**Description of the algorithm Surrogate Synchrony (SUSY)** WT, 24.9.2019

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. The *.txt-file may contain time series of different durations; the longest time series must be in the first two columns. The missing data of the other columns must be empty; only the separators should be in the file.

(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 (or, a video had 10 frames per second: 10 fps) 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  of e.g. 30s. The time series is divided into segments without overlap, thus a time series of say five minutes contains ten 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. (note: SUSY computation is scale-invariant. Thus, if your time series are sampled at lower frequencies, you may use other time scales. E.g., instead of Hz the unit may be 1/min, and parameters <Maxlag>and  are accordingly in minutes).

(2) Segment shuffling (segment-wise permutation) is used to create surrogate time series. If a time series contains 10 segments, 10x9=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>. Importantly, 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.

Plot-ID:
0 = no plot
1 = mean cross-correlations (absolute correlation values); export cross-correlations
2 = synchrony by segment (absolute correlation values)
3 = mean Z cross-correlations (absolute correlation values)
4 = times series plot
5 = mean Z cross-correlations (no-absolute values)

The SUSY algorithm was coded by David Leander Tschacher instructed by Wolfgang Tschacher. If you use SUSY, please cite: **Tschacher W & Haken H (2019). The Process of Psychotherapy – Causation and Chance. Cham: Springer Nature.**