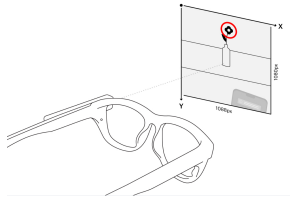




Looking for Empathy: Eye Synchrony across Audience Members

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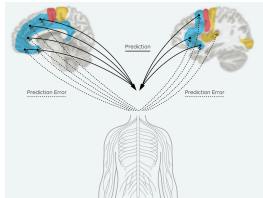
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Introduction

Empathy is the ability to perceive, understand and self-reflexively feel how another person is feeling. The notion of vicariously feeling another person's emotional experience is a complex phenomenon. Emotions themselves are consequence of various undetermined dynamic systems, including both cognitive and sensorimotor processes. Classical psychologists and philosophers alike believed in a ubiquity of emotional states across all humankind (Darwin, 1872 and James, 1884). From these beliefs stemmed research such as "Affect Theory" by psychologist Silvan Tomkins, categorizing emotions into innate discrete classifications (Tomkins, 1962).

However, modern research such as Lisa Feldman Barrett's "Theory of Constructed Emotion" breaks from the tradition of ubiquitous emotion-states to define emotion as constructs specific to each individual based in situational semantic context, past experiences and learned emotion-concepts (Barrett, 2016). Rather than unmediated emotional mirroring, Barrett's theory would suggest that empathy is a cognitive-perceptual inference driven by the brain using prediction and conceptualization.



This research looks for markers of empathy as cognitive-perceptual inference by way of the visual system. In research by Gupta and colleagues (2019), individuals were found to have significant synchrony of eye and head movements while participating in conversation, an affective-social interaction. This research explores whether eye movement synchrony among audience members of a live performance can reveal how they engage empathically as the emotional expressiveness of the performance varies.

Research Questions

- How does synchrony of eye movements between audience members capture empathic engagement?
- How does emotional expressiveness of the performance affect synchrony of eye movements between audience members?
- Does physical proximity between audience members impact the amount of synchrony of eye movements between them?

Central Hypotheses

1. Audience members who self-report more highly on "engaged" will have a greater degree of eye synchrony with the audience as a whole.
2. There will be greater eye synchrony when the performer is in the "performing" modality.
3. There will be a greater degree of eye synchrony between audience members seated in closer proximity to one another.

Aims and Objectives

Research Aim: To explore the relationship between eye movements and engagement with emotional content during an experience.

Focus: Investigating whether the degree of eye movement synchrony can serve as a marker of empathic engagement.

Theoretical Framework: Based on the theory of constructed emotion, viewing empathy not as automatic resonance but as a cognitively inferred, context-dependent process.

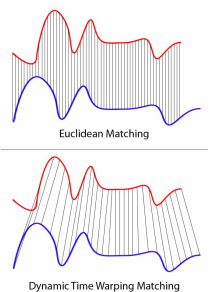
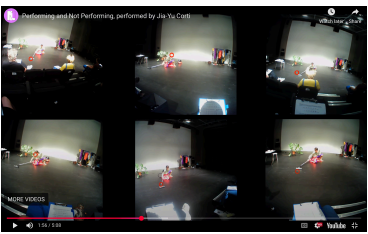
Methods

Experimental Design: The live performance *Performing and Not Performing*, created in collaboration with choreographer and performer Jia-Yu Corti, was held 12 times at Goldsmiths, University of London in July 2023. Each 40-minute performance featured the same set of 10 activities, presented in varying sequences and under either "performing" or "not performing" modality. Audience members wore glasses that recorded eye and head movements throughout.

Data Analysis: Eye-tracking data will first be transformed into a unified 3D world-referenced coordinate system by integrating "eye-in-head", "head-in-body", and "body-in-world" vectors using 3D rotation matrices, IMU data, and the theatre's spatial layout in MATLAB.

Synchrony will be measured using time-windowed Pearson correlations (and, if time permits, Dynamic Time Warping) between pairs of audience members, and between each individual member and the group.

Multiple regression will be used to evaluate how engagement survey responses and participant proximity predict synchrony, which serves as the outcome variable.



Expected Results

We expect higher eye movement synchrony among audience members who report greater engagement and during actively "performed" segments. Closer seating proximity is also predicted to increase synchrony. These findings would suggest that empathic engagement during live performance is reflected in shared visual attention and influenced by both emotional expressiveness and physical closeness.

¹Barrett, L. F. (2016). *Social Cognitive and Affective Neuroscience*, 12. ²Darwin, C. (1872). *The expression of the emotions in man and animals*. ³Gupta, A. et al. (2019). *In Proceedings of the 2019 ACM ISWC*. ⁴James, W. (1884). *Mind*, 9. ⁵Tomkins, S.S. (1962). *Affect, imagery, consciousness*. ⁶Image (Clock-Wise Starting Top Right) Credits: Pupil Labs, Databricks, Neurolive Youtube Channel, Barrett (2016)

Thank you to my supervisor Jamie Ward and the joint-UCL Neurolive project for inviting me to collaborate! :)