



## Exploring Interpersonal Synchrony between Actors and Autistic children in a virtual theatre setting

MSc Student: Isabel Wilke | Supervisor: Dr. Jamie Ward

### Background

One of the main diagnostic characteristics of individuals with autism spectrum condition (ASC) is a nonverbal behaviour limitation during social interactions. Due to the barriers in socially connecting with others, ASC Children's social engagement and learning abilities are highly restrained. Carers and parents track closely the development of ASC children's social engagement and use therapeutical games and play to support the ability to form social connection. One important feature to explore in social engagement is interpersonal synchrony which is a widely used measure in ASC individuals. In definition, its individuals' temporal synchronised coordination during social interactions (Chetouani et al., 2017). The occurrence of interpersonal synchrony in a dyad increases empathy and liking towards each other as well as correlating to success of problem-solving and learning (McNaughton et al., 2020). In ASC individuals research has shown limitations in interpersonal synchrony. To understand the mechanisms underlying the deficit, previous studies suggest gaining a further understanding of the different social signals exhibited by ASC individuals, its timing and coordination (Bloch et al., 2019). In collaboration with the Flute Theatre and the application of a facial unit detection toolkit, video material is analysed on synchronized interactions between ASC Children and Actors.

### Research Question & Expected Outcomes

The research project is an exploratory study to identify and analyse subtle elements of synchrony between Actors and ASC Children applying a public available facial detection toolkit on video material.



Figure 1. Flute Theatre, Actors & ASC Child play

The study focuses on the modality and timing of the social signals exhibited by the ASC Children in the moments of interpersonal synchronization. This will contribute to the understanding of alignment/coordination of social signals in ASC individuals. Further, the timing, intensity and character of these moments is analysed by using Cross-Wavelet Analysis (CW), Average Cross Wavelet (ACW) and Plotting.

It is expected to identify moments classified as interpersonal synchrony and characteristics of these differ against base and non typical interactions (Actors).

### Summary

The research project's focus is to study subtle moments of interpersonal synchrony between Actors and ASC Children by applying a facial unit detection toolkit (OpenFace). Its goal is to contribute new insights about the social signals performed in moments of synchronization by ASC individuals.

Moment of Interpersonal Synchrony

### Methods

**Preparation & Ethics:** The study counts towards internet-mediated research with a non-reactive design. Participants consent and ethics approval has been obtained. Further, participants data is anonymously processed as by GDPR regulation.

**Data Collection:** The data about individuals was collected unobtrusively from secondary sources (Flute Theatre) which was not created as part of the research.

**Data Analysis:** The application of the publicly available Toolbox OpenFace was used to extract the facial unit data from the video recordings. The data is consisting of frame, timestamp, confidence, participant ID, facial unit coordinates (x,y,z) and action unit intensity scores. Matlab is used to apply cross-wavelet analysis and ACW.

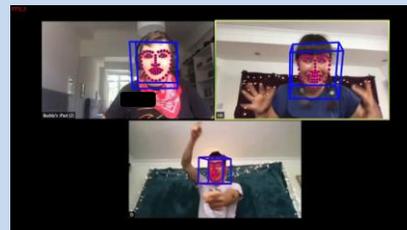


Figure 2. OpenFace processed video recording. Top left Participant A. Top Right Actor 1. Middle Actor 2

### Cross-Wavelet Analysis

A common measure used for interpersonal synchrony is cross-wavelet analysis which compares the similarity of two time-series in both time and frequency domain. The average cross-wavelet (ACW) is a method of summarising the time frequency similarity of two signals. The first results of analysing data show subtle element of synchronization. In the example below, the Facial Action Unit (AU) AU01 has been analysed between ASC Child and Actor as well as between two actors in the same video clip in time. The AU01 is presenting the intensity of the movement of the inner brow raiser.

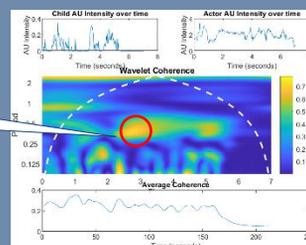


Figure 3. Cross-wavelet spectrogram and ACW between Actor1 and Child

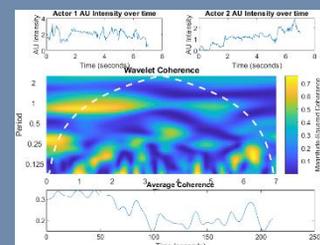


Figure 4. Cross-wavelet spectrogram and ACW between Actor1 and Actor 2

### References:

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- Chetouani, M., Delaherche, E., Dumas, G., & Cohen, D. (2017). Interpersonal Synchrony: From Social Perception to Social Interaction. *Social Signal Processing*, 202-212.
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