



A multimodal approach to coding body movement

Nele Dael

Workshop Multimodality in emotions and their assessment
IM2 & Affective Sciences Summer Institute, September 2008



The production and perception of internal states and cognitions integrates several modalities in the context of everyday life.

Body movements, postures and gestures form an integral part of the verbal and nonverbal communication system

Important factor in multimodal emotion expression (e.g. Tracy & Robins, 2004; Van den Stock, Righart & de Gelder, 2007)

Focus on decoding using emotion recognition (exc. Scherer & Ellgring, 2007)

Does not clarify multimodal emotion encoding process

Emotional expressions are characterized by *synchronized* changes across modalities



Coding requirements

Time locked

Micro coding

Multiple description levels (form, function, anatomical, dynamic)

Modality (speech) independent

No agreement for **body movement and posture** (ref. FACS)

Specific level of description (exc. Wallbott, 1998), not time aligned, no clear unit definition

Gesture definition and segmentation accepted but limited applicability to nonverbal research

- based on semiotic analysis of the accompanying verbal content or other semantic information (context)
- limited to (hand) gestures as deliberative and recognized attempts to convey a message



- Definition of posture and action units
 - On the anatomical, formal & functional level
 - Onset, apex and offset time-points

- Coding of segments, i.e. position and action units
 - Type of kinematical action (e.g. turn, bend, lean), direction, orientation, manner

- Unsegmented coding, 'continuous'
 - Orientation, gaze, symmetry, touch
 - Absolute and relative spatial locations
 - Dynamic performance (e.g. velocity, acceleration)



- Observation tool for the manual Annotation of Video and Spoken Language (Kipp, 2004)
- In continuous development to fit GEMEP requirements, e.g.
 - Synchronized view of frontal and profile recordings
 - Project tool for handling many short videos
 - Spatial annotation *Bug fixes!*
 - Coder agreement test
- Implementation of coding scheme via XML specification
 - High flexibility***
- HTML browsable manual and info buttons
 - Systematic observation following fixed protocol***
- User friendly playback and screen settings
 - High precision time-locked coding***



Anvil user interface

The screenshot displays the Anvil 4.7.3 user interface, which is used for video annotation and gesture analysis. The interface is divided into several main sections:

- Main Video: B05fie132.avi**: A large window showing a man in a dark shirt and white sleeves speaking and gesturing.
- Slave Video: C05fie132.avi**: A smaller window showing the same man from a different angle.
- Annotation: V05fie132.anvil**: A timeline window showing various annotations for the video. The timeline is marked with time intervals (00:00, 00:01, 00:02). Annotations include:
 - head position: right
 - trunk position: up
 - left arm position: at side, at waist
 - right arm position: at side, at side
 - joint arms position
 - left shoulder position
 - right shoulder position
 - arm position symmetry: asymmet., asymmetry
 - body position symmetry: asymmetry
 - action behavior
 - gaze: straight ahead (gaze is fixed into camera), averted sideways (straight ahead)
- edit element**: A dialog box for editing an element. It contains several dropdown menus for attributes:
 - spine: none
 - chest lift/drop: up
 - trunk lean frontal: none
 - trunk lean lateral: none
 - trunk rotation: noneThere is also a "Comment <<" field with the text "Chest ou juste neutre avec respiration... ?".
- Attribute: chest lift/drop**: A text box providing a definition: "A chest lift is caused by lifting the sternum and straightening the spine and is sometimes accompanied by pulling the shoulders backward, resulting in the chest being pushed to the front. Here only the vertical change is coded, shoulder movement is coded under the arm tracks."

The Windows taskbar at the bottom shows the Start button, system tray icons, and the time 5:55 PM.



- SPAN 1.3 runs in MATLAB
- allows the user to locate the positions of n user-defined targets on each frame of a video.
- The target points are annotated in a fixed order and categorized in one of three classes according to their visibility for the observer.



Applied on GEMEP

- Continuous micro-coding of six body parts actively involved in gestures and postures and/or demarcating major body regions
 - Head
 - Left and right shoulder
 - Abdomen centre (navel)
 - Left and right hand
- Create trajectories in three-dimensional Euclidian space from annotation in frontal and profile view



Features related to the form and dynamics of hand and head movement trajectory

- Length, direction, orientation
- Velocity, acceleration, fluency

Gesture range

- Height, width, depth or surface area of the 'bounding box' of the extremes of the hand positions in the three dimensions

Hand location relative to other body parts

- Euclidian distance between body parts (hand to hand, hand to head)
- Spatial occupation of the hands in major body regions

Do these cues differentiate between emotions and do they relate meaningfully to patterns of vocal and facial expression?



Spatial annotation of body parts

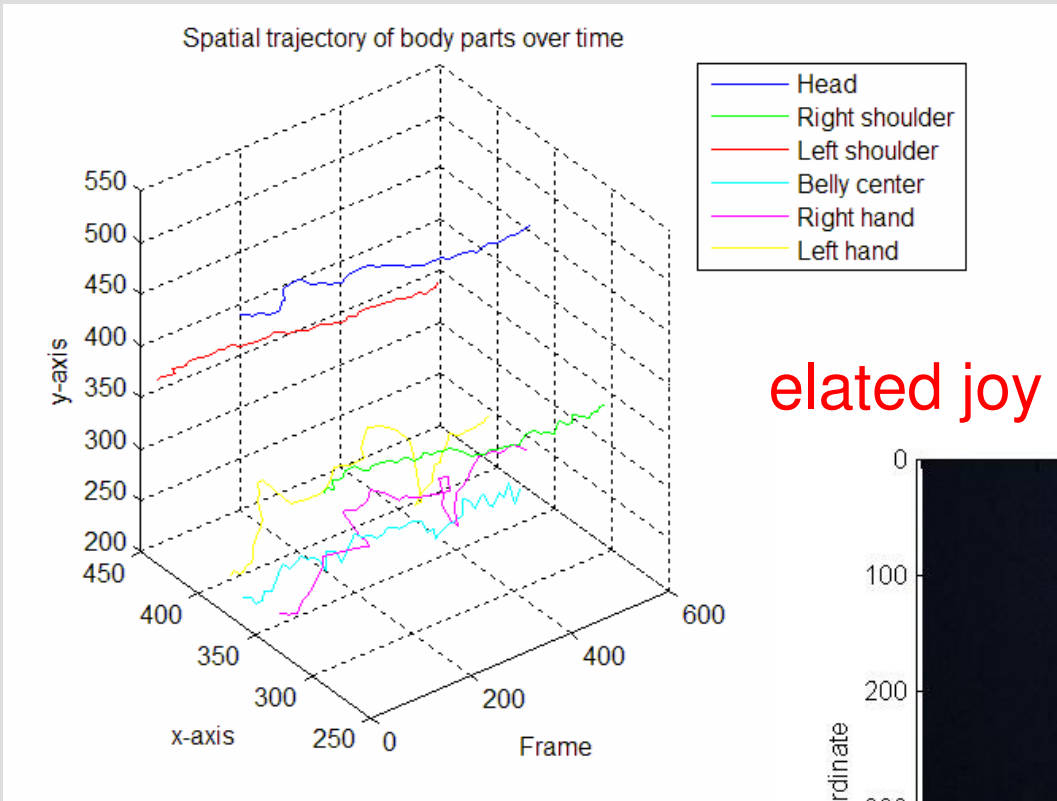
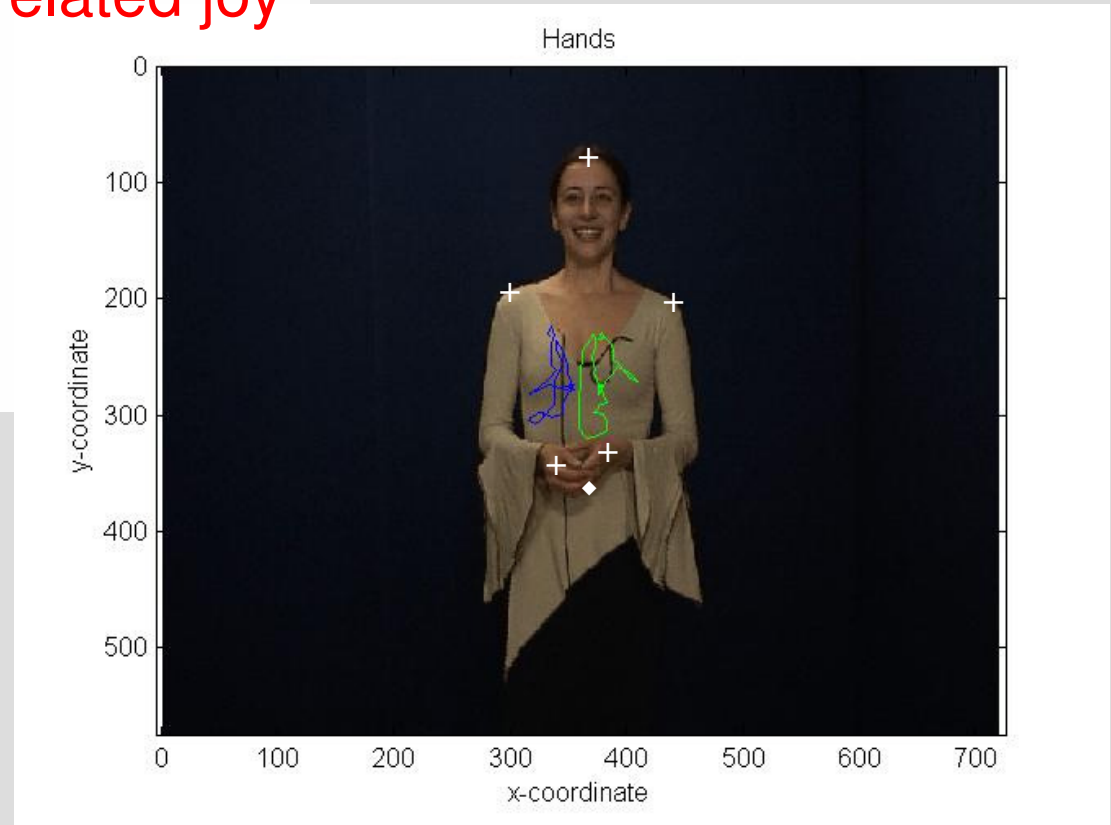


Illustration - trajectories

Trajectories of body movement over time in 2D space, frontal view

related joy



Hand movement trajectories in 2D space, frontal view

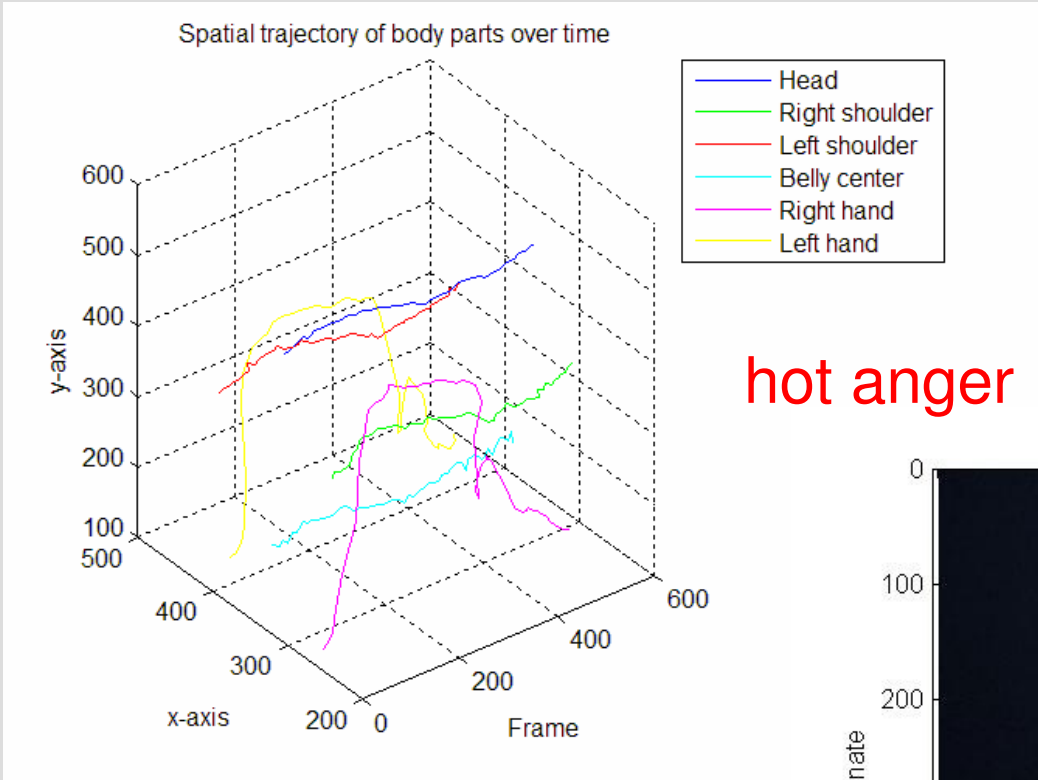


Spatial annotation of body parts

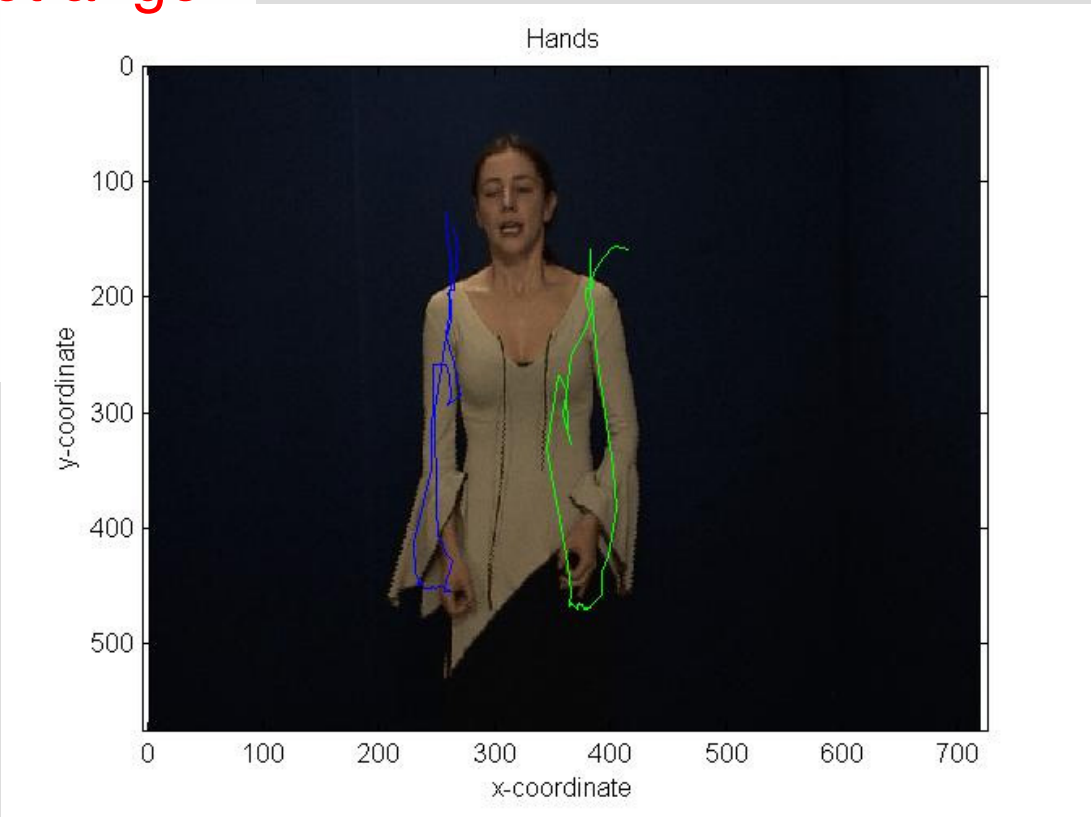
Illustration - trajectories

Trajectories of body movement over time in 2D space, frontal view

hot anger

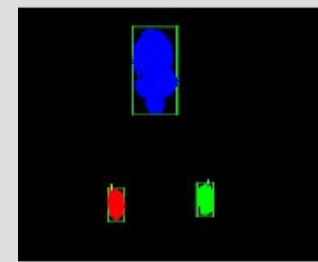


Hand movement trajectories in 2D space, frontal view





- Feasibility testing of different tracking algorithms
 - Body based on silhouette extraction
 - Head and hands based on skin color extraction
- Extraction of dynamic and form cues
 - Perimeter of bounding triangle connecting head and hands
 - Overall velocity
- Extraction of cue specific temporal features
 - Number and magnitude of maxima, peak duration, attack and release of movement unit



Presentation ongoing in parallel workshop “database management and annotation”

*In collaboration with Donald Glowinski, Gualtiero Volpe and Antonio Camurri
(University of Genova)*