Levator and sternocleidomastoid EMG: Motivational direction during anger and disgust inducing films

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Background

- Levator has previously been found to be associated with self-reported pathogenic and moral disgust (Chapman, Kim, Susskind & Anderson, 2009).

Hypothesis 1: Levator activity can be used to differentiate anger and moral disgust when they are co-reported (mixed)

- Preliminary analyses indicated increased frequency of "looking away" during avoidance related emotional stimuli.
- The sternocleidomastoid (SCM) is involved in horizontal movement of the head and will measure looking away

Hypothesis 2: SCM muscle activity will increase with self-reported avoidance.

- Dynamic emotional stimuli are associated with fluctuation in emotional experience reflected by changes in expression.

Exploratory data analysis of EMG peaks can be used to locate emotional "hotspots" and individual variability in dynamic emotional stimuli**.**

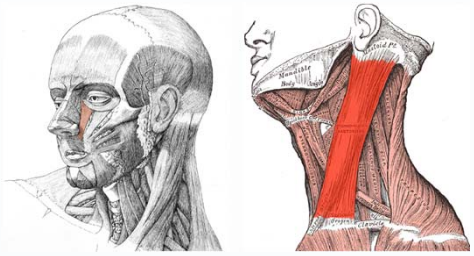


Fig. 1 –EMG recording locations –Levator (left) & Sternocleidomastoid (right)

Participants

18 (11 females) psychology students

Stimuli

8 film clips validated in preliminary study: 2 disgust, 2 neutral & 4 anger –which also evoked mixed disgust. Duration: 1.5 to 2 minutes

Electromyography

Specifications: Online Bipolar Ag/AgCl electrodes, 1000 Hz sample rate, band-pass filtered .03-200 Hz, notch filtered 60 Hz, online. Offline highpass 15 Hz 96 dB/oct, signals rectified

Recorded over levator facial muscle group and SCM neck muscle group.

Post film rating

Rate 0-8 Anger, Grossed-Out, Sad, Moral Disgust, Sympathy, Boredom, Happiness, Fear, Protective, Vengeful.

Motivational direction

"To what extent did you feel compelled to ____..." 1.) Approach or 2.) Avoid " … the situation?"

Rated from "I didn't feel like moving" to 1.) " I really wanted to step in" or 2.) "leave the scene".

Analyses

Within participant Pearson correlations were calculated for each participant across films, to produce a correlation between mean muscle activity during each film and the ratings for each film. These correlations were then Fisher Z-transformed, averaged across participants, and inverse Z-transformed for display. One-sample T-tests were used to test significance.

Exploratory Data Analysis

A dendrogram of hierarchical clusters was plotted for within participant correlations with Levator (Fig. 4). Branches of the tree indicate the smallest distance (Euclidean) between clusters (Martinez, Martinez & Solka, 2011).

Exploratory Data Analysis (continued)

To examine the contributions of each participant to the median waveform across subjects, the peaks for each participant was plotted for each movie (e.g. Figs. 5-6). Peaks were defined as time points (1000 Hz) with an amplitude greater than 4 standard deviations above the mean z-score for each participant. The sum logical of peaks (1 or 0 at each time point) was calculated. The number of peaks per time point may suggest cross- participant reactions to movie stimuli and indicate "hotspots" where activity is similar. These hotspots will be used for future studies on affective chronometry and individual differences.

Results

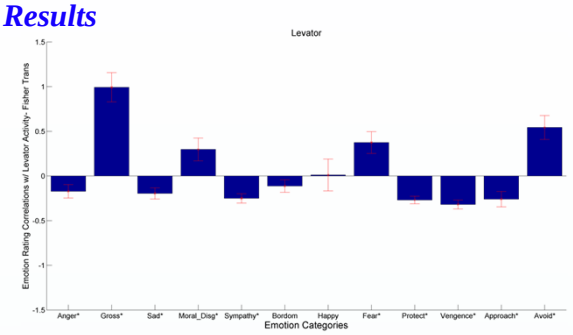


Fig. 2 Within subject correlations across films, between Levator and self-report emotion ratings. Avoidance related emotions are positively correlated. This functionally differentiates between anger and moral disgust. Hypothesis 1.

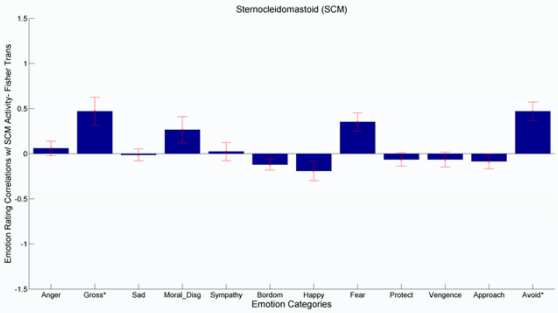


Fig. 3 Within subject correlations across films, between SCM and self-report emotion ratings. SCM is highly correlated with self-reported avoidance and grossed out. Hypothesis 2.

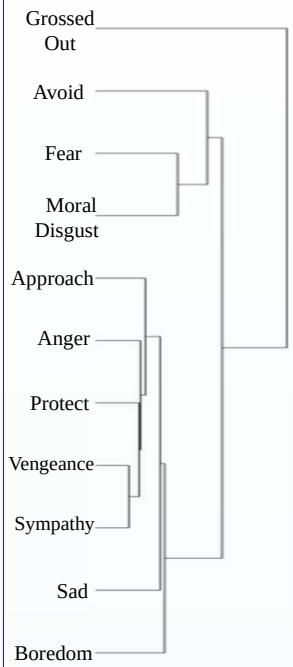
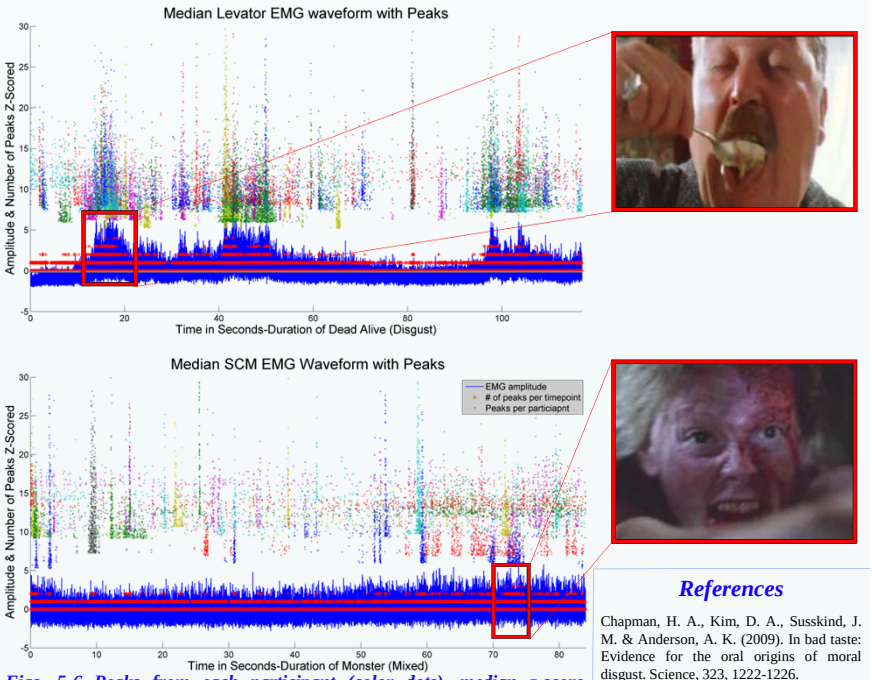


Fig. 4 Dendrogram of Levator correlations- Length of branches represent the distance between hierarchical clusters. This pattern provides further illustration of Hypothesis 1.



Figs. 5-6 Peaks from each participant (color dots), median z-score waveforms (blue lines) and the number of peaks across participants per time point (red stars) are combined to show both individual variability and similarities in muscle behavior during film viewing. Hotspots coincide with emotional events in the films. Disgust and mixed examples shown.

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