$, $p = 0.064$, 30 s: $z(66) = 2.50$, $p = 0.012$, 36 s: $z(66) = 2.32$, $p = 0.020$, 42 s: $z(66) = 2.26$, $p = 0.024$), but not in the Repeated Scrambled condition ($p = 0.532$, $p = 0.540$, $p = 0.561$, $p = 0.358$, respectively). We observed a significant interaction effect with all window sizes (24 s: $F(1,66) = 4.10$, $p = 0.047$, 30 s: $F(1,66) = 6.18$, $p = 0.015$, 36 s: $F(1,66) = 6.98$, $p = 0.010$, 42 s: $F(1,66) = 7.02$, $p = 0.010$). Likewise, global efficiency increased during the high comprehension moments, only in the Initial Scrambled condition (24 s: $z(66) = 3.24$, $p = 0.001$, 30 s: $z(66) = 3.59$, $p < 0.001$, 36 s: $z(66) = 3.67$, $p < 0.001$, 42 s: $z(66) = 4.09$, $p < 0.001$), but not in the Repeated Scrambled condition ($p = 0.439$, $p = 0.424$, $p = 0.566$, $p = 0.102$, respectively). Again, we observed significant interaction effects with all window sizes (24 s: $F(1,66) = 9.38$, $p = 0.003$, 30 s: $F(1,66) = 10.19$, $p = 0.002$, 36 s: $F(1,66) = 10.62$, $p = 0.002$, 42 s: $F(1,66) = 19.51$, $p < 0.001$). There were main effects of varying window sizes for both measures (all ps < 0.001). **(b)** Results were replicated using the Brainnetome atlas (246 ROIs), in addition the Yeo atlas (122 ROIs), with the sliding window size fixed at 36 s. As in (**a**), modularity significantly decreased during the high comprehension moments in the Initial Scrambled condition ($z(66) = 3.50$, $p < 0.001$), whereas the opposite pattern of results was observed in the Repeated Scrambled condition, such that the modularity increased during high comprehension ($z(66) = 3.02$, $p = 0.002$), with a significant interaction effect ($F(1,66) = 21.79$, $p < 0.001$). Global efficiency increased during the high comprehension moments in the Initial Scrambled condition ($z(66) = 6.90$, $p < 0.001$). In the Repeated Scrambled condition, the efficiency showed significant decrease during the high comprehension moments ($z(66) = 3.34$, $p < 0.001$), with a significant interaction effect between Scrambled conditions and comprehension states ($F(1,66) = 75.68$, $p < 0.001$).

Supplementary Information S5. Synchrony of the latent neural states across individuals, inferred from hidden Markov model (HMM). (a) Results using *The Kid* (movie stimulus 2; N = 23), and **(b)** *Mr. Bean, the animated series* (movie stimulus 3; N = 20). The figure complements **Figure 7a**.