Expression of Emotions in Human Locomotion: Effects of Speed

Avi Barliya†, Lars Omlor‡, Martin A. Giese‡, Alain Berthoz§, Tamar Flash†

†Department of Computer Science & Applied Mathematics, Weizmann Institute of Science
‡Department of Cognitive Neurology, Hertie Institute for Clinical Brain Research, Tubingen, Germany
§Laboratoire de Physiologie de la Perception et de l’Action, College de France, Paris, France

Introduction

Emotion manifests itself in various aspects of human behavior. Among others, body expressions are means of non-verbal communication which affect day-to-day social judgments about the traits, attitudes and emotional states of individuals.

Body movements at large and specifically gait are rich with information including emotional state. How emotions are encoded in movement is not yet known, however, they are easily recognized by human beings.

It was shown that during locomotion the elevation angles of the leg segments co-vary and are constrained by a plane (Borghese et al., 1996). The plane of intersegmental coordination is extremely robust and it rotates with increasing speed in order to facilitate reduction of energy expenditure (Bianchi et al., 1998).

Since different emotions are associated with different speeds of movement, the co-variation plane is a natural tool to study kinematic differences among emotions and to determine whether these changes are only due to speed, or conveying something inherent and unique to the expressed emotion.

Materials & Methods

• Vicon 612 motion capture system with 6 cameras
• 41 Markers at 120 Hz
• Two subject sets: Professional actors (8)
  Non-professionals (13)
• Subjects were walking while expressing Neutral, Anger, Fear, Happiness or Sadness emotions
• Elevation angles definition

Results - Kinematics

Fitting the elevation angles

\[ \theta(t) = \alpha + \sum \beta \sin(\omega t + \varphi) \]

Model

The orientation of the plane is predicted to be a function of the amplitudes of the segments' elevation angles and the phase-shifts among them (Barliya et al. 2009)

\[ \mathbf{N} = \begin{bmatrix} A_1 \sin(\varphi_1 - \varphi_2) \\ A_2 \sin(\varphi_2 - \varphi_1) \\ -A_1 \sin(\varphi_1 - \varphi_2) \end{bmatrix} \]

Discussion

Kinematic parameters which control the orientation of the plane were compared across emotions

Emotion was found to be a significant factor for all the parameters whereas the professional vs. naïve was not

The changes in the kinematics were consistent with the changes in speed corresponding to the different emotions

The thigh amplitude behaves differently than would be expected by changes in speed alone.

The plane rotates during expression of anger beyond the expected effect of speed

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Contact: avi.barliya@weizmann.ac.il