



Multimodal User Interfaces

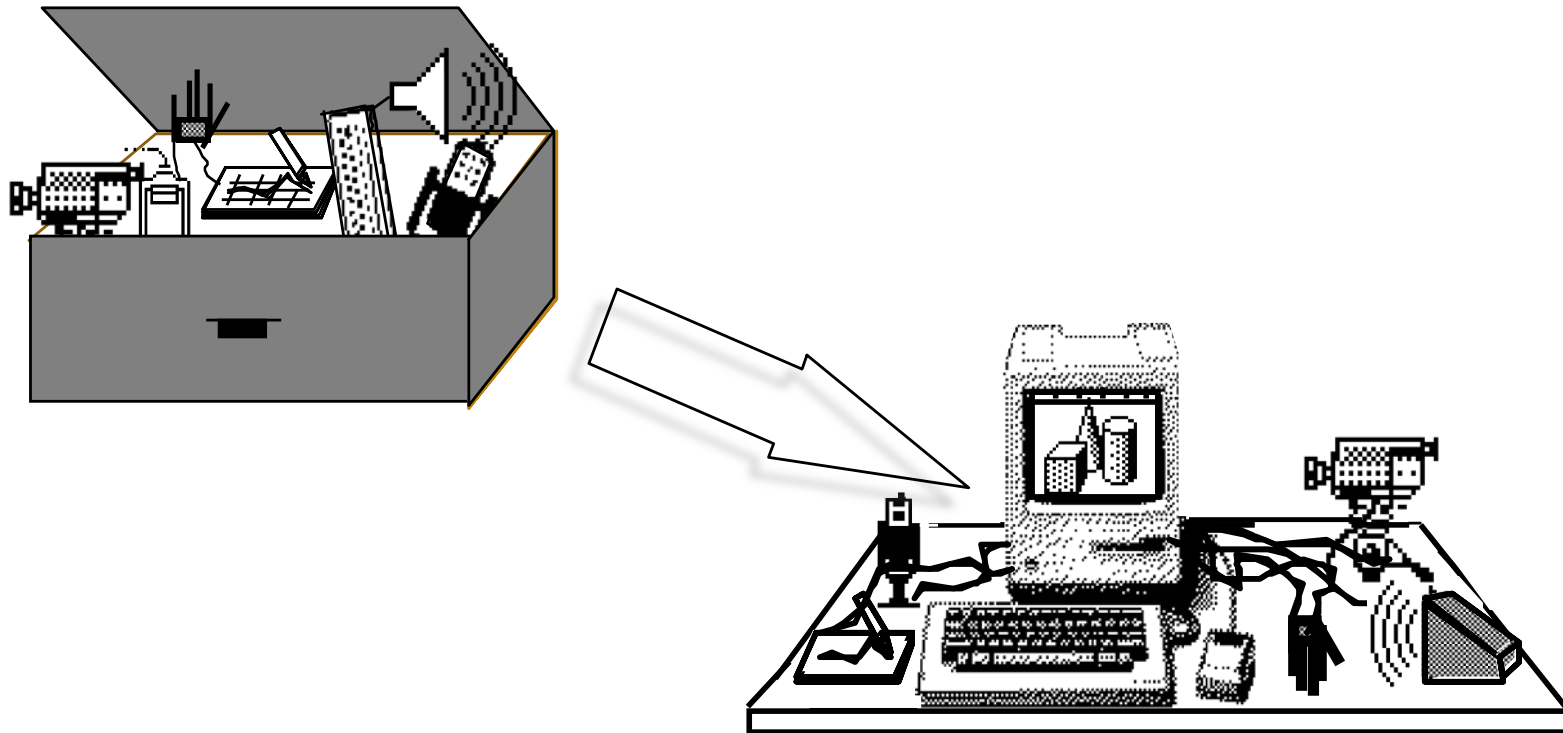
Introduction - 2019

19th February, 2019

What is this Course About?



Challenge: How to combine modalities ??



What is Human Computer Interaction?

- “Human Computer Interaction is a discipline concerned with
 - the design, evaluation and implementation of interactive computing systems
 - for human use
 - with the study of the major phenomena surrounding them.”

-- ACM SIGCHI

The Machine in Human-Machine Interaction

- What is a Machine, anyway?

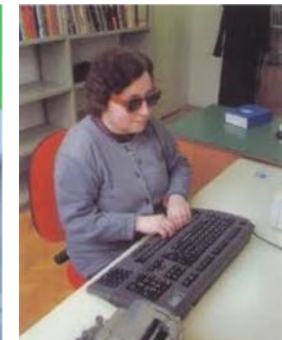


- Common features:
 - Can be **interacted** with
 - Have some form of **input** and/or **output**
 - Have some form of **processing power**
- Human *Computer* Interaction vs. Human *Machine* Interaction
 - “Machine” is more generic. However, both are synonyms



The Human in Human-Machine Interaction

■ What is a Human, anyway?

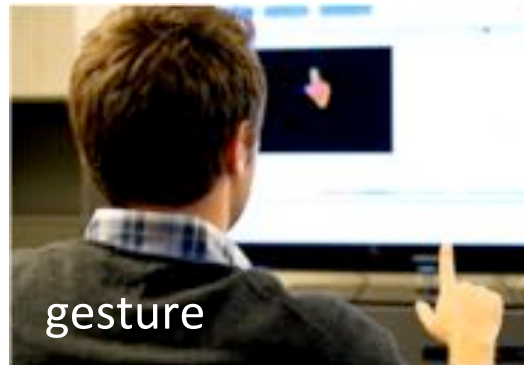
- Senses
- Cognition
- Emotions
- Social skills
- Experience
- Specific needs
- ...



Evolution of human computer Interfaces

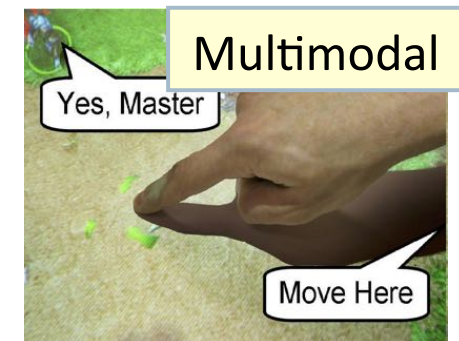
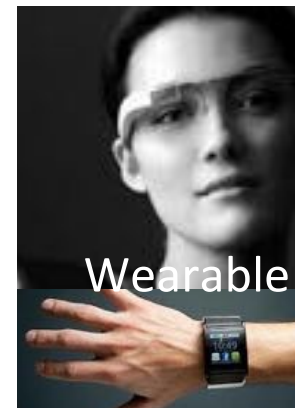
			
	Original Macintosh	MacBook Pro	
year	1984	2014	+ 30 years
price	\$2500	\$2000	x 0.8
CPU	68000 Motorola 0.7 MIPS	i5 Turbo Boost > 50'000 MIPS	x 70'000
memory	128KB	16GB	x 128'000
storage	400KB floppy drive	1 Tera flash	x 2'500'000
monitor	512x342 68 dpi	2880x1800 220 dpi	x 30 x 4
devices	mouse keyboard	mouse keyboard	same same
GUI	Desktop WIMP	Desktop WIMP	same

Improvement of the integration in the real world



1960

2030



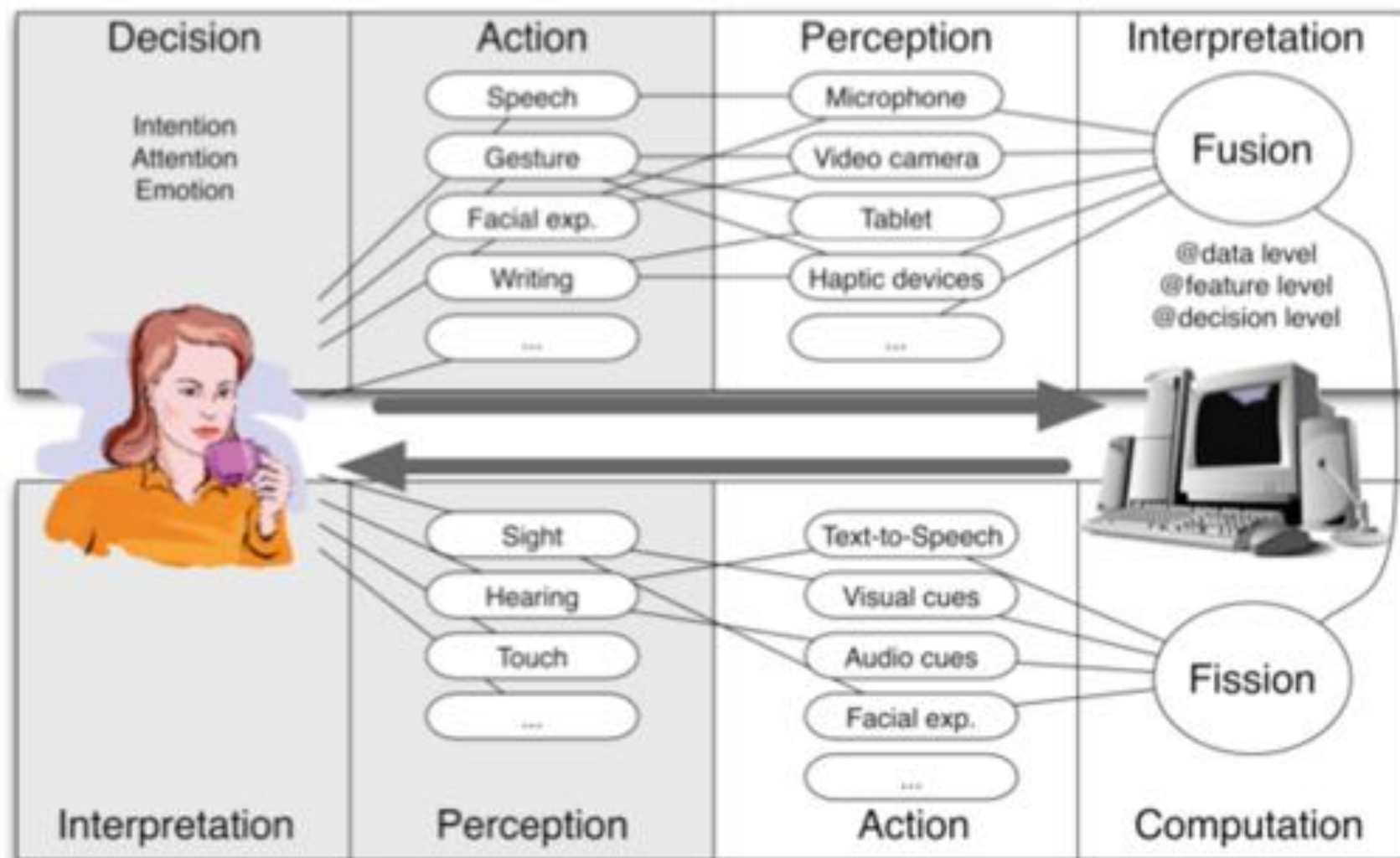
Natural, smart and simple interfaces

- Natural:
 - As in the real world
 - Depends on effort, learning, accuracy, speed, and ability to remember (Norman, 2010)
- Smart:
 - the machine knows what we want
 - relying on machine learning
- Simple:
 - Complexity is hidden
 - Less is more

Natural?

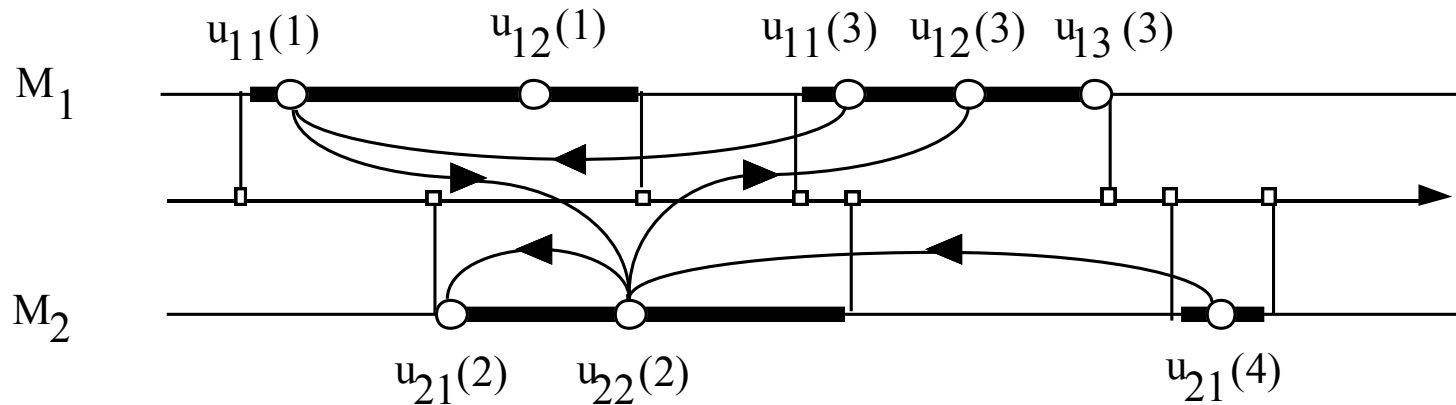


Multimodal Interaction



Multimodal

- Means at least 2 input modalities (speech, gesture, tangible, emotion, movement, etc.)



- If possible complementary:
 - Need both of them to trigger a command
 - They refer to each other
 - E.g. “Put that there”
 - ✓ $F(M1, M2) \rightarrow 1$ command
 - ✓ For instance, 1 can be the function, the other the parameter



Multimodal interfaces: important features

- Synchronization
 - Interpretation might change depending on sequence of events
 - Delay might be due to recognition processing or hardware
- Error-handling
 - There are sometimes recognition errors (e.g. speech)
 - Mechanisms to correct or manage these errors should be well thought in advance
 - Use visual or sound feedback (so that user can understand the machine interpretation)
- Software architecture

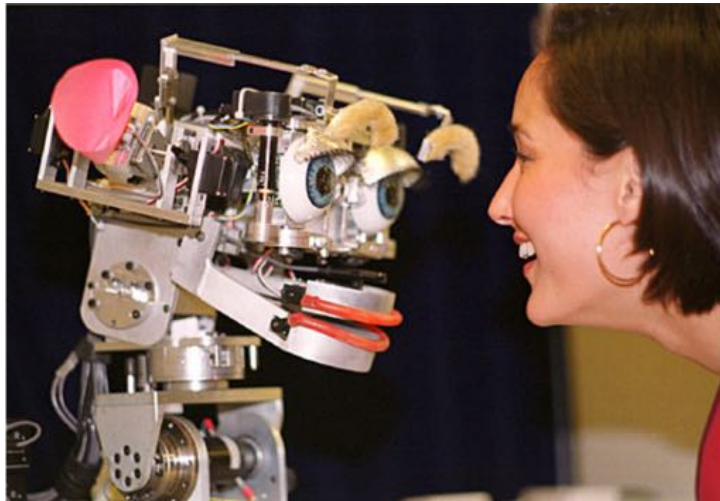
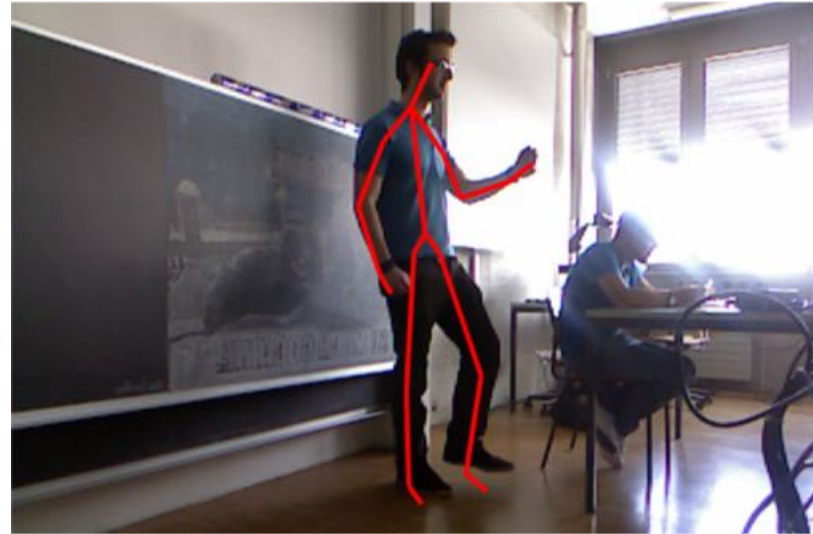
W	Course	Date	What
1	MMI_01	19.02	Introduction (DL)
2	MMI_02	26.02	Multimodal Interaction (DL)
3	MMI_03	05.03	Multimodal Fusion (DL)
4	MMI_04	12.03	Tangibles + Gestures + Voice (DL)
5	MMI_05	19.03	Wearable & ubiquitous Computing (AL)
6	MMI_06	26.03	Virtual Reality + Augmented Reality (AL)
7	MMI_07	02.04	Ambient computing (HA)
8	MMI_08	09.04	User Evaluations of MMI (DL)
9		16.04	Intermediary presentations (ALL)
10		24.04	Easter
11	MMI_09	30.04	Affective & Brain interfaces (DL)
12	MMI_10	07.05	Information Visualization (FE)
13	MMI_11	14.05	CSCW (HA)
14	MMI_12	21.05	Wrap Up (DL)
15		28.05	Final presentations (ALL)

Objectives of the class

- Theoretical (60% written exam of 2h):
 - Learn fundamental mechanisms to build multimodal interactive systems
 - ✓ fusion of multimodal inputs, fission of outputs
 - ✓ error handling,
 - ✓ knowledge about specific recognizers for gesture, voice, etc.
 - ✓ Interaction styles and paradigms
 - ✓ Important aspects for design and evaluation
- Practical (mini-project 40%):
 - Develop and evaluate a multimodal interface

Mini projects (40% of the final grade)

- Create a fully multimodal application
- Combining eye tracking + speech + gesture
 - To control a video streaming application
- Focus on interface, not on the application!
- Performances and satisfaction can equally considered
- Position your work according to CARE/CASE models
- In group of 3



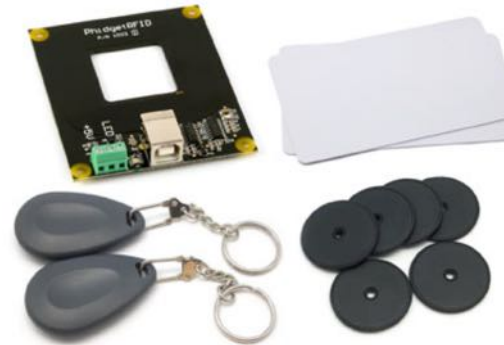
Schedule of mini-project

- For next week... (week 2)
 - create groups!
 - Week 3: Decide topic and discuss it in class
 - Week 9: Mid-term presentation of project ideas and positioning according to CASE/CARE
 - Week 15: Final presentation of the project
-
- .. And hopefully regular discussion in class about novel HCI.

Mini-project: Evaluation criteria

1. Idea / design
2. Quality and amount of work
3. Multimodality
 - In respect to CASE/CARE models
 - Both inputs (fusion) and outputs (fission)
4. Interaction quality
 - Dialog
 - Error handling
5. Report
6. Presentation (oral presentation, demo, video)
7. User evaluation

Hardware...



Phidgets

- simple devices easy to program
- « Phidgets™, or physical widgets, are building blocks that help a developer construct physical user interfaces. »
- <http://www.phidgets.com/>



Sphinx 4.0

- Target : speech recognition
- « state-of-the-art speech recognition system written entirely in Java »
- Language : java / Platform : all
- <http://cmusphinx.sourceforge.net/sphinx4/>

Vista ASR

Kinect SDK

Praat



ReacTiVision

- Target : tangible interaction
- « open source, cross-platform computer vision framework for the fast and robust tracking of fiducial markers in a real-time video stream. It was mainly designed as a toolkit for the rapid development of table-based tangible user interfaces (TUI). »
- Platform : All (nearly)
- <http://mitg.upf.es/reactable/?software>



WiiMote + Kinect

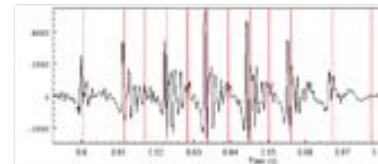
- Target : gesture recognition
- « The Wii Remote, sometimes unofficially nicknamed "WiiMote", is the primary controller for Nintendo's Wii console. A main feature of the Wii Remote is its motion sensing capability through the use of accelerometer and optical sensor technology. »
- Platform : All (nearly)
- <http://www.wiim.org/index.php>



Wiigee MS Kinect Open NI

FestVox

- Target : speech synthesis
- « The Festvox project aims to make the building of new synthetic voices more systemic and better documented, making it possible for anyone to build a new voice. »
- Language : C++ / Platform : *nix
- <http://festvox.org/>



d-touch

- Target : tangible interaction
- « d-touch is a software framework for building inexpensive tangible user interfaces and mixed reality systems. »
- <http://web.media.mit.edu/~enrico/research/research.php?projectTitle=d-touch>



EyesWeb

- Target : multimodal toolkit
- « EyesWeb consists of a number of integrated hardware and software modules which can be easily interconnected and extended. »
- Plate-forme : Windows
- <http://www.infomus.org/EyesWeb.html>



HandVu

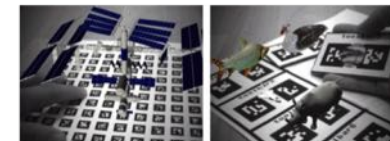
- Target : gesture recognition
- « Detects the hand in a standard posture, then tracks it and recognizes key postures - all in real-time and without the need for camera or user calibration. »
- Language : C / Platform : Linux, Win32
- <http://www.movesinstitute.org/~kolsch/HandVu/HandVu.html>



+ Igesture
+ Mudra

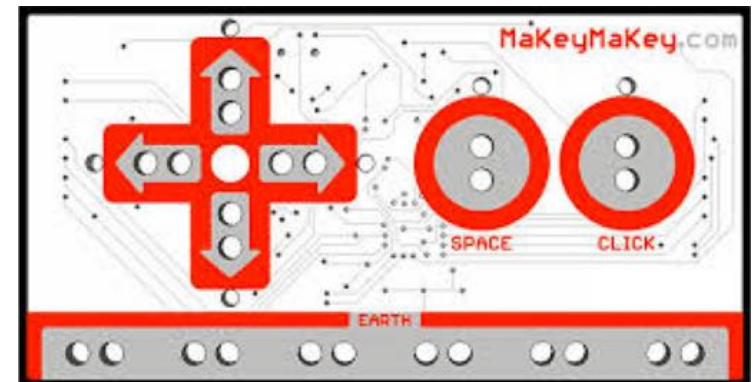
ARToolkit + jARToolkit

- Target : augmented reality
- « Software library for building Augmented Reality (AR) applications. These are applications that involve the overlay of virtual imagery on the real world. »
- Language : C / Platform : all
- <http://www.hitl.washington.edu/artoolkit/>
- <http://sourceforge.net/projects/jartoolkit/>



Most recent

- Interactive wall
- OpenEar
- Affectiva mobile SDK
(we also have bracelets available)
- Leap motion
- Paralinguistic:
<http://daisukesakamoto.jp/project/vam/>
- Makey makey
- HTC Vive
- Thermal camera
- Optitrack system
- ... others? suggestions?



Previous years

OIVA Department of Informatics University of Fribourg					
MULTIMODAL INTERFACES					
Home Multimodal libraries Student projects					
Students projects					
This page links to the files associated with the student projects.					
2012					
Group	Project	Report	Presentation	Video	
Master UniFr					
Film Ismaili, Ruzhita Velkova, Resul Collaku	Challenger 1	[pdf]	[pdf]	[vid]	
Thi Thu Hang Nguyen, Thibaud Chardonnes	Kemote	[pdf]	[pdf]	[vid]	
Marwa Bouzeyane, Revathi priya Muthusamy, Muhyiddine Cherik	Melody	[pdf]	[pdf]	[vid]	
Soroosh Mortezaipoor, Mehdi Taale, Samaneh Soleimani	A Multi Modal Interface Approach to Control an Unmanned Aerial Vehicle	[pdf]	[pdf]	[vid]	
Caroline Voeflay, Hervé Siero, Amaud Gaspoz, Frédéric Aebi	MultiTunes	[pdf]	[pdf]	[vid]	
Siavash Bigdeli, Christian Lutz	Remotoid	[pdf]	[pdf]	[vid]	
Simpal Kumar, Dani Rotzetter and Jan Kühni	SpheryX	[pdf]	[pdf]	[vid]	
Mathias Seuret, Pierre Vanhulst, Marc Chatton	VirtualDJ	[pdf]	[pdf]	[vid]	
Bachelor EIA-FR					
Alick Deillon, Nicolas Gury, Jonathan Sigg	Blueprint	[pdf]	[pdf]	[vid]	
Yannick Jemmely, Dorian Gambin, Vincent Pasquier	Magnificent Monocle Multimodal Minecraft (MMMM)	[pdf]	[pdf]	[vid]	
Jocelyn Duc, Carlo Filippone, Andrea Marcacci	MMario	[pdf]	[pdf]	[vid]	
Didier Crausaz, Valentin Bourqui	MultiPong	[pdf]	[pdf]	[vid]	
Maxime Wicht, Vincent Grivet, Geoffrey Papaux	Multitask Your Brain	[pdf]	[pdf]	[vid]	
Bernhard Leutwiler, Fabien Yerly, Michael Heinzer	WiiPresenter	[pdf]	[pdf]	[vid]	
2011					
Group	Project	Report	Presentation	Video	
Master UniFr					
Carine Poffet, Simon Vogt, Samuel Vonlanthen	Multis	[pdf]	[pdf]	[vid]	
Patrick Brunner, Simon Brunner, Mahamat Abakoura	HelpCopter	[pdf]	[pdf]	[vid]	
Felina Kaufmann	chickenclimb	[pdf]	[pdf]	[vid]	

XPaint

(Zingg, Della Bruna et Thiessoz)



ShareDesk

(Yerly, Palme et Bodmer)



<http://human-ist.unifr.ch/courses>

Admin information

- Professor
 - Denis Lalanne (A429)

- Teaching material
 - Master JMCS: Ilias (key: slides4MMI19)
 - ✓ <https://ilias.unibe.ch/>

Questions



SF movies

