

Increasing Feeling of Presence with Affective Modalities

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Introduction

- Creating Believable and Social Agents
- Why?
- Applications
 - Games
 - Pedagogical learning systems
 - Maintenance training systems
 - Therapy Systems
 - Cultural Heritage



Overview

- What is Presence?
- Physical Presence
 - Simulation of sensory channels
 - Realistic rendering
- Social Presence
 - Verbal and Nonverbal Interaction
 - Emotion & Personality
 - Immersion to the real (perception of the real human)
 - Memory
- Conclusion



What is Presence?

- Subjective sense of “being there”
- Lombard et. al.* “perceptual illusion of non-mediation”
- Two types of presence
 - Physical Presence
 - Social Presence



* Lombard, M., Reich, R.D., Grabe, M.E., Bracken, C. and Ditton, T.B. Presence and Television: The role of screen size. *Human Communication Research*, 26 (1)

Physical Presence

- perceive the virtual environment as close as the real one through sensory channels
 - vision, hearing, touching and even smelling and tasting
- Sheridan defines three dimensions*
 - Number of sensory channels
 - Control of sensory channels
 - Modification of environment



* T. B. Sheridan, Musings on Telepresence and Virtual Presence, Presence, 1992, 1, 120-126.

Physical Presence (2)

- Visual Sensory Channel

- Head-mounted devices

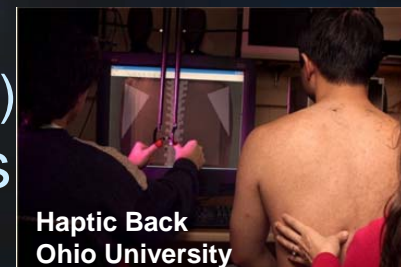
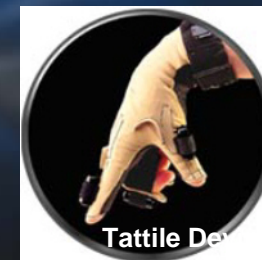
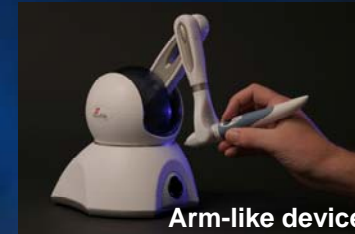
- Stereoscopic view in front of subject's eyes
- Resolution, field of view, frame rate
- Augmented reality



- Projection-based devices (CAVE-like systems)

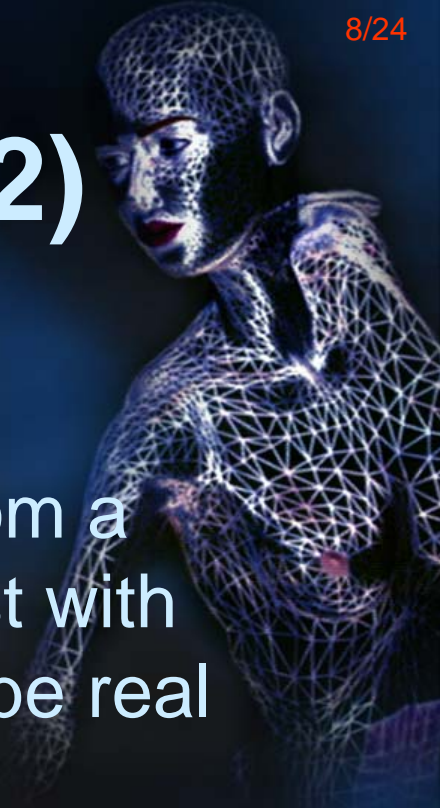
Physical Presence (2)

- Haptic Sensory Channel
 - Human sense of touch
 - Force-feedback (muscles, tendons, joints)
 - Tactile (receptors in the skin)
 - Bidirectional channel
 - Devices
 - Arm-like devices (e.g. PHANTOM)
 - Exoskelatons (e.g. CyberGrasp)
 - Tactile devices (e.g. CyberTouch)
 - Usually interaction with objects
 - E.g. textile, medicine
 - Few study on human-virtual human interaction
 - Limited technology for creating human like touch



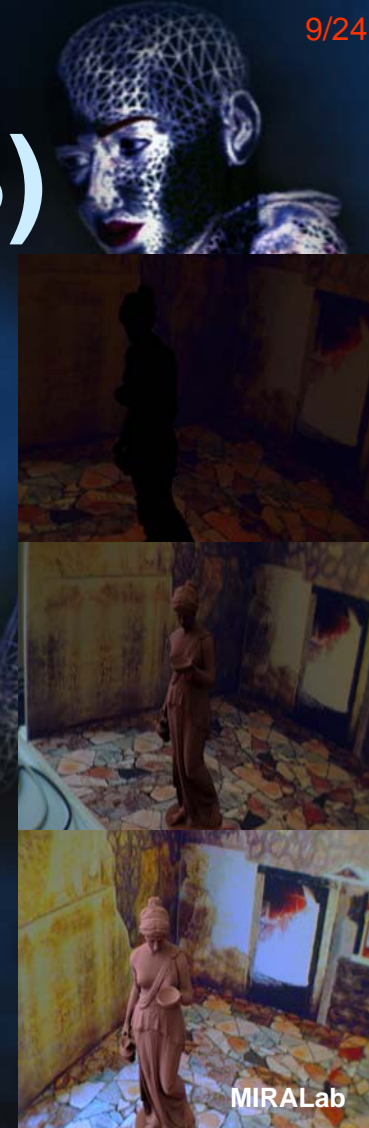
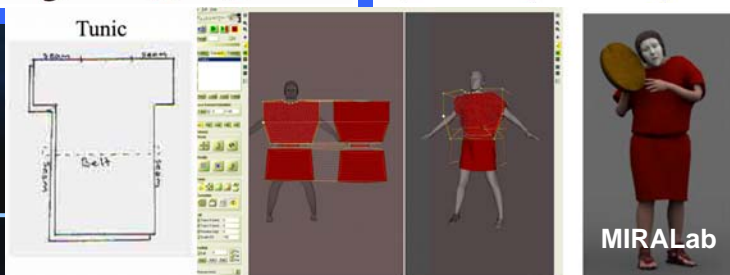
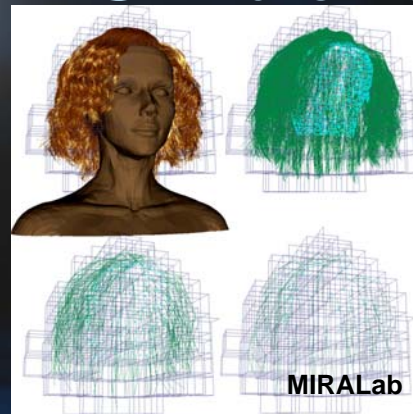
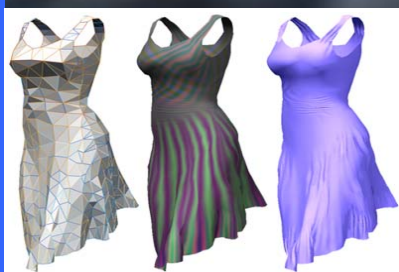
Physical Presence (2)

- Auditory Sensory Channel
 - illusion of hearing a voice coming from a sound source that doesn't really exist with same acoustic conditions if it would be real
 - Source, medium, receiver
 - Attenuation, reverberation, Doppler affect
 - Human-like binaural hearing



Physical Presence (3)

- Realistic Shape Modeling
 - Real photo, laser scanners
- Realistic Illumination Modeling
 - Shadows, shading
- Realistic Hair and Cloth Simulation



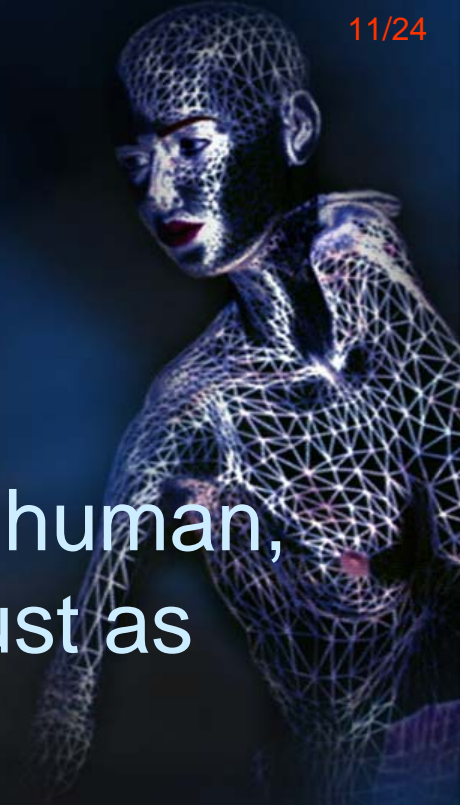
A possible scenario: Rendezvous at ancient Pompeii

- Travel between ages



Social Presence

- Is physical presence enough?
- Think that you can see the virtual human, touch them and hear their voice just as real.
-But what if they do not realize us?
- Social presence = feeling the existence of other intelligence in the environment
- **physical presence + social presence**



1. Verbal & Non-verbal Interaction (1)

- Dialogue System
 - Recovery of incomplete information
 - Feedback with filler words such as “yes”, “mhhhmm”
 - Turn-taking mechanism
 - Interpretation of non-spoken parts as part of the dialogue
- Expressive speech animation
 - Interpolating between visemes
 - Blending with facial expressions



1. Verbal & Non-verbal Interaction (2)

- Gestures

- REA, BEAT, MAX

- Synchronization with speech

- Realistic body movements

- MIRALab

- Idle Motions (Posture changes)

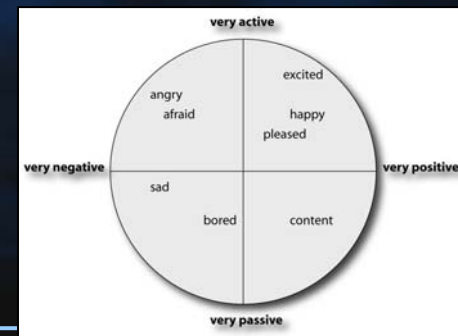
- Apply noise on joint (small movements such as breathing)

- Dependent Joint Motions (body movements do not occur on a few joints)



2. Emotion & Personality

- Three layer model
 - Personality - Mood - Emotion
- Multidimensional personality
 - OCEAN model
- Emotional Face
 - Based on OCC Model
 - 22 emotions + surprise & disgust



Personality-Mood-Emotion (PME Model)

- Individual

individual I_t as a triple (p, m_t, e_t)

- Personality

$$p = \begin{bmatrix} \alpha_1 \\ \vdots \\ \alpha_n \end{bmatrix}, \forall i \in [1, n] : \alpha_i \in [0, 1]$$

- Emotional Influence

$$\alpha = \begin{bmatrix} \delta_1 \\ \vdots \\ \delta_m \end{bmatrix}, \forall i \in [1, m] : \delta_i \in [0, 1]$$

- Mood state

$$m_t = \begin{cases} \begin{bmatrix} \gamma_1 \\ \vdots \\ \gamma_k \end{bmatrix}, \forall i \in [1, k] : \gamma_i \in [-1, 1] & \text{if } t > 0 \\ 0 & \text{if } t = 0 \end{cases}$$

- Emotional state

$$e_t = \begin{cases} \begin{bmatrix} \beta_1 \\ \vdots \\ \beta_m \end{bmatrix}, \forall i \in [1, m] : \beta_i \in [0, 1] & \text{if } t > 0 \\ 0 & \text{if } t = 0 \end{cases}$$



Personality-Mood-Emotion (PME Model)

- Step1:Mood Update
 - Personality-Mood Influence Matrix
 - Emotion-Mood Influence Matrix

$$m_{t+1} = m_t + \Psi_m(p, \omega_t, \sigma_t, a) + \Omega_m(p, \omega_t, \sigma_t)$$

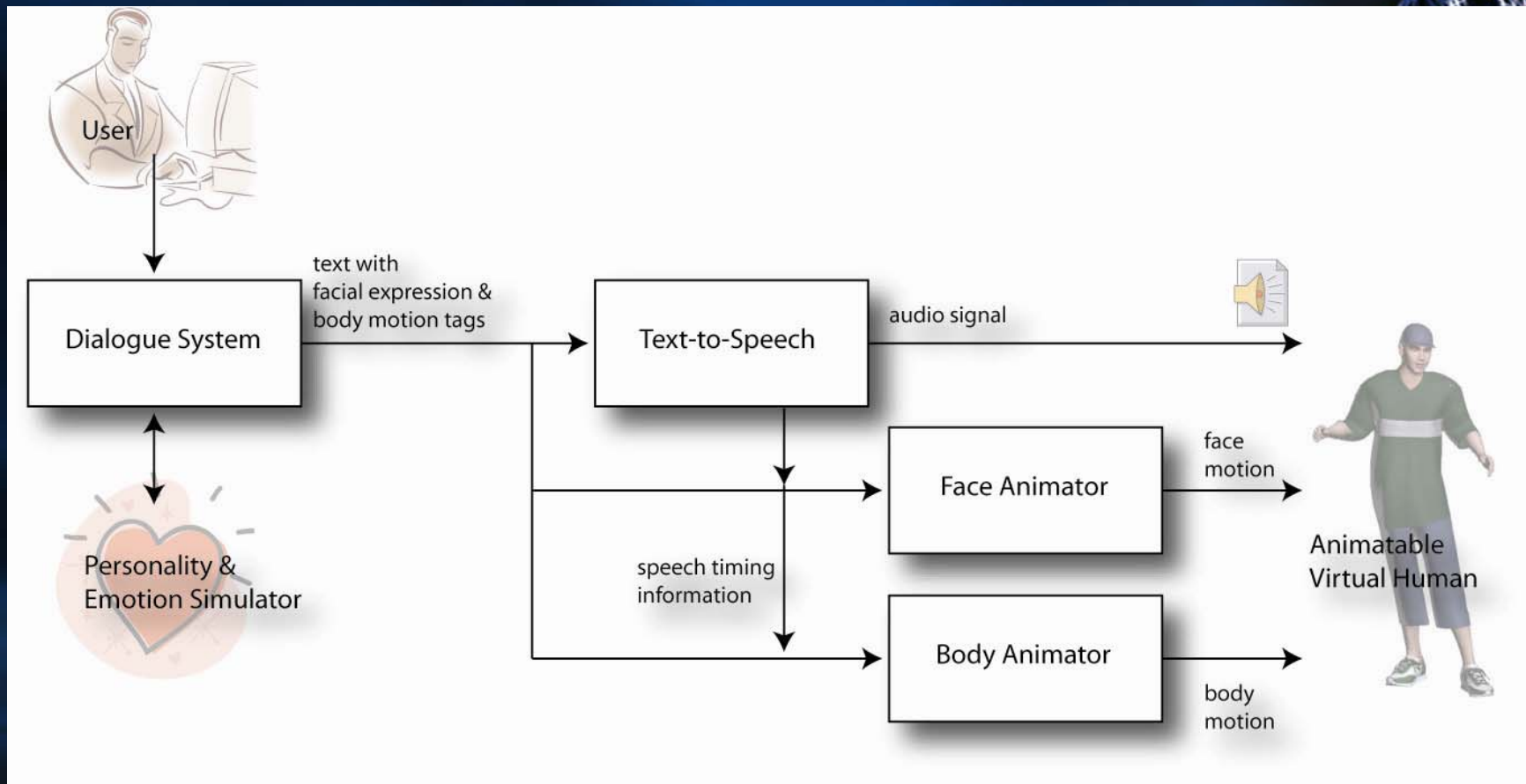
Emotion history

- Step2:Emotion Update
 - Personality-Emotion Influence Matrix
 - Mood-Emotion Influence Matrix

$$e_{t+1} = e_t + \Psi'_e(p, \omega_t, \sigma_{t+1}, a) + \Omega'_e(p, \omega_t, \sigma_{t+1})$$

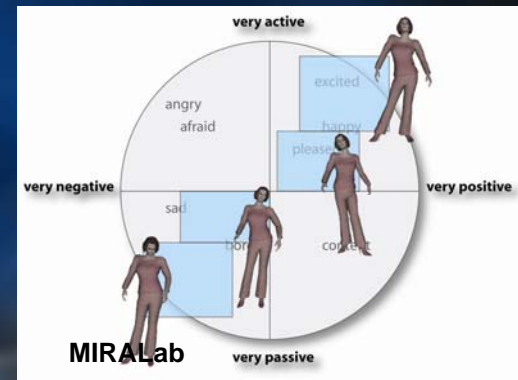
Mood history

Components



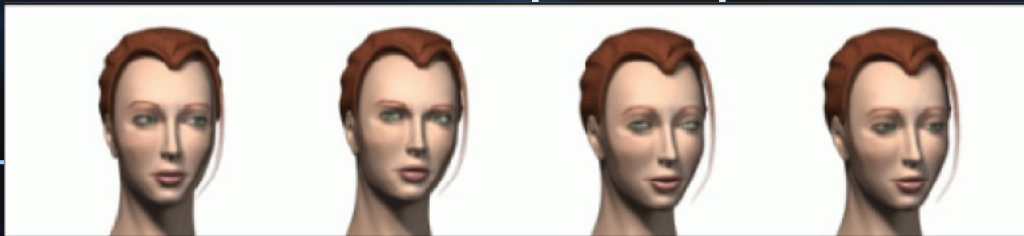
2. Emotion & Personality

- Emotional Body
 - Emotional balance shifts
- Why difficult?
 - Systems exist mapping low-level movements to emotional labels for face but not for body
- Modeling other details such as blushing, sweating, crying etc.



3. Gaze

- Gaze as a dialogue function (+head node)
 - Interaction with the dialogue system
- Gaze as a way of conveying emotions, giving impression
 - Interaction with the emotion & personality engine
- Gaze as a result of attention (+head and torso movement)
 - Interaction with perception module



Recognition of Real People (1)

- Recognition of real people
 - Speech/Speaker recognition and speech understanding
 - Emotional speech recognition
 - Face/Facial Expression recognition
 - Preprocessing
 - Facial expression extraction
 - Facial expression classification



Recognition of Real People (2)

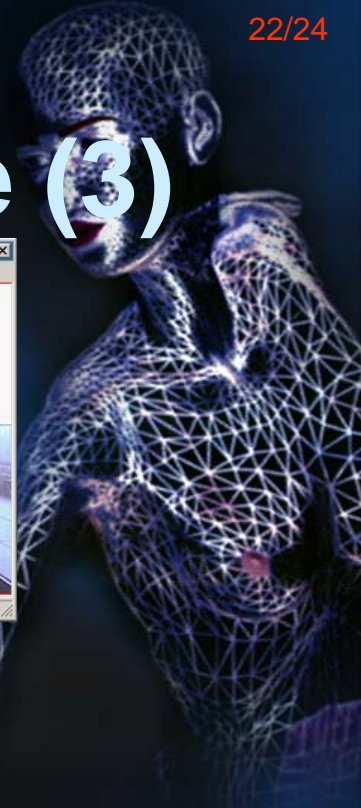
- Gaze recognition
 - Eye-tracking devices
- Head tracking
 - Head-mounted devices
- Gesture recognition
 - Tracking and interpretation of human movement
 - Vision-based & tracker-based systems
 - Interpretation
 - Slater & Steed*
 - if the user can not get the desired response to his/her gestural movements, this will decrease the quality of interaction and cause a break in the experience of presence



* Slater, M. & Steed, A. 2000. A virtual presence counter. *Presence*, 9(5), 413-434.

Recognition of Real People (3)

- Emotion recognition
 - Face & Body tracking
 - Some systems are trained with explicit feedback
 - Measurement of physiological signals such as heart rate, skin temperature etc.



Memory

- Interpret and store what is perceived
 - Remember dialogue history
 - Remember faces, identities
 - Remember personalities and emotions
 - Remember behaviors, actions
 - Remember objects



Conclusion

- How to increase feeling of presence?
 - A combination of physical and social presence
- What need to be done next?
 - A more effective dialogue system
 - Emotional Body and gaze
 - Recognition and respond to real human
 - Directing attention to real human (through gaze, head and torso movement etc.)
 - Memory Model to store what is perceived

