multimodal interfaces

lecture 01: definitions & introduction

Martin Kaltenbrunner, Interface Culture Lab
University of Art and Industrial Design, Linz

++ professional background

research focus on experimental human computer interaction design and its implementation within tools for artistic production

→ mediator between Art, Science & Technology

+ MTG: Music Technology Group, Barcelona

Research assistant and lecturer at the Pompeu Fabra University
Human Computer Interaction Designer – Reactable project
DEA - Diploma of Advanced Studies in Digital Communication
Ph.D. research on the abstraction of Tangible Interactive Surfaces

+ UFG: Interface Culture Lab, Linz

Lecturer for Tangible User Interfaces since its foundation in 2004
Head of Interface Cultures appointed to act for Prof. Sommerer in 2010

++ professional background

+ MIT Medialab Europe, Dublin

Visiting Researcher, Palpable Machines Group - Dr. Sile O'Modhrain

Research on tangible interaction with a focus on tactile object design

+ Faculty of Fine Arts, UCP Porto

Lecturer on Tangible User Interfaces at the Digital Arts Dept.

+ Aalborg University, Copenhagen

Visiting Lecturer at the Medialogy Department

Tangible and Auditory User Interfaces

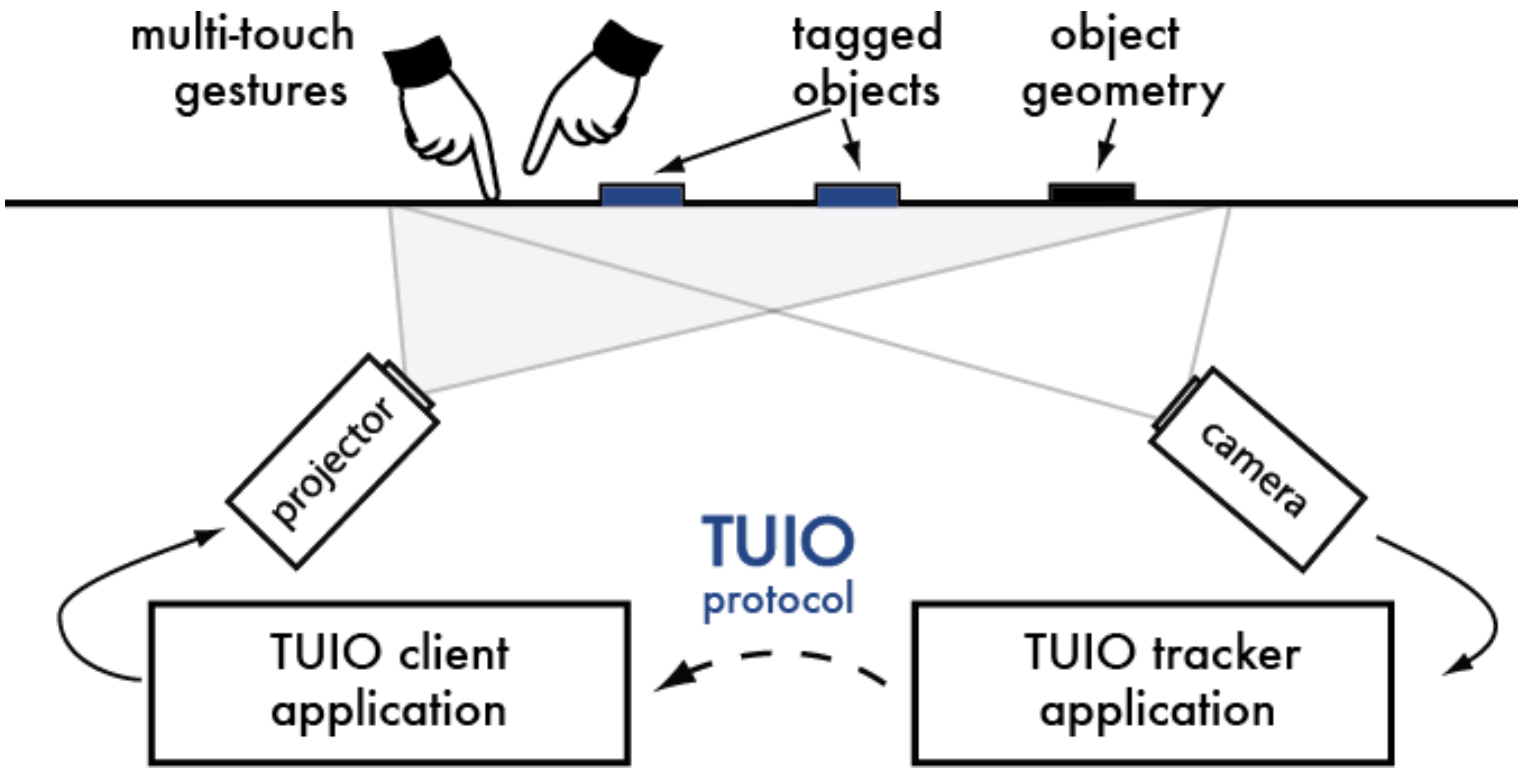
+ CEA: Centre for Electronic Arts, London

Research Intern, working on Auditory User Interfaces

++ reactable - tangible modular synthesizer

Kaltenbrunner, M. & Jordà, S. & Geiger, G. & Alonso, A. "The reacTable: A Collaborative Musical Instrument", Proceedings of the IEEE Workshop on "Tangible Interaction in Collaborative Environments (TICE2006). Manchester, U.K

++ TUIO framework & reacTIVision



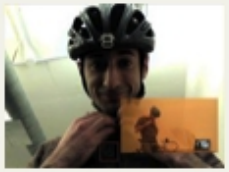
Kaltenbrunner, M. "reacTIVision and TUIO: A Tangible Tabletop Toolkit", Proceedings of the ACM International Conference on Interactive Tabletops and Surfaces (ITS2009). Banff, Canada.

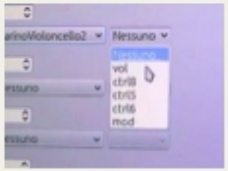
++ community projects

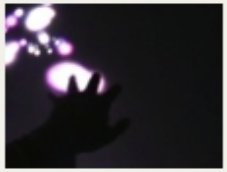
Description ♥ 0 likes 0 comments


Ribosound - Concept
by Victor


Stadtplanung
by Fabian Gronbach


Interfaces for Encoura
by JAG


Demo Reactable Ketai
by Dario Freddi


Tuio Kontrol+++multit
by Vision Nocturne


Learn about the RGB
by YUFANGISED


Learn about the RGB
by Harsha Vardhan


Block Environment
by Amee

reacTIVision

182 videos / 138 subscribers

This channel is a showcase for tangible interface projects made with the reacTIVision toolkit.
reactivision.sourceforge.net/

Another list of tangible musical interfaces made with reacTIVision:
modin.yuri.at/tangibles/?list=7

Facebook page: facebook.com/reacTIVision

Settings Unsubscribe

Share

Moderator

Martin Kaltenbrunner - Creator
Created October 2009
4 videos / 292 likes / 197 contacts

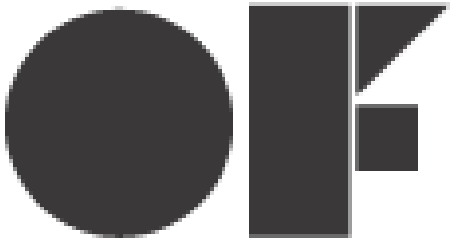
Shout Box

Thanx for adding the vid to your channel... And thx for your great reacTIVision framework of course!!!
Posted by **Fabian Gronbach** 2 days ago

Martín, gracias por incluir nuestro video!
Posted by **derooted creative agency** 6 months ago

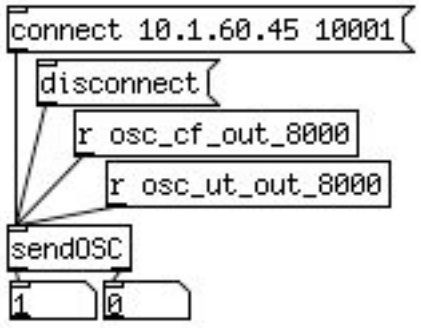
++ open tools made by artists

Processing

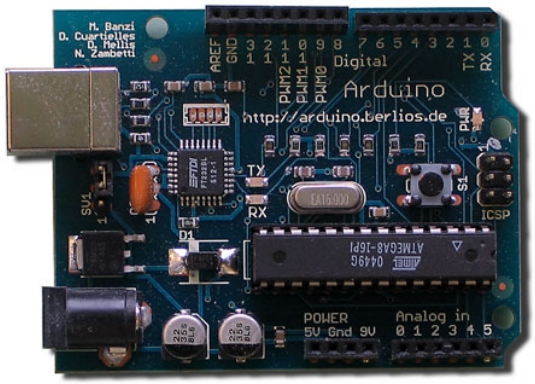


Open Frameworks

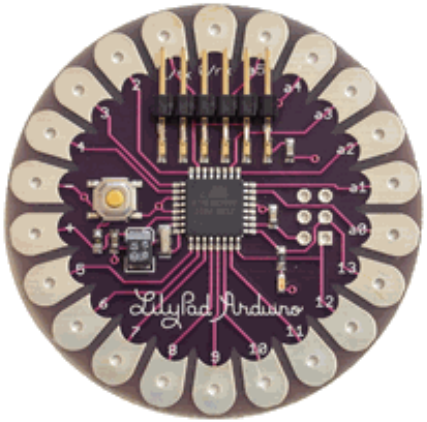
Pure Data

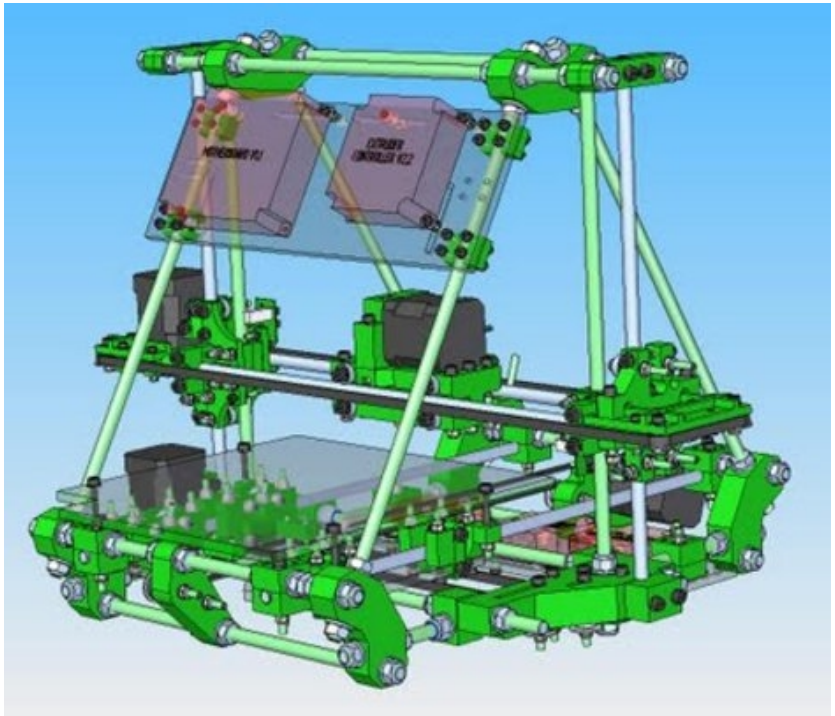


++ open hardware projects for art



Arduino/LilyPad

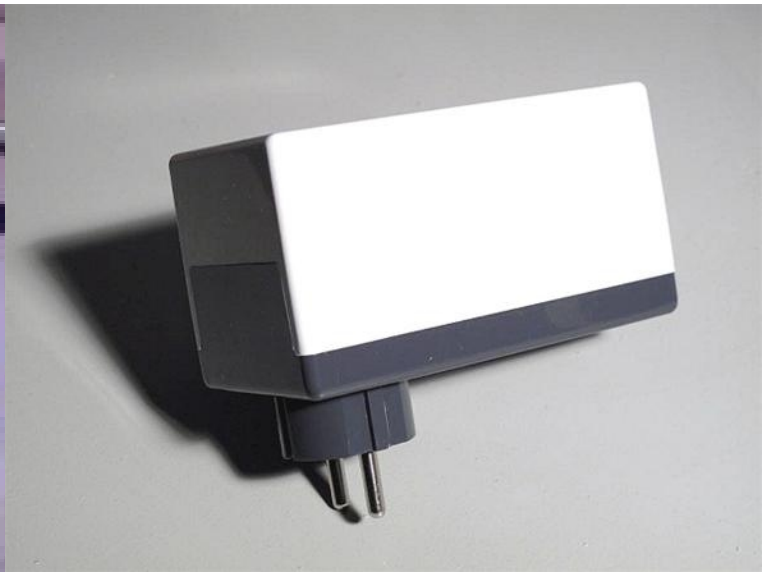




RepRap – 3D printer

++ open artworks

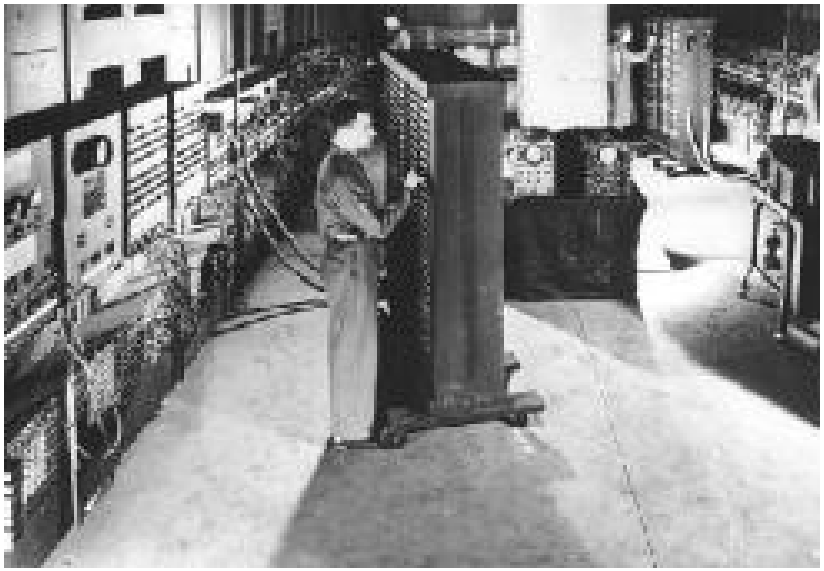
Eyewriter
(Zach Lieberman et.al.)
Golden Nica 2010

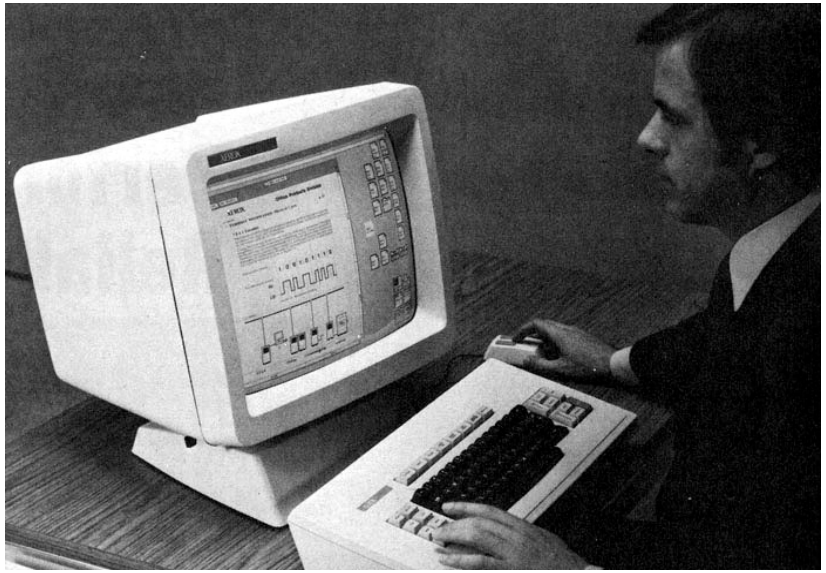


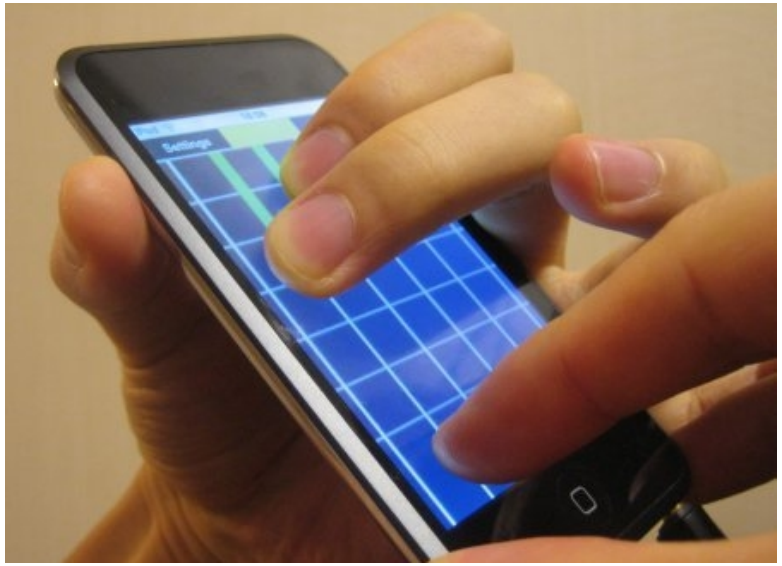
Newstweek
(Julian Oliver & Danja Vasiliev)
Golden Nica 2011

Based on open source toolkits such as OpenFrameworks, OpenWRT.
Source code and hardware specifications of the whole work published

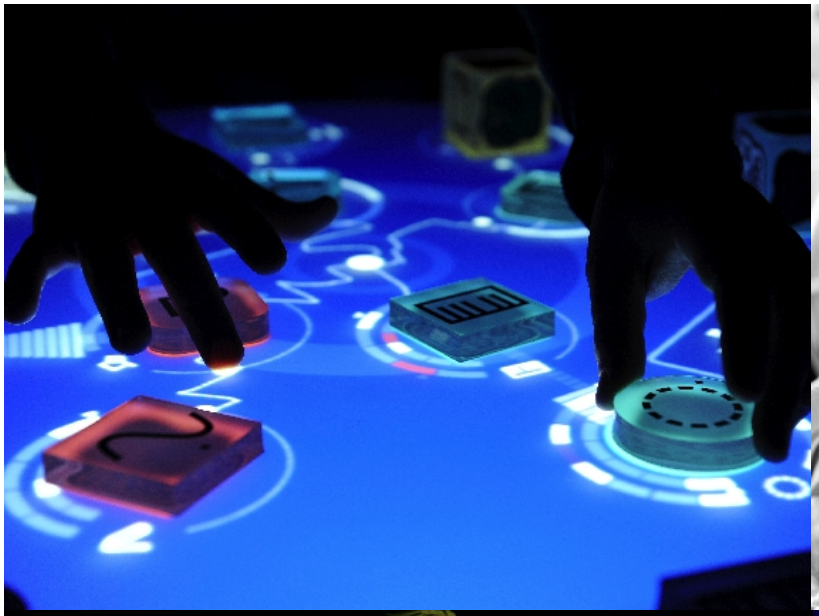
++ human machine interfaces







++ artistic user interfaces



++ HCI & Digital Arts

state-of-the art HCI concepts are often an unexplored territory

The artistic approach may define different goals and methods compared to the scientific methodology demanding results

niche modalities such as smell-interfaces have technical limitations

… but so did speech, tangible and graphical user interfaces

artistic practice can allow a ludic approach towards new interaction modalities

exploring phenomenons such as synaesthesia or sensory cross-talk from an artistic point of view other than cognitive psychology

“any sufficiently advanced technology is indistinguishable from magic“

(Arthur C. Clark)

++ planned topics for this class

auditory user interfaces

auditory display, audification, sonification

speech synthesis, speech recognition, voice control

physical user interfaces

tangible and haptic interaction

natural user interfaces

gestural control (multitouch, hand, full-body)

edible user interfaces

interactive food, eat art, edible interaction

olfactory interfaces: smell'o'rama, smell to sell, RGB of smell?

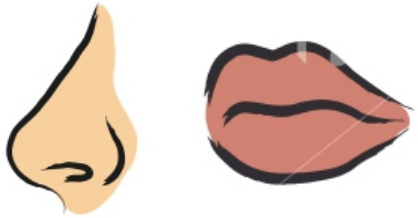
++ modalities

the human senses are grouped into five principal **modalities** which are generally defined by the various sensory organs

see: visual modality
hear: auditory modality

touch: tactile modality
kinaesthetic modality

smell: olfactory modality
taste: gustation modality



++ sub-modalities

defining the properties for each individual modality
usually defined by analog/continuous dimensions or binary qualities

visual: light/darkness (intensity), colour/monochrome (chroma)
contrast, sharpness, three/two dimensional
auditory: loudness/intensity, pitch/frequency, timbre
harmony, rhythm, melody, location/source/speed

tactile: texture, temperature,
smooth/rough, hot/cold
kinaesthetic: force, resistance, weight
soft/hard, heavy/light, strong/weak
proprioception: equilibrium, orientation, movement

olfactory: smelly/pleasant, toxic/attractive, aromatic/dull
gustation: sweet,sour,bitter, salty, umami, fatty
sweet/sour, tasty/dull

++ display modalities / multimedia output

creating devices that stimulate the various sensory channels,

defining technical models that generate stimuli that match the sensory dimensions and „specifications“ of the human organs

visual display: monitors, projections (2D dot matrix), illumination

- HMD (3D – immersive display), holographic displays
- still images, resolution > 100dpi
- moving images (> 25fps)
- color (visible spectrum) - RGB (additive colour model)
- print (CMYK – subtractive colour model)

auditory display: speakers (mono, stereo, multi-channel)

- headphones (stereo), personal display
- frequency (20Hz-20.000Hz), amplitude (loudness, dB)
- music, speech, recordings, synthesis (FM, physical models)
- spatial audio processing (HRTF,room models)

haptic display: force feedback (game controllers), vibro-tactile display (mobile phone), temperature

olfactory display: „RGB“ of smell? complex synthesis, persistence

++ display types

++ input modalities

creating input devices that perceive the various sensory channels, generate control data or semantic input

haptic: mechanical input devices: keyboard
mechanical pointer devices: mouse, stylus, joystick
touch interfaces: trackpad, surfaces (touchscreen, tablet)
tangible user interfaces: physical objects

acoustic: speech recognition, speech commands
voice control (e.g. pitch-to-midi, loudness, vowels, unvoiced)

visual: computer vision (image analysis), OCR (text)
hand/body tracking, gestural input
symbol recognition, face recognition

olfactory: digital nose, alcohol test

++ textual input using different modalities

++ application areas

Mobile devices: limited screen size, tiny keyboards

Solution: introducing alternative modes using interfaces such as touch screens, accelerometers or displays such as auditory or vibro-tactile feedback

Ubiquitous computing: disappearing computer

Solution: using voice/speech interfaces and gestural control

ambient displays providing visual and auditory feedback

Virtual Reality: addresses many modalities (visual, auditory, haptic) in order to increase the effect of *immersion*

++ multimodal interface examples

Mobile phone – Interactive Voice Response System
alternative usage of speech recognition and DTMF keys

e.g. a car driver prefers hands-free interaction
in a noisy environment with limited intelligibility DTMF is more robust

Cave – Virtual Environment
ambient display & sound, full body interaction & speech interface

++ accessibility

allowing multiple modalities to compensate a sensory impairment or limited articulation of the user

e.g. *blind users* may prefer speech synthesis or speech recognition

speech impaired users rely on textual input or gestural control

paralysed users may require alternative input modalities (BMI)

This implies a dialog system design that allows for example textual input in addition to GUI direct manipulation elements or gestural control

++ bandwidth

multi-modal interaction can increase the communication bandwidth
bundling the properties of various input or display modalities

may result in improved usability and performance

bandwidth & performance:
textual input: morse key, BMI, keyboard, speech recognition
hierarchical menus: direct manipulation, voice dialogs
manipulation: mouse, touch-screen, multi-touch, physical interface

++ cross-modal effects

Crossmodal perception involves interactions between two or more sensory modalities

Synaesthesia stimulation of one sensory channel causes involuntary experiences of another sensory perception

e.g. seeing sounds, hearing colours

grapheme to colour: letters or numbers appear coloured

can also be induced by psychedelic drugs

Sensory cross-talk / Sensory substitution

e.g. simulation of haptic feedback using visual cues

replacing a sensory impairment through another modality:

e.g. seeing with sound – sonification of visual cues

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