

Description of the algorithm Surrogate Synchrony (SUSY)

SUSY computes synchrony on the basis of windowed cross-correlations. **Synchrony** is defined as the correlation (or 'coordination', 'entrainment', 'coupling') of two simultaneously occurring processes. The processes are given as bivariate time series. In a .txt-file, the time series are in columns, the single measurements are lines. Variable names can be in the header line. It is assumed that the processes are sampled at high frequency, 1 Hz (1/s) or higher.

(1) Cross-correlations of the bivariate time series are computed up to a specific lag in seconds (s). This is the parameter <Maxlag>. For example, if the process was sampled at 10 Hz and <Maxlag> = 5 is chosen, then 101 cross-correlation values result (because the time series has 100 lags between lag=-5s and lag=5s, plus lag zero). Cross-correlation is performed within a chosen <Segment> of e.g. 30s. The time series is divided into segments without overlap, thus a time series of say 5 minutes contains 10 30s-segments. All cross-correlations are then aggregated – this is done by transforming correlations to Fisher's Z, using absolute values only, then computing the mean Z in a segment. This is repeated across all segments of the time series. The mean Z of all segments are finally aggregated, yielding the overall mean_Z of the time series.

(2) Segment shuffling (segment-wise permutation) is used to create surrogate time series. If a time series contains 10 segments, $10 \times 9 = 90$ different surrogates can be generated. On each surrogate the above computations (1) are run. This delivers a distribution of surrogate mean_Z, hence an effect size <ES> of the 'real' mean_Z against surrogates. Thus SUSY provides two different synchrony measures of each bivariate time series: mean_Z (always a positive number because of the use of absolute values) and ES of mean_Z.

(3) SUSY output contains two different synchrony measures of each bivariate time series: mean Z and ES of mean Z. The respective output variables are <Z> and <ES>. The data are also computed without the use of absolute Z ('no-absolutes'): <Z(noAbs)> and <ES(noAbs)>.

If <Automatic> is clicked, the synchrony is computed of all adjacent pairs of columns in the .txt-file. If <Automatic> is unclicked, you may choose the two columns to be analyzed for synchrony, and two plots are additionally prepared.

The SUSY algorithm was coded by David Leander Tschacher by order of Wolfgang Tschacher.