

Sketching with Hardware

01: Introduction & Overview

What are we doing here?

Combine the features of
physical objects and actions with
digital data and algorithms

Tangible User Interfaces

A **tangible user interface** (TUI) is a user interface in which a person interacts with digital information through the physical environment.

- Wikipedia

What is a TUI?

- UI that can be manipulated physically
- State of physical artifact and digital data are linked
- Real world information (like position) as parameters

Hirosi Ishii (MIT) on TUIs

Physical World

Digital World



A **graphical user interface** only lets us see information and interact with it indirectly, as if we were looking through the surface of the water to interact with the forms below.

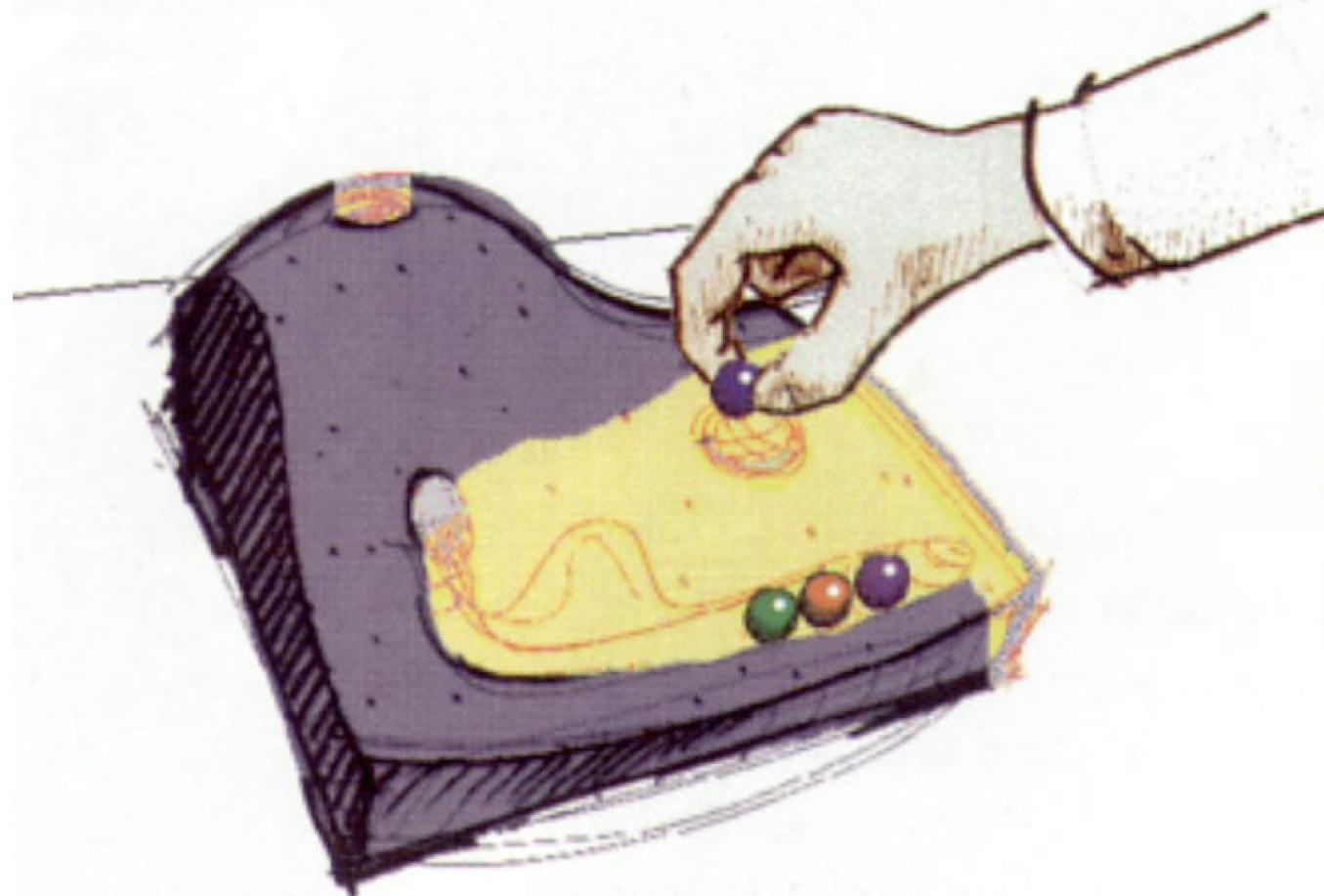


A **tangible user interface** is like an iceberg: there is a portion of the digital that emerges beyond the surface of the water - into the physical realm - so that we may interact directly with it.



Radical Atoms describes our vision for the future of interaction, in which all digital information has physical manifestation so that we can interact directly with it - as if the iceberg had risen from the depths to reveal its sunken mass.

Marble Answering Machine (Bishop, 1992)



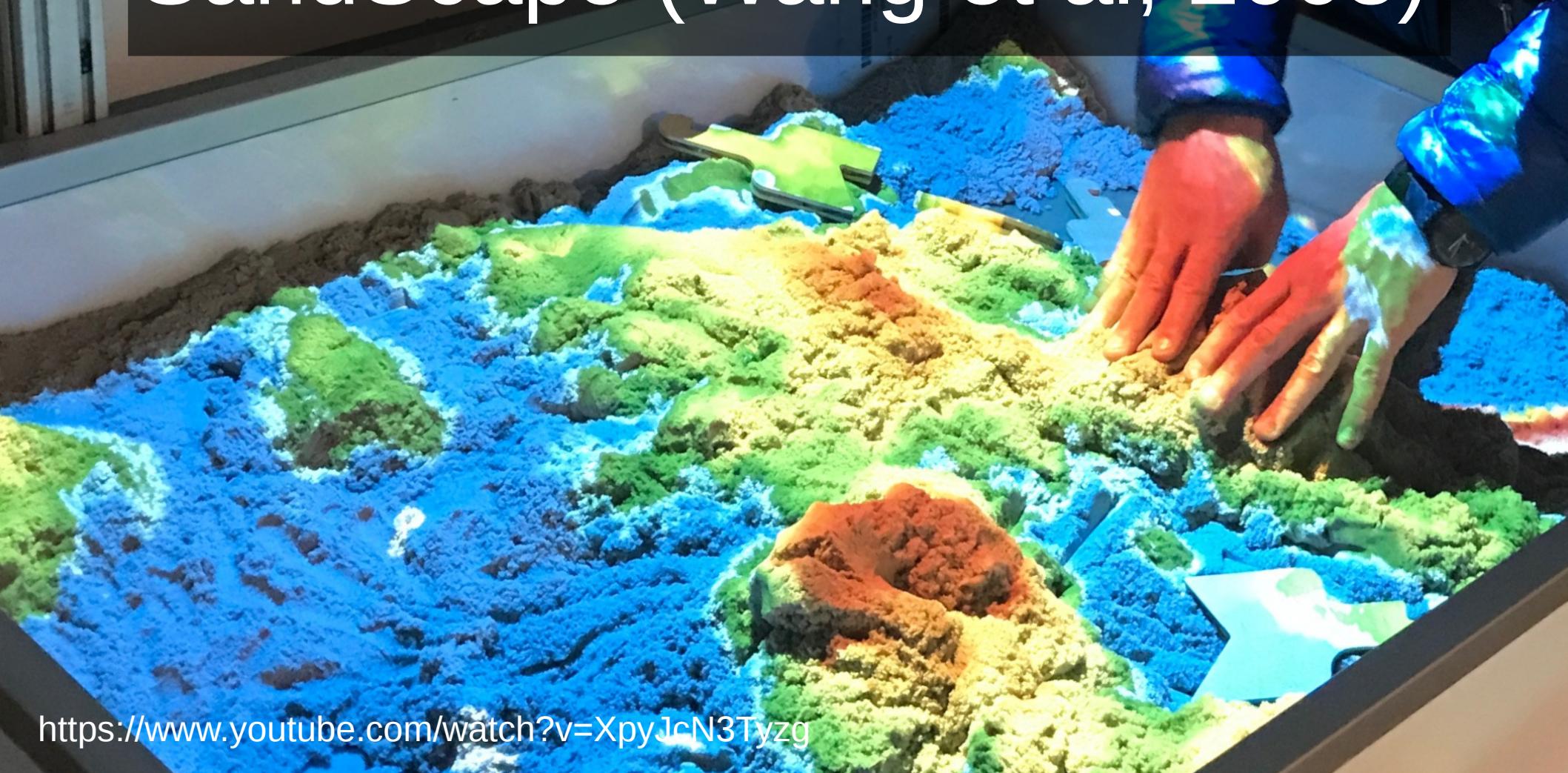
<https://www.youtube.com/watch?v=RgVbXV1krgU>

Reactable (Jordà et al, 2010)



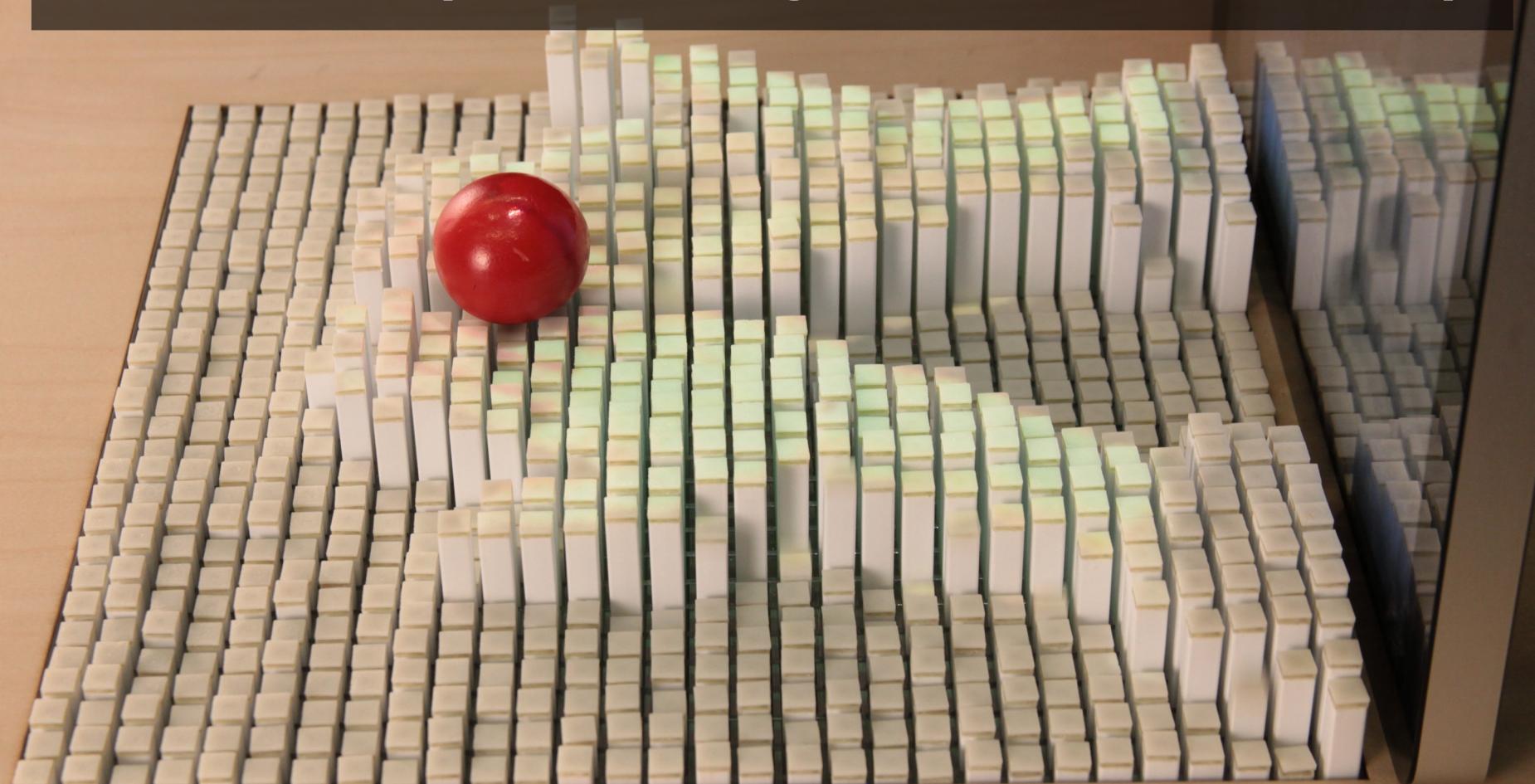
<https://www.youtube.com/watch?v=ItjQJz2uz2E>

SandScape (Wang et al, 2003)



<https://www.youtube.com/watch?v=XpyJcN3Tyzg>

InForm (Leithinger et al, 2013)



What are we doing here?

- Building interactive, tangible, intuitive **experiences**
- Basics of electronics
- Basics of microcontrollers
- Designing physical user interfaces

Timetable

Monday	Tuesday	Wednesday	Thursday
Introduction Electronics Soldering	Arduino Programming	Serial Protocols Sensors & Actors	Interaction Design Brainstorming Topic!
Friday to Thursday: Final Project		Friday	until xx.yy.
Implementation Testing Documentation Thursday: Presentation		Bugfixing Polishing Cleaning up ;)	Final Assignment: Project Video Documentation Finished Prototype

Day 1: Monday, xx.yy.

09:00 Introduction

10:00 Electronics 01, Multimeter

12:00 *Lunch Break*

13:00 Soldering

15:00 Electronics 02

17:00 End

Who are you?

- What's your name?
- Why did you apply for this course?
- What's your experience with electronics?

After this course, you can...

...repair a broken bicycle light

...build a pet robot

...build an alarm clock that wakes you up with an electrical shock

...build a custom game controller

...estimate the cost and workload of developing electronic gadgets

...write a thesis with an interesting topic

Choice of Partners

- Random!
- Only for today
- New partners each day (Mon, Tue, Wed)

Task: A machine the world needs

- Invent machines that should exist
- Example: “*A device that automatically locks the door when I want to concentrate.*”
- **Do not** think about the technical implementation!
- Time: 10 minutes

Tips and Rules for the Course

- Take notes!
- Take care of material and other participants
- Work in groups
- Be present
- Ask questions
- Continuously document your progress

Safety Instructions

- Mind the lab rules
- Fire extinguisher and first aid kit
- No open drinks or food at the workplace
- Ask before you use tools
- Ask before you power a circuit
- No experiments with AC power
- Keep your workplace tidy
- In case of severe or repeated violation: **Exclusion from the course!**

What's in the Box?

Cutter



Solder



Soldering Tip Cleaner



Soldering Flux



Soldering Kit

Soldering Iron Stand



Soldering Iron



Desoldering Pump

Third Hand

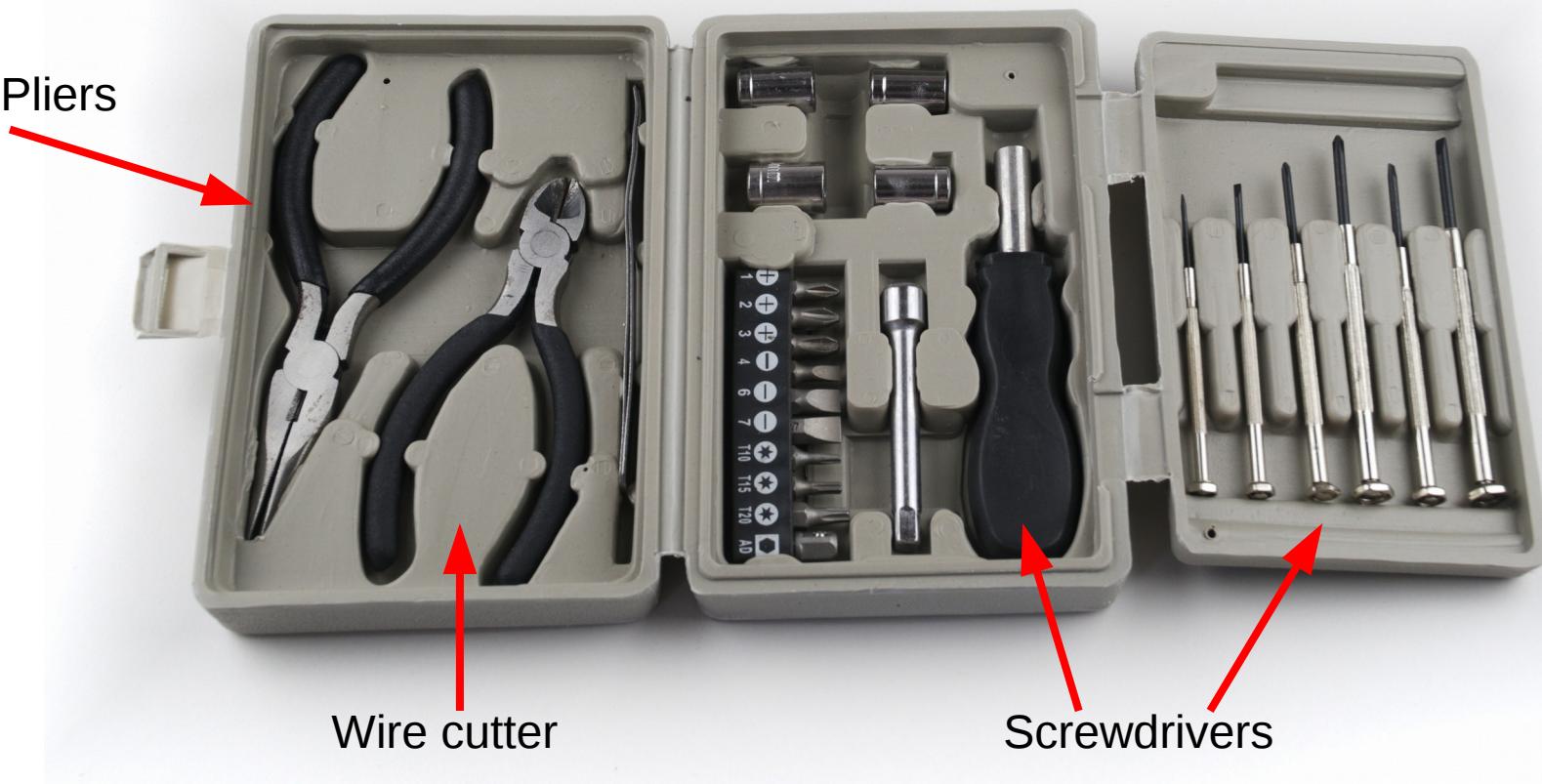


Safety Goggles



Toolbox

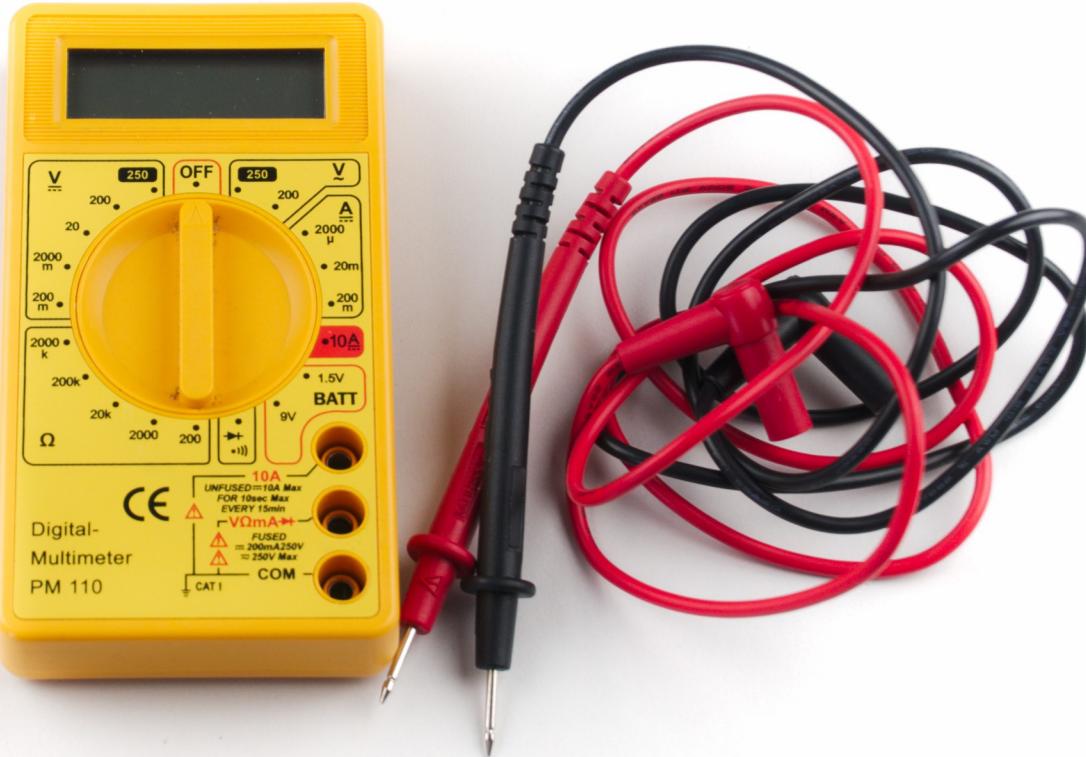
Nose Pliers



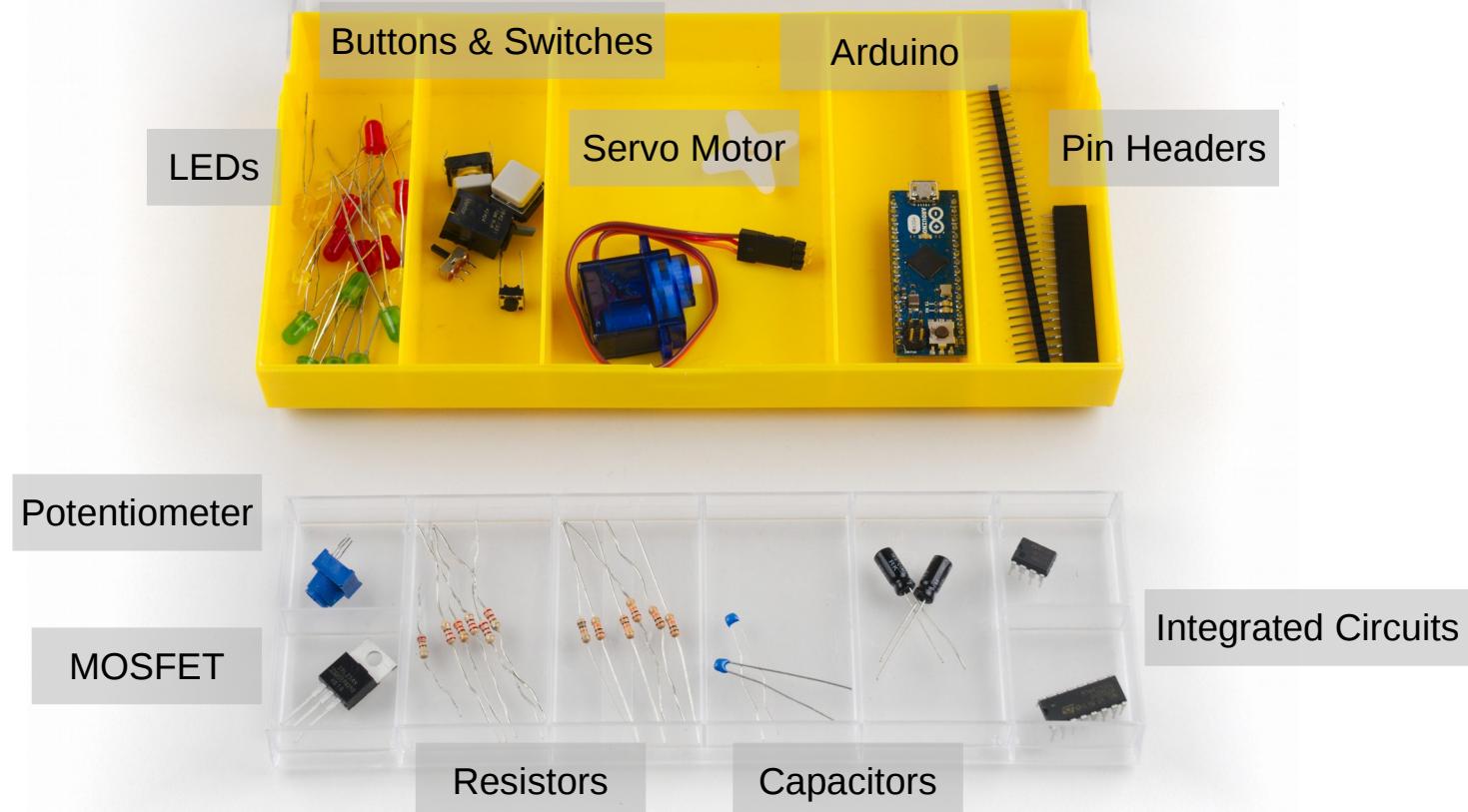
Wire cutter

Screwdrivers

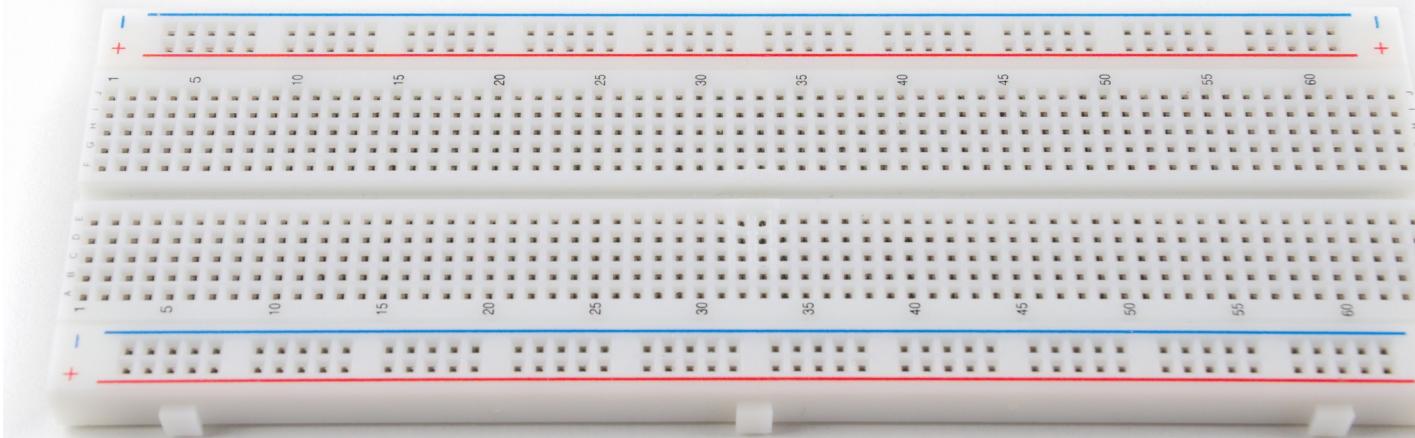
Multimeter



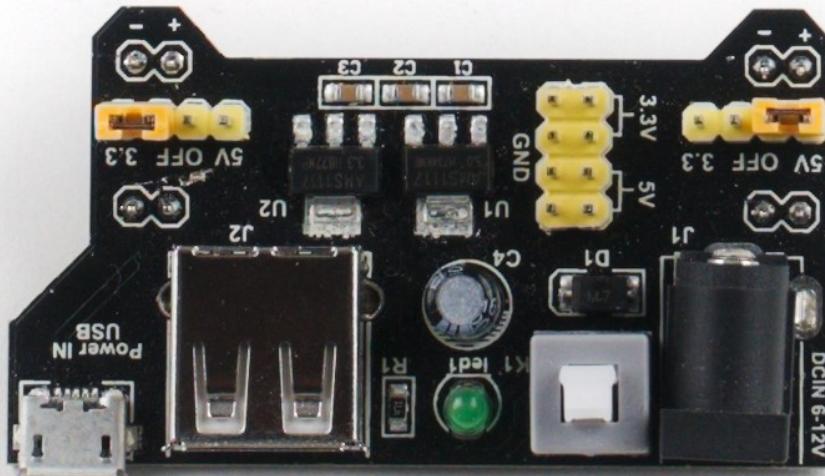
Electronic Components



Breadboard



Breadboard Power Supply



Power Supply



USB Hub



USB Cable



Jumper Wires



Wire



Short break (10 min)...