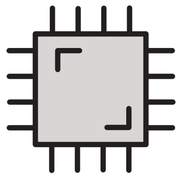
An Introduction to Physical Computing

Lesson Plan

Level 7: Taught MSc in CS Masters

Timothy Neate



Context

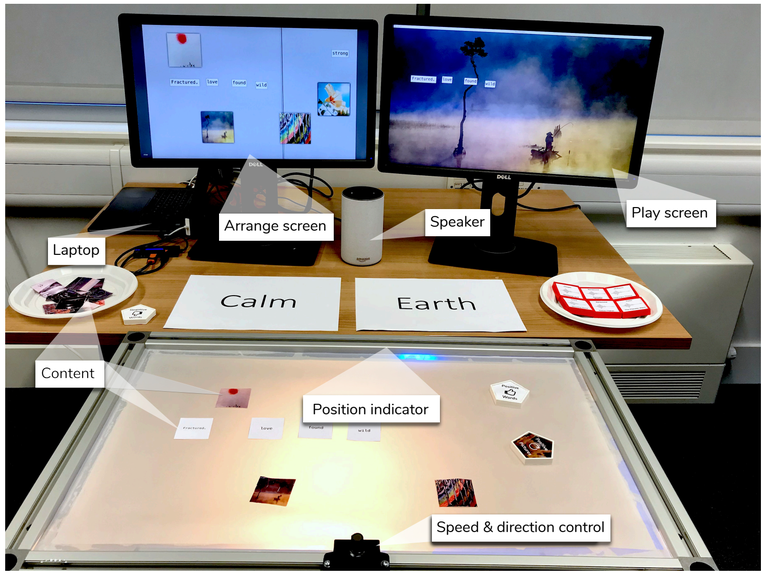
- I am a **post-doctoral researcher** in computer science**.** One of my research interests is exploring alternative modes of interaction with computers

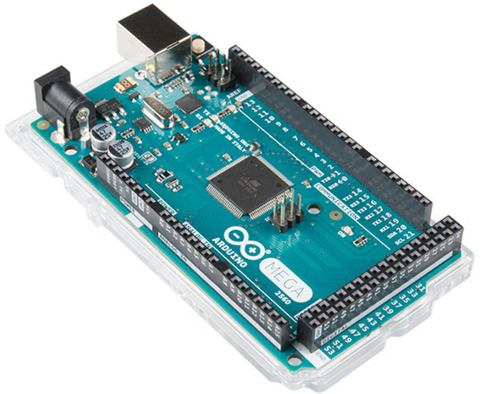
- I want to our **students** think critically about what computers *can be* (i.e., as more than just screens we poke)

- Over the past 5-10 years simple, cheap **microcontrollers** have become available to all

- I want to teach the **basics** of **input** (sensors) and **output** (actuators) and encourage a reflection on designing for non-standard computing contexts

- This is loosely based on a class I gave (with others) last year to **MSc students**. This would be the first lecture of a module which extends this to include a more conceptual underpinning.





Lecture Overview

- **Duration:** 3 hours

- **Number of students:** 40-50

- **Lesson Aim:** Students are expected to understand the core principles of physical computing and develop simple hardware prototypes for input and output with a microcontroller.

- **Previous sessions:** This is the introductory module. It is assumed that students have experience designing or developing digital platforms.

- **Links to future sessions and assessment:** Future sessions, and the assessment for this module, build off of the core concepts and skills learned in this session: tangible computing and microcontroller prototyping.

- **Resources:** 10 Arduino starter kits (4/5 per group). Will be run in on the tables shown right.

Specific learning outcomes

Students will:

1. **Recall** the general definitions of physical and tangible computing systems, and contrast them to a range of technology
2. **Demonstrate** the ability to choose the appropriate sensor or actuator for a given input/output modality.
3. **Create** a prototype which demonstrates how digital information affects physical output
4. **Create** a prototype which demonstrates how physical action affects digital information
5. **Reflect** on the created prototypes in the context of Hiroshii Ishii's Tangible Bits vision

Approximate Time Plan

Time	Activity (Merged for brevity)
Before class	Students will read the "Radical Atoms" article to become familiar with tangible user interfaces and their context in the wider computing literature. They will research physical computing user interfaces further and create a post on Moodle briefly describing one.
0:00 - 0:20	In an open discussion, the students will discuss some of the technologies posted on Moodle.
0:20 - 0:50	The lecturer will give an overview of the different modes of input and output a physical computing system might utilise. Students will provide input on examples of each.
00:50 : 01:00	Break.
1:00 - 2:40	Over the next hour and a half (10 minute break in the middle with 'check-in'), the students will make two prototypes using Arduino, sensors and actuators. Lecturer and teaching assistant will circulate, help with specific issues and give feedback.
2:40 - 2:50	To conclude, students will discuss in their groups and reflect on the fictional material-based computer "Perfect Red" from the paper they read before the session and discuss the steps between what has been made in today's session and this 'theoretical' vision. Students will upload their notes to Moodle at the end of this and discuss.

Learning Theory Rationale

- I aim to keep most of the **theoretical learning** of this lecture to **pre-class activity** and associated discussion to keep things as **active** as possible during the **session**

- **Theoretical learning** can then be **reiterated** in the lecture-based part - to offer different learning styles and to contextualise the practical work which follows

- In the **practical** aspects of the class, I aim to instil the things students have learned as they do the practical exercise through ***experimental learning***

- In the **reflective aspects** of this class at the end and in the post-class exercise, I aim to get the students to reflect on the practical exercise they have just complete, in the broader more conceptual literature

Thanks