eNTERFACE'13

Experimental User Interfaces

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Contents

- Why experimental interfaces?
- Towards common methodology
- Cases from research experiments
- Trends for future

1. Why experimental UI ?

- dominant design now
- gestural 2D interfaces: mouse / touch
- sensory limitations in current UI, new devices
- missing established methodology

Current dominant paradigm

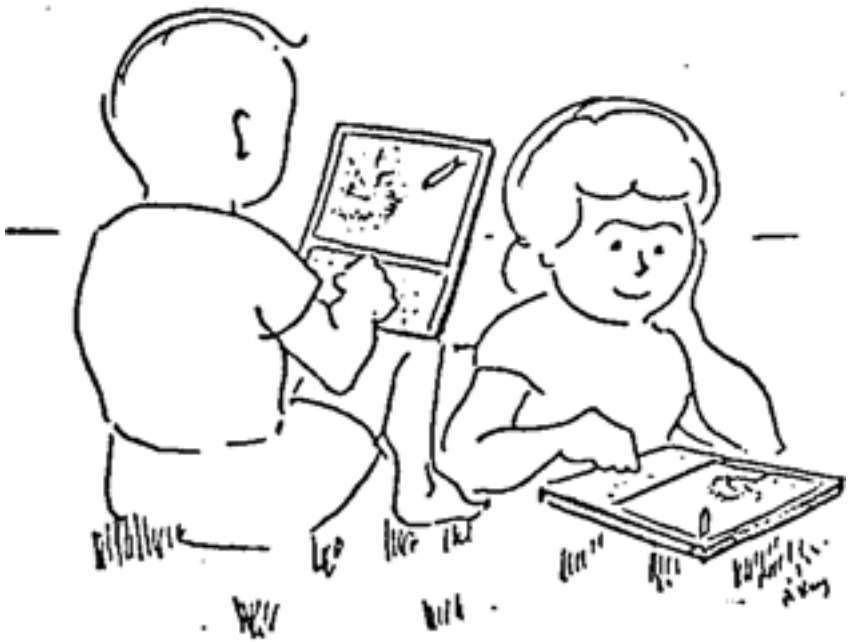
- **Basic features**
  - 2D visual display + point & click device (mouse)
  - direct manipulation
  - hierarchical window structure
  - virtual devices (widgets)
    - menu
    - button
    - text box
    - scroll bar
  - event-based control loop
    - window manager
    - device handlers
  - gestural interaction techniques
    - drag & drop
    - selection by ”sweeping”
    - opening by double click

WIMP = Windows - Icons - Menus - Pointers

Isn't this enough ?

- *"A Personal Computer for Children of All Ages"*

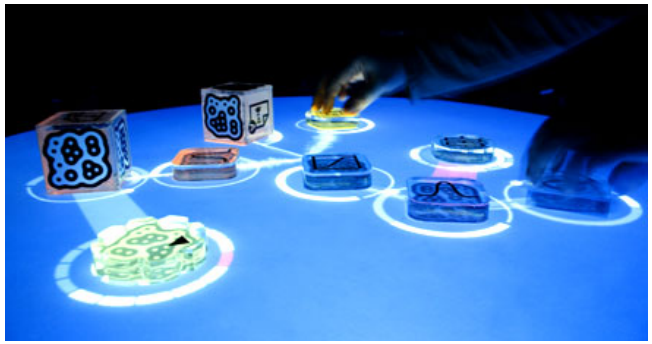
(Alan Kay's Dynabook vision, 1968)



using iPad today,
after 40 years of development

theguardian

Natural interaction is…



not just a notebook, but

- multisensory / multimodal
  - different concurrent devices / kinds of use
  - image, sound, video…
  - graspable / movable objects (tangible UI)
  - wearable computing
  - smart environment watching the user
- continuous (non-discrete) control
  - no command dialogue, but continuous flow
  - computer may act as an initiative agent
- tied to the real environment, "physical computing"

Use of senses in current interfaces

	input (to computer)	*output (display)*
sight	webcam **offline images**	**UI (widgets) and content (text, images, video, etc.)**
hearing	speech recognition **content recording**	alert signals (UI) **soundtracks (content)**
smell	**?**	**?**
taste	**?**	**?**
touch	**keyboard** **mouse / finger**	force feedback (in some game consoles)

- very asymmetric: tactile input + visual output; sound underutilised
- exception: multimedia content (sound and images in and out)
- NOTE: the fifth ”feel” sense actually covers several different senses

New input devices

- current standard devices: keyboard + mouse
  - recently being replaced by touch pad
- available but less used
  - pen/stylus, joystick, track ball
  - 3D trackers
  - force/torque handles
  - speech recognition
- new potential
  - image capture
  - non-speech sound
  - motion sensors (accelerometer)
  - positioning (GPS)
  - biosensors (EMG)
  - chemical sensors, smell/taste
  - etc.

'Put That There' (Bolt 1980)

- pointing gestures
- speech commands
- large screen display
- multi-user interface

Why these still aren't standard features of a UI ?

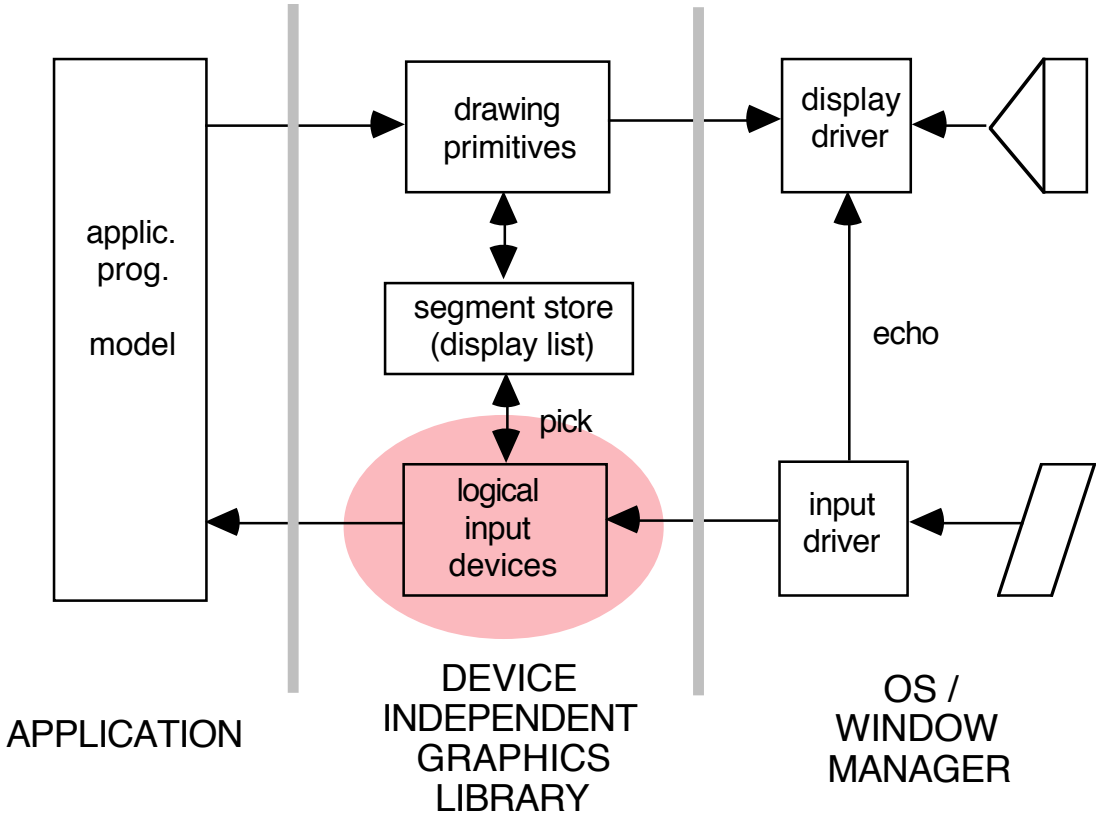
2. Towards methodology in software

- Computer graphics standardization
- Model-View-Controller framework
- Device abstractions
- A mental experiment

CG standardization

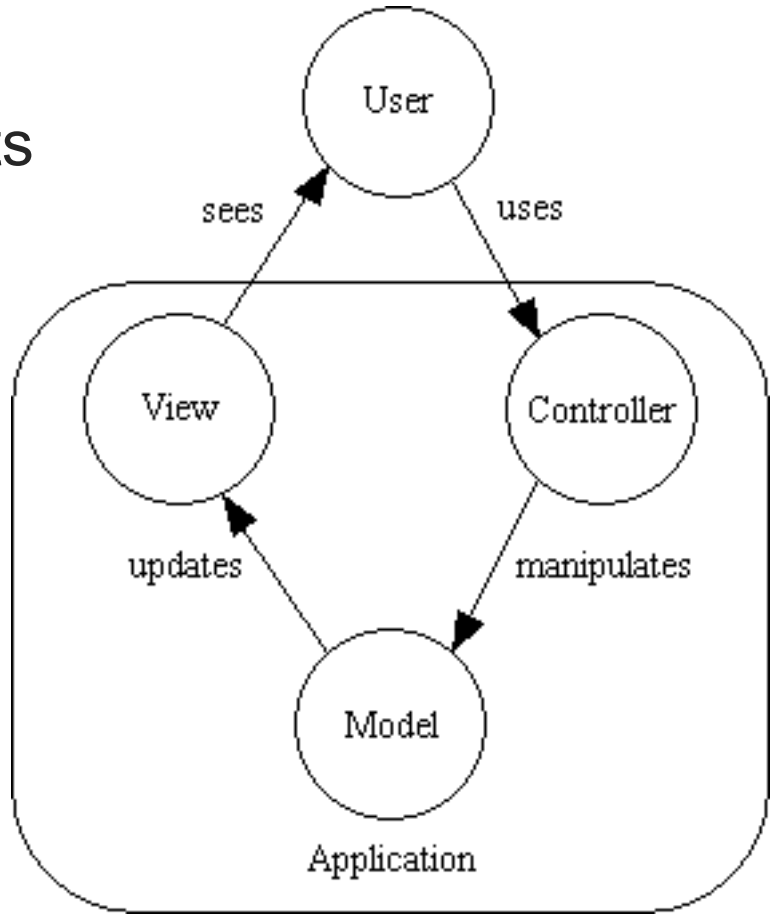
official: GKS (1985)
de facto: OpenGL (1992)

- drawing in device independent coordinates
- input part not well established



The MVC conceptualization

- often used in web applications
- works well with common widgets
  - also with hierarchical structure
- may become difficult in more general use
  - the controller may become very complex



Input device abstractions

- a useful framework for conceptualization and generalization
- what information is transferred from human to machine ?
  - state or its change (on/off) ➔ boolean
  - one from a set of alternatives ➔ integer [enumeration]
  - text ➔ character [string]
  - continuous numeric value ➔ float
  - location (2D/3D) ➔ vector [x,y]
  - reference to a pointed object ➔ id (name/address/number)
- may be implemented in many ways by different devices
  - switch, function key, alphanumeric key, slider, cursor on screen (indicator of mouse), drawing tablet, 3D tracker, camera, speech recognizer …
  - **Try it out: implement devices by each other ☺**

Exercise: fill the empty slots

information for the computer: \ physical device:	keyboard	slider	function keys	drawing tablet	camera
text string (char)	native	?	?	?	?
real number (float)	?	native	?	?	?
choice (one out of few alternatives)	?	?	native	?	?
2D position (x,y)	?	?	?	native	?
object picked from screen (identifier/name)	?	?	?	?	?

Conclusion (for today)

- Real life communication too complex to be standardized
  - attempts in early 80's to do the same for interaction as for graphics, with limited success
  - works for limited applications and modalities, e.g. the desktop/notebook metaphor
- However, abstractions help to keep it simpler
  - software modularity: separate data manipulation from action control, if possible
- Be ready for very different paradigms in the future

Paradigm changes in UI software

Current

- single-threaded I/O
- discrete tokens
- precise tokens
- sequence, not time
- explicit user commands

Future

- parallel, asynchronous dialogues; may be interrelated
- continuous inputs and responses (plus discrete)
- probabilistic input, not easily tokenized
- real-time requirements, deadline-based
- passive monitoring of the user

source: Butler, Jacob & John CHI'98

3. Sample cases

- Musical applications
- New art forms
- Motion based games
- Eyes-free interfaces

DIVA virtual orchestra

- animated musicians playing MIDI encoded music
  - automatically computed grips on the instruments
  - physically based sound synthesis
- sound reverberated according to virtual concert hall

- music conducted with a baton
  - neural networks trained to follow the motion
  - mapping from motion samples to relative timing between beats
- also recognition of conductor's emotional intent

- performance at Siggraph'97 Electric Garden

Virtual instruments

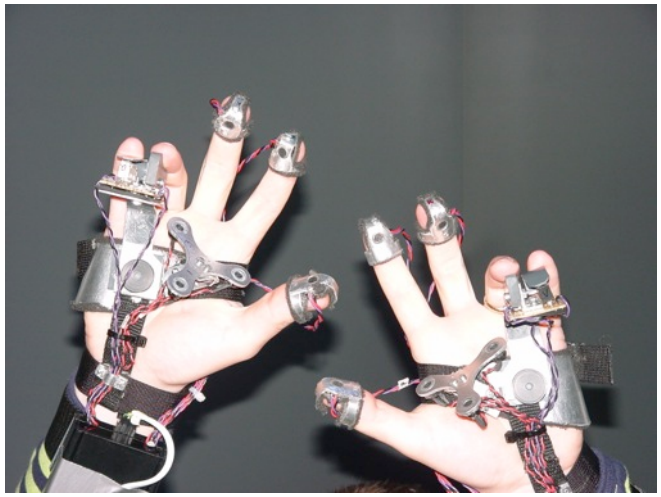
- new user interfaces for synthesized sound
- more degrees of freedom than with a keyboard
- mappings to control parameters of physically based synthesis algorithms
- free configurability
  ➔ build your own instrument
- examples:
  - xylophone
  - drum plate
  - virtual air guitar

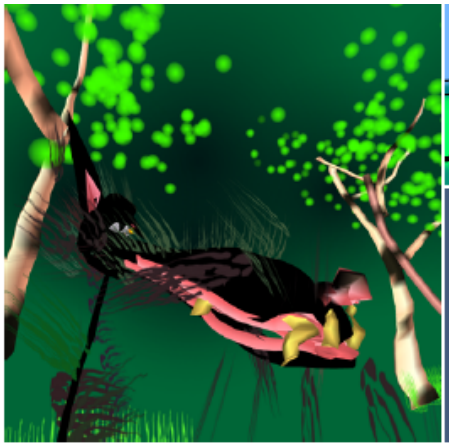
  (became a media success and later spinned off a game company)

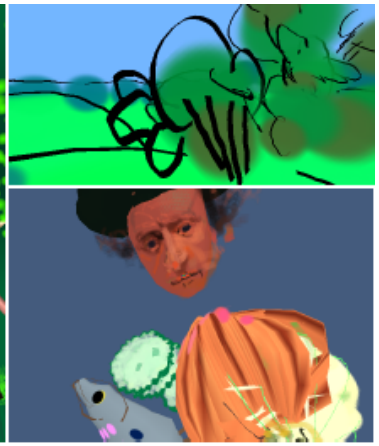
Drawing in the air

- Fine motoric interaction methods for immersive free-hand expression
- A new art medium
- Experiments with artists
  - exhibition at the Kiasma museum of modern art (2005)

Mäkelä, Reunanen, Takala 2004







Art installations (student work)

- Experience design
- "Tranquil interaction"

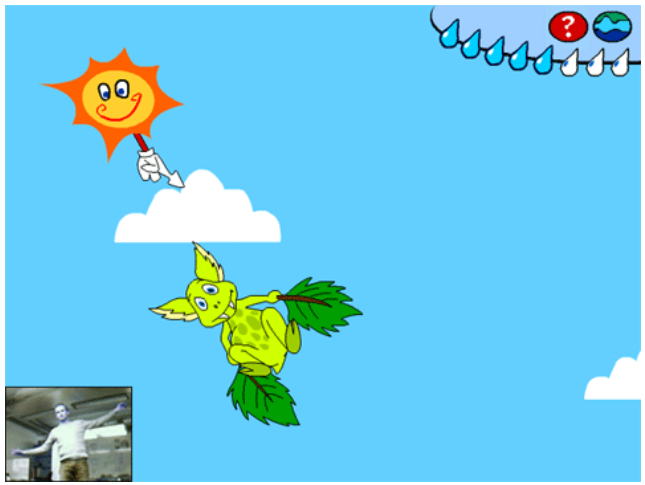
Tommi Ilmonen 2007

the village

prisoned dancer

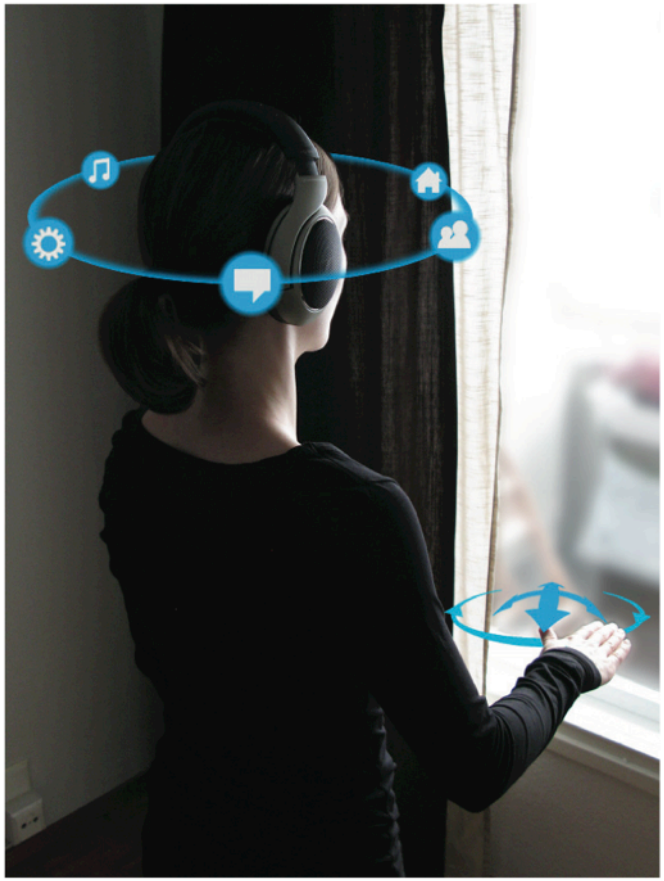
Motion-based entertainment and games in VR

- hand gestures and sound effects
  - virtual aquarium
  - virtual snow fight
- camera based tracking of full body movements
  - children's game *QuiQui's Giant Bounce*
  - fighting game *Kick Ass Kung-Fu*



Perttu Hämäläinen

Eyes-free interfaces



Raine Kajastila 2013

- gestural menu selection
- spatialized (3D) auditory display
- use cases when sight is reserved (e.g. while driving) or missing

Concept of free-hand controlled circular auditory interface

4. Current research and trends

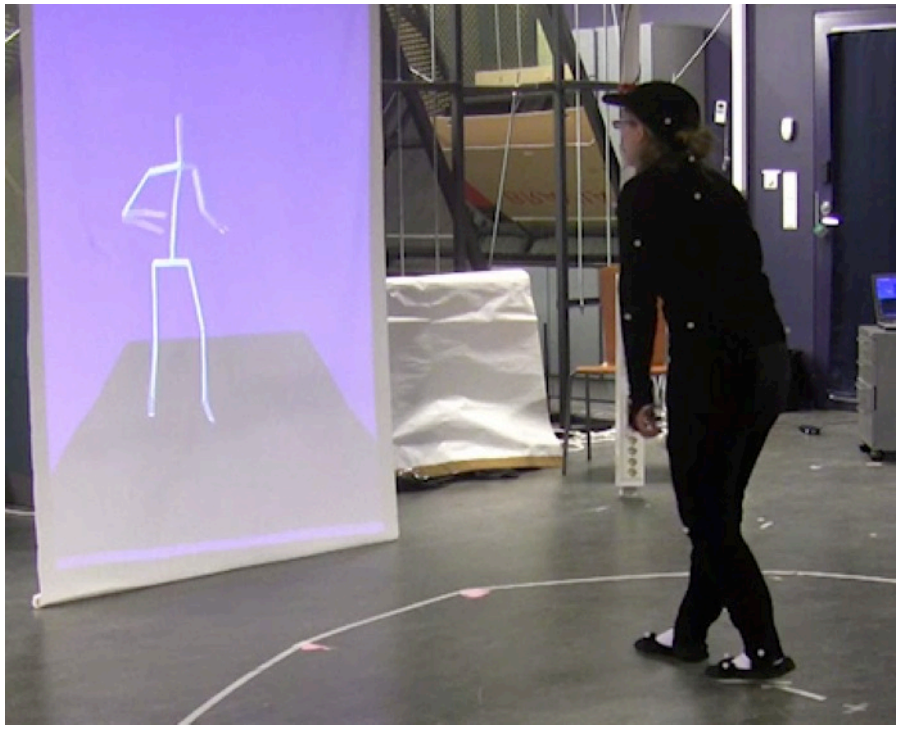
- Embodied "enactive" interfaces
- Emotions in motion
- Active virtual agents
- Excergames – motion based activities
- Variability and commoditization
- Different thinking in software design

'Enactive media' as research approach

- direct and impicit human-machine communication by embodied activity, without symbolic abstractions inbetween
- aiming at natural interaction with human-like companions
  - *"not using, but living with computers"*
- topics:
  - affective computing (emotions)
  - virtual agents

Meeri Mäkäräinen 1996

Interaction with captured motion

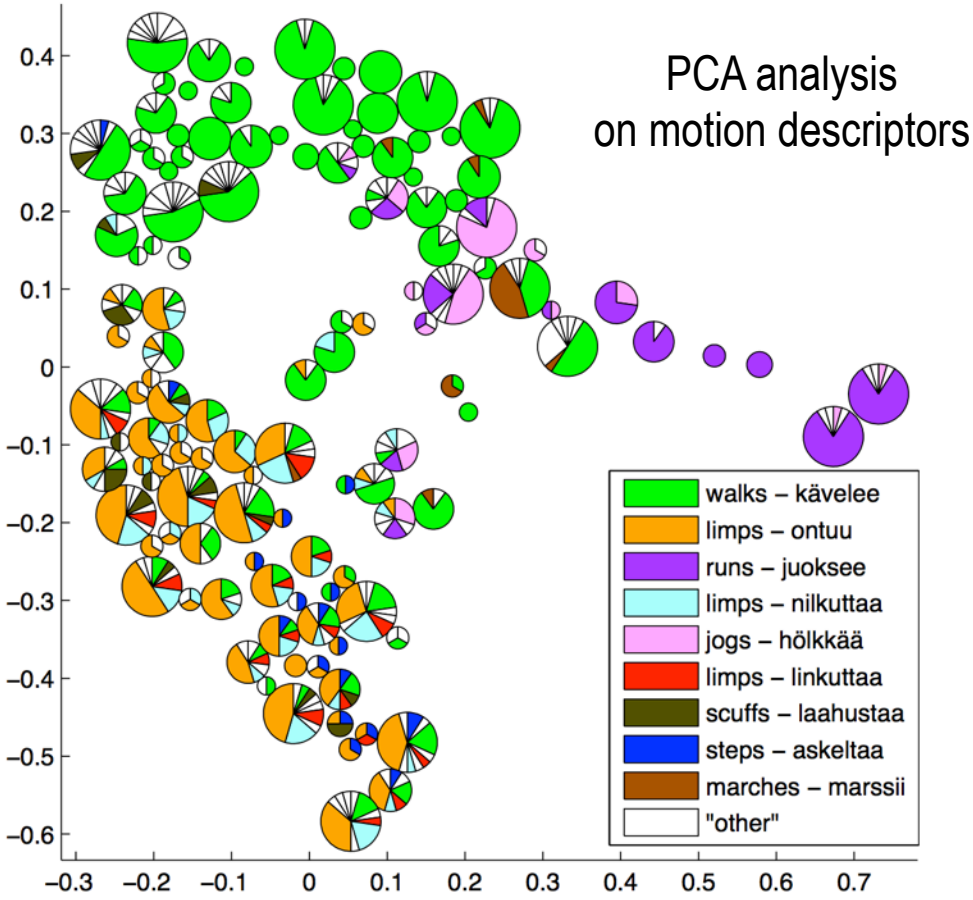


Klaus Förger et al. 2011

- analyzing activities and styles by motion descriptors
- animated responsive character programmed with behavioral rules
- may simulate virtual personalities

Classification and synthesis of motion

Förger 2013



- motion samples observed and characterized by words (human)
- resynthesis by selecting samples from a data base (computer)
- goal: directing animated characters by verbal instructions

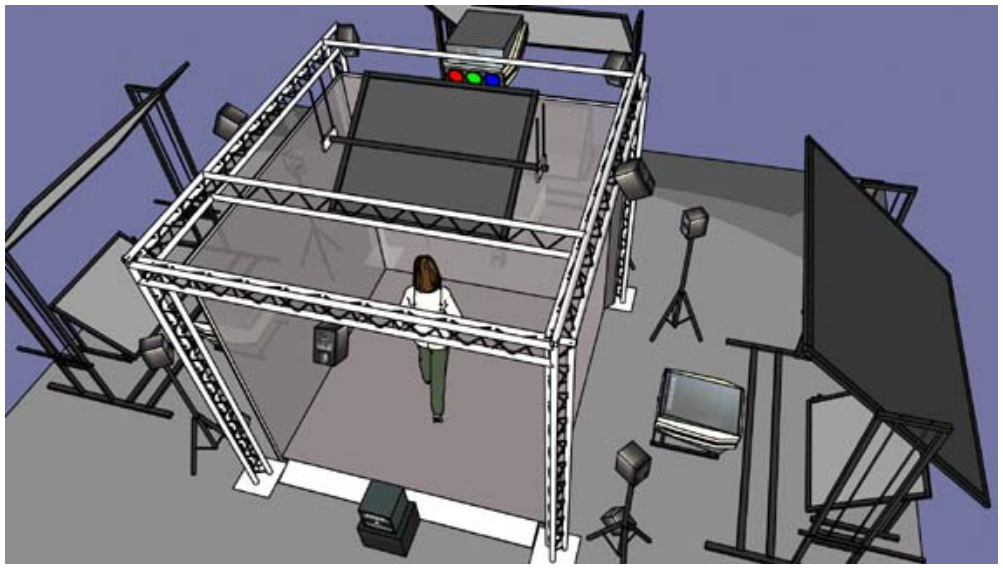
ExcerGames

- studying psychological/perceptual aspects of games
  - what affects player's motivation to move?
- presenting captured human motion in a different context
- sample: trampoline as game controller

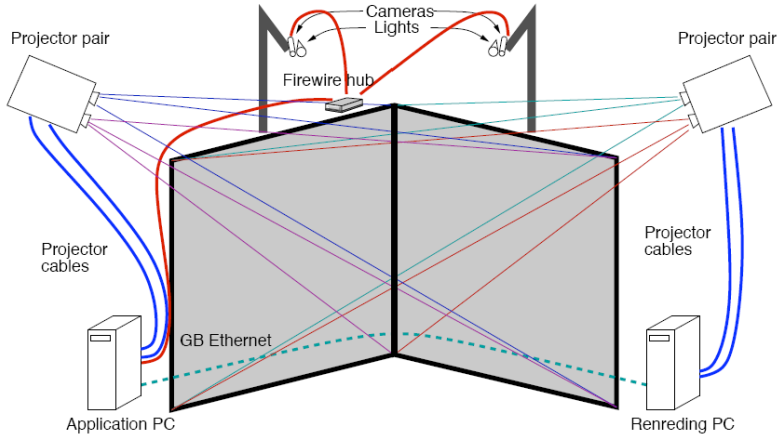
Commoditization

- basic devices getting cheaper
  - webcam
  - game consoles and controllers (Wii, PSMove, etc)
- large number of special devices available
  - sensors
  - interface hw/sw platforms (e.g. Arduino)
- development by hobbyists and open communities

From expensive VR to open platforms



Cave installation http://eve.hut.fi



a light-weight cave *"Upponurkka"*

RUIS platform

Cases

- RUIS (Reality-based User Interface System)
  - open source platform for affordable VR
  - see demo on Vimeo

- Using customer level 3DUI for designing
  - combining Blender modeling software with RUIS UI
  - demo video: Will it Blend ?

5. Final notice

- Open your mind for creativity
  - interdisciplinarity, human studies
  - art and entertainment
- Just do it – be bold, but patient
  - experiment, prototype, and learn
  - *"The best way to predict the future is to invent it."* (Alan Kay)
- KISSS principle in interface design
  - *Keep it simple and stylish, stupid*

Thank you!