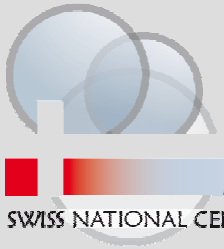

Affective Sciences
SWISS NATIONAL CENTER OF COMPETENCE IN RESEARCH

A multimodal approach to coding body movement

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Workshop Multimodality in emotions and their assessment

IM2 & Affective Sciences Summer Institute, September 2008

Multimodal emotion encoding

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

Implications for coding body movement

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

Towards an integrative coding system

- 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)

Coding scheme implementation

- 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
  - Coder agreement test

Bug fixes!

- Implementation of coding scheme via XML specification

  High flexibility

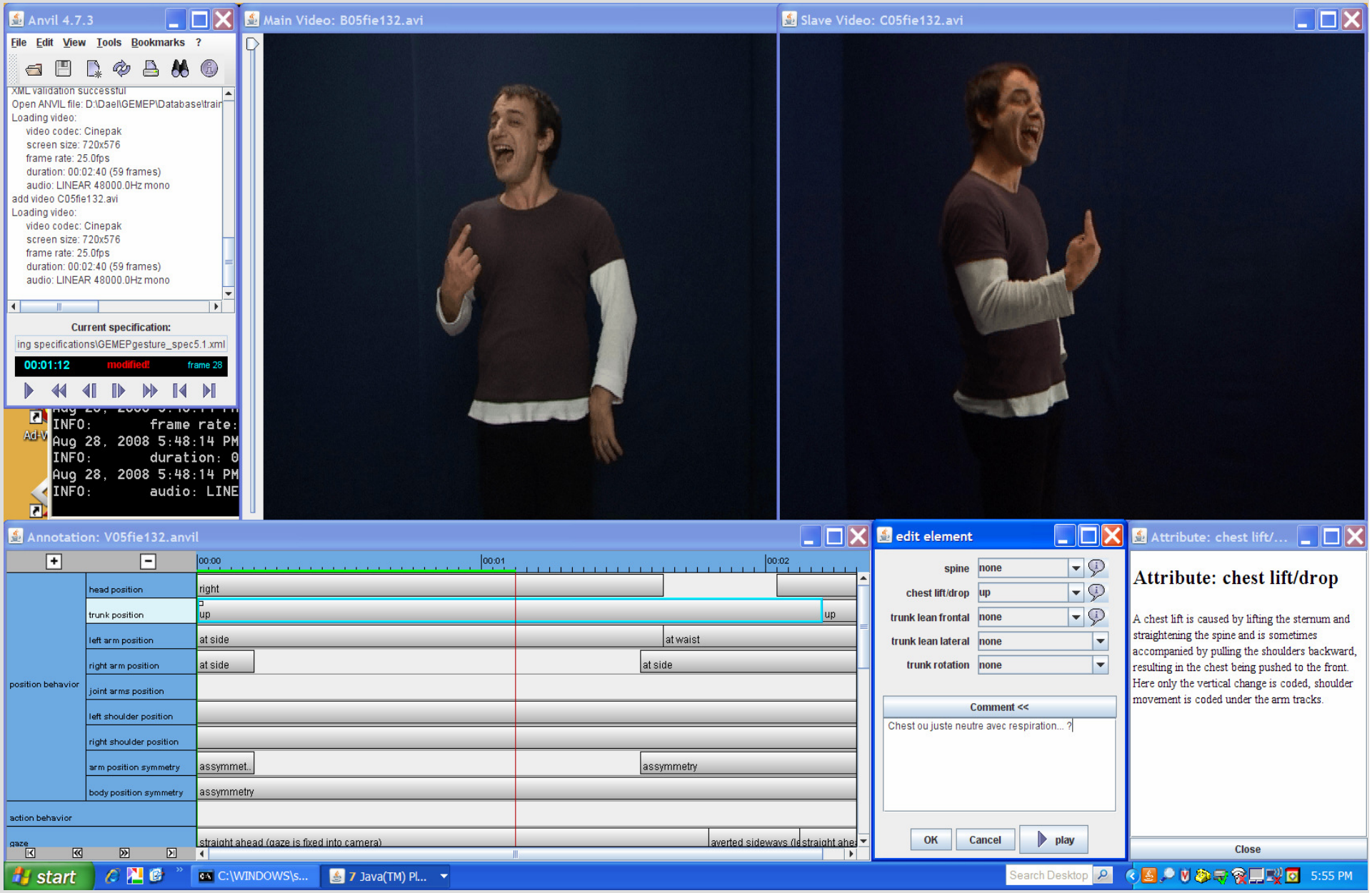
- HTML browsable manual and info buttons

  Systematic observation following fixed protocol

- User friendly playback and screen settings

  High precision time-locked coding

Anvil user interface



Spatial annotation of body parts

- 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

Spatial annotation of body parts

Cue extractions

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?

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Spatial annotation of body parts

Illustration - body regions

Back Trunk Front

Lateral right Trunk Lateral left

Above head

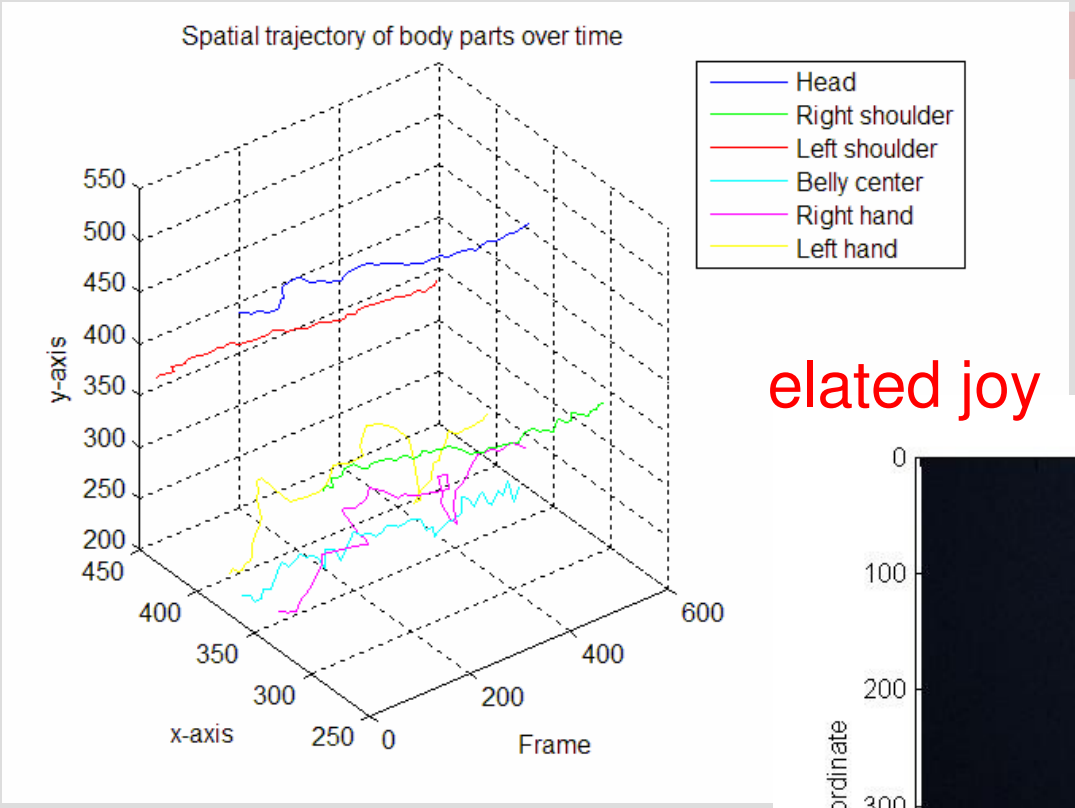
Head

Trunk

Below trunk

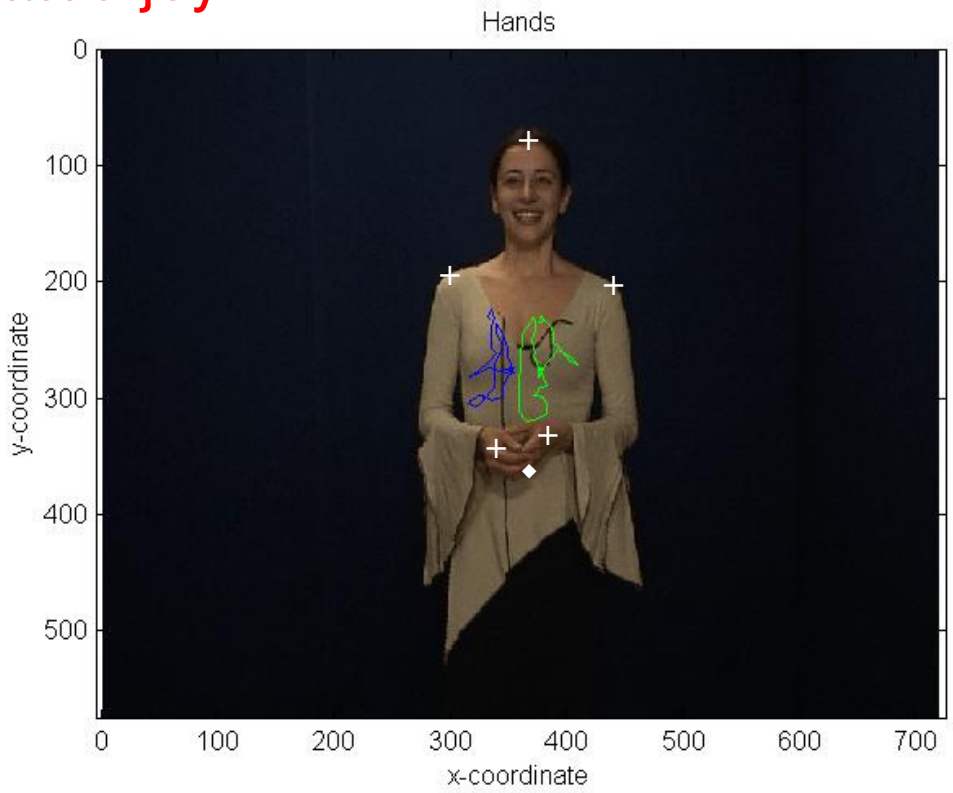
Spatial annotation of body parts

Illustration - trajectories



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

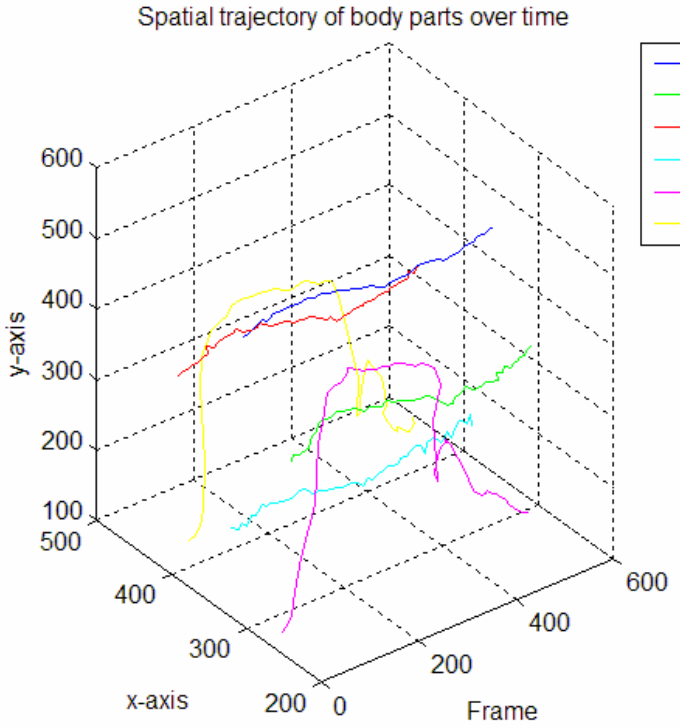
elated joy



Hand movement trajectories in 2D space, frontal view

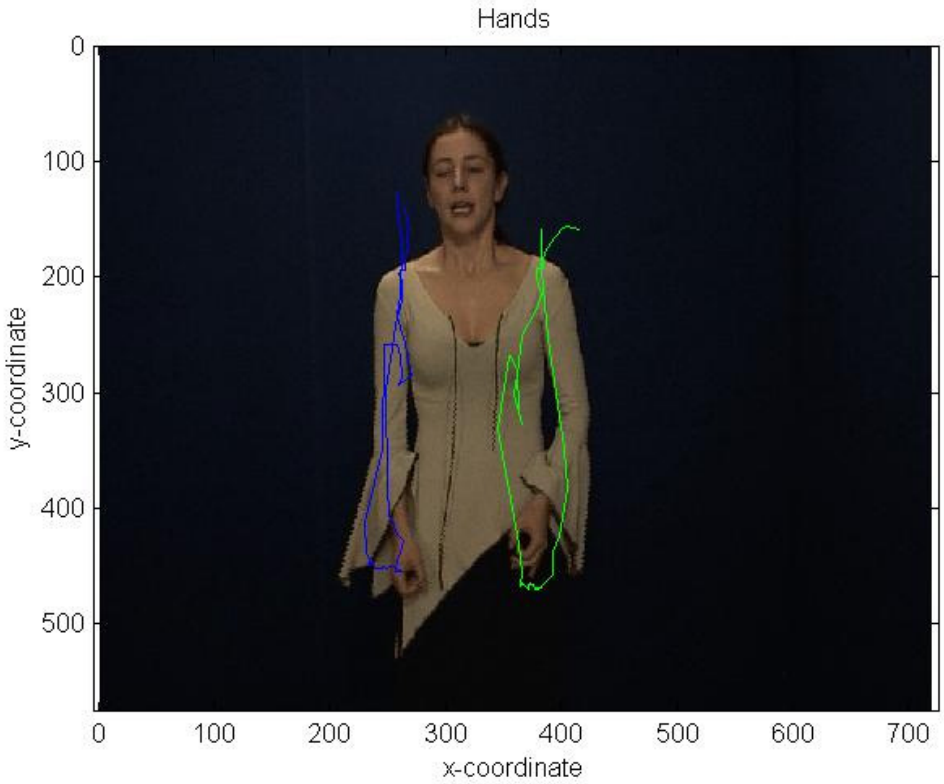
Spatial annotation of body parts

Illustration - trajectories



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

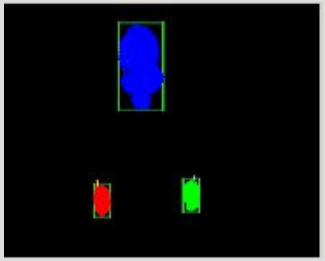
hot anger



Hand movement trajectories in 2D space, frontal view

Algorithms for automatic tracking and cue extraction

- 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)