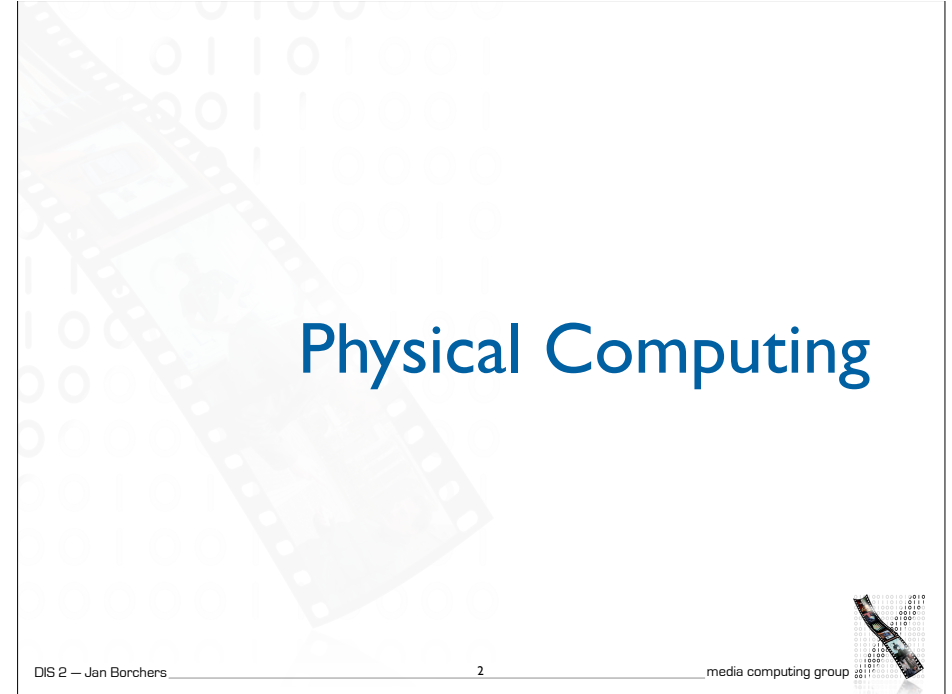


Designing Interactive Systems II

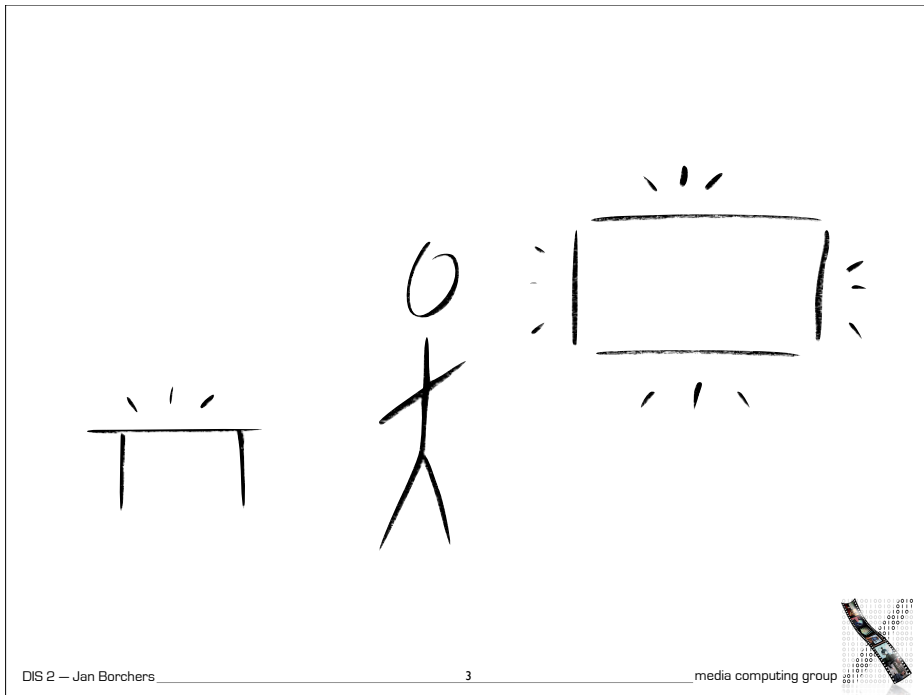
Computer Science Graduate Programme SS 2010

Prof. Dr. Jan Borchers
RWTH Aachen University

<http://hci.rwth-aachen.de>



Physical Computing





Toolkits



4 Visual Ubicomp UI Prototyping Software
iStuff Mobile, Exemplar,...

3 Ubiquitous Technology Prototyping
Middleware
iStuff, d.tools, (Phidgets),...

2 Programmable μ Controller Boards
*Arduino, Wiring, MAKE Controller,
iCubeX, Basic Stamp,...*

1 Dumb Interfaces to Sensors & Actuators
MidiTron, MidiTron Wireless,...

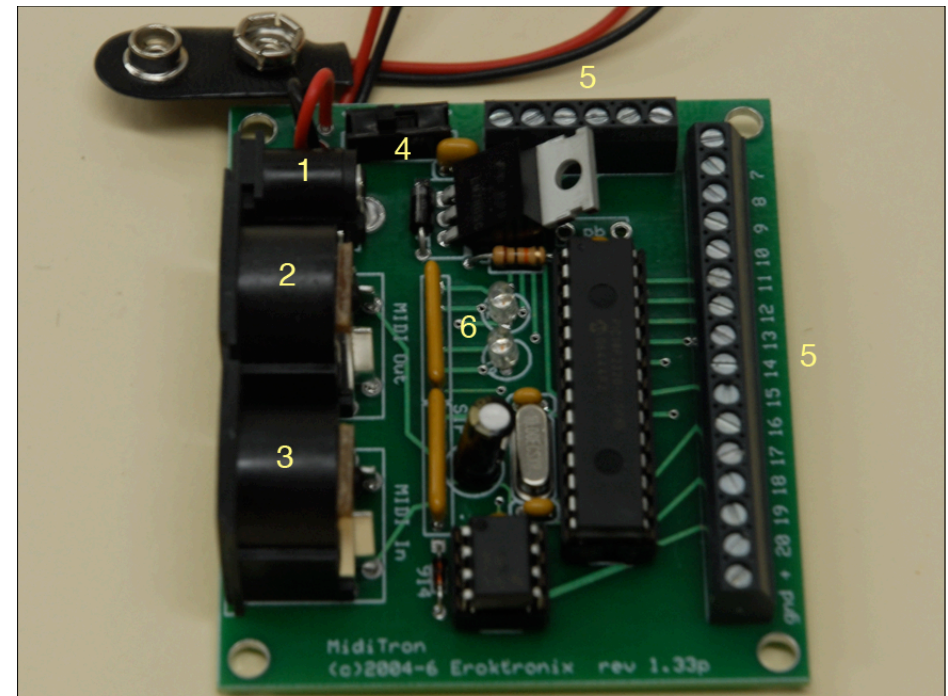


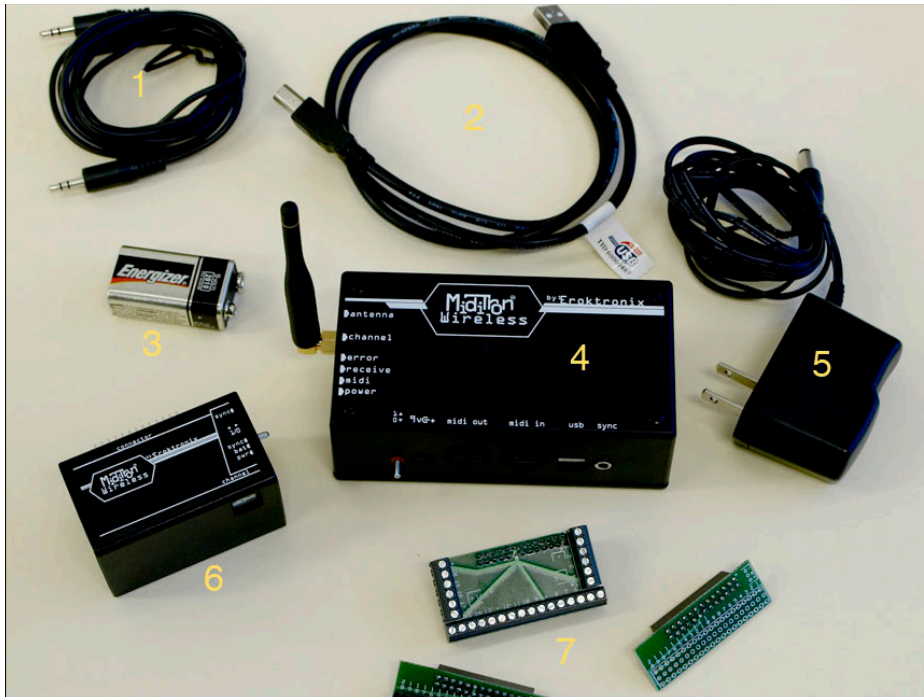
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<http://hci.rwth-aachen.de/toolkits>

	MIDI	Serial	USB	BT	Stand-alone
Win/Mac/ Linux	iCubeX \$\$\$ ●		Phidgets \$\$ ● MAKE Con- troller \$\$ ●	Arduino \$ ●	●
Win/Mac					
Win		●	Basic Stamp ● \$\$		●



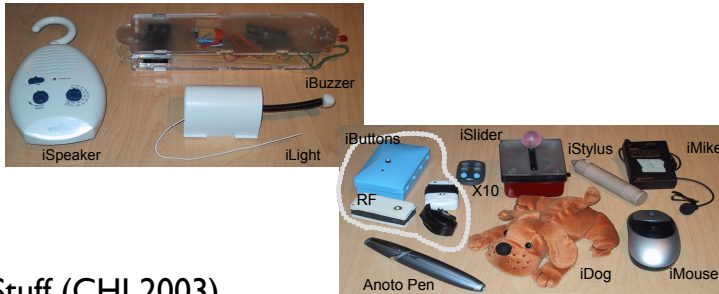
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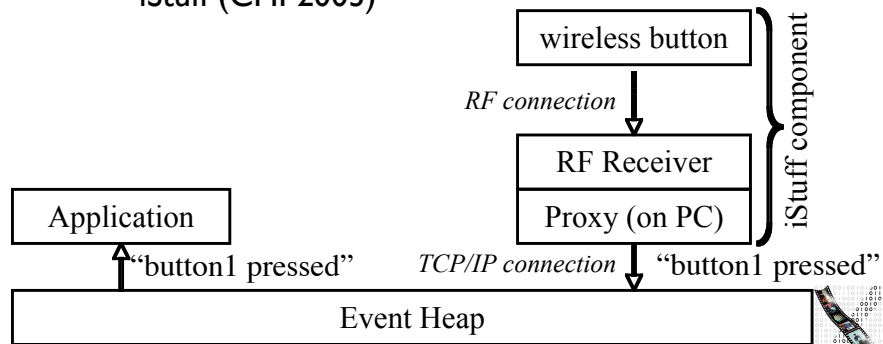
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iStuff (CHI 2003)

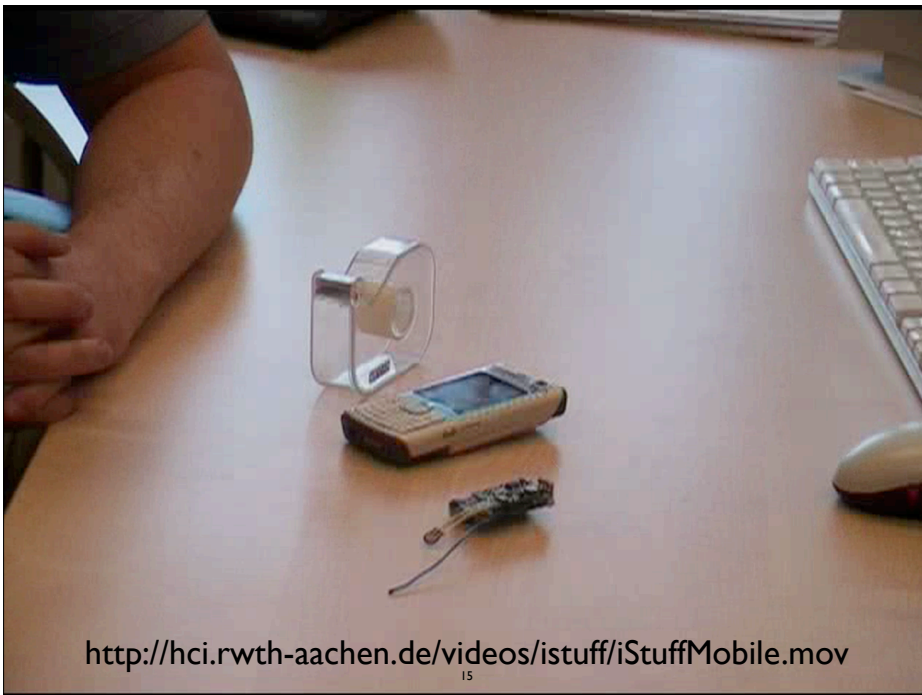


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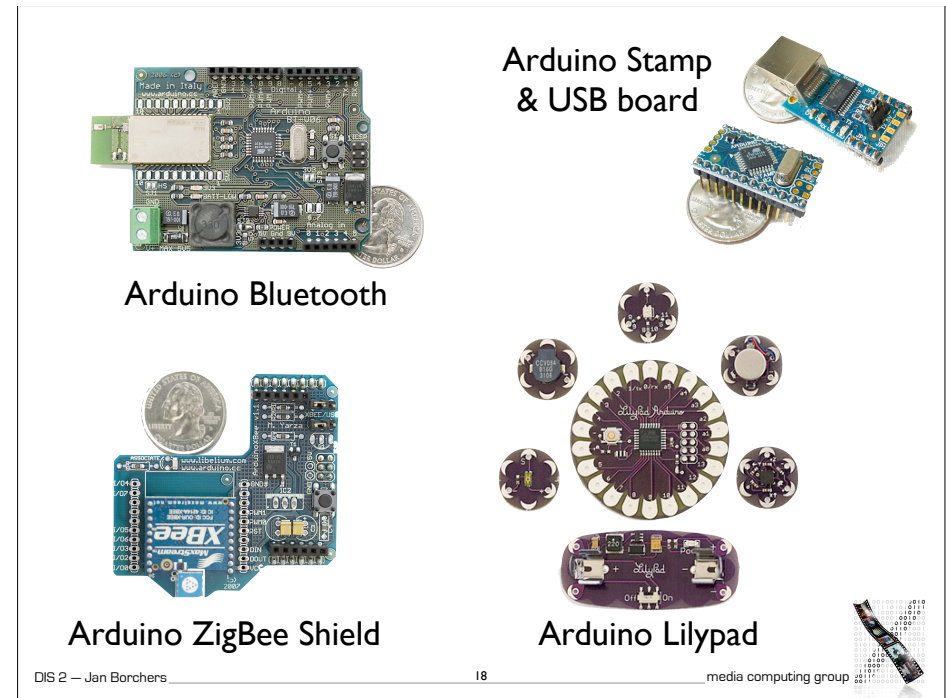
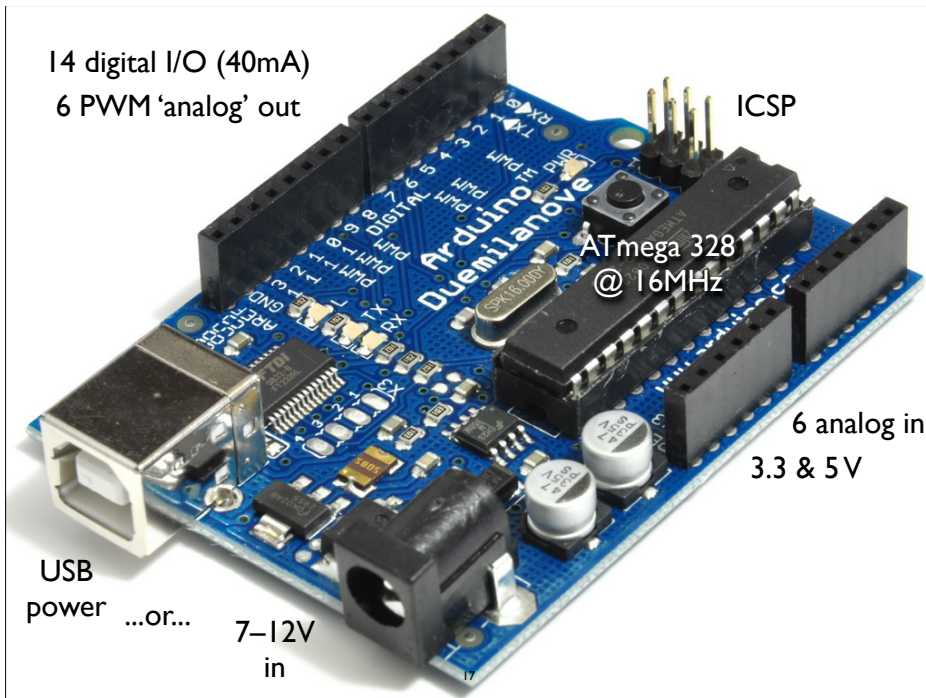
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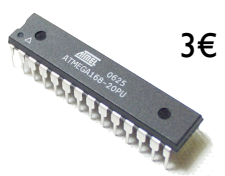
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<http://hci.rwth-aachen.de/videos/istuff/iStuffMobile.mov>

Arduino Crash Course

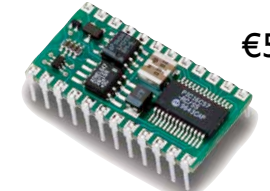




3€

Arduino

```
int ledPin = 13;
void setup() {
  pinMode(ledPin, OUTPUT);
}
void loop() {
  digitalWrite(ledPin, HIGH);
  delay(1000);
  digitalWrite(ledPin, LOW);
  delay(1000);
}
```



€50

Basic Stamp

```
'{$STAMP BS2}
'{$PBASIC 2.5}
OUTPUT 14
DO
  HIGH 14
  PAUSE 1000
  LOW 14
  PAUSE 1000
LOOP
```

Arduino Language

- C with some C++ constructs
- Similar to Processing (for visual programming)
- Links against AVR-libc (open-source gcc library for Atmel μ Controllers)
- All programs have `setup()` and `loop()`
- Of note: digital & analog I/O, pulse and shift output, timers, interrupts, serial communication, port manipulation, flash memory access

Max/MSP

Flash

Processing

DIS 2 — Jan Borchers 21 media computing group

3-axis accelerometer (20€)

IR distance sensor (13€)

Hall effect sensor (2€)

Sonar sensor (30€)

Photocell (1€)

Tilt ball switch (2€)

DIS 2 — Jan Borchers 22 media computing group

Example from our group: Wearable Snowboard Assistant

Sensor interface (Arduino BT)

Mobile phone

Digital compass

DIS 2 — Jan Borchers 23 media computing group

run5-julie.mov

Compass

Upper body Diff: -37 Lower body

6 8

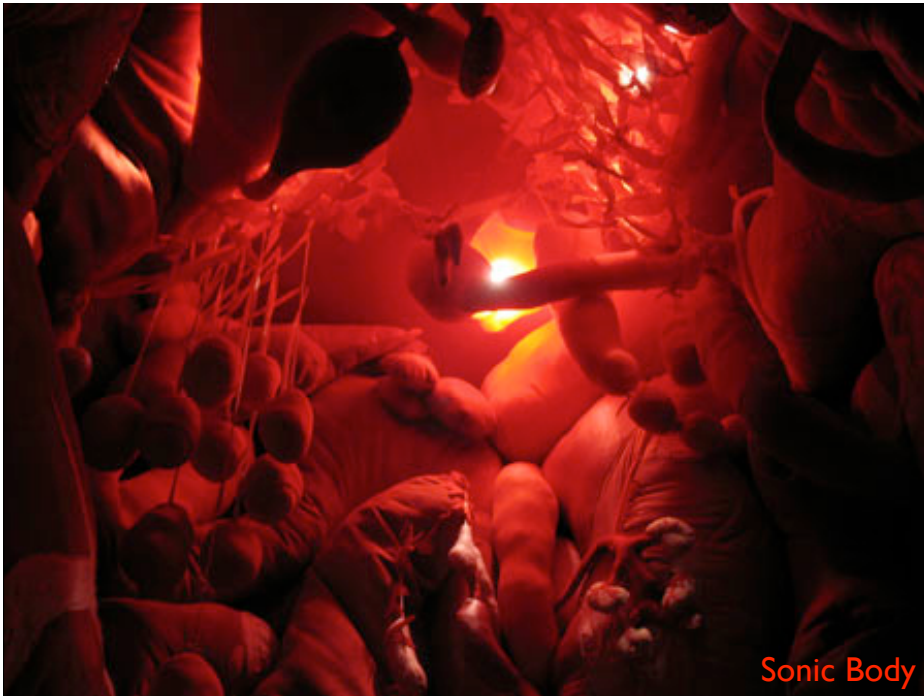
Time: 24.57 sec (24569 ms)

Video

24.28 s

Sync Video with Sensors

DIS 2 — Jan Borchers 24 media computing group



Arduino and You

1. Buy 30€ Arduino Duemilanove board, download and install free development IDE & USB driver (all via www.arduino.cc)
2. Plug in board using a USB cable, launch IDE, select menu “Tools:Serial Port:/dev/tty/usbserial...”, select “File:Sketchbook:Examples:Digital:Blink”, then select “File:Upload”
3. There is no step 3



If it doesn't work

- Select “Arduino Duemilanove” in the “Tools:Board” menu
- Windows users, use “run.bat” to launch IDE instead of executable
- Get latest USB driver from <http://www.ftdichip.com/Drivers/VCP.htm>



Summary

- The case for physical prototyping toolkits
- Dumb interfaces, μ Controllers, middleware, IDEs
- Arduino: modern, open-source, cross-platform, cheap



More Info

- <http://hci.rwth-aachen.de/toolkits>
- <http://arduino.cc>
- <http://www.ladyada.net/learn/arduino/>

