**Supplemental Digital Content 1: Methods**

*Genuine networks reconstructed from electroencephalographic data*

The genuine network was constructed with 21-channel electroencephalographic data based on the method introduced by Rummel *et al*.1 Functional connections were determined by linear cross-correlations between electroencephalogram channels. The genuine correlation and the random correlation (spurious correlation) were estimated by the surrogate data method independently, using only the genuine correlation data for the reconstructed network. The reliability of this method was tested with computational simulated data and empirical data.

The moving window method was applied to electroencephalographic data in order to investigate the temporal properties of brain networks. The electroencephalogram for each channel was segmented into approximately 12-s long windows (3,000 points, 11.57 s). To generate the ensembles of surrogate data and original data for each window, the electroencephalographic data were segmented into smaller windows (1,000 points, 3.9 s), moving with about 0.39 s (100 points). For each small window the 50 surrogate data were generated with the shift surrogate data generation method. Thus, 20 subwindows for the original electroencephalographic data and 1,000 surrogate data (= 50 surrogate data \*20 subwindows) were produced for a 12-s long window. The statistical significance for the correlation strength and the network property was assessed with these two ensemble sets.

Pearson’s equal-time cross-correlation coefficient was used for determining a functional connection between two signals and (normalized to zero mean and unit variance),

(1)

The genuine correlation matrix , random correlation matrix and total correlation matrix were defined with as following

(2)

(3)

(4)

, where , and (“med” indicates the median value for over all sub-windows, “sign” takes the sign from the signed median).

The factor *s* in (4) evaluates the significance of the difference . Since a Gaussian distribution of and cannot be guaranteed, the Mann-Whitney-Wilcoxon U-test was used with the null hypothesis of equal medians. If it was rejected, then *s*=1; otherwise, *s*=0. The *p*-value was set as and the Bonferroni correction for multiple U-tests for M-dimensional matrix elements was applied . In our case, m=21.

By the windowing method above, was constructed in each window and the effects of topological structure and connection strength on information transmission capacity were calculated from (t) independently. Finally, we analyzed the effects of general anesthesia on topological structure and connection strengths of brain networks.

*Genuine, random and total correlation strengths*

The correlation strengths of 21-channel electroencephalographic data were evaluated by measuring the absolute deviation of its eigenvalues () from the eigenvalue of ideally independent signals as the data length ). If there are differences between them, they may result from genuine correlation, random correlation, or both.

To quantify the genuine, random and total correlation strength, the difference between the eigenvalues was defined as

(5)

The brackets indicate that each eigenvalue is averaged over all sub-windows.

The total, random and genuine correlation strengths were defined as following

(6)

(7)

(8)

The three correlation strengths were measured by using the correlation matrix defined in equation (2), (3) and (4). The random correlation strength measures the deviation of eigenvalues of surrogate data from the ideal case . Because the surrogate data is randomized data, any “correlation” identified comes from the finite size effect. The genuine correlation strength measures the difference between two eigenvalues of original electroencephalographic data and surrogate electroencephalographic data. If there is any difference, it indicates that the original data contain signficant correlation above the finite size effect.

References:

1**.** Rummel C, Müller M, Baierd G, Amora F, Schindler K: Analyzing spatio-temporal patterns of genuine cross-correlations. J Neurosci Methods 2010; 191:94–100