Facial Kinematic Characterization of Genuine and Simulated Expressions

Elisa Straulino[1], Alessio Miolla[1], Cristina Scarpazza[1], Luisa Sartori[1,2]
[1]Department of General Psychology, Università di Padova, Padua, Italy
[2]Padova Neuroscience Center, Università di Padova, Padua, Italy

NEUROSCIENCE OF MOVEMENT LABORATORY

Introduction

Past research investigating emotional displays has mainly focused on the facial muscle activation using manual coding approaches, such as the Facial Action Coding System (FACS; Ekman & Friesen, 1978). Although this is the most widely used method to categorize emotion expressions, its primary drawback is that it analyzes each facial movement independently from other movements. The true move towards an objective analysis of emotional function is the synergetic 3-D tracking of facial expressions. Notably, temporal and spatial parameters might reveal the inner syntax of emotional displays such as fear.

Methods

Nine naïve participants (age = 24.9) were requested to watch videos which triggered genuine (GE) fear emotional states (Figure 1a).

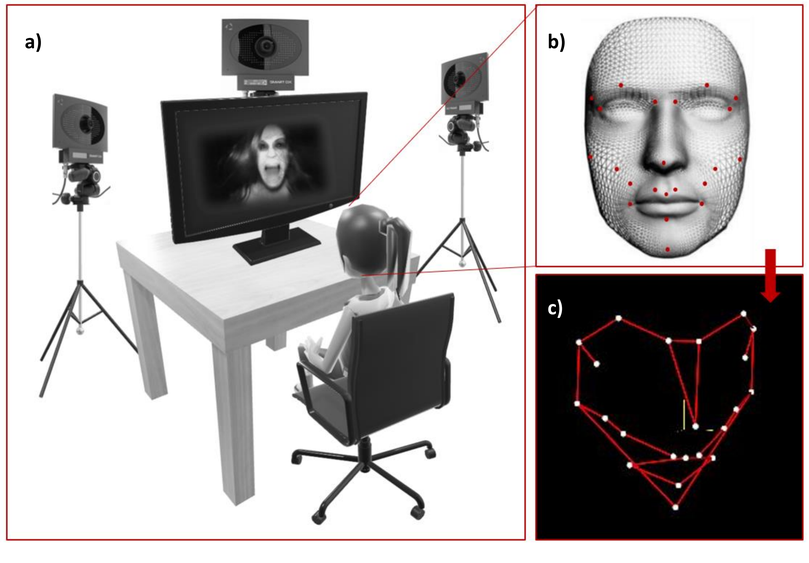


Figure 1. a) Experimental Setup and example of stimulus. **b)** Location of the key points for the expression emotions: 2 middle eyebrows–right and left, 2 nasions –right and left, 2 frontotemporal –right and left, 2 exocanthion–right and left, 2 mandibular joints –right and left, 1 nose tip, 2 zygomaticus –right and left, 2 nasogenian–right and left, 2 crista philtri–right and left, 2 cheilion–right and left, 2 lip midpoint –upper and lower, 1 chin. c) Development of the 3-D kinematic model.

Afterwards, they were asked to spontaneously reproduce the same expressions without video support (SE).

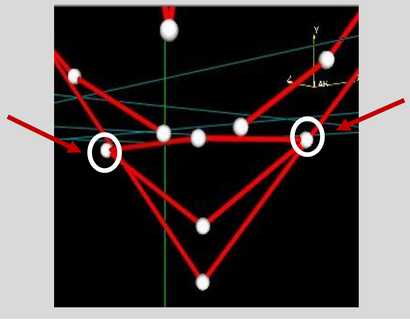
Twenty-two reflective hemispherical markers, each 3 mm in diameter, were used to acquire motion data. For both GE and SE, kinematic profiles of facial movements were recorded by means of six infra-red cameras using a 3-D motion analysis system (Figure 1b-c).

Preliminary Results

We found that fear expressions are characterized by spatial and temporal changes at the level of the mouth's corners (right and left cheilion).

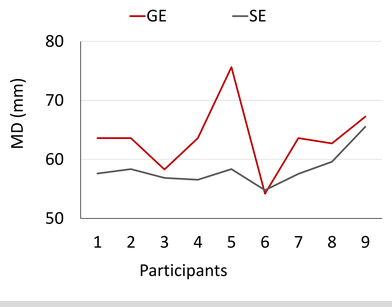
In addition, these landmarks are relevant to discriminate GEs from SEs.

Corners of the Mouth



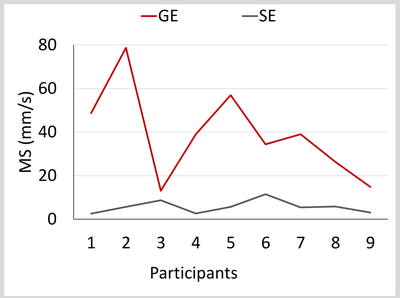
For instance, an authentic expression of fear entails a larger distance between the corners of the mouth compared to a simulated one ($t = 3.045$, $p < 0.05$).

Maximum Distance (MD)



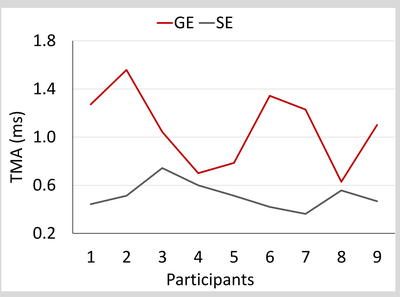
Crucially, this effect is also evident on the velocity profiles: the maximum speed reached by the anatomical landmarks is higher for genuine than for simulated expression ($t = 4.682$, $p < 0.05$).

Maximum Speed (MS)



Moreover, in terms of time, the time required to reach the maximum distance is longer for genuine than simulated expression ($t = 4.454$, $p < 0.05$).

Time to Maximum Amplitude (TMA)



References

Ekman, P. & Friesen, W. (1978). The facialaction coding system. Palo Alto: Consulting PsychologistsPress.

Conclusion

These findings indicate that genuine expressions are characterized by greater amplitude and higher velocity peaks, but the time required to reach the maximum extension of the mouth is longer compared to the simulated one. In practical terms, these results will provide a decisive step forward for the detection of facial deceptive cues and the creation of a well-established database of GEs and SEs for multidisciplinary future studies.