Quantification of Signal Carriers for Emotion Recognition from Body Movement and Facial Affects

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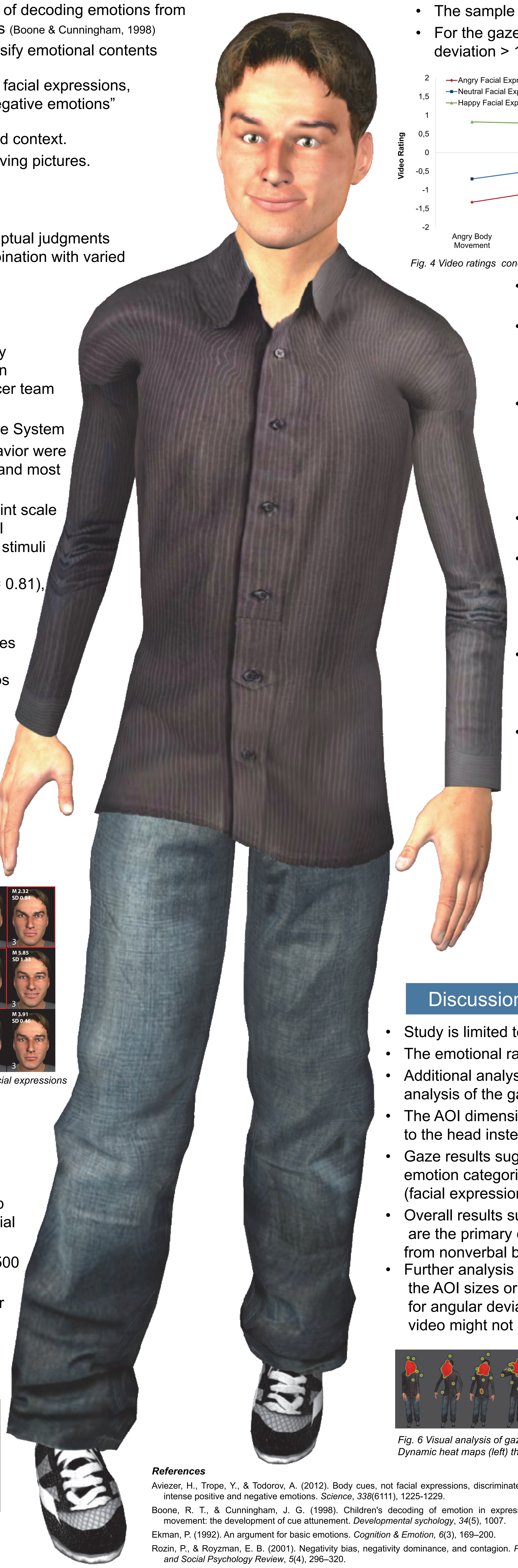


Introduction

- Humans are equipped with the essential skill of decoding emotions from nonverbal cues which develops in infant ages (Boone & Cunningham, 1998)
- Facial expression are said to universally classify emotional contents (Ekman, 1992)
- Recent findings suggest that "body cues, not facial expressions, discriminate between intense positive and negative emotions" (Avezier, Trope, & Todorov 2012).
- Findings rely on static stimuli with background context.
- We want to find out what discriminates in moving pictures.

Goal

- Investigation of channel dominance in perceptual judgments when observing nonverbal behavior in combination with varied facial expression.

Methods

- Five layman actors were instructed to display gradiations of happiness and anger based on predefined scenarios (e.g. your favorite soccer team won/lost).
- Actors were recorded using a Motion Capture System
- 40 stimuli displaying expressive motion behavior were selected that had the best recording quality and most natural looks.
- From pretesting (N = 43, M_{age} = 24.23, 7-point scale (1 = very happy, 7=very angry) with a neutral character, no face displayed, we identified 5 stimuli perceived as "angry" (M = 3.13, SD =1.09), 5 ambiguous "neutral" stimuli (M=3.99, SD = 0.81), and 5 stimuli perceived as "happy" (M=4.73, SD=1.81).
- Friedmann-Test showed significant differences between groups $\chi^2(2, N = 5) = 10$, p = .007, Wilcoxon pairwise test showed that all groups were significantly different (all p < .05).
- The duration of the clips between groups was not significantly different (χ^2 (2, N = 5) = 1.78, p = .41).

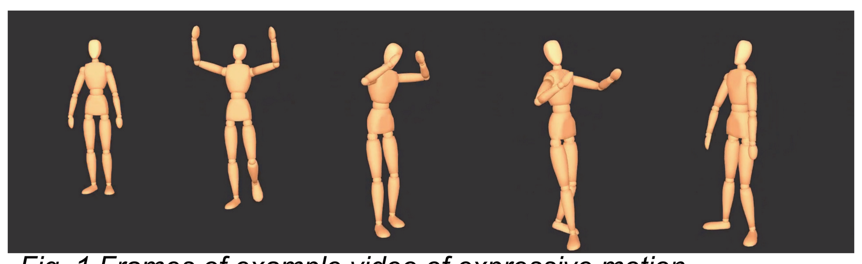


Fig. 1 Frames of example video of expressive motion

- The second part of the prestudy identified neutral avatar clothes as well as expressive facial expressions.
- Animation tools were used to predefine expressions using blend shapes to come close to FACS recommendations for happy and angry faces.

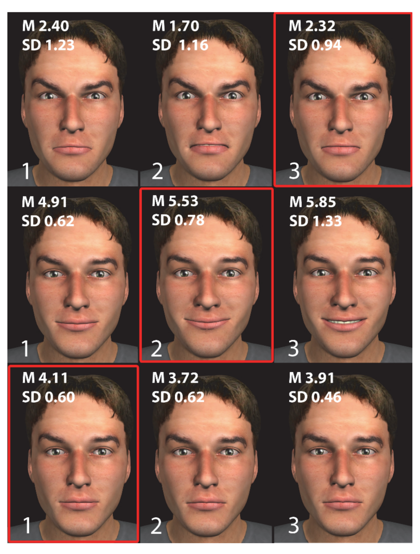


Fig. 2 Pretested facial expressions

- Based on most neutral ratings, the casual clothes were selected.
- We chose a slightly happily rated face in the neutral condition to compensate for the negativity bias (Rozin, & Royzman, 2001).
- These conditions result in a 3x3 within group design (3 x 5 expressive movements x 3 facial expression variations = 45 video stimuli).
- Gaze data was recorded with an SMI RED 500 eye gaze tracker.
- After each video, participants were asked for their impression on a 7-point scale (1 = very happy, 7=very angry).
- For each video, we dynamically coded AOIs for Head and Body.

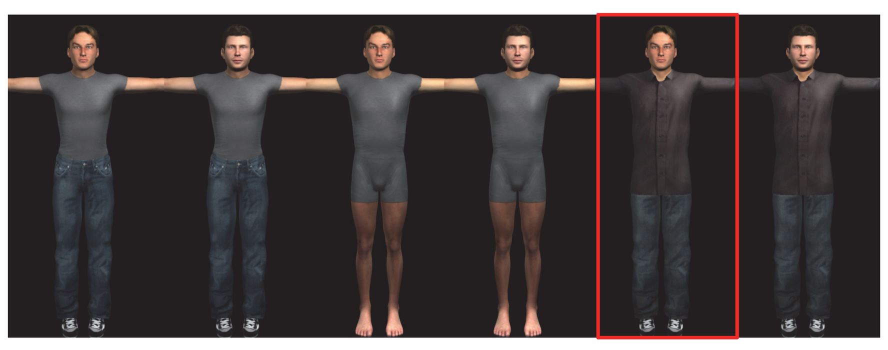


Fig. 3 Pretested Avatar appearances and clothes

Results

- The sample size was N = 68, M_{age} = 25.71, SD = 6.55.
- For the gaze data analysis, we excluded subjects that had a x or y deviation > 1.5 in either pre or post experimental validations.

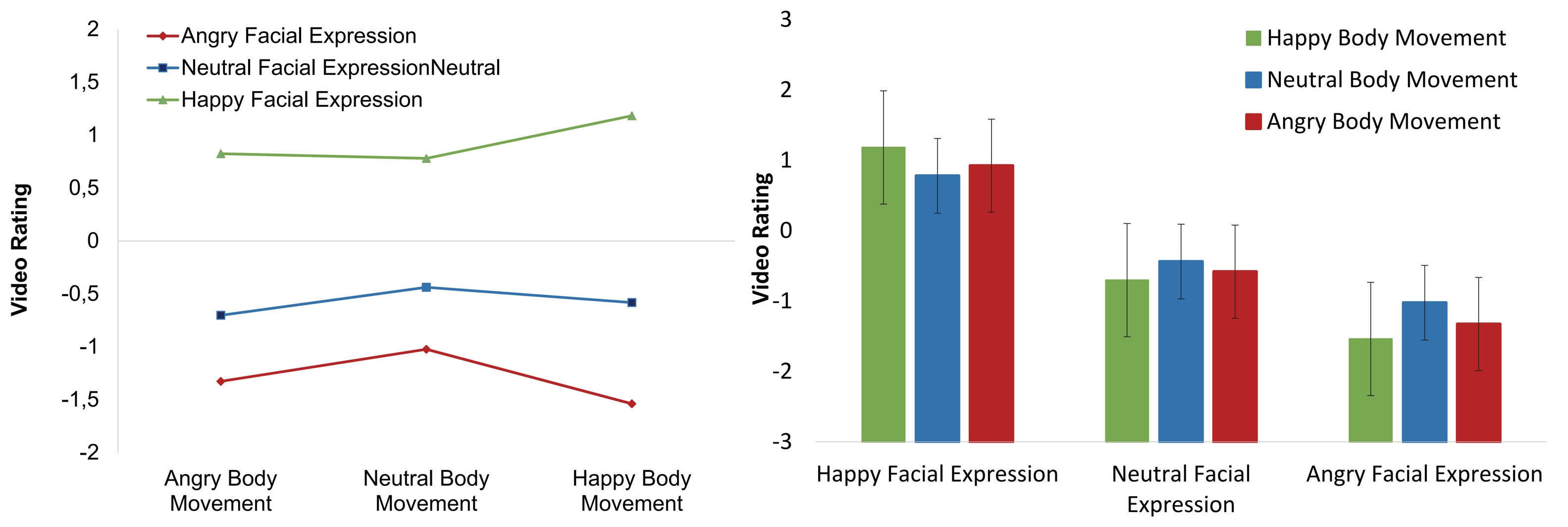


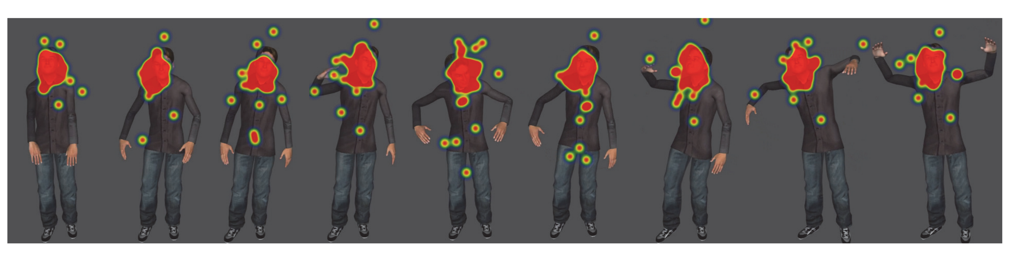
Fig. 4 Video ratings conducted by each participant after each video

- We conducted a 3 (Facial Expression) x 3 (Body Movement) ANOVA for video ratings.
- Results show a significant main effect for Facial Expression, F(1.59, 106.37) = 664.11, p < .001, η_p^2 = .91 as well as a significant main effect for Body Movement F(1.47, 98.71) = 4.04, p = .03, η_p^2 = .06.
- A significant interaction effect, F(3.25, 217.87) = 23,94, p < .001, η_p^2 = .26, demonstrated that a happy facial expression in combination with happy body movement was perceived as more positive, whereas neutral or angry facial expression with happy body movement were perceived more negatively (all p<.05).
- We conducted a 3 (Facial Expression) x 3 (Body Movement) x 2 (AOI: Head, Body) ANOVA for dwell time.
- Preliminary analysis of gaze data showed a significant main effect for Body Movement, F(2, 120) = 123.20, p < .001, η_p^2 = .67, and a significant interaction effect between Body Movement & AOI (Head vs Body), F(2, 120) = 14.68, p < .001, η_p^2 = .20.
- Simple comparisons revealed that only in the „happy" body movement condition dwell time for the Head AOI was significantly higher than for the Body AOI, t(60) = 2.08, p < .05, d_z = 0.27.
- The pattern of results did not change when controlling for mean video lengths per condition.

Fig. 5 Dynamic Avatar AOIs and dwell times for AOIs in gesture conditions

Discussion

- Study is limited to static facial expressions.
- The emotional ratings and stimuli are limited to only two dimensions.
- Additional analyses are to be conducted according to preliminary visual analysis of the gaze data.
- The AOI dimensions are not equal, and we decided to use an AOI matched to the head instead of the face.
- Gaze results suggest that with expansive body movements that are still not emotion categorized, people tend to look for a second source of information (facial expression) in order to reduce uncertainty.
- Overall results suggest that facial expressions are the primary channel to decode emotions from nonverbal behavior.
- Further analysis should take into consideration the AOI sizes or expand both sizes to make up for angular deviations, as the head size in the video might not be large enough.



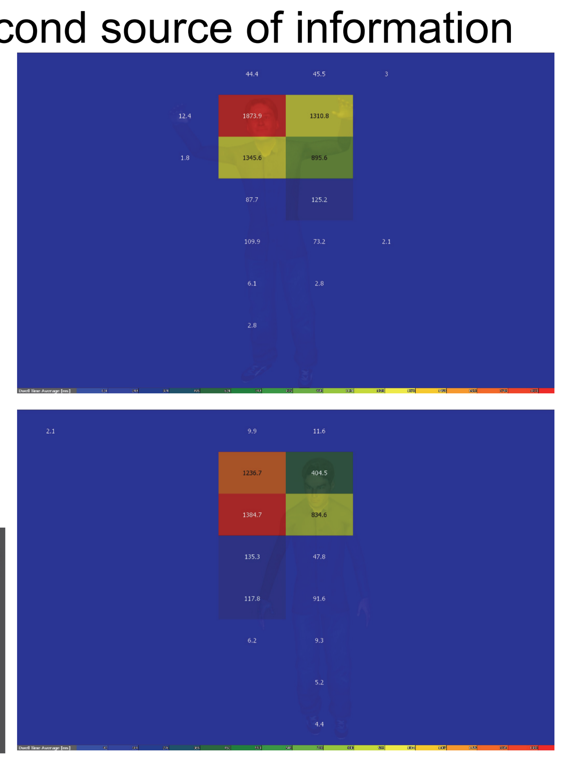


Fig. 6 Visual analysis of gaze data. Gridded AOI results (right) show that there is focus on the facial area. Dynamic heat maps (left) throughout the video confirm this focus.

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