Ambient Entertainment

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According to the ISTAG vision statement, humans will, in an Ambient Intelligent Environment, be surrounded by intelligent interfaces supported by computing and networking technology that is embedded in everyday objects such as furniture, clothes, vehicles, roads and smart materials - even particles of decorative substances like paint. AmI implies a seamless environment of computing, advanced networking technology and specific interfaces. This environment should be aware of the specific characteristics of human presence and personalities; adapt to the needs of users; be capable of responding intelligently to spoken or gestured indications of desire; and even result in systems that are capable of engaging in intelligent dialogue. Ambient Intelligence should also be unobtrusive – interaction should be relaxing and enjoyable for the citizen, and not involve a steep learning curve.

Ambient Intelligence – From Vision to Reality
IST Advisory Group

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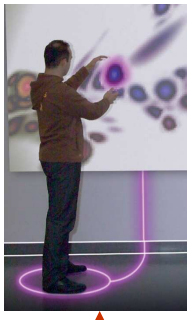
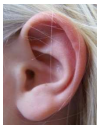
Human Computing





Visual processing

Audio processing

Tactile processing

Others

Who the user is?
What his/her task is?
Where he/she is?

Context-sensitive human behaviour interpretation

Context-sensitive responding

Proactive and Reactive Sensor-equipped Environments

Human Computing
+ Proactive and Reactive Environments

Sensors could help catch first signs of dementia

Monitors and online tests track subtle changes in daily mobility, behavior

meeting environments, home & office environments, research teams, healthcare, education, sports, training, games, entertainment, ….

Outline

- Sensor-equipped environments
- Interactions with smart environments and devices
- Ambient entertainment
  - Dancing, Conducting, Training, Exertion
- Everyday Life interactions
- Conclusions and future research

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Sensor Equipped Environments

Observe Verbal and Nonverbal Interaction in a Meeting Situation

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Smart Environments

EXAMPLE: AMIDA Project

- Off-line access to captured meetings
- Real-time support to Meeting Participants
- Sensing and Interpreting everything that is important to the Meeting and providing Reactive and Proactive Support
- Corpus Collection

Instrumented meeting rooms at IDIAP, UEDIN and TNO

Proactive and Reactive Environments

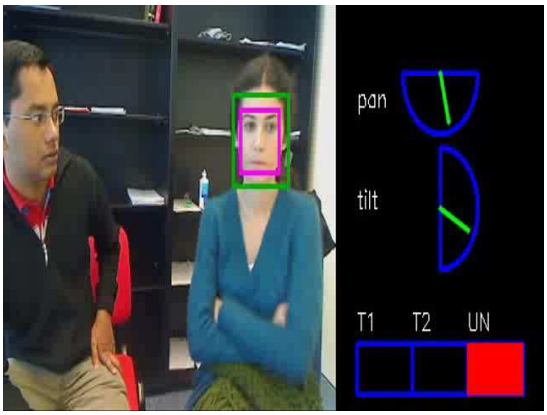
Sensor-equipped environments

EU FP6

AMI & AMIDA Projects

Environment needs to understand verbal and nonverbal behavior of its inhabitants

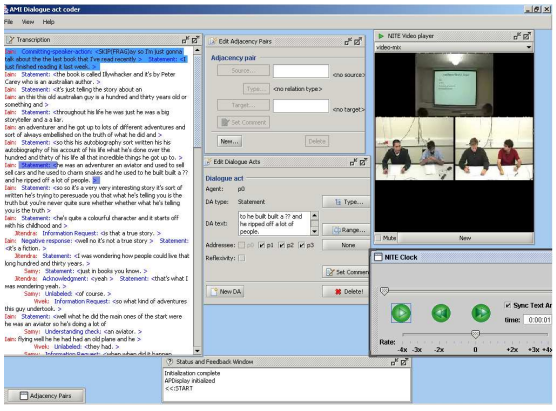
Processing Technologies



- Manual and (semi-) automatic annotating
- Audio-visual analysis (speech processing, computer vision)
- Gaze, gestures, posture, head orientation, facial expression, prosody, …
- Tracking, identification. emotion detection, turn taking, addressee detection, …
- … listening …

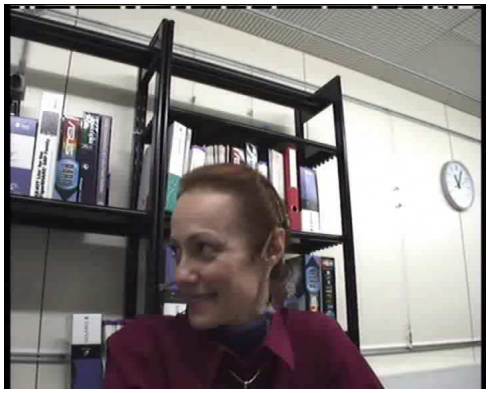
Annotation Tools

- Dialogue acts
- Gaze direction
- Addressee
- Affective state
- Argumentation
- Turn taking
- ……



Methodology

- Analysis of annotations brings us heuristics, rules and models
- Annotations are starting point for machine learning of rules and models
- Rules and models become algorithms that allow interpretation and adequate reactions (re-active and pro-active) on demands and events



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High-level Information from Low-level Features

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Interactions with Smart Environments and Devices

Home, Office, Entertainment
Environments, Public Spaces

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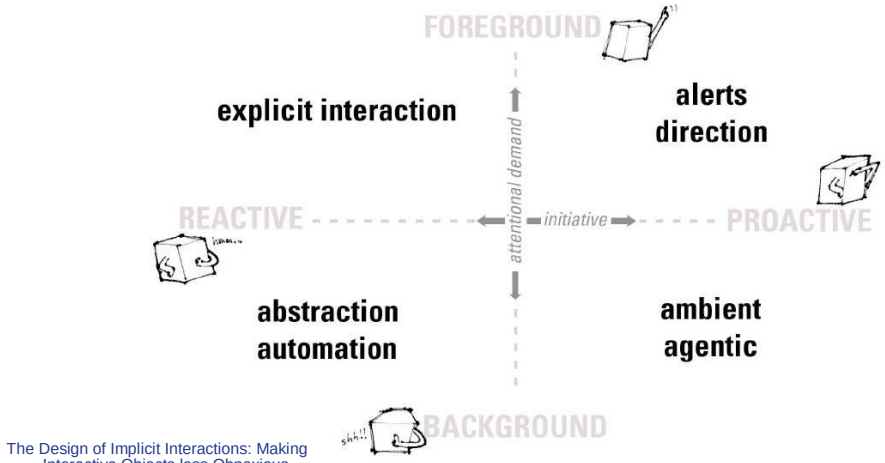
Interaction with the Environment



The Design of Implicit Interactions: Making Interactive Objects less Obnoxious. Wendy Ju & Larry Leifer.

FOREGROUND

Interactions take place explicitly and at the user's command. Users are given explicit and detailed oversight over actions and feedback on results. Appropriate when the interaction is the primary task and is controlled by an expert user.

Interaction takes place in the attentional foreground, but involves greater agency on the part of the object. The object may provide unsolicited information (alerts) *or guide the interaction by instructing the user what to do* (direction). *These interactions are useful typical in reminder and tutorial scenarios.*

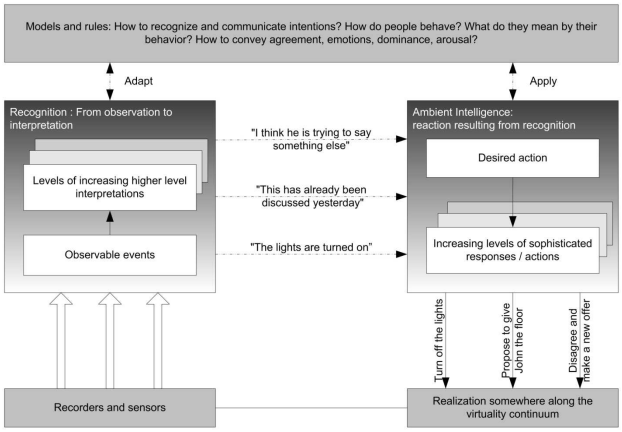
REACTIVE — *attentional demand* — *initiative* — PROACTIVE

Interactions occur in response to user actions or external stimuli, but the object generalizes or hides information from the user (abstraction). *Such interactions can spare the user from the nitty-gritty details of a task, or help perform routine tasks automatically* (automation).

The object anticipates what to do and performs with low oversight or input. Usually used for tasks where the cost of error is low: e.g. pre-fetching data, modelling buyingpreferences. It can also enable critical tasks that the user is somehow unable to perform, like alerting the police when someone is intruding into the user's home.

BACKGROUND

Levels of Understanding by the Environment



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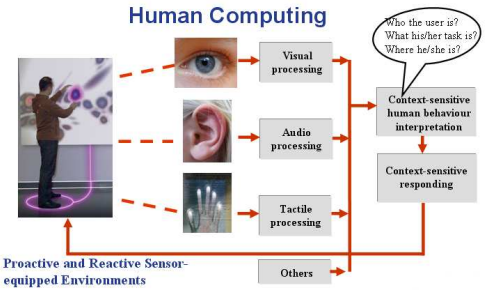
Ambient Entertainment



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Interactive Virtual Dancer

Demonstrated in Montreal,
London, Eindhoven, ….

Interactive: Leading and Following

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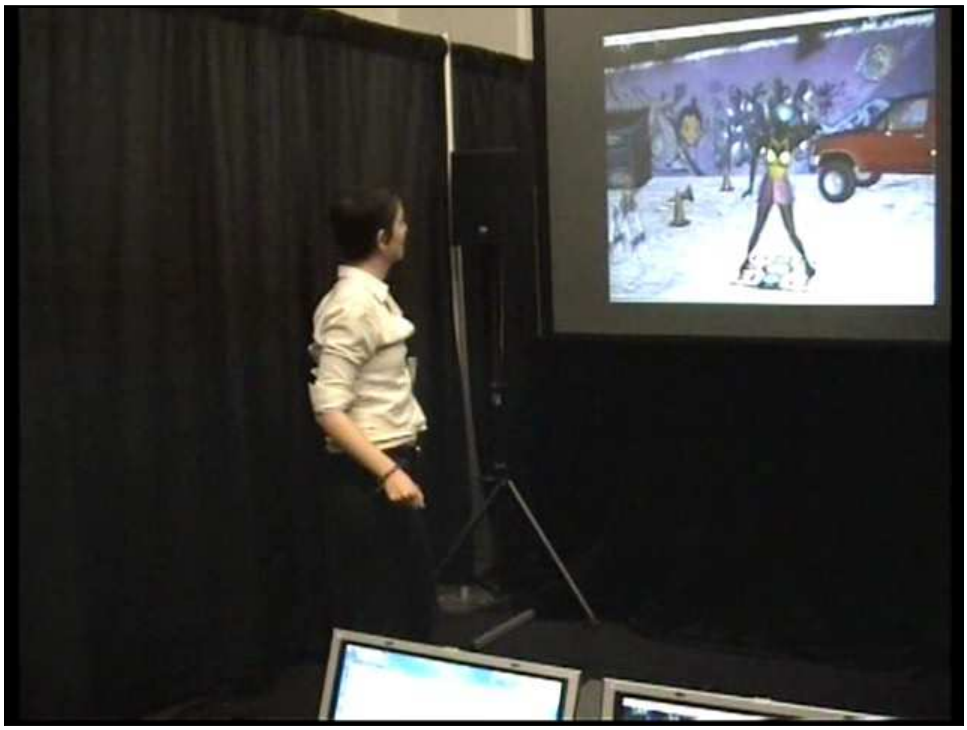
Computer vision

Beat tracking

Pressure mat

Demonstrated in London, Montreal, …



Interactive Virtual Conductor

(HMI) Musicians Interacting with a Virtual Conductor

Beat tracker

Score follower

Loudness detection

Intention generator

Conducting schedule

Animations

Beat tracker

Score follower

Loudness detection

Intention generator

Conducting schedule

Animations

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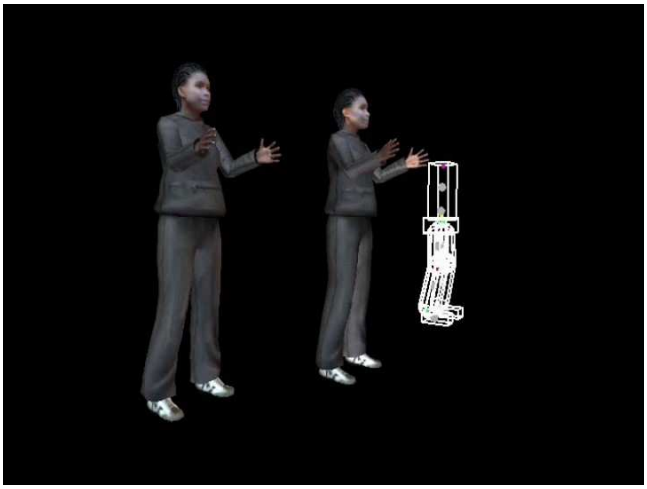

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Interactive Virtual Trainer

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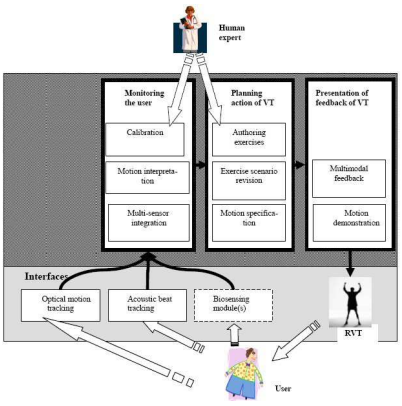

Physiotherapy
Aerobics
Fitness
….

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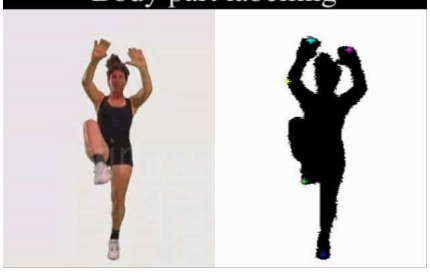
Body part labelling

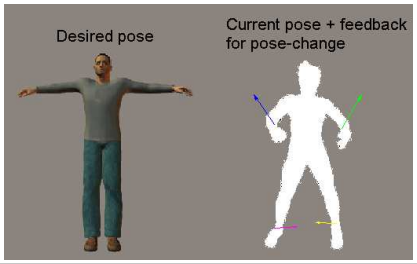


Computer vision

Monitoring the user

Exercise schedule

Animations



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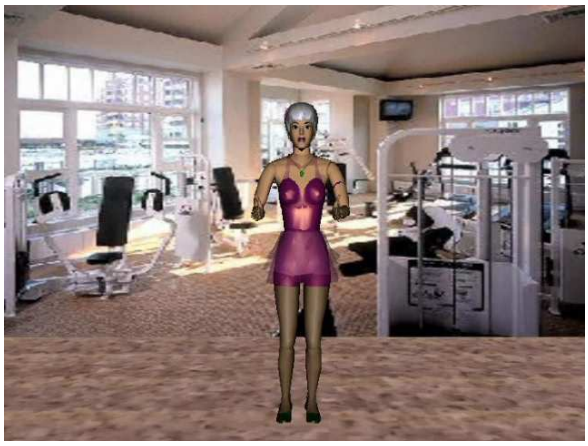
Generating Trainer Behavior



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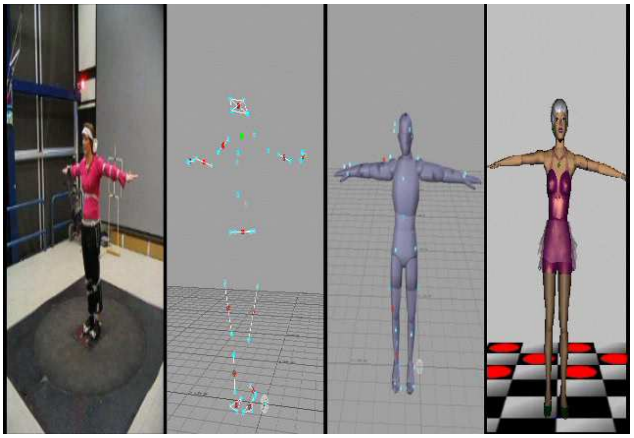
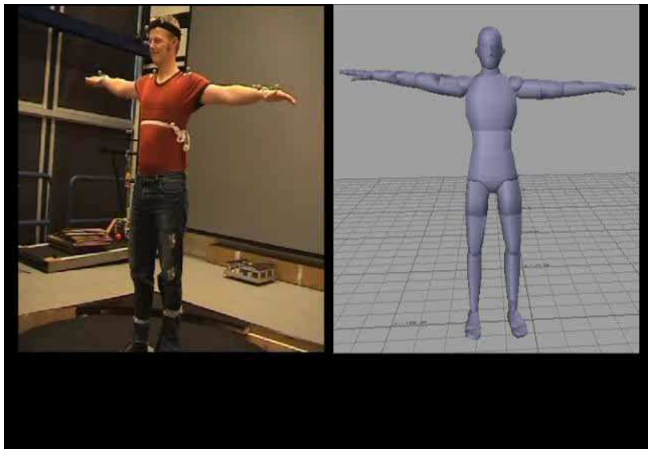
Motion Capturing



Hand Clapping Exercise



Exertion Interfaces

Entertainment, Exercises, &
Sports that require and encourage
physical body movements

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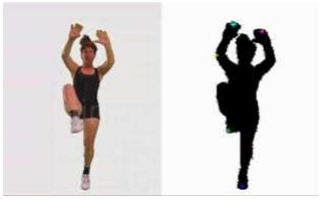

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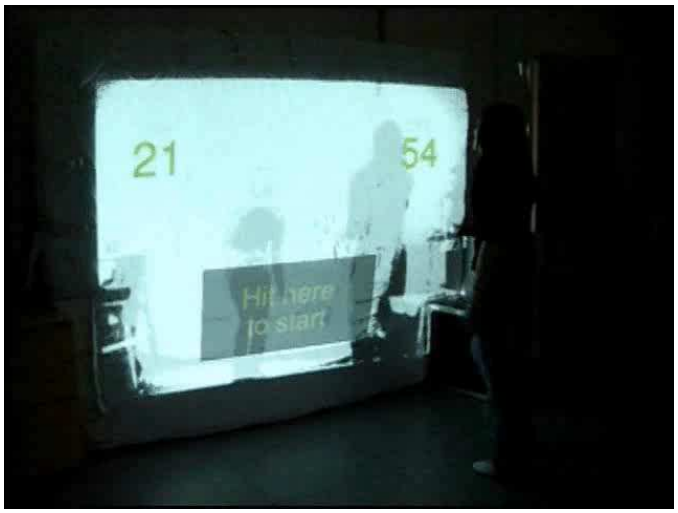
- BreakOut for Two
- Florian Mueller et al (2005)



- Brute Force
- Florian Mueller et al (2007/8)

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(What we have learned for modeling)

Everyday Life Interactions

Not necessarily (explicit) turn taking
Mutually coordinated continuous interaction
Synchronization with ‘external events’
Not necessarily Gricean behavior
Competition and self-interest
Exertion for fun, artistic dimensions

Social Talk among Friends

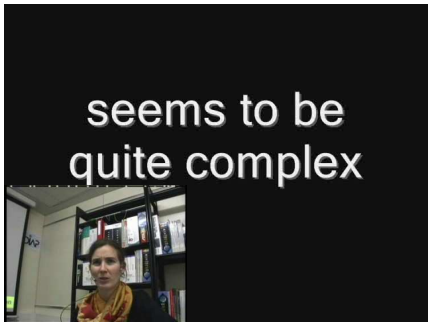
- attract-repulse, provoke, joke, tease, …
- continuous interaction, no explicit turn taking, nevertheless synchronization, …
- synchronization with 'external' events

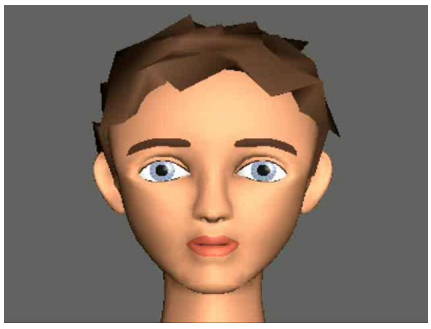
Conductor and Orchestra

- attract-repulse, challenge, …
- continuous interaction, no explicit turn taking, synchronization, …

Dancing

- attract-repulse, provoke, joke, tease, …
- continuous interaction, no explicit turn taking, synchronization, …


seems to be
quite complex



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Conclusions & Future Research

- Processing Technologies, Interaction Models
- Agent models for virtual dancers, trainers, conductors, ….. ; provide our virtual partners with affective and cognitive models
- Everyday Life Interactions
  - Mutually coordinated continuous interaction
  - Synchronization with ‘external events’
  - Not necessarily Gricean behavior
  - Measure for quality and engagement?

- http://hmi.cs.utwente.nl/

- Thanks to
  - Many PhDs & Master students

- A. Nijholt. D. Reidsma, R. Poppe. Games and Entertainment in Ambient Intelligence Environments. Chapter in *Human-Centric Interfaces for Ambient Intelligence.* H. Aghajan et al. (Eds.), Elsevier, 2009.