SUPPLEMENTARY MATERIAL 1 – Techniques used to analyze interpersonal coordination

Analytical technique	Main numerical tools	Description	Input data	Output data	Interpretation	Advantages	Uses	Examples
Cross-correlation analysis	**Cross-correlation**	A statistical tool used to measure the similarity between two time series as a function of the lag of one relative to the other. It helps in identifying any time lag between the variables and how one variable can predict another.	Time Series Data (X, Y)	Cross-Correlation Coefficient	If the coefficient is high at a particular lag, it suggests that one time series consistently leads or lags the other by that amount of time, indicating a potential predictive or synchronized relationship.	Identification of temporal relationships in coordination or synchronized activities Analytical approach is adequate to deal with non-stationary time series data	Study of coordinative patterns in a broad set of interactional settings, from sports and play to non-structured conversation, providing insights into the timing and structure of interactions.	Dan-Glauser, 2023; Kamphorst et al., 2022; Marzoratti et al., 2023; Miles et al., 2023
	Pearson correlation	A measure of the linear correlation between two variables	Time Series Data (X, Y)	Pearson Correlation Coefficient (r): A single numerical value between -1 and 1	A value between -1 and 1. It provides a measure of the strength and direction of the linear relationship between two variables			
	Fisher z-transform	A transformed value of the Pearson correlation coefficient that follows a normal distribution, making it suitable for further statistical analysis.	Pearson Correlation Coefficient (r)	Fisher z-transformed value (z)	A higher z-score suggests a stronger correlation that is statistically reliable, as the transformation normalizes the data, allowing comparisons across different datasets			
Coherence analysis	**Wavelet transform**	The wavelet transform decomposes signals into time-frequency space, providing coefficients that represent the signals in the time-frequency domain.	Time Series Data (X, Y)	Wavelet Coefficient Matrix. Each coefficient indicates the amplitude of the signal at a specific time and frequency. Rows: Different scales (frequencies). Columns: Different time points.	Range: The values of wavelet coefficients can be any real number. Magnitude: The magnitude of each coefficient represents the amplitude of the signal at a specific time and frequency. Positive Values: the amplitude of the signal is high Negative Values: the amplitude of the signal is low	An analytical approach that allows for the study of unstructured interactions in time and frequency domains. This method captures changes in both dimensions simultaneously, making it well-suited for complex, non-stationary signals.	Studies of coordination in physiological data (e.g., heart rate, brain activity)	D'Amario et al., 2023; Hale et al., 2020; Nozawa et al., 2016
	Cross-spectral density	A matrix that represents the cross-power spectral density between the two signals at various frequencies. It provides information about the amplitude and phase relationship between the signals across frequencies.		Cross-Spectral Density Matrix. Each value in the matrix indicates the power and phase relationship at a specific frequency. Rows: Frequencies of signal X. Columns: Frequencies of signal Y.	Range: The values in the CSD matrix are complex numbers because they represent both the amplitude and phase relationship between the two signals. Magnitude: the power of the relationship between the signals at the corresponding frequencies. Phase: the phase difference between the signals at the corresponding frequencies.	Non-linear analytical approach to study synchrony between people engaged in rythmic activities Ideal for the analysis of activities where rhythmic movement is not necessarily identical and oscillatory but similar in rhythmic patterns.	Study of coordinative patterns between two people engaged in joint activities such as moving objects, finger tapping or playing musical instruments.	Allsop et al., 2016; Colley et al., 2021; Tranchant et al., 2022
Cross-recurrence analysis (CRA)	**Cross-Recurrence Plot (CRP)**	A technique for measuring the similarity of states between two time series representing the states of two different systems over time. The analysis allows for identifying moments when both systems exhibit similar states with different lags.	Two time series	A matrix in which the rows and columns correspond to discrete times for the systems (1 and 2). Each point in the matrix indicates a coincidence of states between the two systems at specific times.	A recurrent point (marked) on row i and column j shows similar state between first system in time i and second system in time j.	An analytical method that provides a non-linear analytical approach ideal for examining complex, dynamic systems like biological or physiological oscillators, which often do not meet the linearity and stationarity assumptions required by other methods, such as phase analysis	Study of in natural systems (e.g., biological and physiological oscillators) that violate the assumptions of linear methods such as the recurrences of movement during less structured or spontaneous activities (e.g., conversation).	Crone et al., 2021; Miles et al., 2023
	Recurrence Rate (RR)	Ratio of reccurrent points to all possible points.		Percentage	Indicates how frequently both systems exhibit cross-recurrence (recurrent points), showing how often the systems reach similar states.			
	Determinism (DET)	Ratio of diagonal recurrent points to all recurrent points.		Percentage	A high rate suggests a high degree of immediate state similarity, indicating more predictable, patterned synchrony between the systems.			
	Laminarity (LAM)	Ratio of vertical line recurrence points to all recurrent.		Percentage	Rate of "chaos to chaos" transitions. Reflecting stability within chaotic states.			
	Mean diagonal length (L)	Mean length of diagonal recurrent point lines.		Integer length	Robustness of "chaos to order" transitions. Higher values reflect periodicity and stability in similar states over time.			
	Trapping Time (TT)	Mean length of vertical lines.		Integer length	Robustness of "chaos to chaos" transitions. Higher values showing that the systems tend to remain in chaotic states for longer periods			
	Entropy (ENTR)	Shannon information of diagonal lengths.		Integer amount of bits	More bits implies less "chaos to order" consistency.			
Motion energy analysis	**Frame-differencing**	Motion energy analysis detects and quantifies motion in video data by calculating the differences between consecutive frames.	Video Data	Difference Frames, Motion Energy	Difference frames: Show pixel-wise changes between consecutive frames, highlighting motion. Motion Energy: Scalar values representing the total amount of motion between frames. A higher value indicates more motion between the frames.	Analysis can be automatically conducted on the overall movement of the person or regions of interest (ROI) depending on the researcher's aims Ideal for data associated to non-structured movement	Study of coordination patterns in ecological contexts mainly focused on spontaneous activities (e.g, conversation, therapy)	Paxton & Dale, 2013; Romero & Paxton, 2021; Tsuchiya et al., 2020
Phase analysis	**Fourier transform**	A mathematical transform that converts time-domain data into frequency-domain data. It decomposes a signal into its constituent frequencies and phases.	Time Series Data (X, Y)	Amplitude Spectrum: the amplitude of each frequency component in the signal. Phase Spectrum: the phase of each frequency component in the signal.	Real numbers indicating the amplitude of each frequency component. Higher values indicate stronger presence of those frequencies in the signal.	Analysis can be used to study more than two persons in an interaction Ideal for data with cyclical or repetitive behavior	Study of dynamics of motor coordination in sports and coordination in rythmic activities (e.g., postural swaying, walking)	Macpherson & Miles, 2023; Michela et al., 2023; Miyata et al., 2017; Romero et al., 2016
	Relative phase	A measure of synchronization between two oscillating signals, indicating the timing difference in their cycles	Phase Spectrum of X and Y	Relative Phase Values: The phase difference between the corresponding frequency components of the two signals	Real numbers in radians represent the phase of each frequency component, indicating how much each component is shifted relative to the start of the signal.			