

Instrumented Environments

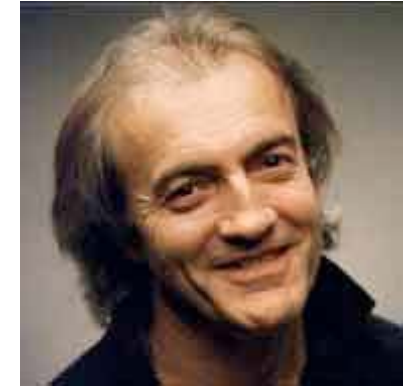
Andreas Butz, butz@ifi.lmu.de, www.mimuc.de

Fri, 12:15-13:45, Theresienstr. 39, Room E 045



Special Lecture on 07.07.

- Visit by Bill Buxton, Abigail Sellen and Shahram Izadi (Microsoft Research Cambridge)
- All working on interaction with Instrumented Environments
- Expect a Guru-level presentation!
 - Detailed topics yet TBD
- Bring friends!
- **Theresienstr. Room 112**



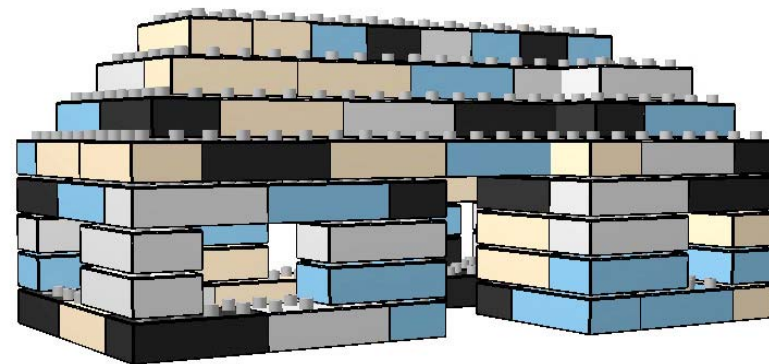
Tangible User Interfaces

Specialized TUIs

3D modeling with LEGO

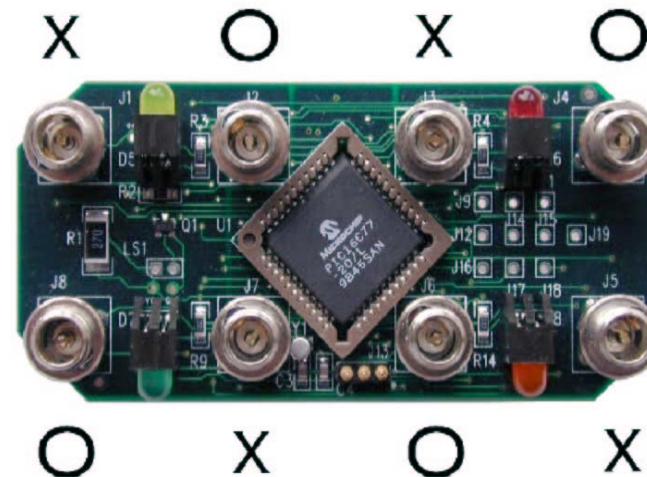
(Anderson et al., SIGGRAPH 00)

- LEGO blocks with connectors and CPU
 - Keep track of their spatial configuration
 - Describe a voxel („volume pixel“) model
- Reconstruction in the host computer
- Interpretation acc. to prototypes



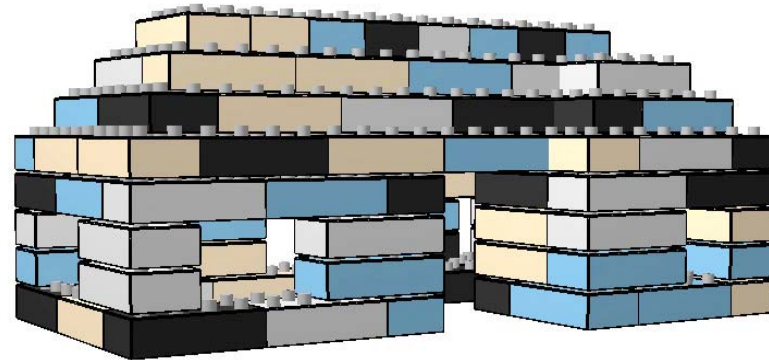
3D modeling with LEGO

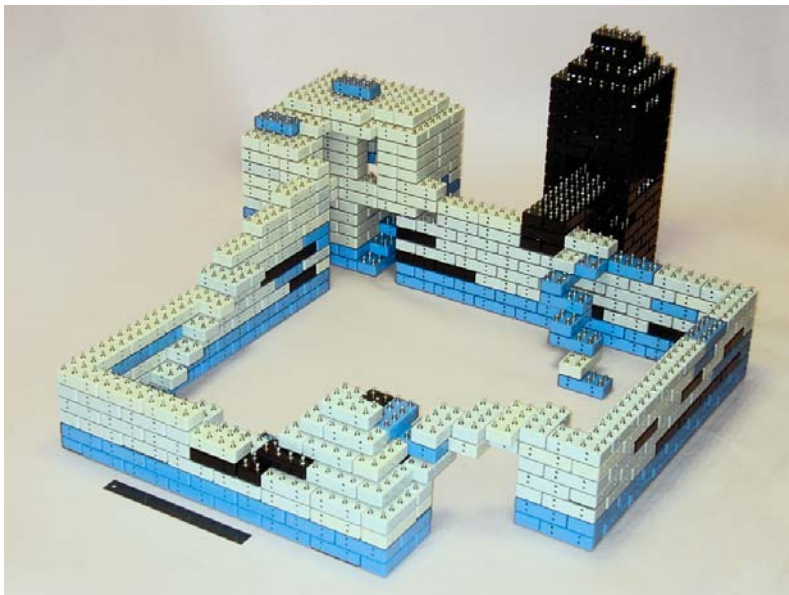
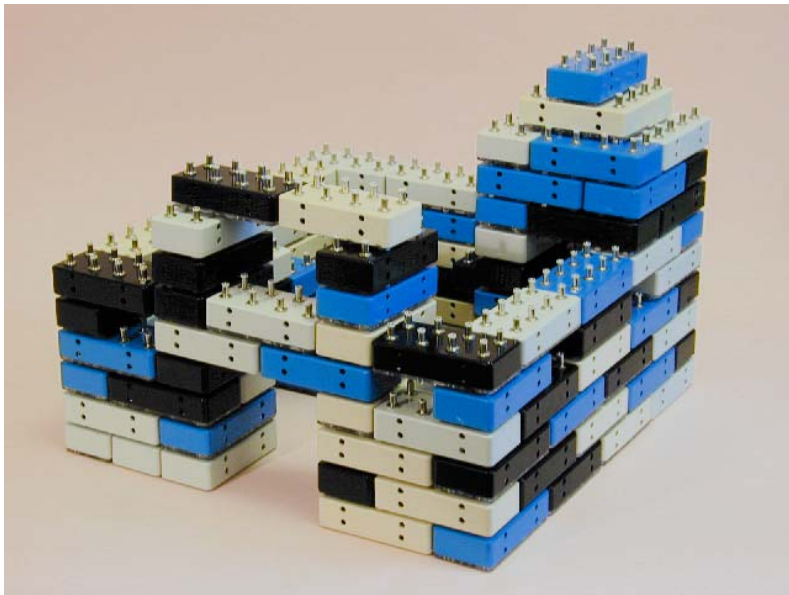
- Each block has 8 plugs on top and 8 jacks on the bottom
 - Inner contact: communication
 - Outer contact: power
 - Use alternating layout and rectifier to power circuit
- When a new block is added, it triggers recognition process



3D modeling with LEGO

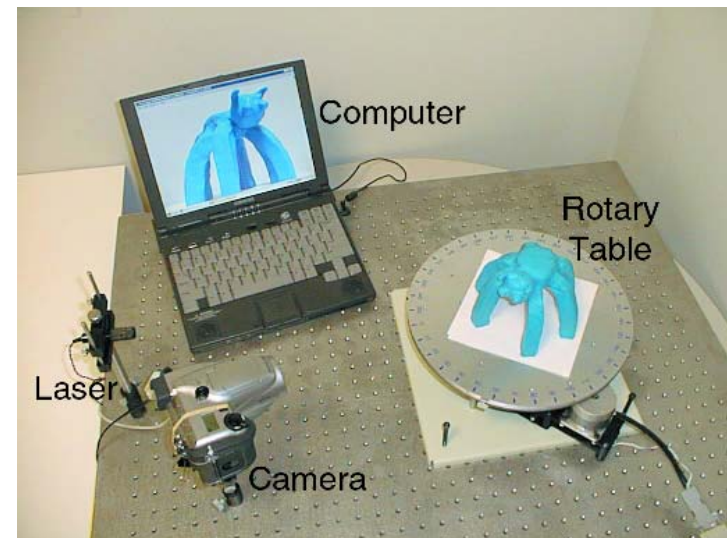
- Interpretation of structure:
 - Transform structure into a set of logical propositions
 - Define rules what is a wall, roof, window...
 - Determine from structure and rules, what block has which function
 - Construct 3D model accordingly





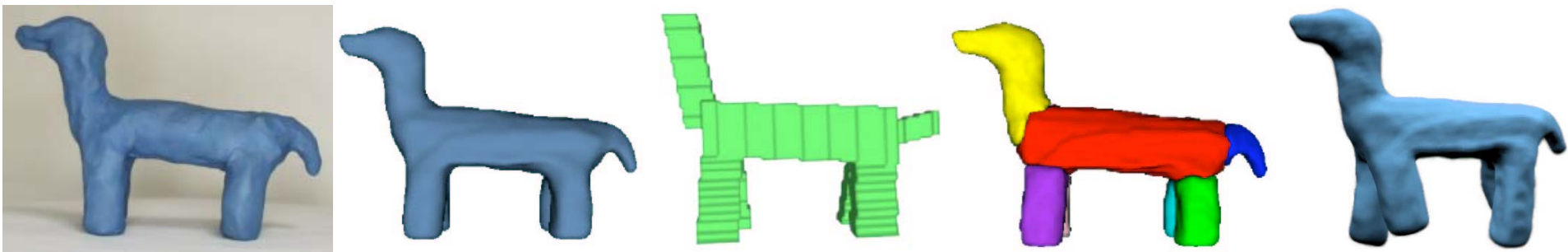
3D modeling with clay

- Model an object in clay
- Scan in its 3D shape
 - Laser striper
 - Camera recording silhouettes
- Try to recognize the structure by matching it to templates
- Interpret the structure according to template and animate it



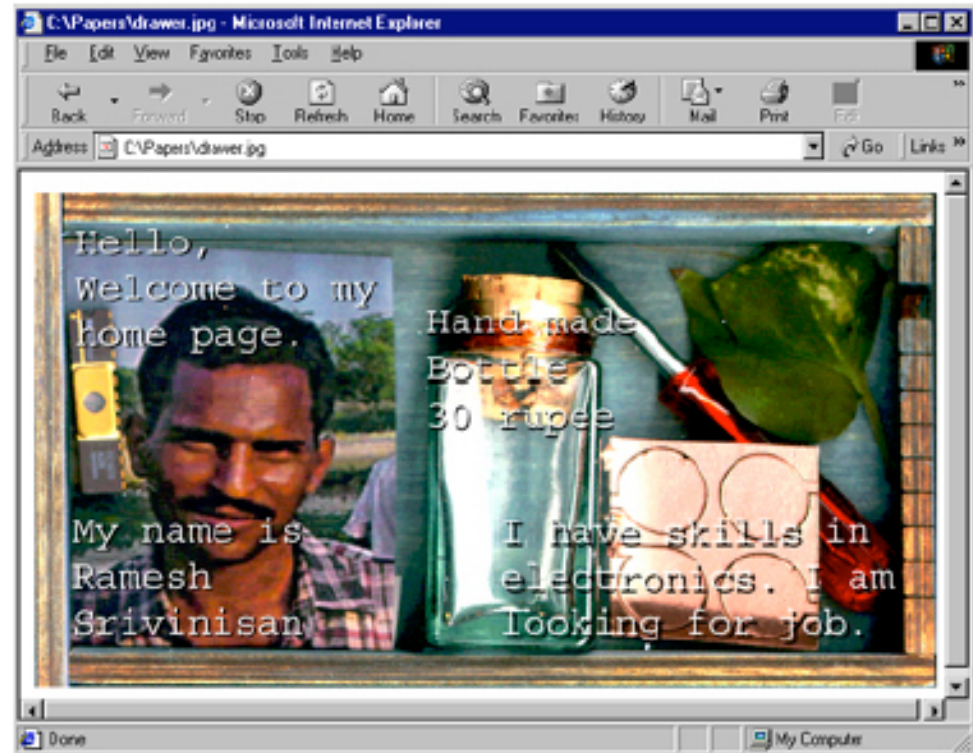
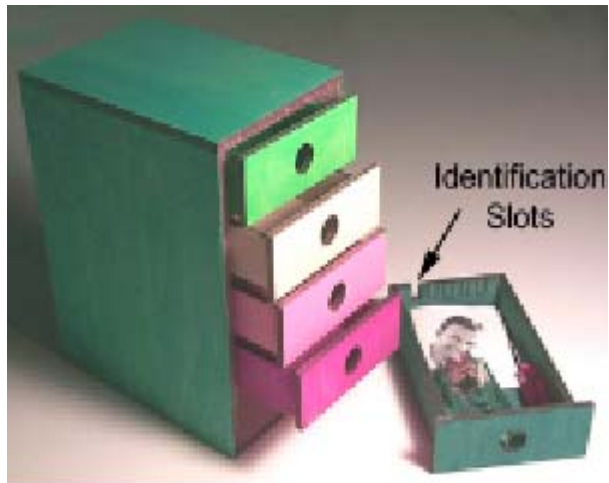
3D modeling with clay

- Direction is known, size is normalized
- Compare for each voxel, whether it is filled in the template and the scan → find best match
- Templates have meaningful segments
- Cut scan into the same segments
- Use skeleton animation with the scan



HomeBox

[\(Piper, Hwang, Chi 00\)](#)

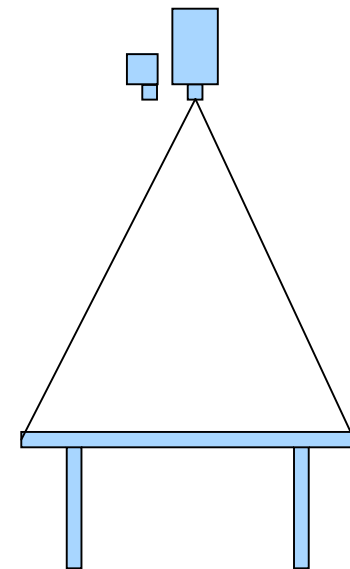
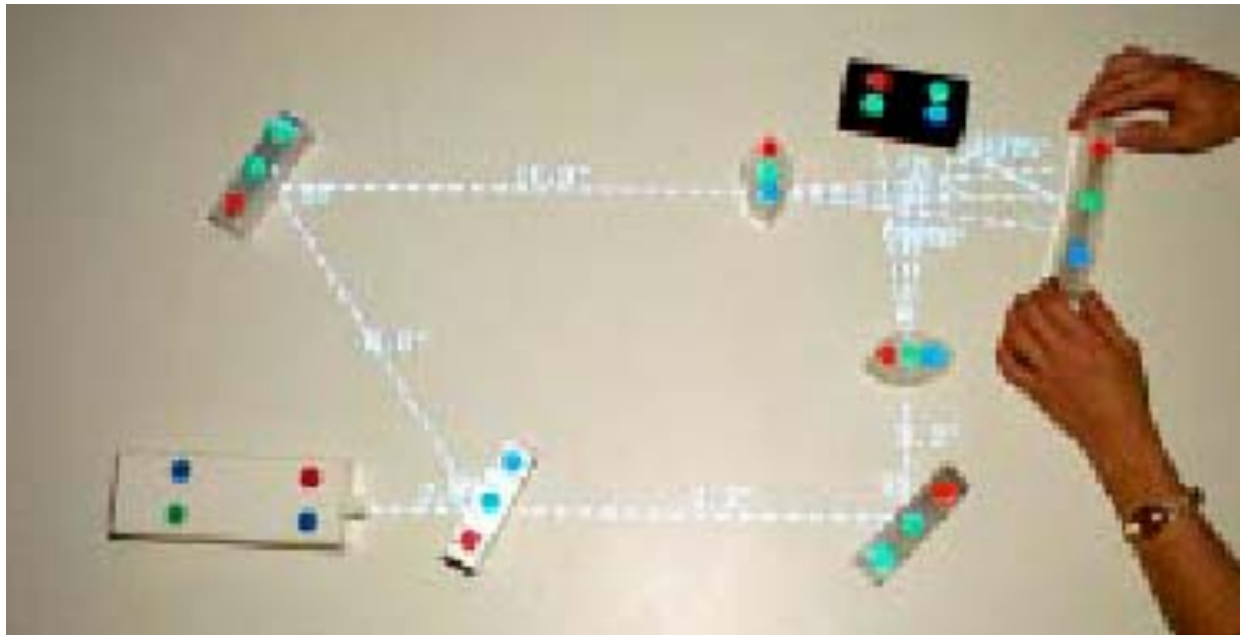


- Drawer represents page
- Physical content is put into drawers
- Insert drawer into scanner
- Annotate with additional text

Luminous room: Illuminating Light

[\(John Underkoffler and Hiroshi Ishii, CHI 98\)](#)

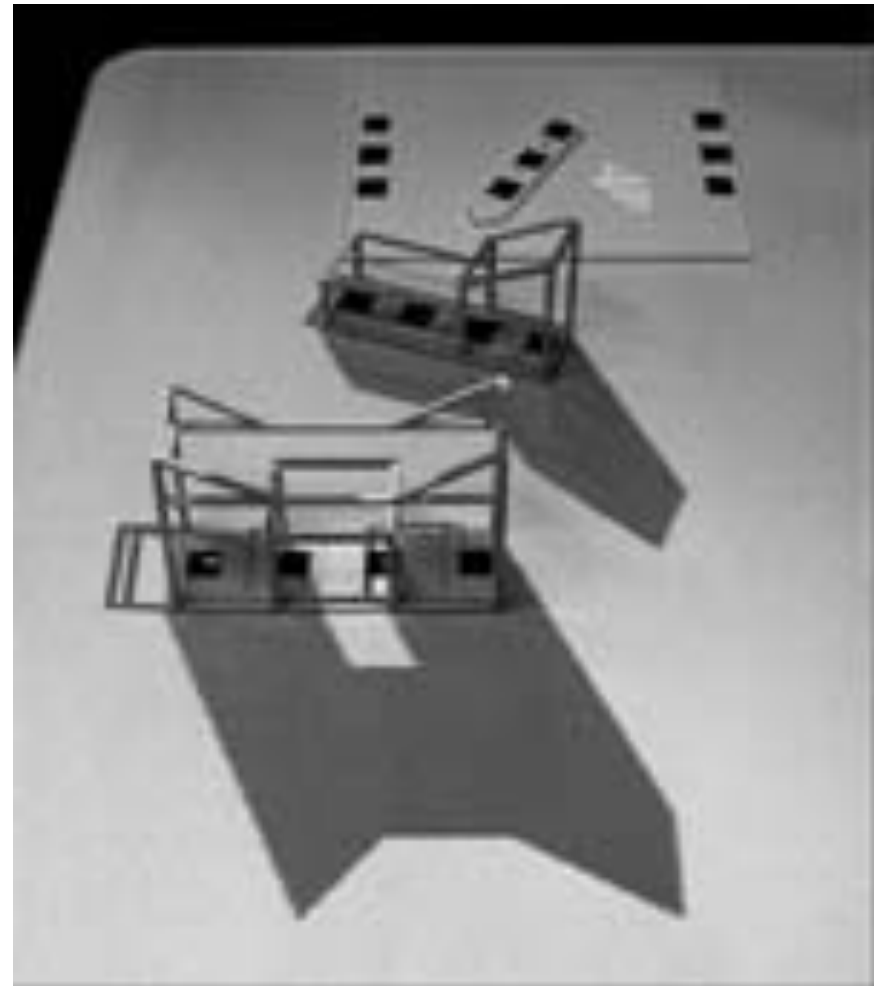
- Simulation of optical/holographic setups
- Phys. objects represent optical elements
- Top projection of resulting laser beam



Luminous room: Urban Planning (URP)

[\(John Underkoffler and Hiroshi Ishii, CHI 99\)](#)

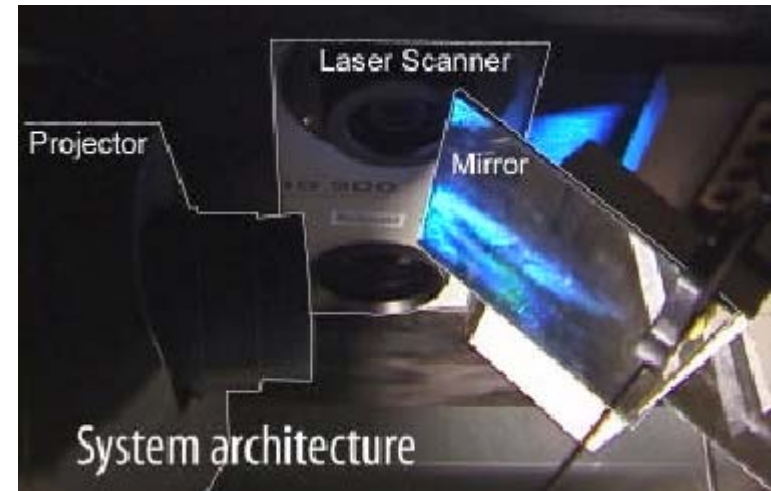
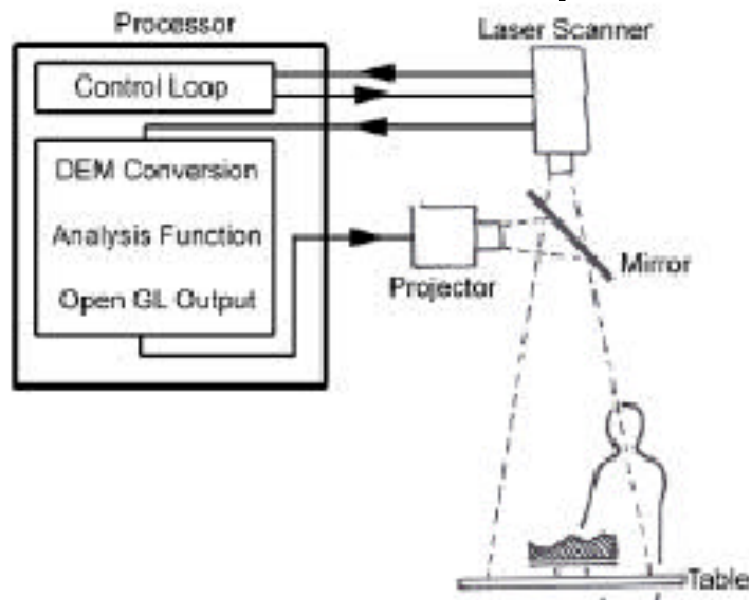
- Move physical models of houses on a desk surface
- Simulate in the computer:
 - Shadows
 - Window reflections
 - Air flow and wind



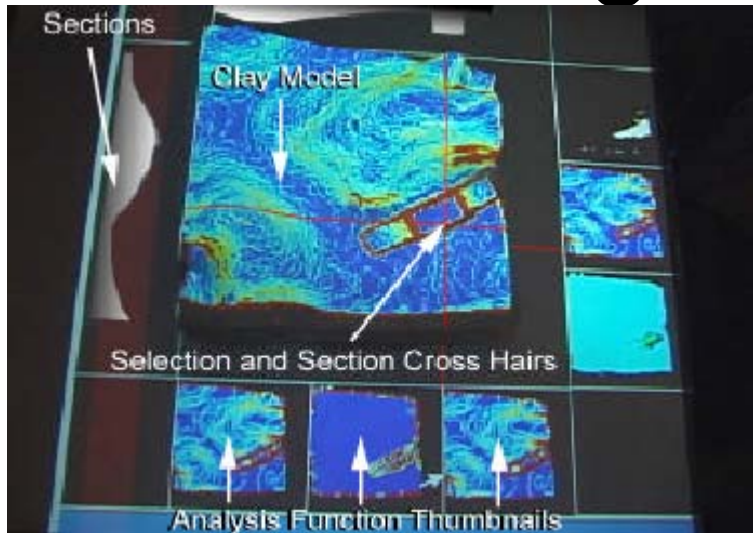
Illuminating Clay

(Piper, Ratti, Ishii, Chi 02)

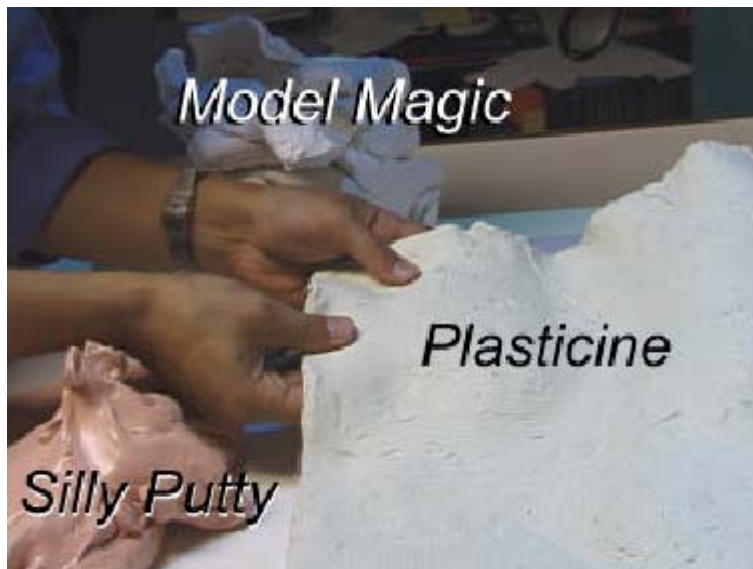
- Clay model on desk surface
- Top projection = output
- 3D laser scanner = input
- Used for landscape design



Illuminating Clay UI elements

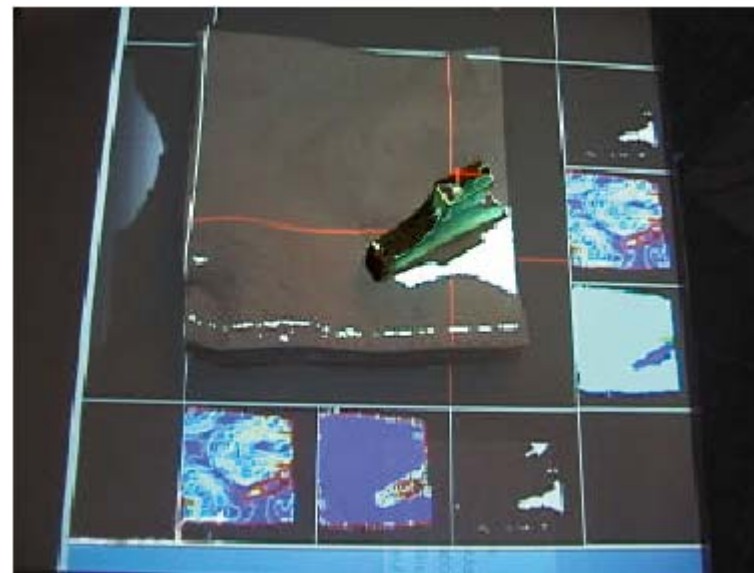
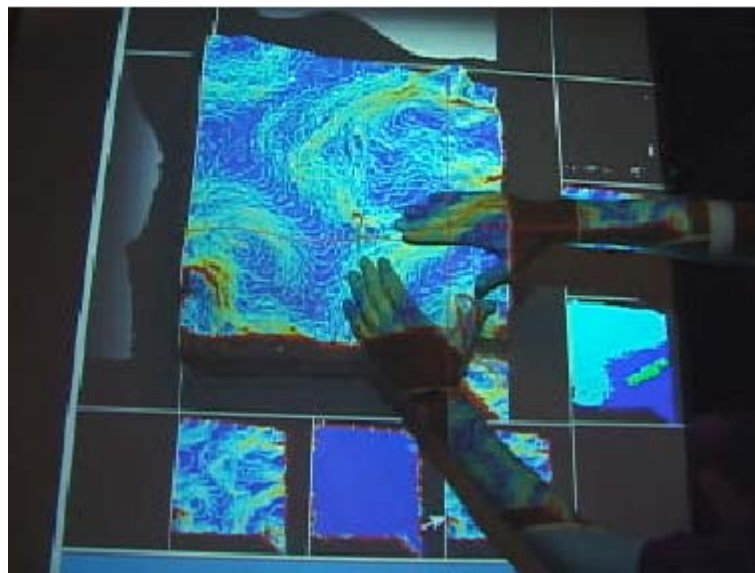


- Deformable clay model
- UI elements for section and analysis functions
- Interaction with terrain



Illuminating Clay applications

- Slope variation with color feedback
- Solar radiation, shadows



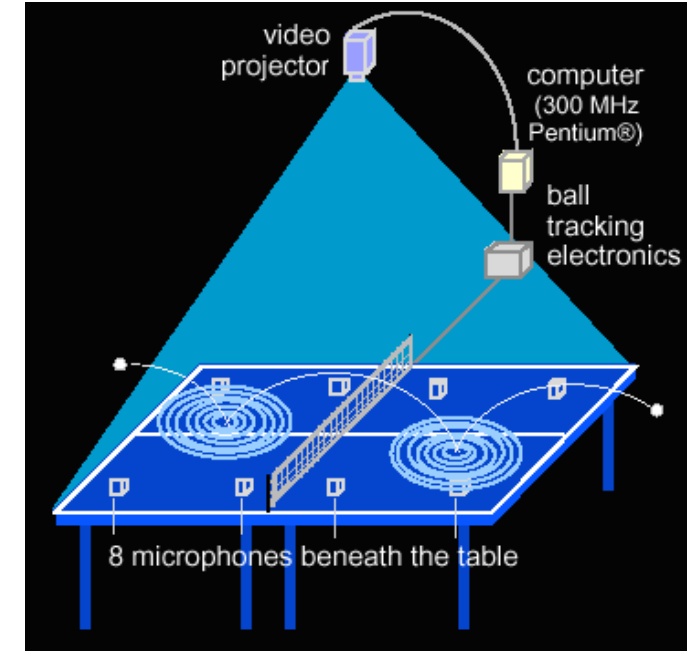
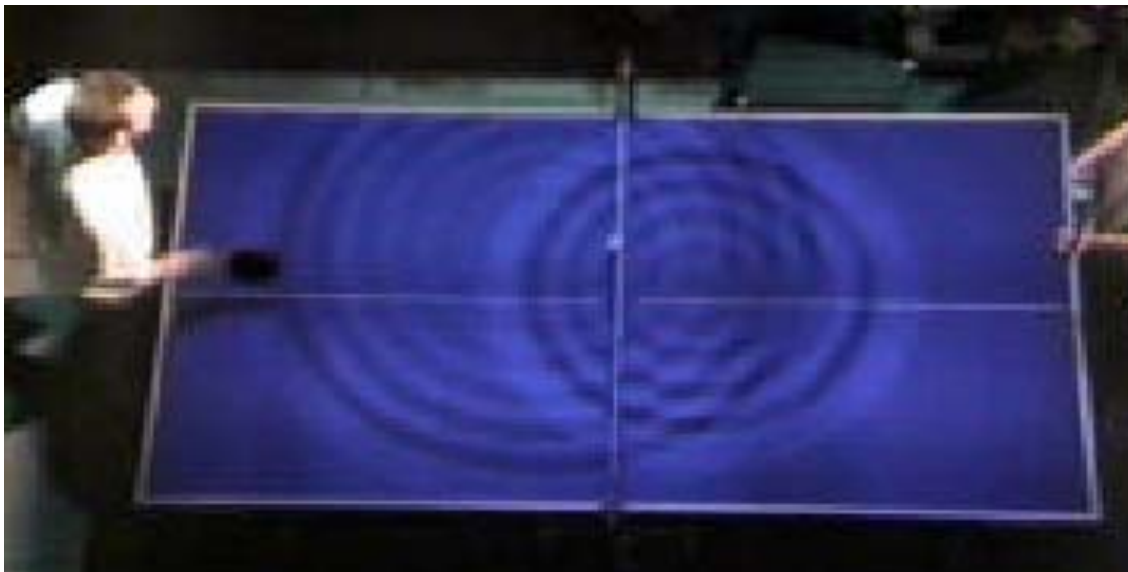
Tangible User Interfaces

TUIs in everyday objects

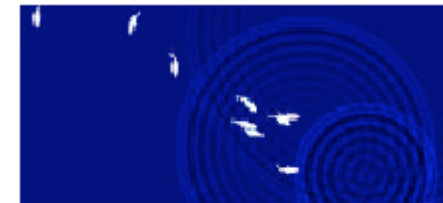
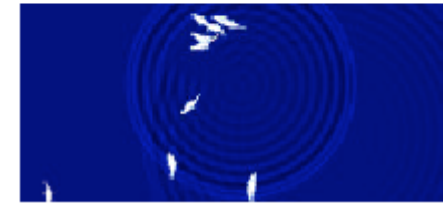
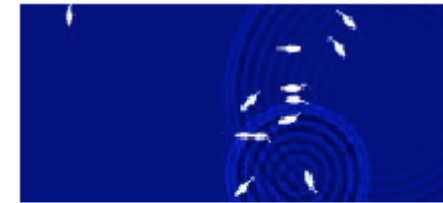
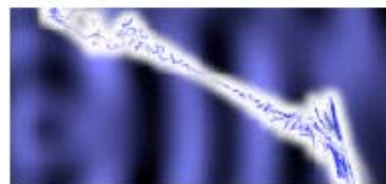
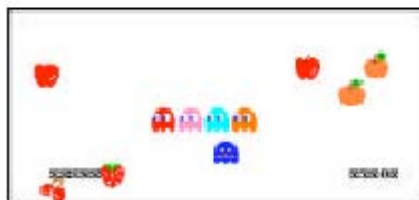
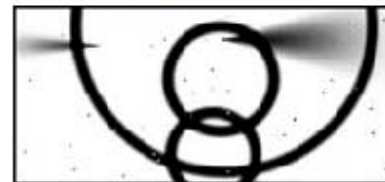
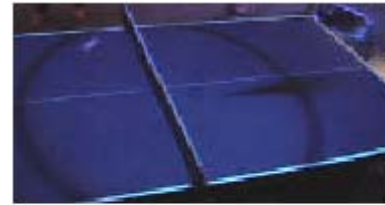
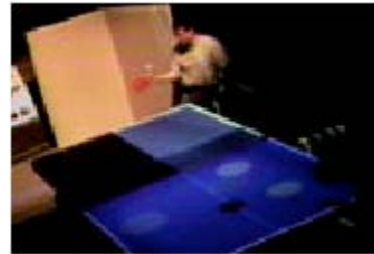
PingPongPlus

(Ishii et al. SIGGRAPH 98)

- Physical PingPong
- Virtually augmented
- Additional game functionality



PingPongPlus variations



MusicBottles

(Ishii, Mazalek, Lee, CHI 01)



- Bottles contain music (classical, jazz, techno)
- When placed on the desk, light appears around them
- When opened, music can be heard
- Metaphor: bottles contain something, can be released when bottle is opened

Marble Answering Machine

(concept study by Gary Bishop, RCA)

- Design study and some prototypes
- Each message represented by a marble
- Placing the marble on tray plays back the message
- Placing the marble on the phone calls back



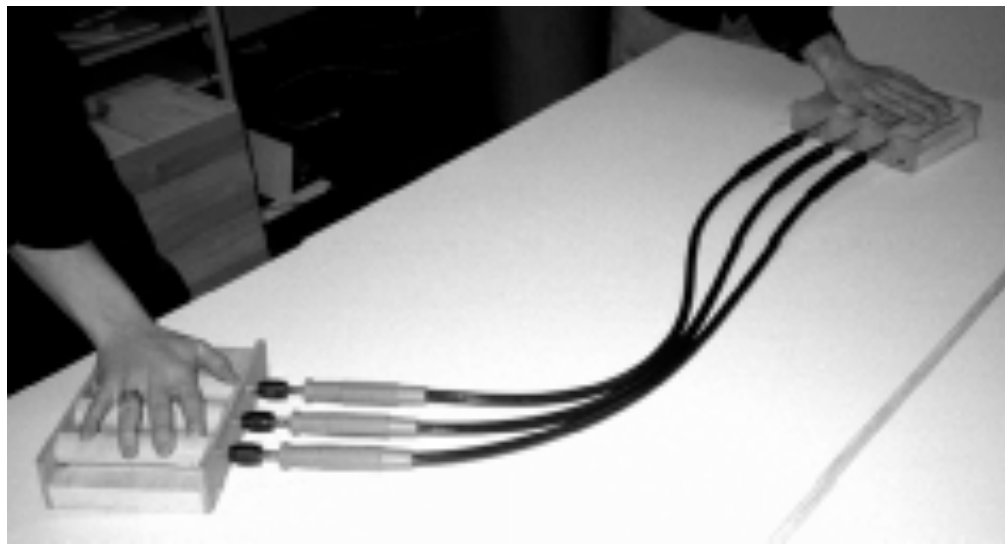
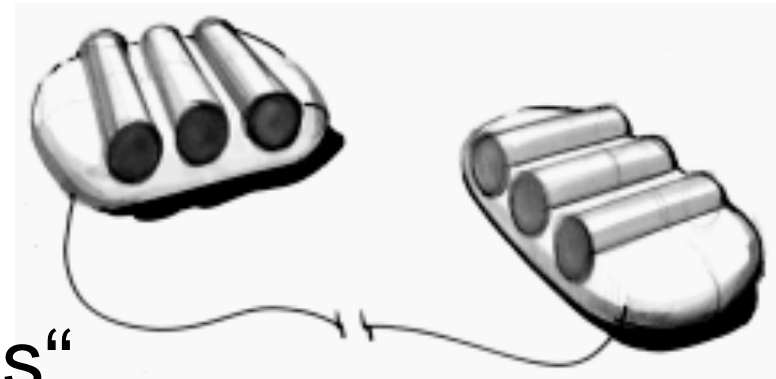
Tangible User Interfaces

Communicative TUIs

InTouch

(Brave, Ishii, Dahley, CSCW 98)

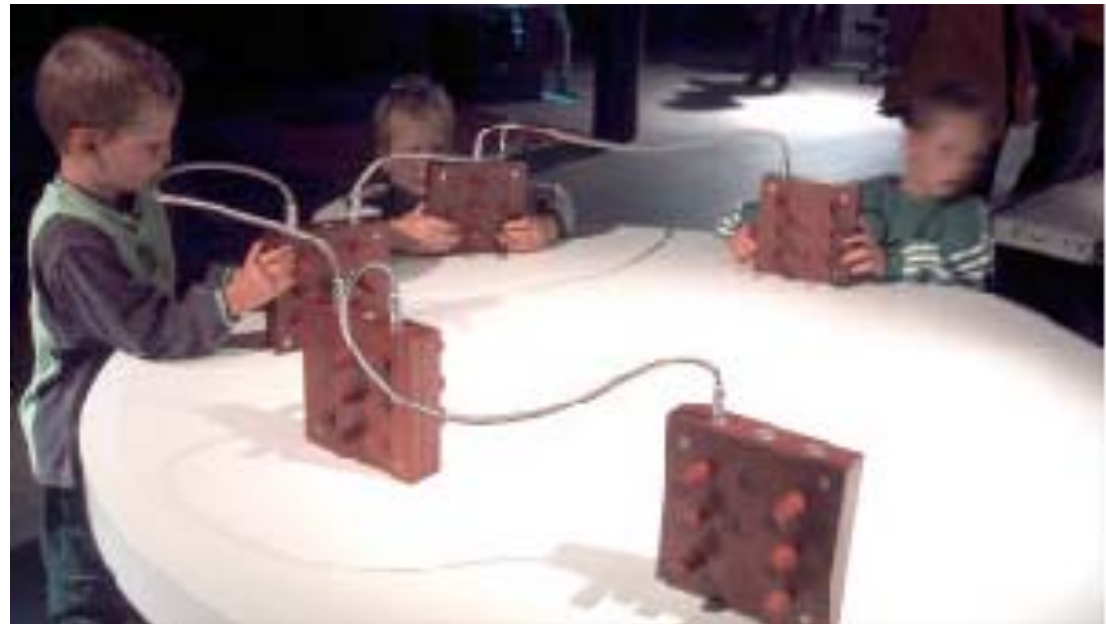
- UI for remote „awareness“
- Enhance the feeling of physical presence



PegBlocks

(Piper, Ishii, CHI 02)

- Networked blocks with turn- and pushable pegs
- Used to teach kindergarten children about basic physical concepts (and to play, of course ;-)



Ambient User Interfaces

Integrated in everyday
environment,
Peripheral perception

Waterlamp

(Dahley, Wisneski, Ishii, CHI 98)



- Lamp shining from below
- Water surface by 3 actuators
- Changing information creates ripples on water surface
- Result: patterns projected on the ceiling

Pinwheels

(Dahley, Wisneski, Ishii, CHI 98)



- Actual pinwheels, mounted on small DC electrical motors
- Rotation speed changes according to information flows
- Metaphor: flow of air ↔ flow of information

The window as the interface

(Rodenstein, 99)

- Projection on „privacy film“ (by 3M)
- Can be made transparent or opaque by applying electricity



Figure 2: It will freeze tonight, better wear gloves.



Figure 1. It will get stormy in the next few hours.

LumiTouch

[\(Chang et al. CHI 01\)](#)

- Connected picture frames
 - show when other frame is squeezed
 - Create a feeling of mutual awareness



Feedback area- Isolated area displays the light being sent.

Three touch sensors indicate pressure on different regions embedded in the frame. Each sensor maps squeeze force to the intensity of three output light colors- red, green or blue.

Color LEDs embedded throughout each frame display the translation from squeeze to light. The active inputs of squeeze are displayed over an Internet connection on the remote frame.

One infrared sensor detects motion near the frame. This is not a positive identification.

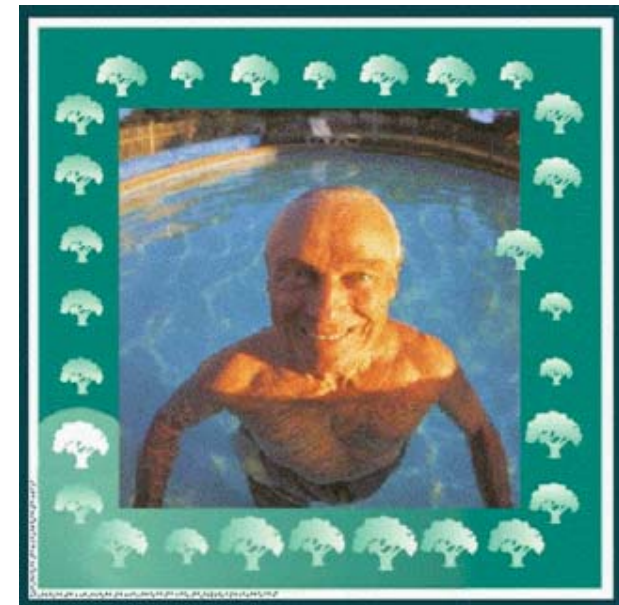
Information on passive motion is displayed by ambient light. This allows people to be aware of each other's abstracted remote presence.

Digital Family Portrait

[\(Mynatt et al. CHI 01\)](#)

- In the “Aware home”
- Lets people “keep an eye” on others
- Balance betw. privacy and contact

- Icons around the frame indicate health, activity or relationships
- 28 icons on 4 sides = 4 weeks
- Position and size carry a meaning



Major interaction models

- strictly tool-based --> appliances
 - Human is the cause of all action
 - Tools just facilitate these actions
- automation, assisted living
 - Things happen magically by themselves
 - Controlled by machine intelligence in the background
- proactivity, intelligent agents
 - Environment takes the initiative
 - Manifestation through conversational agent

Appliances (from wikipedia)

- Appliance: usually referring to a device with a narrow function
- A certain class of computer products, where the device has a specific function, and limited ability to configure.
- Some consider the PDA to be a form of appliance, since most consumers do not make use of them as general purpose computing platforms.



Information appliances

[\[E. Bergmann, 2000\]](#)

- Information appliance: An appliance specializing in information: knowledge, facts, graphics, images, video, or sound. An information appliance is designed to perform a specific activity, such as music, photography, or writing.
- A distinguishing feature of information appliances is the ability to share information among themselves



Smart Homes

(from wikipedia)



- The intelligent home is a technological achievement aimed at connecting modern communication technologies and making them available for everyday household tasks. [...]
- Intelligent home systems guide the user to perform any operation, to control lighting, heating, air conditioning, or to arm or disarm the security system, and to record or to listen to messages.
- Other themes envisioned in intelligent home systems are automation, connectivity, wireless networking, entertainment, energy and water conservation, and information access.

Assisted living (from wikipedia)

- Assisted Living [...] usually refers to a non-medical facility that is used by people who are not able to live on their own, [...]
- This highlights a very important and realistic aspect of this concept when applied to technology:
 - Support for disabled people
 - Support for elderly people

Instrumented Bedroom

- Support for disabled people
 - Robot person lift
 - Robot wheelchair
 - Robot bed
 - Fridge/oven combi
 - Sensing mattress
- Interface:
 - Control via voice input
 - Feedback via talking head („yes, master..“)
 - Gesture input (e.g., for TV for spastic patients)

<http://hwrs.kaist.ac.kr/>



Instrumented Bedroom (2)



<http://hwrs.kaist.ac.kr/>

- Patient can move between bed and wheelchair
 - Wheelchair will come automatically
 - Lift will act on commands
 - Bed will adapt shape on command
 - Fridge will heat up meal
- Sensing mattress can tell whether...
 - patient is in right position
 - patient has fallen off
- Safety + self-determined life
 - Nurse not constantly needed
 - Environment can call if there seems to be a problem
 - Sense of Mastery („yes, master..“)

The Virtual Room Inhabitant (VRI)

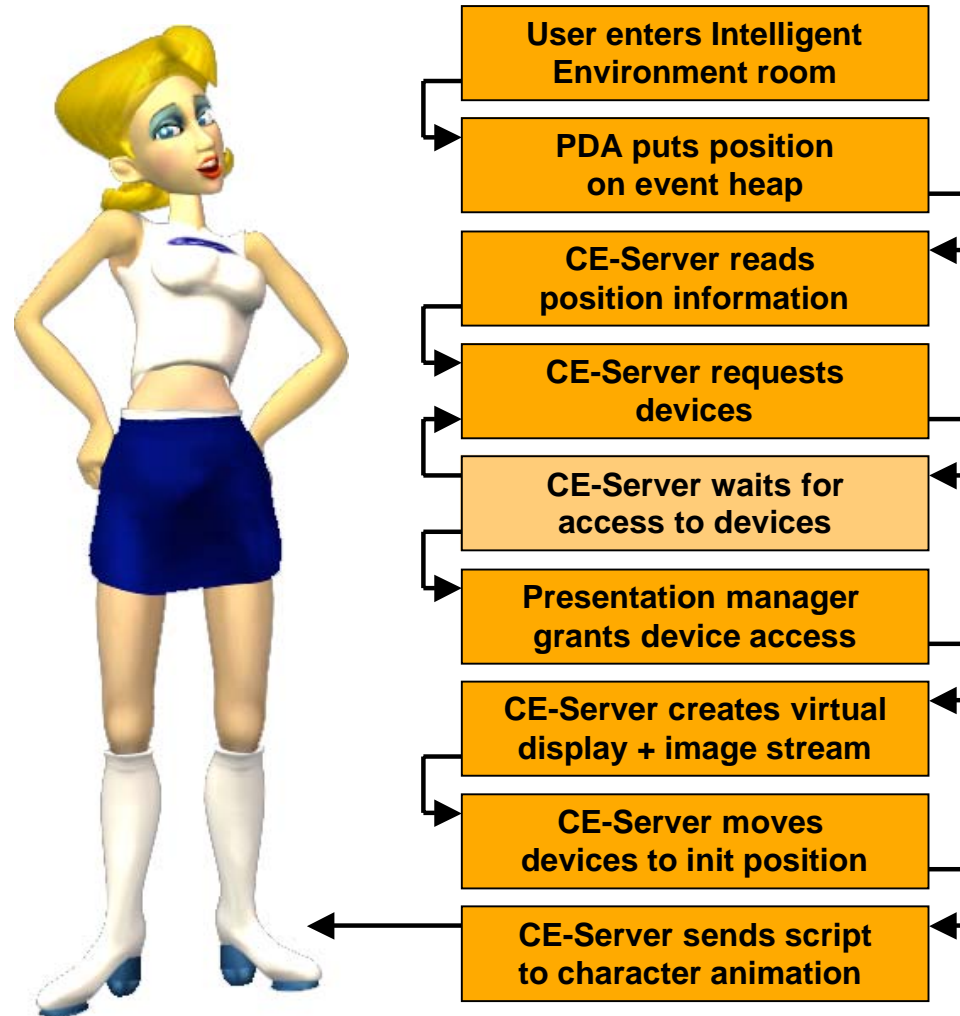
[\[Kruppa et al. AI05\]](#)



VRI: Character Engine

- Character engine server (Java) and character animation (Flash) connected via XML socket connection
- Different character gestures can be combined smoothly using a top level movie and several gesture sequences
- CE-server also controls and synchronizes the spatial audio device and the steerable projector

VRI: Example Scenario



Remaining Dates

- 30.6. Intelligent IE, more example systems
- 7.7. Guest lecture Bill Buxton et al.
- 14.7. Wearable, AR, lecture summary
- 19.7. Presentation of exercise results

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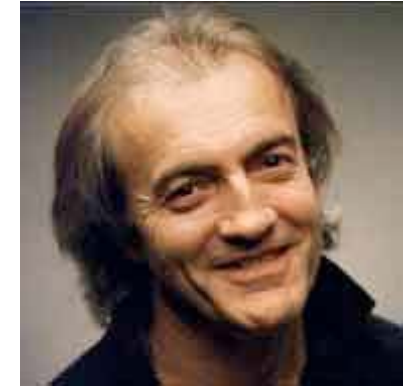


Photo-Workshop: **neuer Termin!**

- Kein Schein, freiwilliges Angebot
- Dauer: 1 Woche: **9.-13.Oktober**
- Morgens ca.1/2 - 1 Stunde Vorbespr.
 - Technische Grundlagen (Optik, Kamera)
 - Bildgestaltung durch
 - Bildaufbau & Perspektive
 - Zeit, Blende
 - Licht, Inszenierung
- Tagsüber praktisches Photographieren
 - Voraussichtlich Architektur + Natur
 - Benötigt: eigene Kamera + Stativ
- Abends Bildbesprechungen am Rechner
- <https://wiki.medien.ifi.lmu.de/view/Main/PhotoWorkshopSoSe06>

