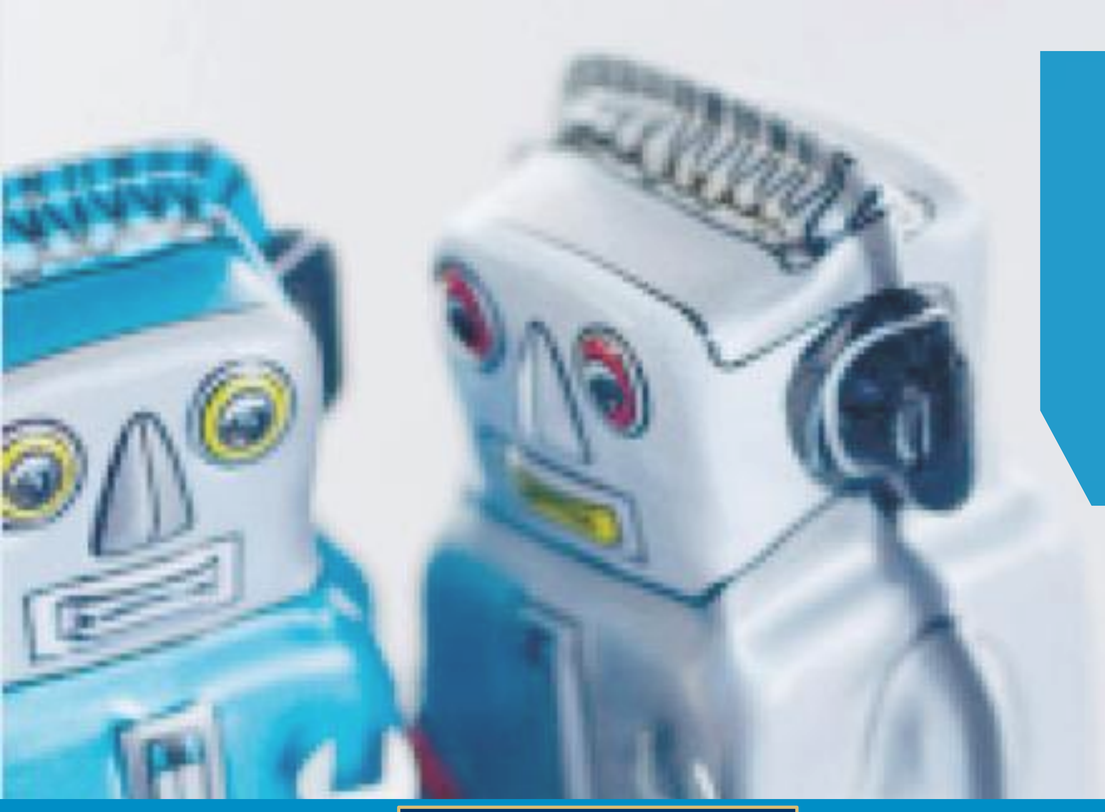


The perception and expression of emotion: The Body Action Coding System

Elisabeth Huis in 't Veld, dr. Geert van Boxtel, prof. Beatrice de Gelder

Cognitive and Affective Neuroscience Laboratory
Tilburg University

Introduction

Body postures provide clears signals about emotional expressions. Even more so than facial expressions, bodily expressions and participating in social interactions alert the perceiver to action tendencies of the other and in turn prepares the observer for action. (de Gelder, et al 2004; de Gelder, 2006).

However, so far it is not clear what specific muscle patterns are associated with specific emotions, even though there is a wealth of knowledge about the expression of emotions in the face: Facial Action Coding System (Ekman & Friesen, 1978) .

Observing action (Fadiga, Craighero & Olivier, 2005), fearful faces (Schutter, Hofman & Van Honk, 2008) or emotional bodily expressions (Borgomaneri, Gazzola & Avenanti, 2012) increase corticospinal excitability and negative emotional stimuli result in activity in those parts of the cervical spinal cord that are related to control of the upper limbs (McIver, Kornelsen & Smith, 2013; Smith & Kornelsen, 2011).

Therefore, the aims of the current study are two-fold.

1. To lay the groundwork for a Bodily Action Coding System (BACS)
2. To assess whether body muscles used in expressing a certain emotion automatically respond to observing emotion in others.

Method

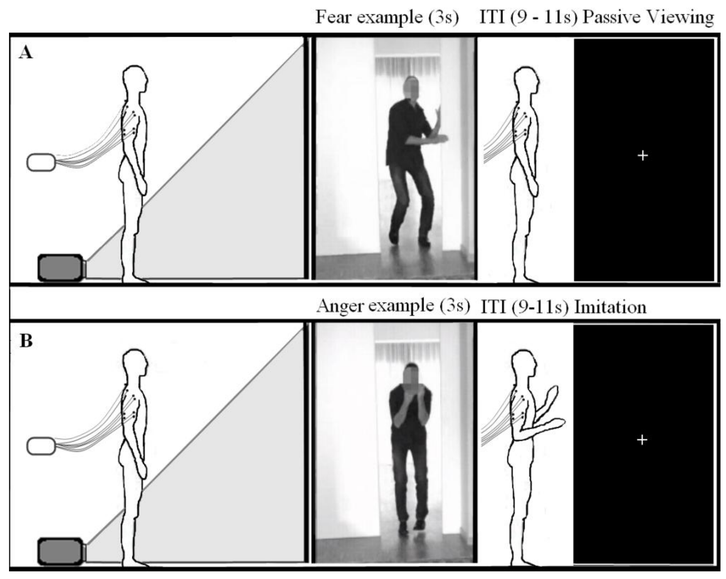
Surface EMG of the bilateral Trapezoid, Deltoid, Biceps and Triceps

- N = 33 (ages between18 and 26)
- 24 videos (3 sec) projected life size
- Showing an actor opening a door and responding
- 2 emotional conditions: **Fear, Anger**
- 36 trials per condition

- 2 experimental conditions:
  Passive viewing: watching the videos
  Imitation: Imitating the emotional expression

- Band-pass filter (20 – 500 Hz); notch filter (50 Hz).
- Rectified, smoothed (50 Hz).
- At least 30 valid trials per condition

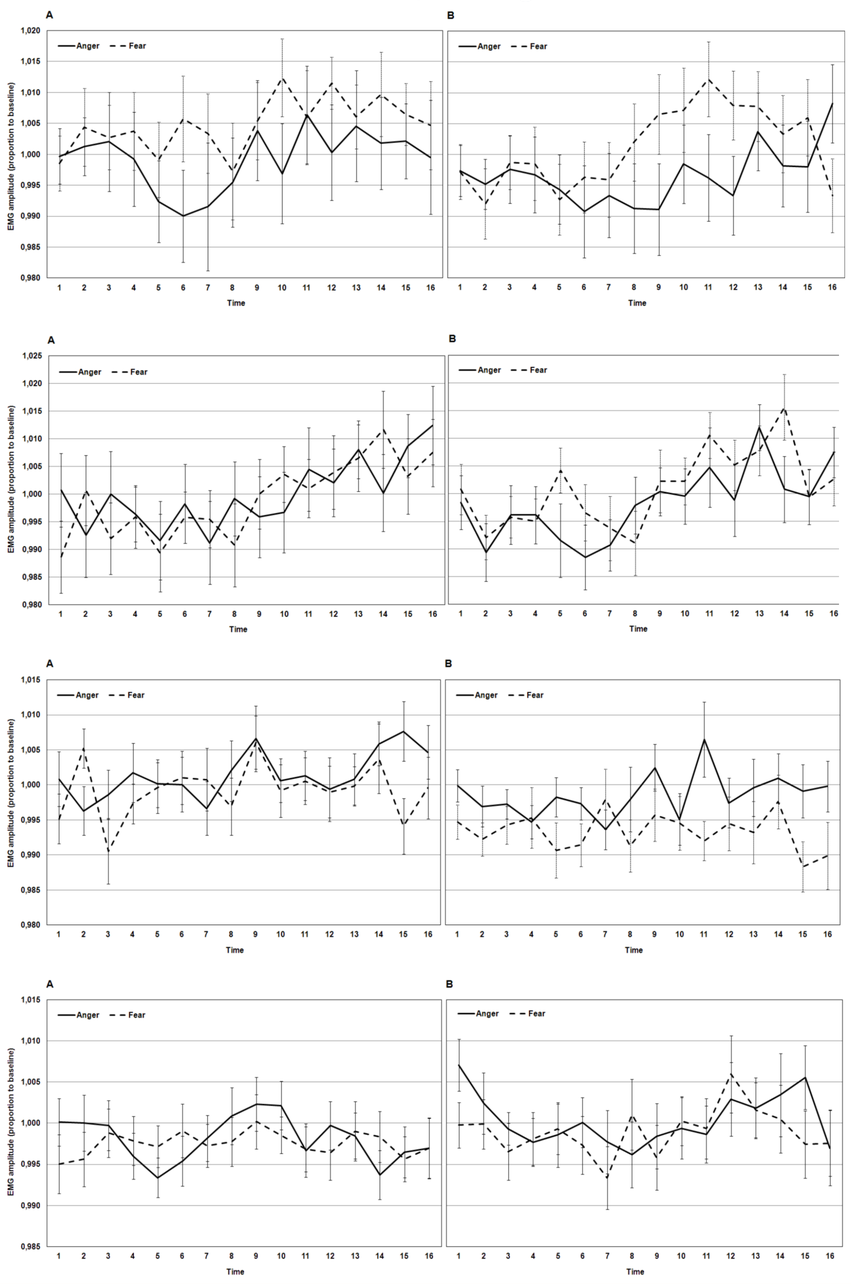
- Average activity of 500 millisecond bins.
- Expressed as proportion compared to baseline.
- Linear mixed-effects (growth) models were fitted.
- Wilcoxon signed-rank test between emotions at same time point, corrected for multiple comparisons.

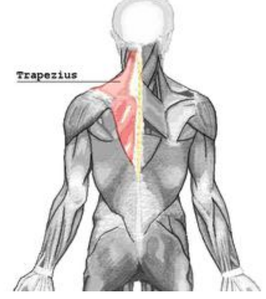


Results

Passive viewing

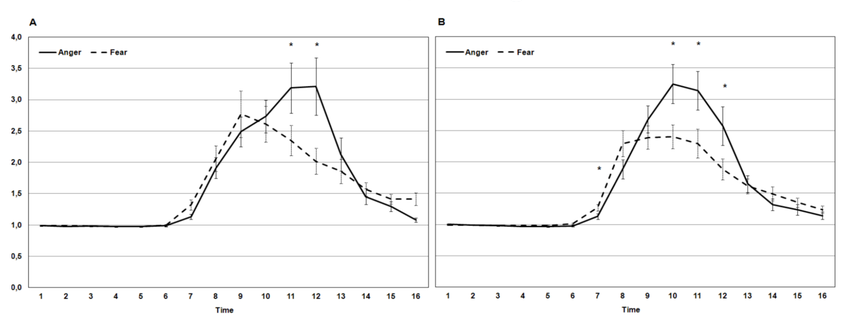
A = left, B = right





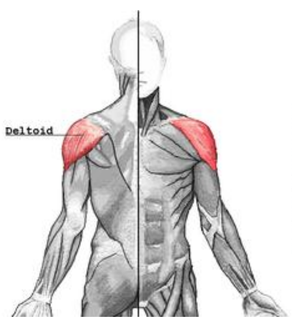
Imitation

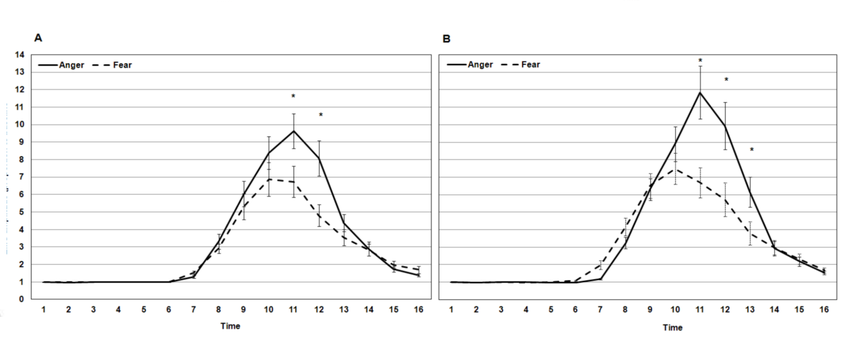
A = left, B = right



The trapezius muscle responds automatically to fearful, but not angry, body movement.

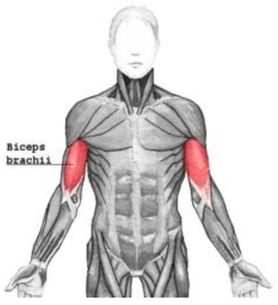
The trapezius muscle is recruited in the expression of both fear and anger.
*** $p < .03$**

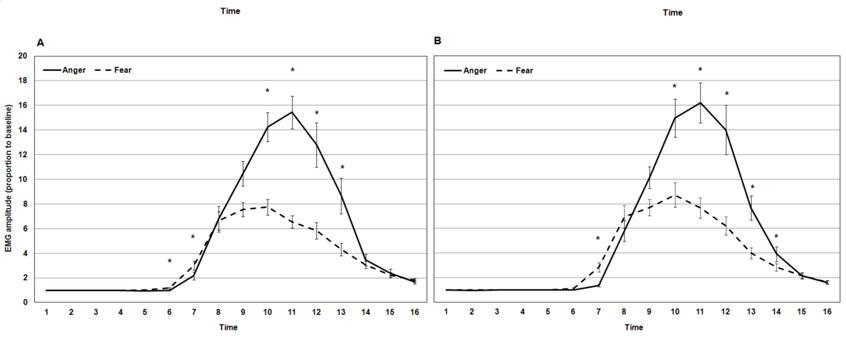




The deltoid muscle activates automatically after perceiving both angry and fearful body movement.

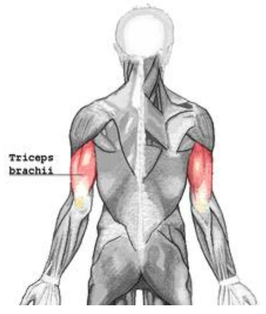
The deltoid muscle is also used in the expression of both fear and anger.
*** $p < .03$**

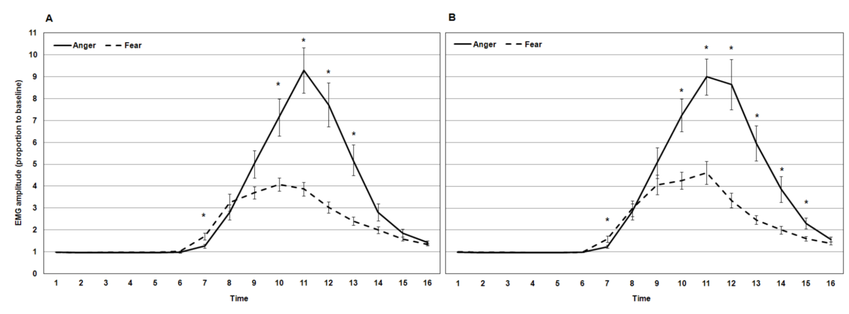




The biceps muscle responds automatically to angry, but not fearful, body movement.

The biceps muscle is used in the expression of both fear and anger, but most strongly for anger.
*** $p < .03$**





Only the right triceps initially deactivated, followed by a slight but significant activation, in response to both emotions.

The triceps muscle is also used in the expression of both fear and anger, but more strongly for anger.
*** $p < .03$**

Discussion

Muscles in the neck and shoulders are involved in both angry and fearful bodily expressions, and the arms are used more strongly for angry expressions.

Furthermore, it is possible to detect small but significant activations in bodily muscles in response to the observation of body language. However, the activation patterns show that not all muscles of the body automatically imitate the emotional expression seen.

This study builds on the existing research showing that emotion and action observation not only has measurable effects in the brain and the face, but also in the body itself, possibly originating from brain areas involved in action preparation, the expression and perception of emotions, social interactions and threat, through connectivity of the amygdala, motor cortex, the brain stem and the spinal cord .

•Borgomaneri, S., Gazzola, V., & Avenanti, A. (2012). Motor mapping of implied actions during perception of emotional body language. *Brain stimulation, 5*, 70-76.
•de Gelder, B., Snyder, J., Greve, D., Gerard, G. & Hadjikhani, N. (2004). Fear fosters flight: A mechanism for fear contagion when perceiving emotion expressed by a whole body. *Proceedings of the National Academy of Sciences*, *101*(47), 16701-16706.
•de Gelder, B. (2006). Towards the neurobiology of emotional body language. *Nature Reviews Neuroscience*, *7*(3), 242-249.
•Ekman, P., & Friesen, W. V. (1978). *Facial Action Coding System (FACS): A technique for the measurement of facial action.* Palo Alto, CA: Consulting Psychologists Press.
•Fadiga, L., Craighero, L., & Olivier, E. (2005). Human motor cortex excitability during the perception of others' action. *Current Opinion in Neurobiology, 15*, 213-218.
•McIver, T.A., Kornelsen, J., & Smith, S.D. (2013). Limb-specific emotional modulation of cervical spinal cord neurons. *Cognitive, Affective, & Behavioral Neuroscience.*
•Pichon, S., de Gelder, B., & Grezes, J. (2008). Emotional modulation of visual and motor areas by dynamic body expressions of anger. *Social Neuroscience, 3*, 199-212.
•Schutter, D. J., Hofman, D., & Van Honk, J. (2008). Fearful faces selectively increase corticospinal motor tract excitability:A transcranial magnetic stimulation study. *Psychophysiology, 45*, 345-348.
• Smith, S. D., & Kornelsen, J. (2011). Emotion-dependent responses in spinal cord neurons: A spinal fMRI study. *NeuroImage, 58*, 269-274.