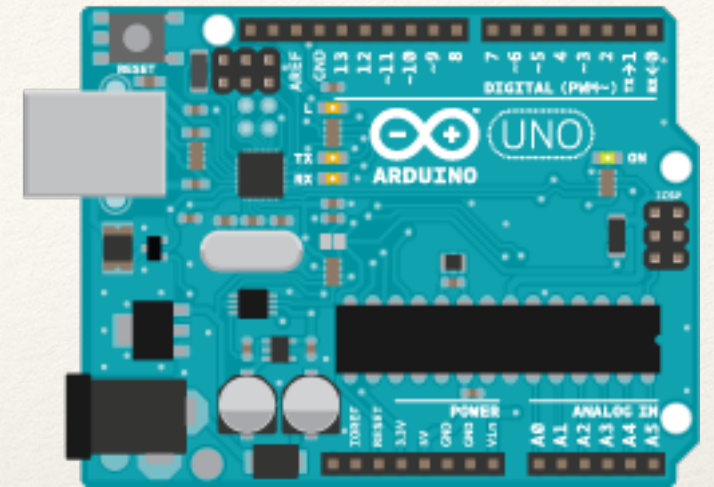*Dr. Sarah Abraham*

University of Texas at Austin

Computer Science Department

Electronics

Elements of Graphics

CS324e

Spring 2019

Beyond "Computers"

Prevalence of Electronics

- We interact with electronics on a daily basis

    - Low cost manufacturing

    - Wide range of specialty (embedded) hardware

- Electronics require programming

    - Worldwide communities of developers

    - Open source libraries

Hardware Perspective

❖ Electrical current moves through material

    ❖ Conductors facilitate the flow of electrons

    ❖ Resistors oppose the flow of electrons

❖ Voltage is the difference in electric potential between two points

❖ Electrical charge over time is current

Hardware Components

❖ Resistors

  ❖ Limits flow of electricity (ohms)

  ❖ Can change resistance based on sliders or sensors

❖ Capacitors

  ❖ Stores electrical charge (farads)

  ❖ Can smooth dips and spikes in current signal

❖ Diodes

  ❖ Allows current to flow in one direction

  ❖ Can block or invert signal

❖ Transistors

  ❖ Acts as electrical switch or amplifier

Sensors

❖ Acquire data from physical world

  ❖ Touch

  ❖ Force

  ❖ Proximity

  ❖ Many more

❖ Signal converted to digital value

❖ Digital value influences hardware's behavior

Circuits and Micro Controllers

❖ Circuits are configurations of hardware components to perform specific tasks

  ❖ Based on the physical properties of electricity

❖ Micro controllers are small, simple computers

  ❖ Allow for programmable control of circuitry

  ❖ Wiring and Arduino use development environment built on Processing

Hardware/Software Layer

❖ Programmable I/O boards are micro controllers that accept a variety of components

❖ Easy to add or remove pieces

❖ Translate Processing-based code into native, embedded language

❖ Code uploaded onto board using Serial library

Serial Library

- ❖ Reads and writes data from external devices

- ❖ Serial port is nine pin I/O port that is emulated through USB

- ❖ Add library to code:

  - ❖ `import processing.serial.*;`

- ❖ `Serial()` constructor takes parent, portName and "baud rate"

Serial Example

```
Serial port;

void setup() {

    //this is program to serialize

    //Serial.list() finds all available serial
ports

    //9600 is default baud rate

    port = new Serial(this, Serial.list()[0],
9600);
}
```

Basic Functions

- `buffer(int)` sets the number of bytes in buffer to serialize

- `read()` reads number between 0 and 255 for next byte in buffer (-1 if no byte)

- `write(src)` writes bytes, ints, chars, bytes[] or Strings to serial port
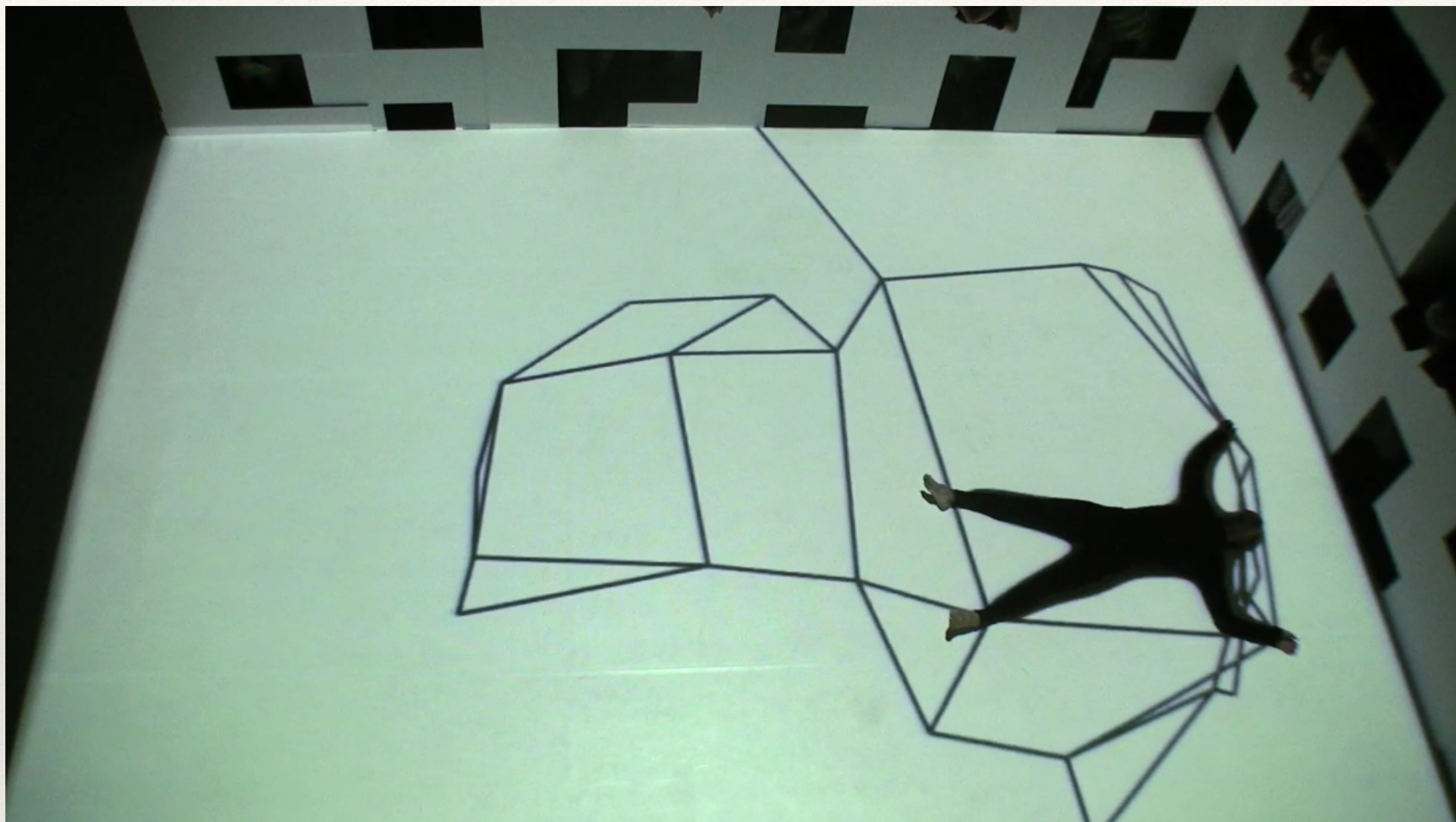
- `stop()` shuts down data communication on port

Processing and Micro Controllers

https://vimeo.com/74377028

http://digitalmedia-bremen.de/en/project/automatic-orchestra/

http://ole.kristensen.name/works/body-navigation/

Quiz Question!

❖ True or false (A or B): A serial port is a connection that can transmit multiple bytes of data in parallel from a computer to a device.

Quiz Answer

❖ False. A serial port must send data between a computer and a device in sequence, one byte at a time — i.e. in serial :).