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Electronics

Elements of Graphics
CS324e
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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
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 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.
False. A serial port must send data between a computer and a device in sequence, one byte at a time — i.e. in serial :).