How do we distinguish between emotions? Analysing the kinematics of emotional interactions.

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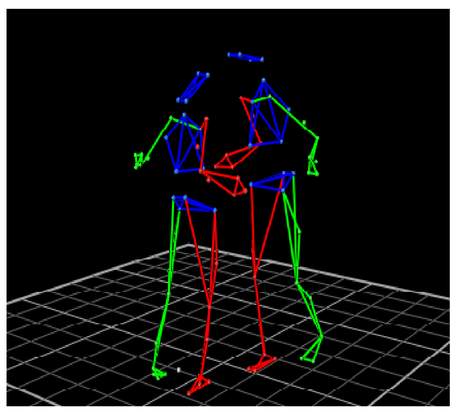
Introduction

"Basic emotions" (e.g. anger, happiness, sadness, romantic love) can readily be identified from various stimulus types, such as static and dynamic faces or bodies (Atkinson et al., 2004; Atkinson et al., 2012). Even when stimulus information is reduced to a minimum, as, for instance, seen in point-light displays (PLD), in which form information is greatly removed, yet motion information is preserved (Atkinson et al., 2012). Using PLDs, it has been shown that affective states can be inferred from numerous human actions, including dance movements (Dittrich et al., 1996), gait pattern (Michalak et al., 2009) and knocking movements (Gross et al., 2010). Several parameters, for instance gait speed and cycle duration, arm acceleration and velocity as well as movement jerkiness have been shown to vary depending on the emotional state of a person. However, most studies that investigated the biomechanics of emotional movements used single agents. Yet, Lorey et al. (2012) showed that social interaction as depicted by point-light displays facilitates the perception of emotional states. Interestingly, Clarke et al. (2005) highlighted that some emotions are more socially expressive than others. More specifically, joy and romantic love were particularly affected by the presence of a second actor. By implication, it could be assumed that there are interaction specific parameters that lead us to identify which emotion we are perceiving. The aim of the current study is to identify interaction-specific parameters that may contribute in the, often subconscious, process of emotion perception. Moreover, it will be analysed whether these parameters can be used to discriminate between different emotion categories (i.e. love, anger, happiness, sadness).

Methods

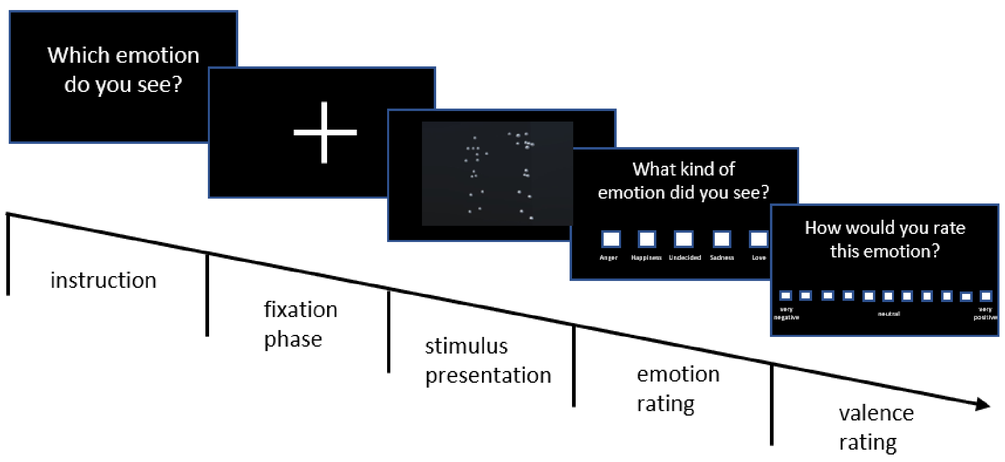
Stimulus Material

- 16 subjects (8 female, Ø age 26 years ± 4.1)
- instructed to enact 4 basic emotions (anger, happiness, sadness, love)
- motion capture system (9 CCD cameras, VICON)



Validation

- determination of difficulty from rating data (easy/medium/ difficult to recognise)
- rating of valence (negativity/positivity)



Interaction-specific parameters

Interpersonal distance (mean of clavicula and C7 vertebra)

- mean distance
- variance over time

Interpersonal orientation

(frontal plane defined by right and left shoulder markers)

- time facing the other subject [%]

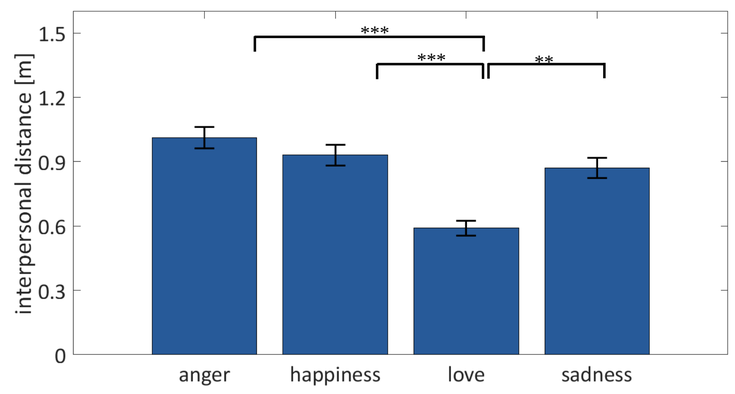
Covered distance of hands (right and left wrist markers)

- Spearman rank correlation

Results

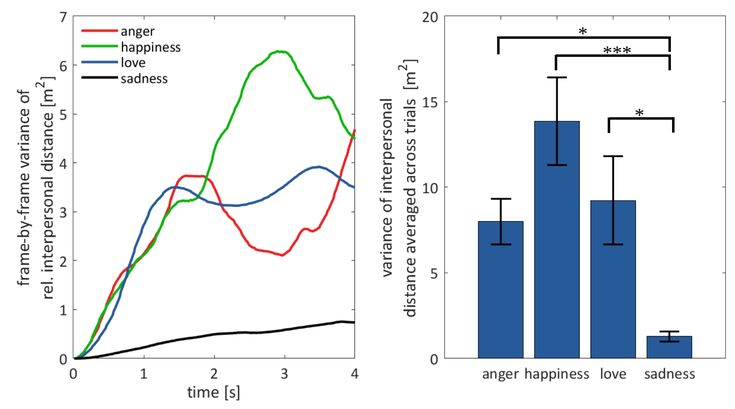
Mean distances between subjects

The IPD between subjects varied significantly across the displayed emotions ($F[3,134] = 18.7$; $p < .001$). In the **„love"** interaction, distances were significantly lower than in all other interactions (all *p*s < .001).



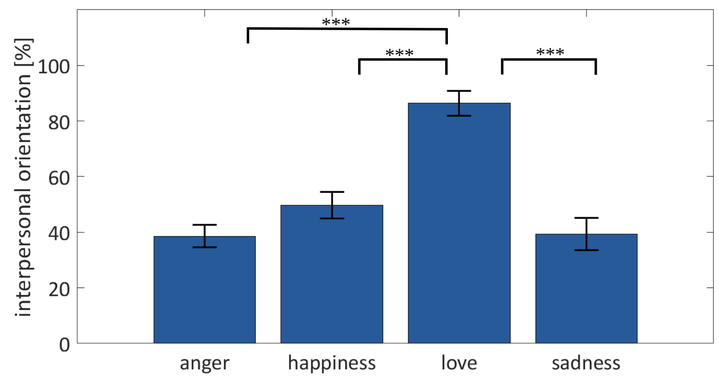
SD of relative interpersonal distances

The variance of the interpersonal distances between agents across trials differs significantly ($F[3,134] = 7.4$; $p < .001$), indicating smaller variances for **„sadness"** interactions (all *p*s < .05).



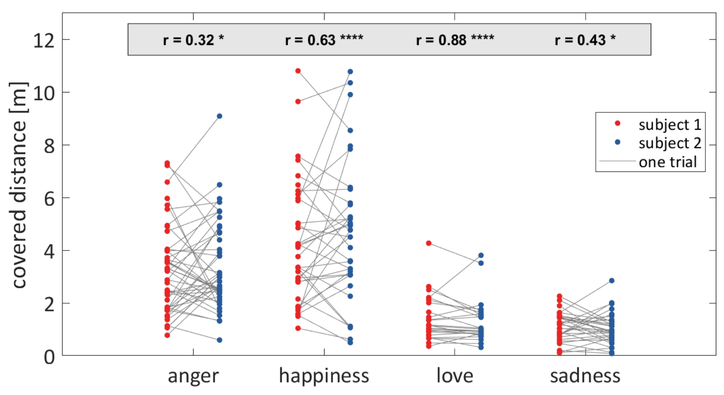
Interpersonal orientation

The percentage of time of both subjects spent facing each across trials other is significantly different between the emotional categories ($F[3,134] = 18.07$; $p < .001$). Post-hoc analyses reveal a significantly greater duration of time spent facing each other for **„love"** interactions (all *p*s < .001).



Covered distance of hand movements

The covered distances of the hand markers of both subjects correlate positively. These results indicate that a greater distance covered by subject 1 goes along with a greater distance covered by subject 2. This effect was greatest for **„love"** interactions.



Discussion

Here, we used an exploratory analysis to investigate interaction-specific parameters of emotional body language. More specifically, we aimed to identify parameters that allow for a discrimination of the emotional content. Mean distances between subjects showed that love interactions can be distinguished from other emotional interactions. However, analyses investigating the variability of interpersonal distances across trials successfully discriminated „sadness" interactions, yet failed to distinguish between other emotional categories. The second parameter measured the time of the agents spent facing each other and also successfully distinguished „love" interactions but failed to do so between other categories. Lastly, there is a relationship between the covered distances of both subject's hands across all emotional categories. However, the strongest relationship can be observed for the hand movements during „love" interactions. Further parameters need to be identified in order to be able to discriminate between the emotional content of interactional kinematics. These parameters can then be tested individually to investigate their contribution in the process of emotion perception.

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