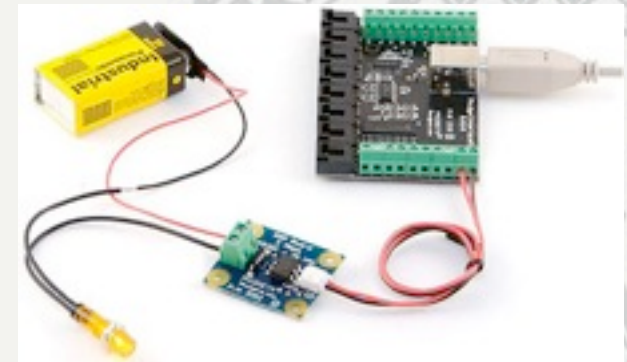


LFE Medieninformatik • Thomas Bauer

# Prototyping in Physical Computing – Sketching in Hardware

Medieninformatik Hauptseminar  
Wintersemester 2009/2010  
„Prototyping“





## Outline

1. Hardware Prototyping: An Introduction
2. Available Toolkits: My Seven Picks
3. Classification: High Level vs. Low Level
4. Project Examples
5. Conclusion and Outlook

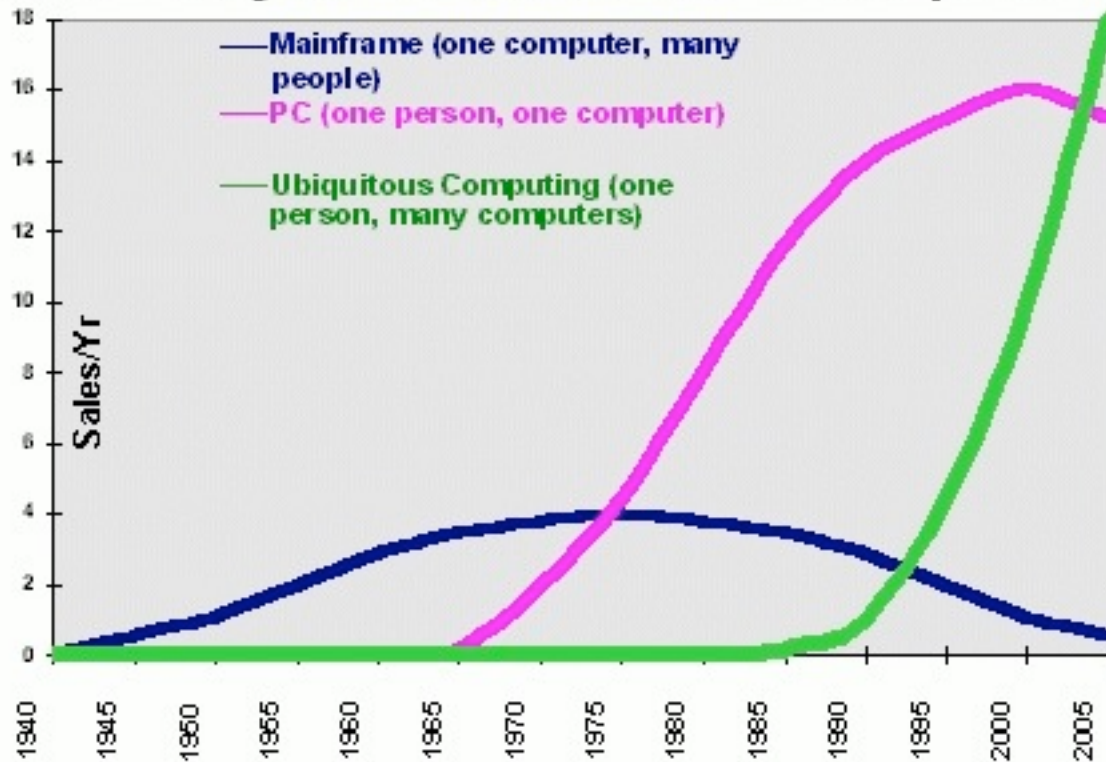
# 1. Introduction

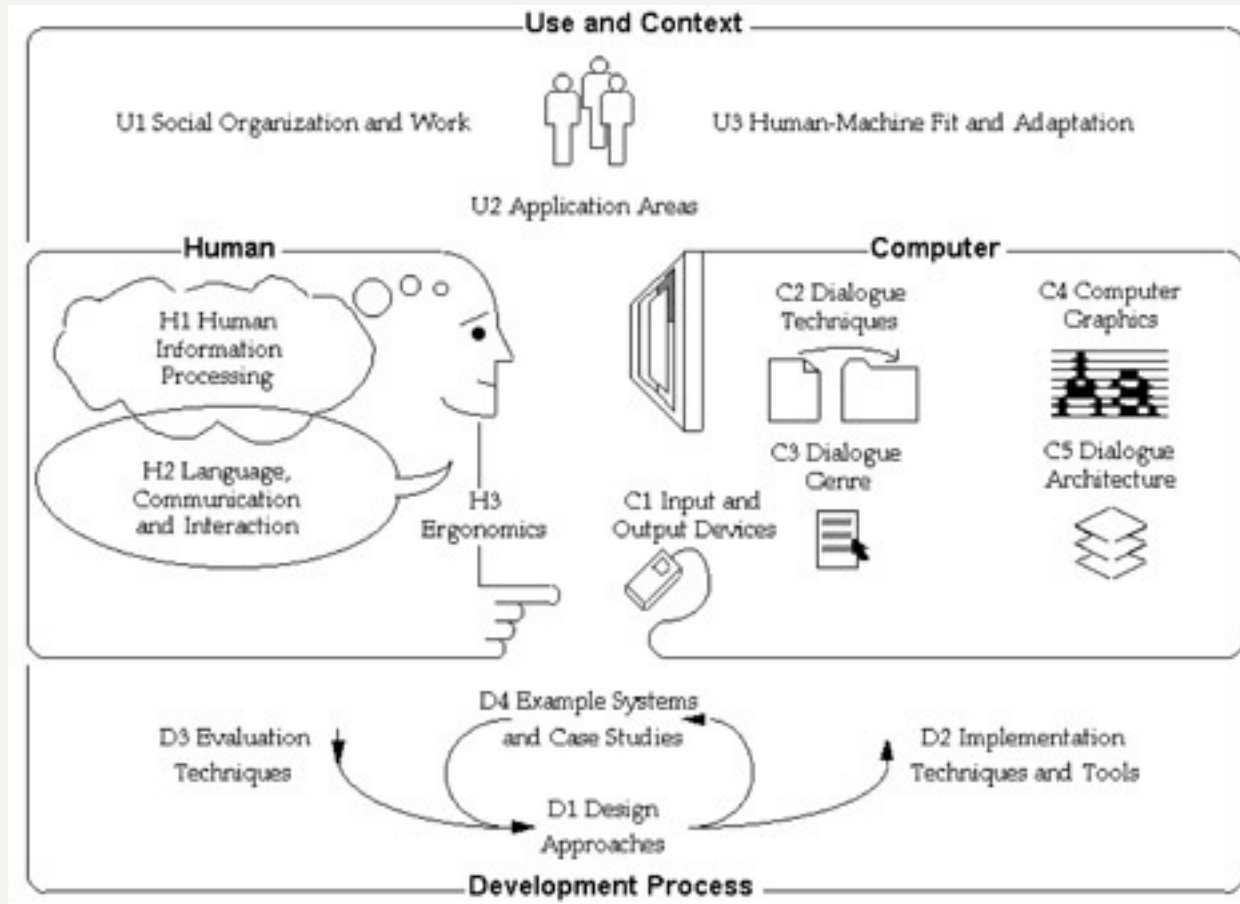






## The Major Trends in Computing











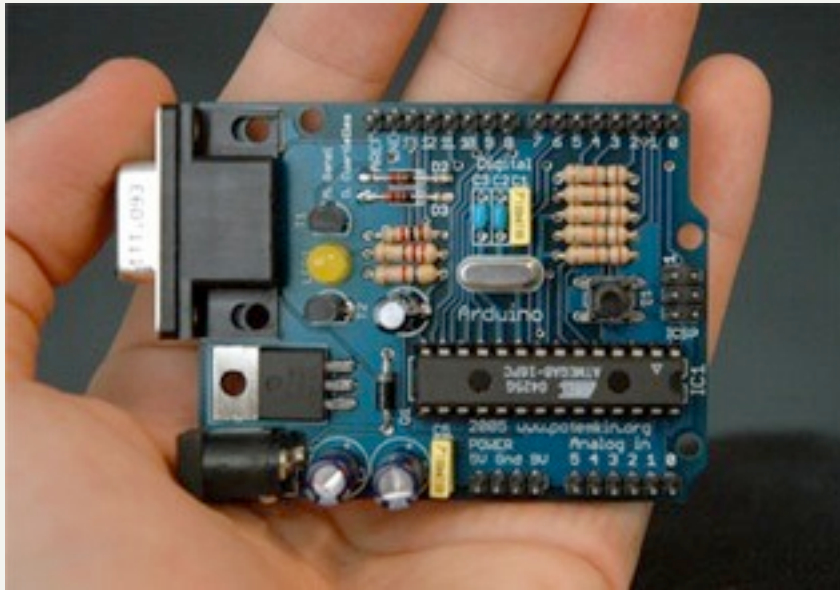
## 2. Hardware Toolkits

### Seven Picks:

- Arduino
- BASIC Stamps
- littleBits
- Electronic Brick
- Phidgets
- LEGO Mindstorms
- The BUG

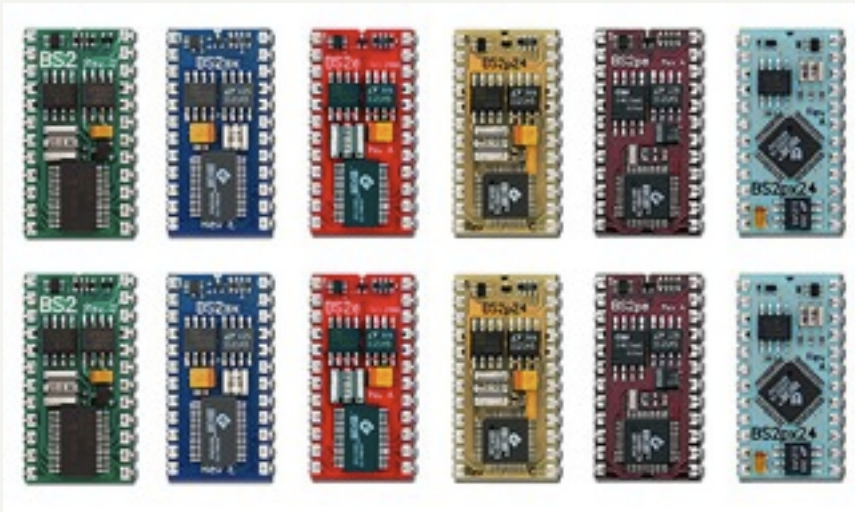


# Arduino



- Minicomputer
- Many different versions
- Open Hardware
- Open Software
- Assembler programmable
- C / C++ programmable

# BASIC Stamps



- Tiny computer modules
- Programmable in BASIC
- I/O slots for communication
- Socket Connections to Flash, Max/MSP
- Various different manufacturers



# littleBits



- Preassembled components
- Connected via magnets
- 4 groups: Power supply, Wire bits, Input & Output bits
- Open Source
- Still to be fully released

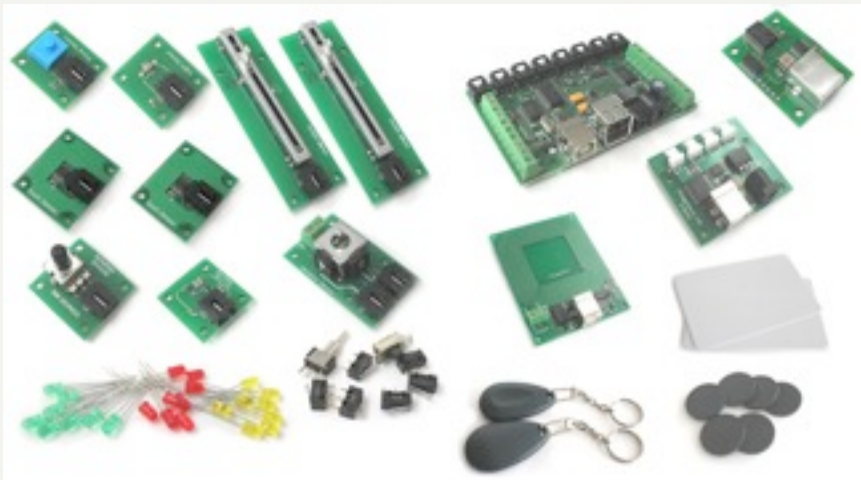
# Electronic Bricks



- Extensive framework of low-level modules
- Central MCU unit
- Connected through 3 or 8 wire bus cables
- Can be used with Arduino boards
- Assembler, C/C++



# Phidgets



- Research background, now commercially available
- Extensive framework
- Plug and Play modules
- C, COM, Java, .NET, Flash
- Connection to host computer necessary

# LEGO Mindstorms



- Children's toys
- Offers all necessities a hardware toolkit asks for
- Various in- and output modules
- Programmable via graphical interface
- USB / Bluetooth connectors





# The BUG



- Modular widget tool
- Base module, attachable in- and output elements
- Programmable in Java
- Accessable via USB, Bluetooth, Ethernet
- Modules like touch-display, camera, GPS Locator

### 3. Classification: High Level vs. Low Level

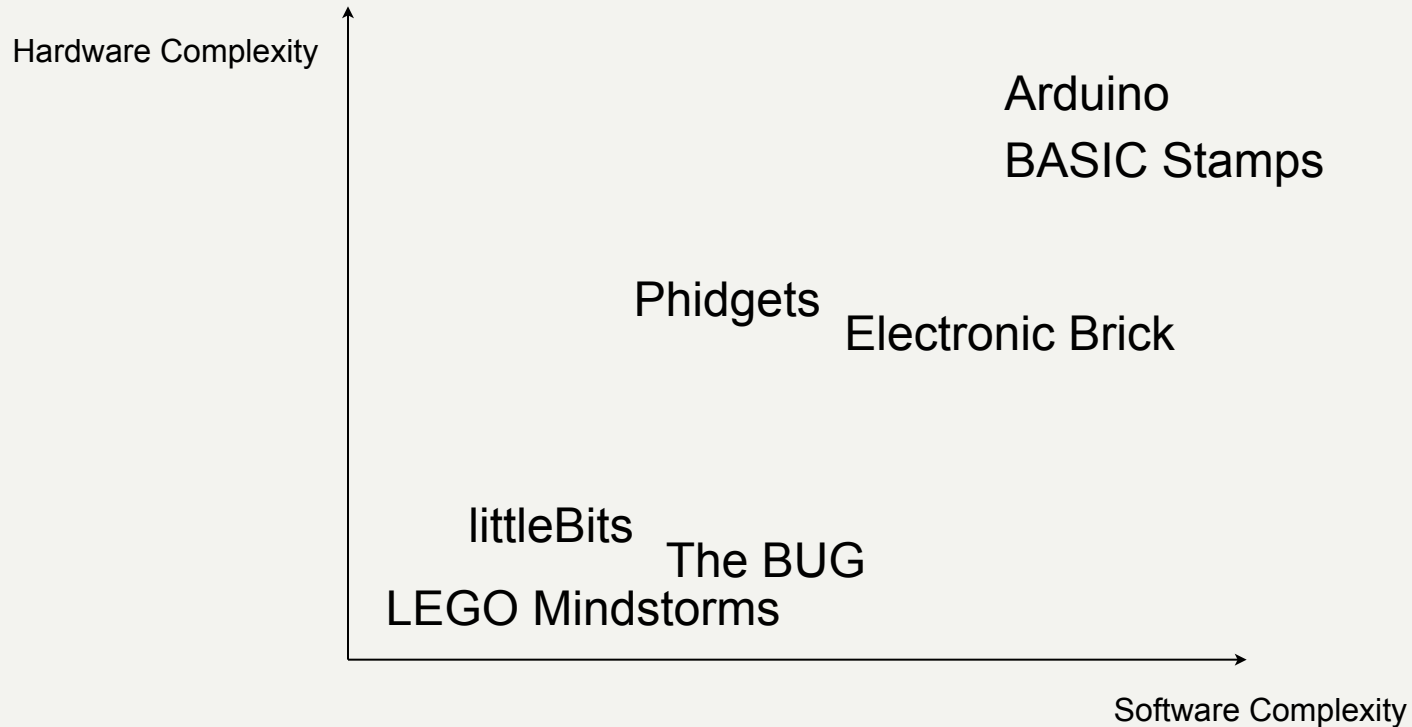


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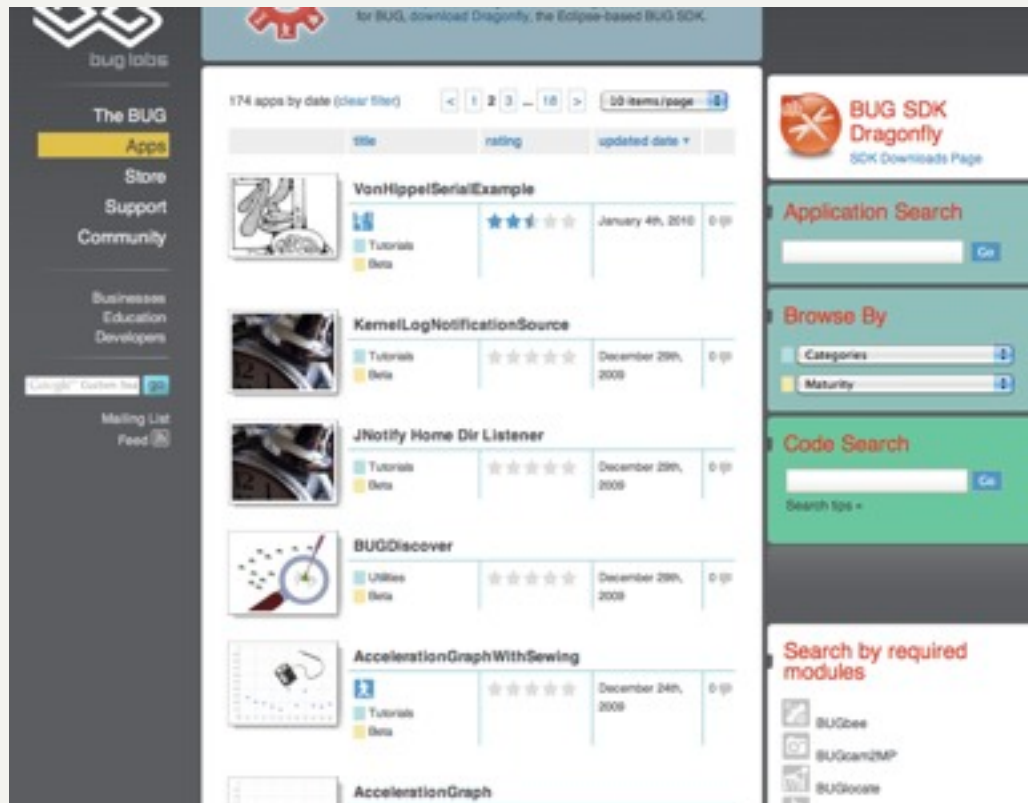










## Classification and Examples



## High Level: The BUG



The screenshot displays the BUG website interface. The main content area shows a list of 174 applications, sorted by date. The list includes the following entries:

title	rating	updated date	0 ip
 VonHippelSerialExample	★★★★★	January 4th, 2010	0 ip
 KernelLogNotificationSource	★★★★★	December 29th, 2009	0 ip
 JNotify Home Dir Listener	★★★★★	December 29th, 2009	0 ip
 BUGDiscover	★★★★★	December 29th, 2009	0 ip
 AccelerationGraphWithSewing	★★★★★	December 24th, 2009	0 ip
 AccelerationGraph			

The right sidebar contains several search and navigation options:

- BUG SDK Dragonfly** SDK Downloads Page
- Application Search** with a search input field and a 'Go' button.
- Browse By** with dropdown menus for 'Categories' and 'Maturity'.
- Code Search** with a search input field and a 'Go' button.
- Search by required modules** with a list of modules: BUGbee, BUGcam2MP, and BUGloose.

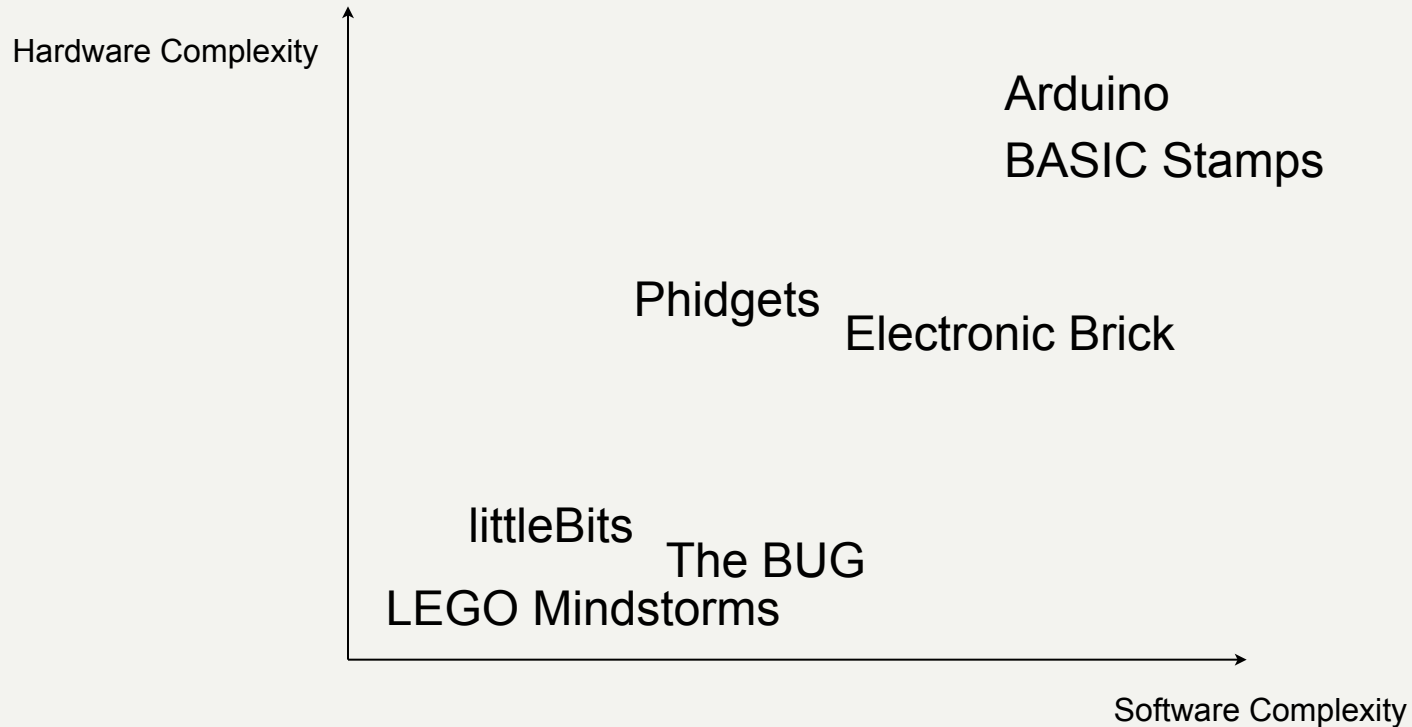


## High Level: The BUG

Bug Labs buildable  
electronics at CES 2009



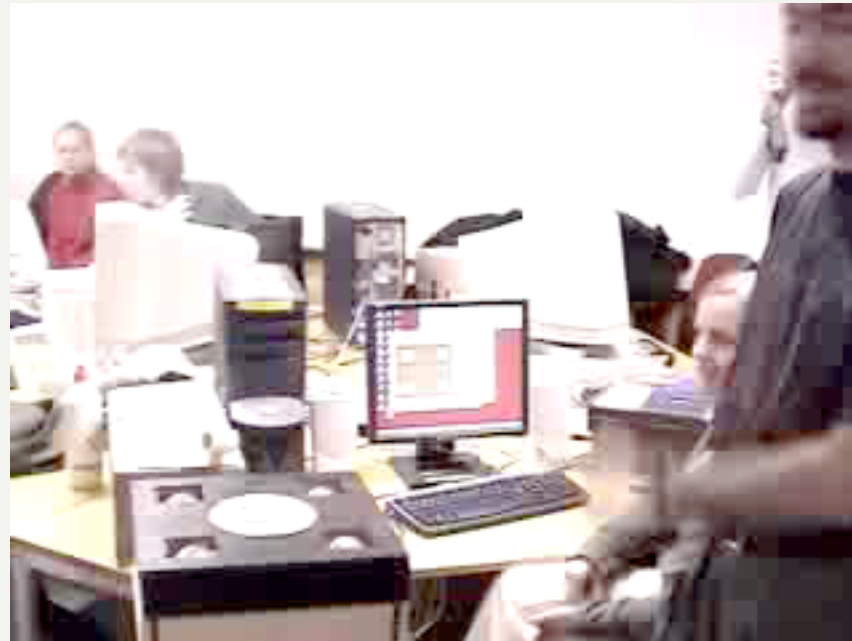
## Classification and Examples

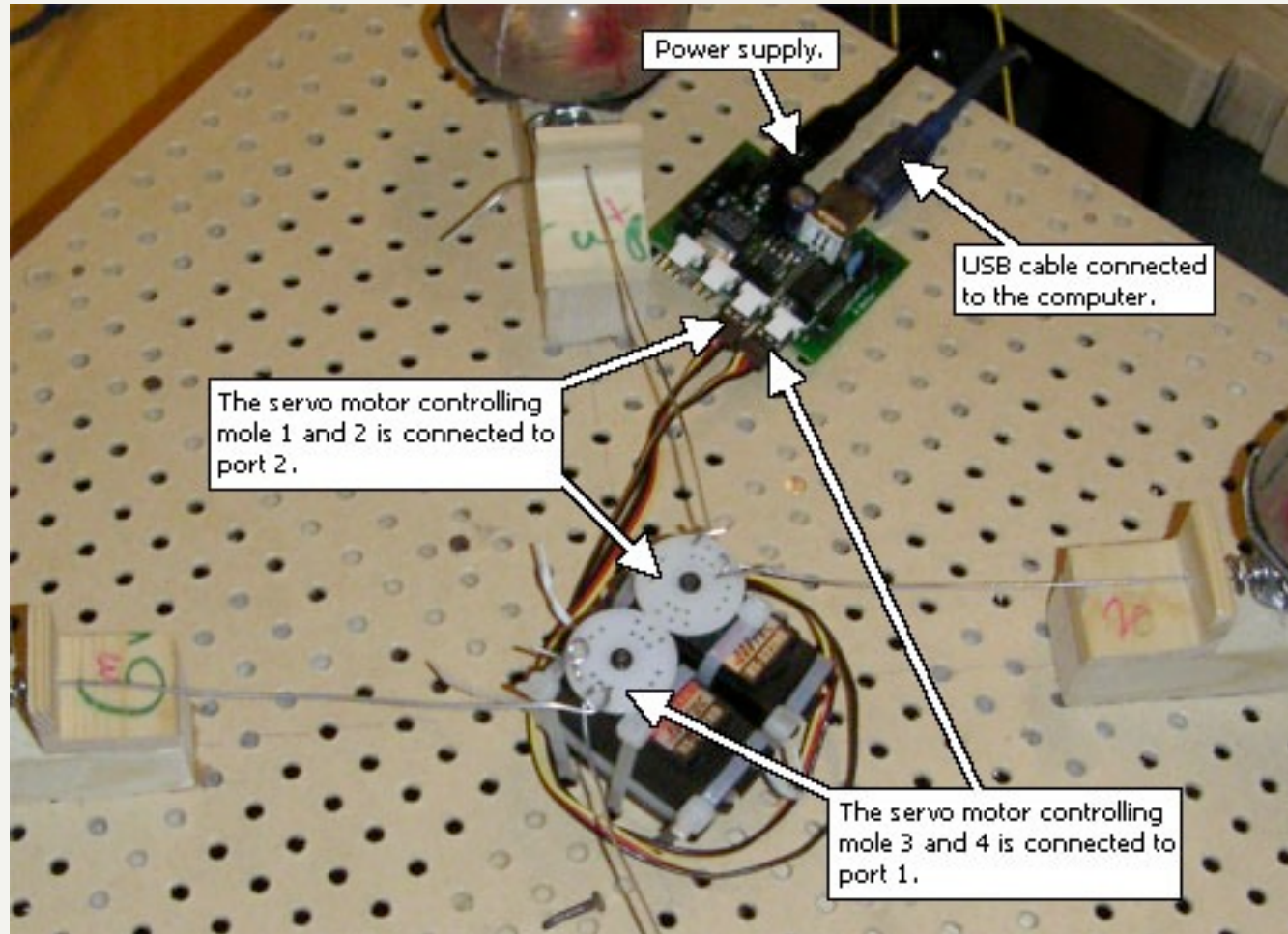




## Mid Level: Phidgets

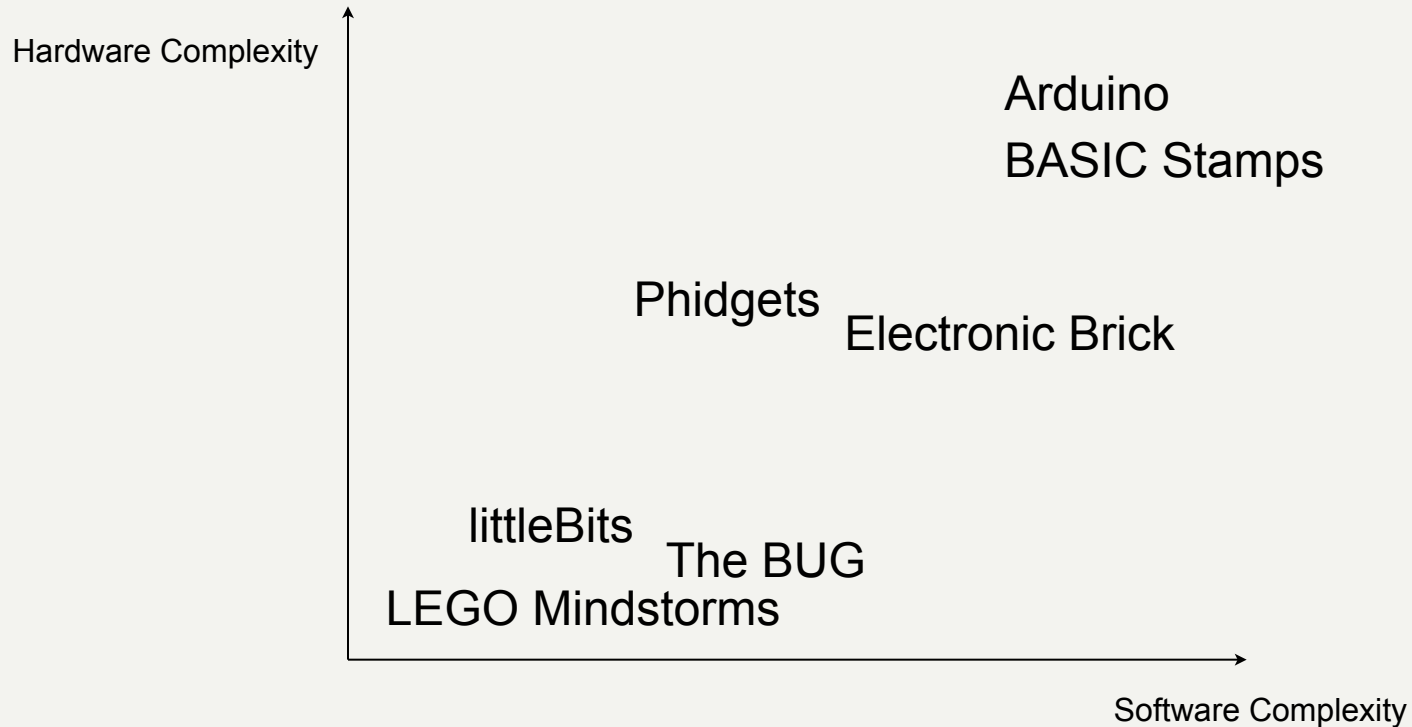




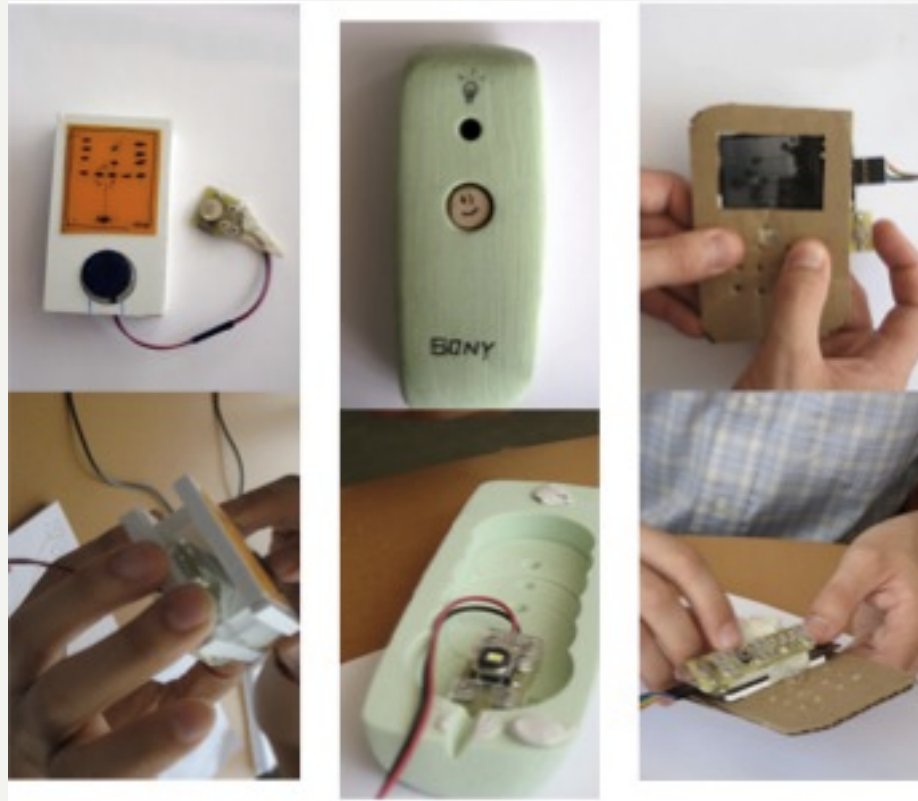




## Classification and Examples



## Low Level: littleBits





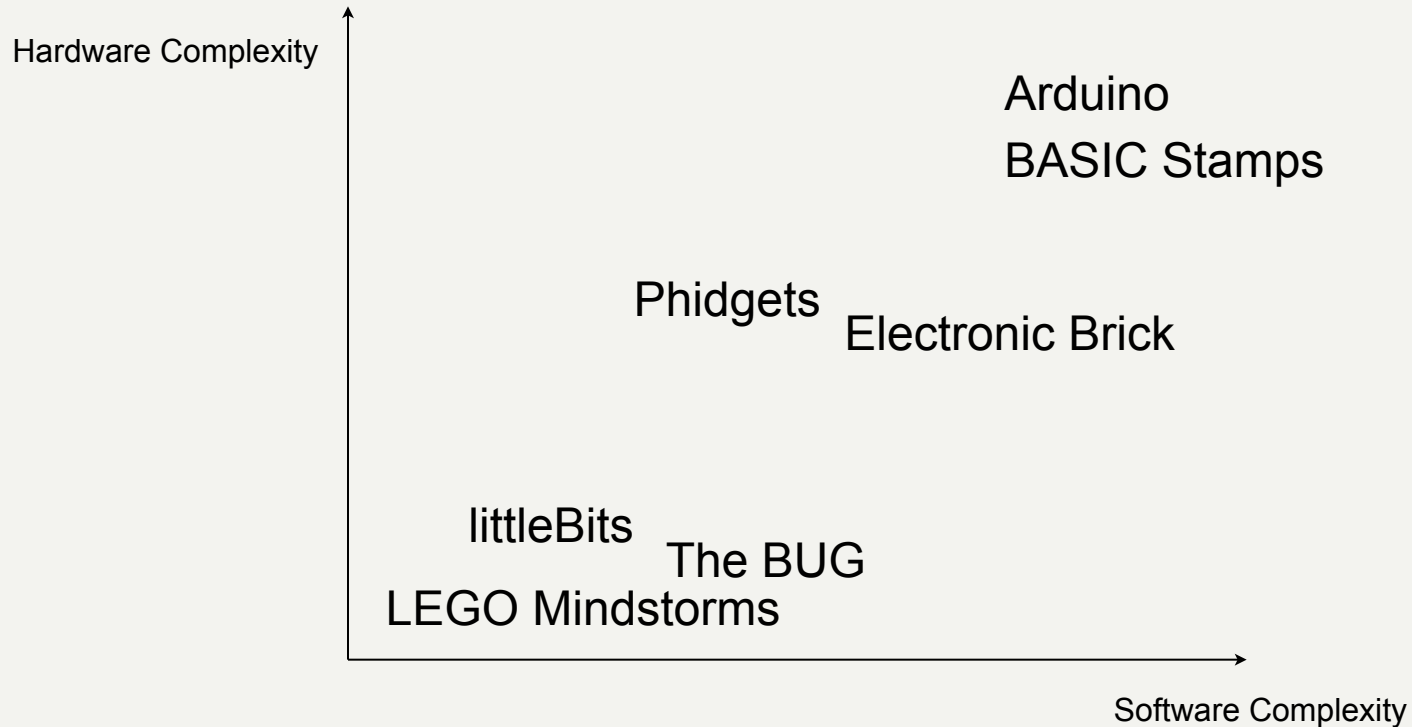
## Low Level: littleBits

<http://vimeo.com/1391017>





## Classification and Examples





## Conclusion and Outlook

- Huge Variety
- Online Communities
- Software Skills become focus
- No borders

A more empirical study would be very interesting to get a more powerful comparison.



**Thank you for listening.**

**Questions?**