SUPLEMENTARY MATERIAL

Section 2.5. Procedure for computing signal coupling

The procedure we applied to compute Cortical Functional Coherence (CFC) is based on the method presented in Bigot et al. (2011). Here, we present a step-by-step explanation with an example between two signals.

1. Select two signals: EEG-channel (C3 electrode) and EEG-channel (FC2 electrode).

2. Select trials to include: trials within the range of the subject-level mean time ± 2 SD.

3. Apply Continuous Wavelet transform of both segmented signals, for each repetition. In this step, WavCrossSpect toolbox by Bigot et al (2011) was used with the parameters: 'Mother'=Morlet, 'nvoice'=5, 'J1'=100, 'wavenumber'=6, 'MaxScale'=default). This step provides an Auto-Spectrum (scalogram or time-frequency map) for every signal segment, for both EEG signals.

4. Compute 'Cross-Spectrum' between signals pair, for each repetition separately. This is a cross correlation between the two auto-spectrums obtained on step 3.

5. Compute ‘Mean Auto-Spectrum’ for each signal separately (Fig S1 A and B), which is calculated as the point-by-point mean from the all power auto-spectrums of repetitions selected on step 3.

6. Compute ‘Mean Cross-Spectrum’ using ‘Cross-Spectrum’ from each signals pair (Fig S1 C), which is calculated as the point-by-point mean from every cross-spectrums computed on step 4.

7. Determine 'Significant Cross-Spectrum' (Fig S1 E), which is the points from 'Mean Cross-Spectrum' map that are above the threshold λ_α obtained with Equation S1, at level $\alpha = 0.05$, explained in detail by Bigot et al (2011).

$$\lambda_\alpha = \frac{\rho_x\,\rho_y}{n}\left(-\log(\alpha/2) + \sqrt{-2n\log(\alpha/2)}\right), \qquad \text{(Eq. S1)}$$

where ρ_x and ρ_y are the largest eigenvalues of the empirical covariance matrices of both signals; and n is the number of repetitions.

8. Compute 'Magnitude-Squared Coherence' $R^2_{xy}(\omega, u)$, which is a normalized value from 0 to 1 (Fig S1 D), with Equation S2.

$$R^2_{xy}(\omega, u) = \frac{|S_{xy}(\omega, u)|^2}{S_x(\omega, u)\,S_y(\omega, u)}, \qquad \text{(Eq. S2)}$$

where $S_{xy}(\omega, u)$ is the 'Mean Cross-Spectrum'; $S_x(\omega, u)$ and $S_y(\omega, u)$ are the 'Mean Auto-Spectrums' of both signals.

9. Apply 'Significant Cross-Spectrum' matrix as a mask over 'Magnitude-Squared Coherence' to obtain normalized coherence only where the 'Mean cross-spectrum' was significant (Fig S1 F).

10. Boundary selection for the windows of interest within the time-frequency map depending of frequency and time interval. We decided to analyze the beta band (15 to 30 Hz). The window of interest are marked with red dashed lines in Fig S1 G.

11. Compute CFC as the single value (mean) of all values within the window of interest.

12. The same procedure was performed between every pair of EEG channels.

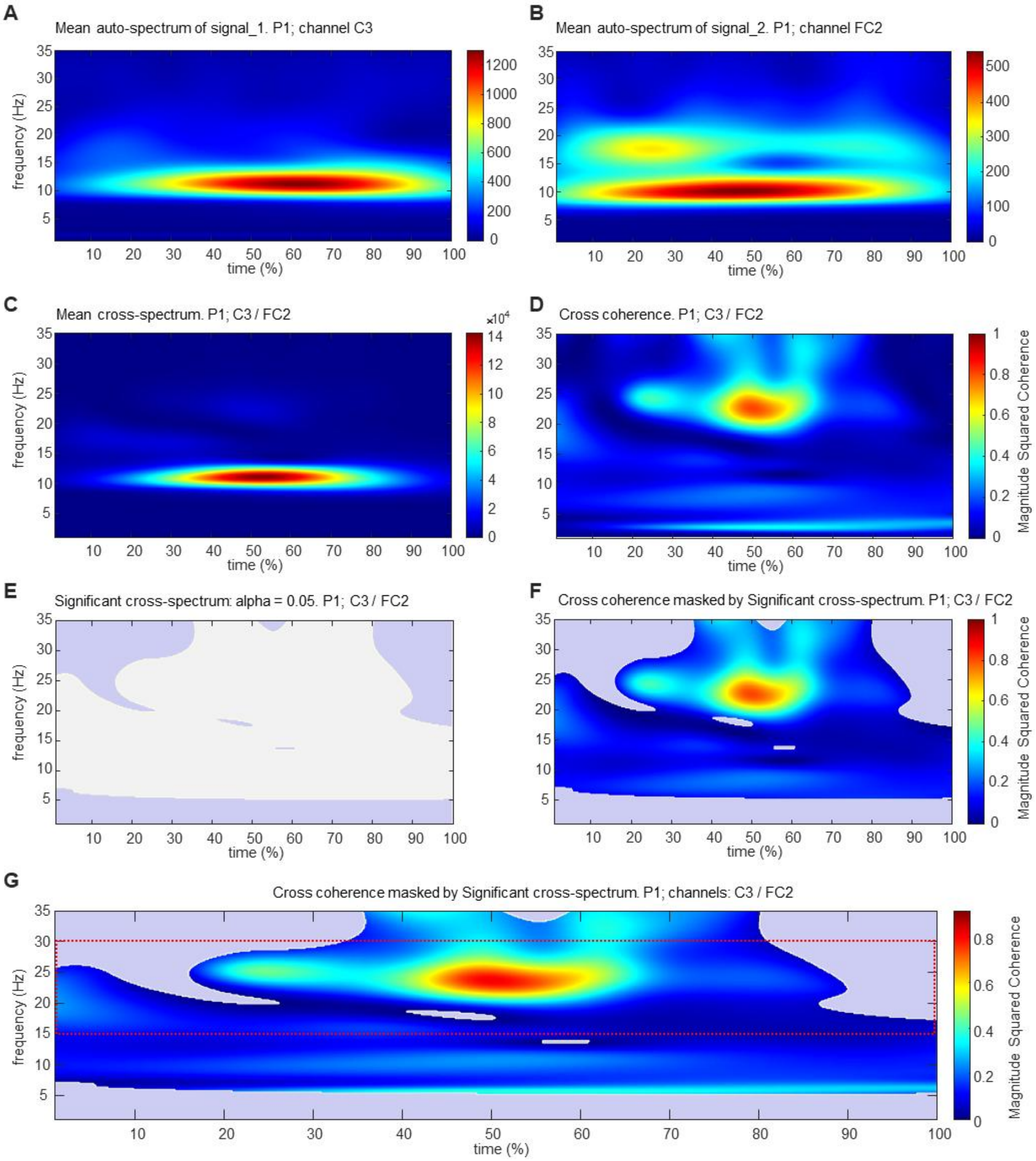

Figure S1. Summary for Cortical Functional Coherence (CFC) compute procedure. (A) Compute 'Mean Auto-Spectrum' from the 'Wavelet Scalogram' of n repetitions for signal 1 (e.g. C3 EEG-channel). (B) Compute 'Mean Auto-Spectrum' from the 'Wavelet Scalogram' of n repetitions for signal 2 (e.g. FC2 EEG-channel). (C) Compute 'Mean Cross-Spectrum' from the 'Cross-Spectrums' from each signals pair. (D) Compute 'Magnitude-Squared Coherence'. (E) Determine 'Significant Cross-Spectrum'. (F) Use 'Significant Cross-Spectrum' as a mask over 'Magnitude-Squared Coherence' (G) Coherence masked with color scale adjusted. The dashed rectangle in red correspond to the window of interest to compute CFC values within beta-band (15 to 30 Hz).

Table S1 Planning times in milliseconds, expressed as mean ± standard deviation for each participant

	Planning times (ms)	
Participants	Left hand (non-dominant)	Right hand (dominant)
P1	255 ± 128	322 ± 123
P2	209 ± 87	225 ± 95
P4	182 ± 86	245 ± 45
P5	193 ± 88	238 ± 91
P6	284 ± 139	347 ± 72
P8	174 ± 112	277 ± 97
P9	266 ± 109	267 ± 98
P10	228 ± 112	211 ± 94
P11	162 ± 90	238 ± 114
P13	271 ± 111	334 ± 61
P14	286 ± 141	316 ± 151
P15	248 ± 146	286 ± 140
P16	266 ± 129	306 ± 68
P17	242 ± 104	243 ± 70
P18	247 ± 89	258 ± 78
P19	235 ± 127	255 ± 121
Group Average	234 ± 39	273 ± 41

Table S2 Gamma GLM for planning time comparison

Fixed effect	Estimate	SE	t-stat	p-value	95% CI
Intercept (non-dominant hand)	5.456	0.039	140.85	<0.001	[5.377, 5.536]
Dominant hand	0.153	0.055	2.794	0.009	[0.041, 0.265]

Model fitted with Gamma distribution and log link function.
Note: The exponentiated coefficient for HandDominant (exp(0.153) = 1.166) indicates that dominant-hand planning time is 16.6% longer than non-dominant-hand planning time.

Table S3 Gamma GLM for planning time prediction (dominant hand): Additive model

Fixed effect	Estimate	SE	t-stat	p-value	95% CI
Intercept	5.2755	0.0953	55.38	<0.001	[5.085, 5.466]
GE	-4.8328	2.6914	-1.7957	0.096	[-10.215, 0.550]
MC	7.8877	2.9031	2.717	0.018	[2.081, 13.694]

Model: log(PT) ~ 1 + GE + MC, Distribution: Gamma, Link: Log, Observations: 16
Overall model fit: F(2,13) = 9.70, p = 0.00265; Estimated Dispersion: 0.0104
Note: GE = Global Efficiency, MC = Mean Clustering, PT = Planning time

Table S4 Gamma GLM for planning time prediction (dominant hand): Interaction model

Fixed effect	Estimate	SE	t-stat	p-value	95% CI
Intercept	5.1773	0.3677	14.08	<0.001	[4.442, 5.913]
GE	-4.3994	3.1812	-1.3829	0.192	[-10.762, 1.963]
MC	9.1692	5.5421	1.6545	0.124	[-2.915, 21.253]
GE × MC	-6.6074	23.892	-0.2766	0.787	[-54.391, 41.176]

Model: log(PT) ~ 1 + GE + MC + GE×MC, Distribution: Gamma, Link: Log, Observations: 16
Overall model fit: F(3,12) = 6.07, p = 0.00936; Estimated Dispersion: 0.0111
Note: GE = Global Efficiency, MC = Mean Clustering, PT = Planning time