

*Steps towards modelling*

# Attention to Expressive Faces

*for agent interaction*

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LINC

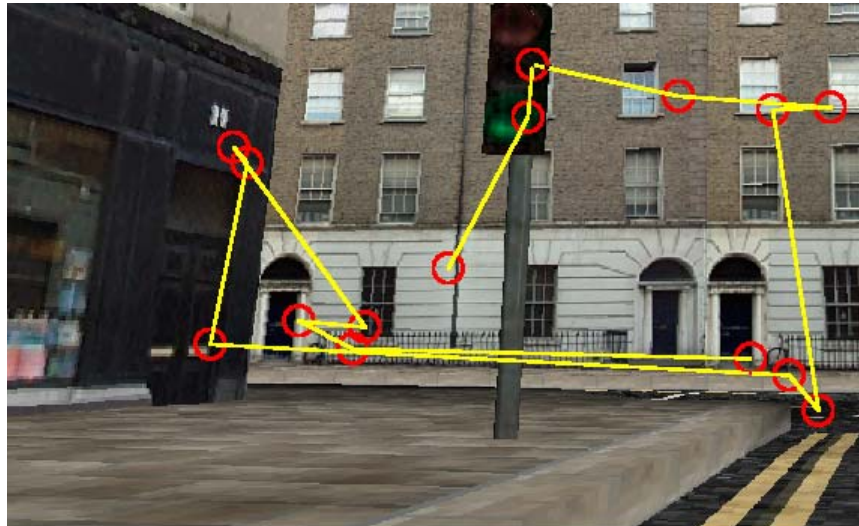
University of Paris 8

**humaine**

WP7 workshop, 4-5th July 2005, London

# Background

- Computational model of visual attention to control an agent's looking behaviour in a V.E. (*Peters, 2004*)
  - Original model bottom-up (*Itti, 2001*)
  - Extended for top-down influences (*Navalpakkam and Itti, 2005*)



# Background

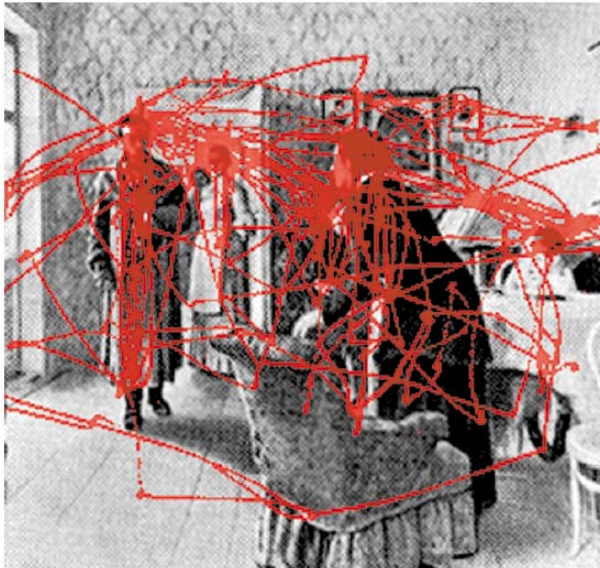
- Computational model of visual attention to control an agent's looking behaviour in a V.E. *(Peters, 2004)*
  - Original model bottom-up *(Itti, 2001)*
  - Extended for top-down influences *(Navalpakkam and Itti, 2005)*
- Our goal is to include a social dimension
  - Social = people, faces and emotions processed in a certain manner by the model



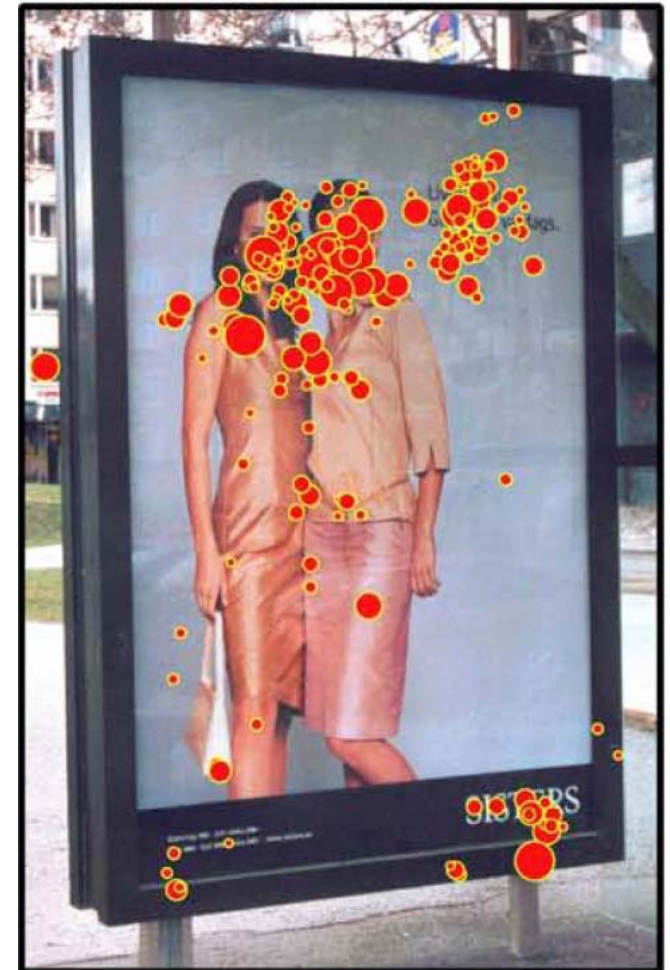
# “The face is a magnet”

*D. Lundqvist, The Face of Wrath, 2003*

- When humans interact, a lot of attention is directed to the face of others
- Social consequences of not prioritising faces (e.g. autism)



*Yarus, 1967 (adapted by Kanwisher 2001)*



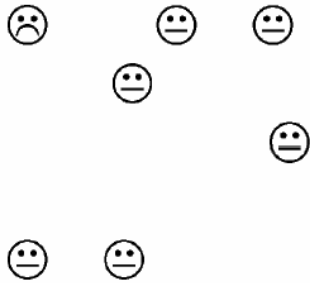
*Lundqvist, The Face of Wrath, 2003*

# Face Processing

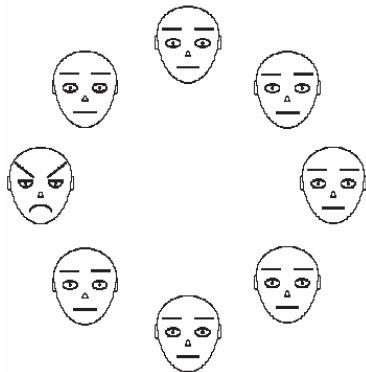
- Faces in scenes
  - Neutral faces capture attention more readily and perceived more rapidly and accurately than other objects in a scene (*e.g. Ro et al., 2001*)
- Emotional expressions
  - attention guidance: emotional faces > neutral (neutral face context) negative > positive
  - (some) can be analyzed in unattended areas and discriminated in a *fairly* automatic manner (*Vuilleumier and Schwartz, 2001*)
  - degree of analysis / automatic?

# 'Pop out' and Faces

- Feature 'pop-out'
  - Flat search function



Adapted from Eastwood et al. (2001)



Öhman et al., (2001)

- Do faces 'pop-out'?
  - Conflicting evidence for preattentive face processing
  - Angry faces 'popped out' of happy crowd (Hansen and Hansen, 1988)
  - Due to a contrast artifact? (Purcell et al., 1996)
  - But see (Öhman et al., 2001, Reddy et al. 2004, Fox, 2000)
  - Near absence / fairly automatic

# Threat

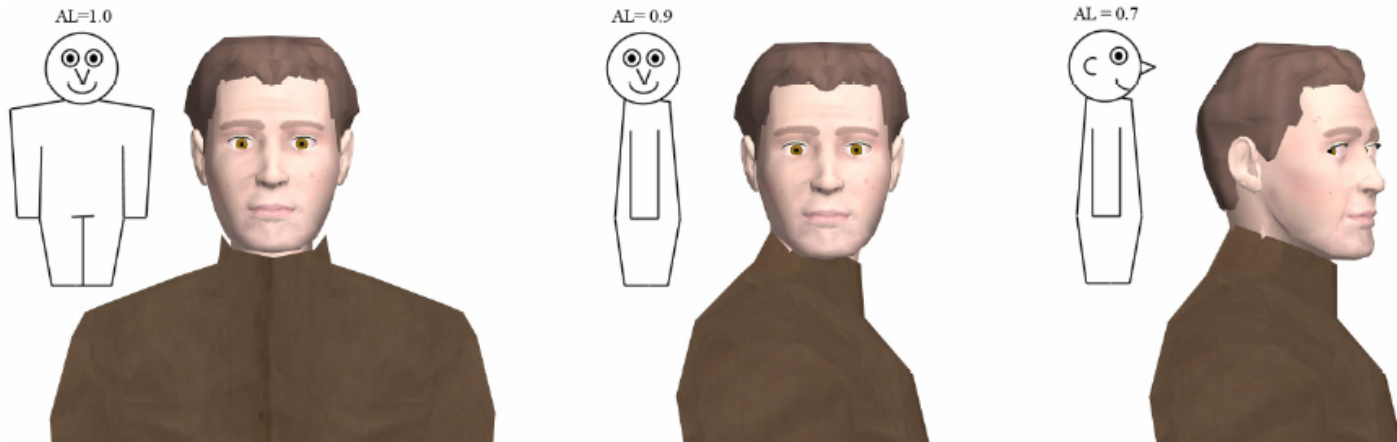
- Fast response to threat-related (fear, anger) expressions
  - Possibly linked to fast danger detection system (*LeDoux, 1996*)
- Processing advantage
  - Compared to neutral, happy and other negative faces
  - Fearful faces (*Vuilleumier et al. 2001*)
  - Angry faces (*Fox et al. 2000*)
  - Most important cues:
    - eyebrows, mouth and eyes (*Lundqvist, 2003*)
- Observer's characteristics are factors
  - High/medium anxiety participants detect threatening faces faster than neutral, happy, or sad faces (*Bradley et al. 2000*)

# Gaze direction

- Important for
  - disambiguation of threat source for anger and fear facial displays
  - concern relevance
  - encoding and retrieval for faces with direct gaze
  - Presented basis for implementation at HUMAINE Paris Workshop, March 2005



*Adams et al., 2003*



*C. Peters, Direction of Attention Perception for Conversation Initiation in Virtual Environments, to appear IVA 2005*

# Integration in model

Input Image



Compute intensity,  
colour, orientation,  
etc contrast



Saliency Map



- Model based on *saliency maps*
  - Input image decomposed into constituent channels
  - Different features have maps (e.g. intensity, colour)
  - Within-feature competition
  - Outputs ‘saliency map’
    - Spatial encoding of conspicuous areas in scene

# Details

- ‘Emotion maps’ for bottom-up model?
  - Facial threat maps
    - Spatial encoding of facial threat over visual area
    - Based on facial expression and gaze direction
    - Hierarchical weighting: eyebrows > mouth > eyes
  - Other possible maps
    - Threat and valence map for more general stimuli
  - Map competition and combination is an important issue

# Steps Involved

- Implement
  1. low level system for direction of attention perception *(complete)*
  2. determine distinct maps, their inputs and automaticity *(in progress)*
  3. investigate how emotion-related values may be incorporated into a scene ontology *(in progress)*
  4. some facial expression capabilities from Greta into Torque engine *(in progress)*
    - Eyebrow and mouth animation
  5. early evaluation study *(to do)*

# Some Questions

- Does any of this hold for virtual faces and facial expressions?
  - Schematic faces Vs. real faces
  - Disrupt perception when inverted, potent affective stimuli, similar ERPs to real (*Eastwood et al., 2001*)
  - But: direct gaze from schematic face may be different to direct gaze from a 'real' face (*Fox, 2005*)
- What about human machine interaction involving dynamic faces?
  - Does human perceive it in same way with an agent?
  - Facial expression Vs. changes in facial expression?

THANK YOU!