**Connectome data**

Connectome data at the subject level is provided in .csv files for each frequency (within-frequency phase synchrony) or each frequency pair (cross-frequency coupling, CFC).

The first dimension in CFC data is that of the low-frequency parcel/contact and the second dimension that of the high-frequency parcel/contact. Values for local CFC are found on the diagonal.

**SEEG connectome CFS:** (used for creating Figs 4, 5, 6, 7, S3, S5, S7, S9, S10)

Connectome of cross-frequency phase synchrony in SEEG data.

**SEEG connectome PAC:** (Figs 4, 5, 6, 7, S3, S5, S7, S9, S10)

Connectome of phase-amplitude coupling in SEEG data.

**SEEG connectome AC Env:** (S6 Fig)

Connectome of amplitude envelope correlations coupling in SEEG data.

**SEEG connectome PS (wPLI):** (S4 Fig)

Connectome of phase synchrony, estimated with the weighted phase lag index, in SEEG data.

**SEEG connectome PS (PLV):** (S4 Fig)

Connectome of phase synchrony, estimated with the phase locking value, in SEEG data.

**MEG connectome CFS:** (Figs 4, 5, 7, 8, S3, S5, S7, S9, S10)

Connectome (200 parcels) of cross-frequency phase synchrony in the main MEG cohort.

**MEG connectome PAC:** (Figs 4, 5, 7, S3, S5, S7, S9, S10, S11)

Connectome (200 parcels) of phase-amplitude coupling in the main MEG cohort.

**MEG connectome AC Env:** (S6 Fig)

Connectome (200 parcels) of amplitude envelope correlations coupling in the main MEG cohort.

**MEG connectome PS (wPLI):** (S4 Fig)

Connectome (200 parcels) of phase synchrony, estimated with the weighted phase lag index, in the main MEG cohort.

**MEG connectome PS (PLV):** (S4 Fig)

Connectome (200 parcels) of phase synchrony, estimated with the phase locking value, in the main MEG cohort.

**MEG connectome PS (wPLI, EO-EC):** (underlying S8 Fig)

Connectome (148 parcels) of phase synchrony, estimated with the phase locking value, in the second MEG cohort. Set names ending with “c” indicate that a subject’s eyes were closed during that recording.

**MEG connectome CFS (EO-EC):** (S8 Fig)

Connectome (148 parcels) of cross-frequency phase synchrony, estimated with the phase locking value, in the second MEG cohort. Set names ending with “c” indicate that a subject’s eyes were closed during that recording.

**Support files for MEG**

**CF matrix MEG:**

Frequencies used as low frequencies (first column) and as high frequencies (2nd to 7th column) for CF ratios 1:2—1:7. All frequencies appear in the first column.

**Parcel Distances:**

Subject-specific euclidean distances between the centers of individual parcels.

**Parcel Fidelity:**

Subject-specific parcel fidelity (see Methods IX).

**Cross-Parcel PLV:**

Subject-specific phase locking value between parcels in simulated data (see Methods IX).

**Morphing Targets 200 to 148:**

Indicates for each of the 200 parcels of the split-Destrieux parcellation its “parent” parcel in the 148-parcel Destrieux parcellation.

**Parcel Names 200:**

Parcel names and abbreviations for each of the 200 parcels in the split-Destrieux parcellation.

**Support files for SEEG**

**All Frequencies SEEG:**

List of all frequencies used.

**CF matrix SEEG:**

Frequencies used as low frequencies (first column) and as high frequencies (2nd to 7th column) for CF ratios 1:2—1:7.

**Contacts per parcel:**

Number of electrode contacts across subjects assigned to each of the 148 parcels of the Destrieux atlas.

**Distances**:

Euclidean distances between pairs of contacts.

**GMPI**:

Grey Matter Proximity Index (see Methods XVII) for each contact.

**Masks:**

Mask for contact pairs that only retains connections between contacts in cortical regions with a minimum distance of 2 cm and non-shared references.

**Neuropsychological data**

Neuropsychological scores for the 8 tests and 19 subjects in the main MEG cohort. A value of -1 indicates that a subject did not perform a test.

**Plot data**

**Plot data Fig 3:**

All data for time point -500 ms to 499ms, in steps of 1ms. For TFR data, frequencies are provided in the files.

**Plot data Figs 4, 5, 6, S3, S5, S6, S7, S8:**

Data files consist of CFC group mean *K* or *GS* (1st row) with lower (2nd row) and upper (3rd row) confidence intervals for all low frequencies.

**Plot data S4 Fig:**

Data files consist of PS group mean *K* or *GS* (1st row) with lower (2nd row) and upper (3rd row) confidence intervals for all low frequencies.

**Plot data Figs 7 and S10:**

Data files contain one directionality value (dir. rel. degree in Fig 7; mean parcel low-high directionality in S10 Fig) per parcel of the 148-parcel Destrieux atlas.

**Plot data Figs 8 and S11:**

Spearman’s r values for correlation of CFC with neuropsychological test scores.

Rows: frequencies from 1.05 to 95.6; columns: ratios 1:2 – 1:7.

**Plot data S9 Fig:**

Spearman’s r values for correlation of CFC parcel degrees in MEG with CFC parcel degrees in networks of different SEEG layer combinations.