Tools to Introduce Computer Science

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Why Computer Science?

Ubiquity of the computer and the Internet.

Demand for Computer Scientists and Software Engineers are among the highest, and continue to grow at above average rates.

The Bureau of Labor Statistics consider the job prospects "excellent" (more jobs than job seekers) for the next ten years.

Programming skills are useful in many different kinds of work.

Like math, teaches logical thinking, but more practical.

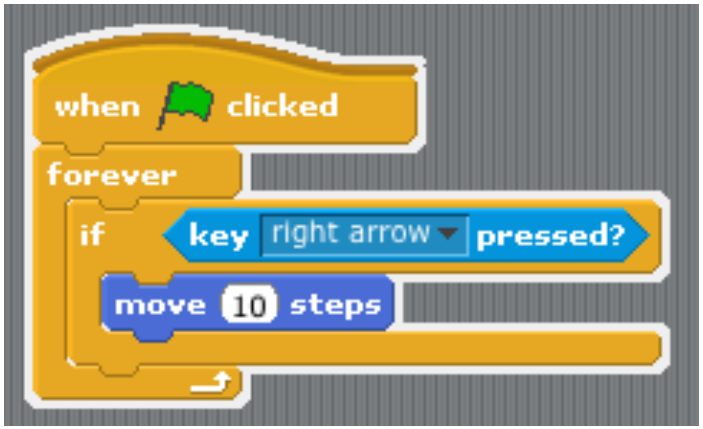
Survey of teaching applications

Dr Java <http://www.drjava.org/>
Processing <http://processing.org>
Greenfoot <http://www.greenfoot.org>
Scratch <http://scratch.mit.edu/>
Alice <http://www.alice.org/>
BlueJ <http://www.bluej.org/>
Arduino <http://www.arduino.cc/>

Two Models

Visual Programming

- Drag and Drop
- Not how industry works



Text Programming

- Copy and Paste
- Standard in industry

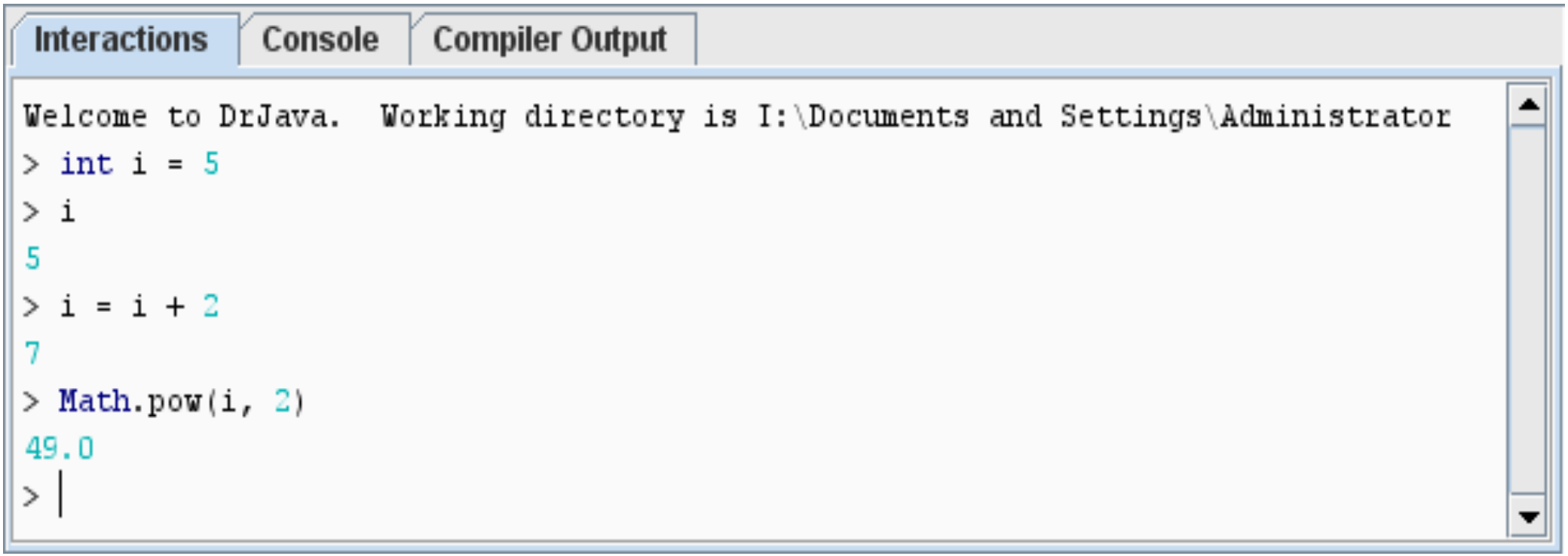
```
void draw()
{
  background(102);

  e1.update(mouseX, mouseY);
  e2.update(mouseX, mouseY);
  e3.update(mouseX, mouseY);
  e4.update(mouseX, mouseY);
  e5.update(mouseX, mouseY);

  e1.display();
  e2.display();
  e3.display();
  e4.display();
  e5.display();
}
```

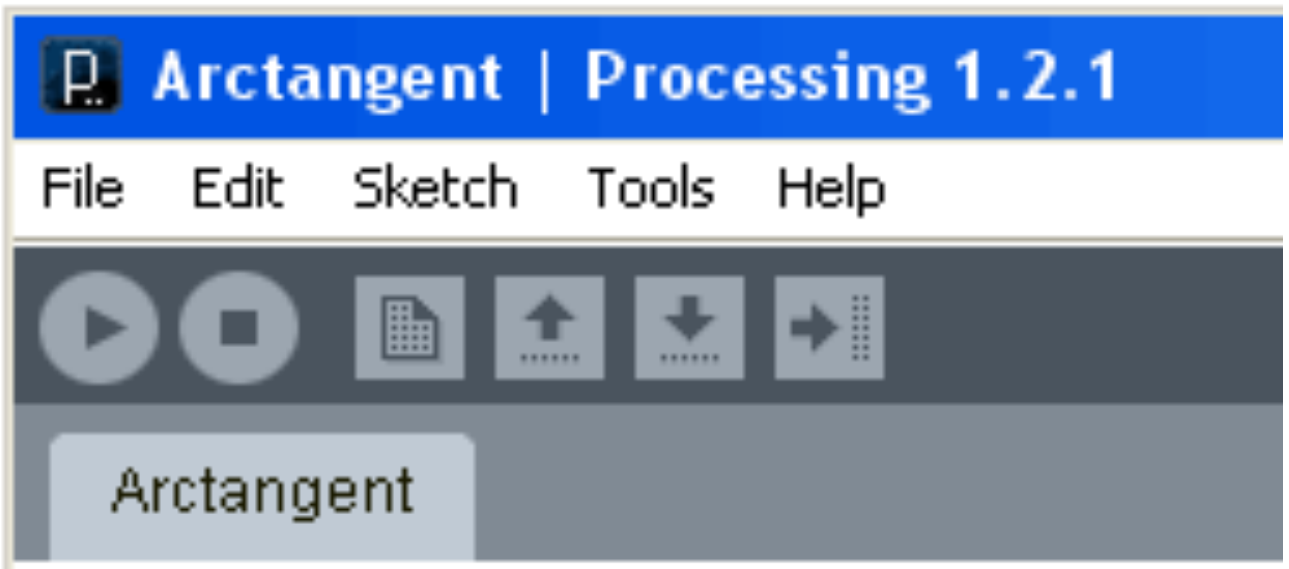
Dr Java

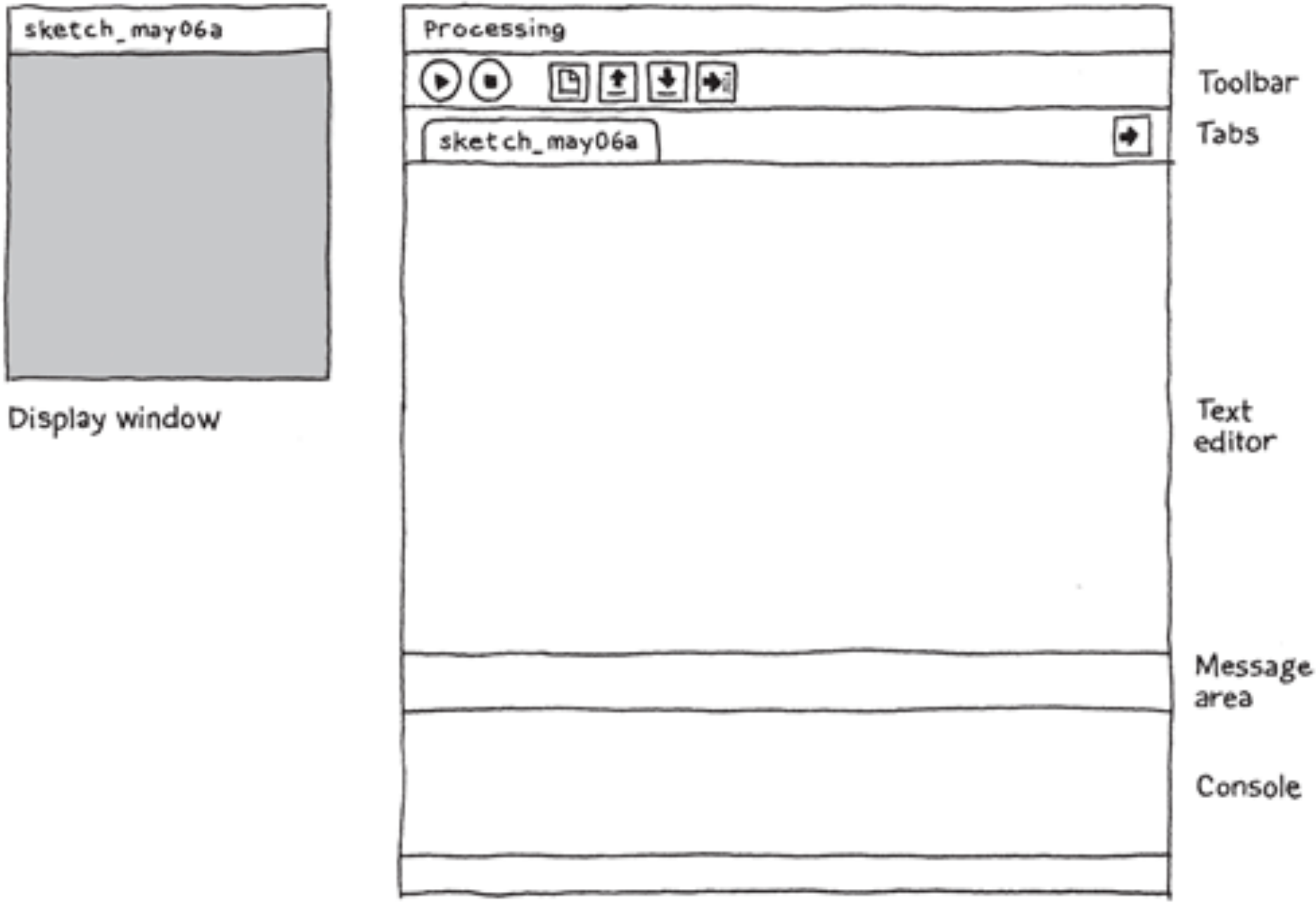
Interactions Pane == great for learning Java



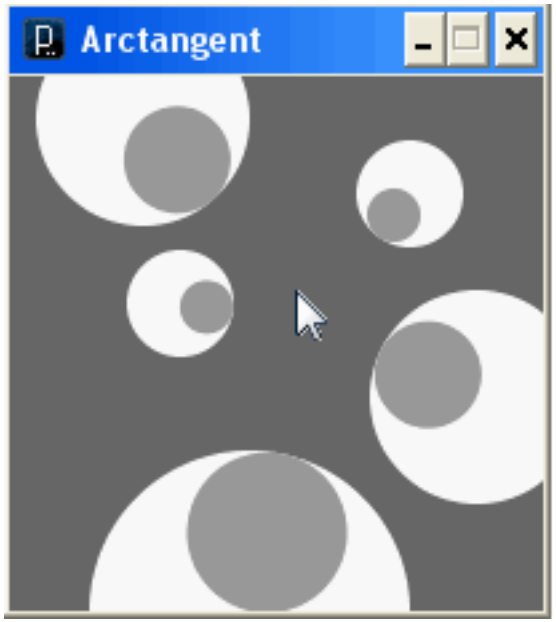
Processing

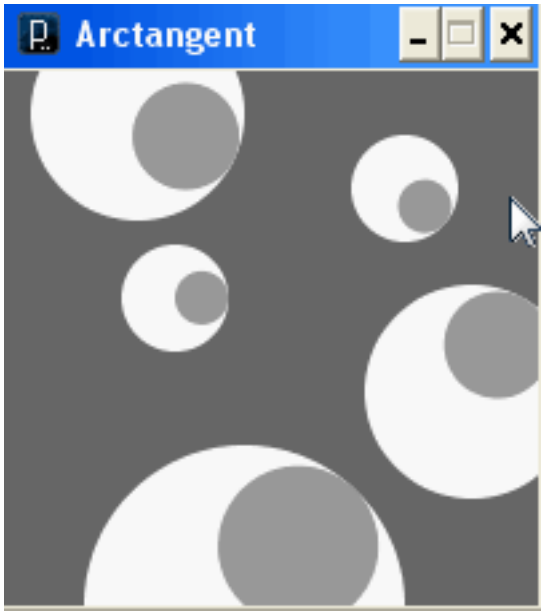
Simple
Visual Feedback
Cross Platform



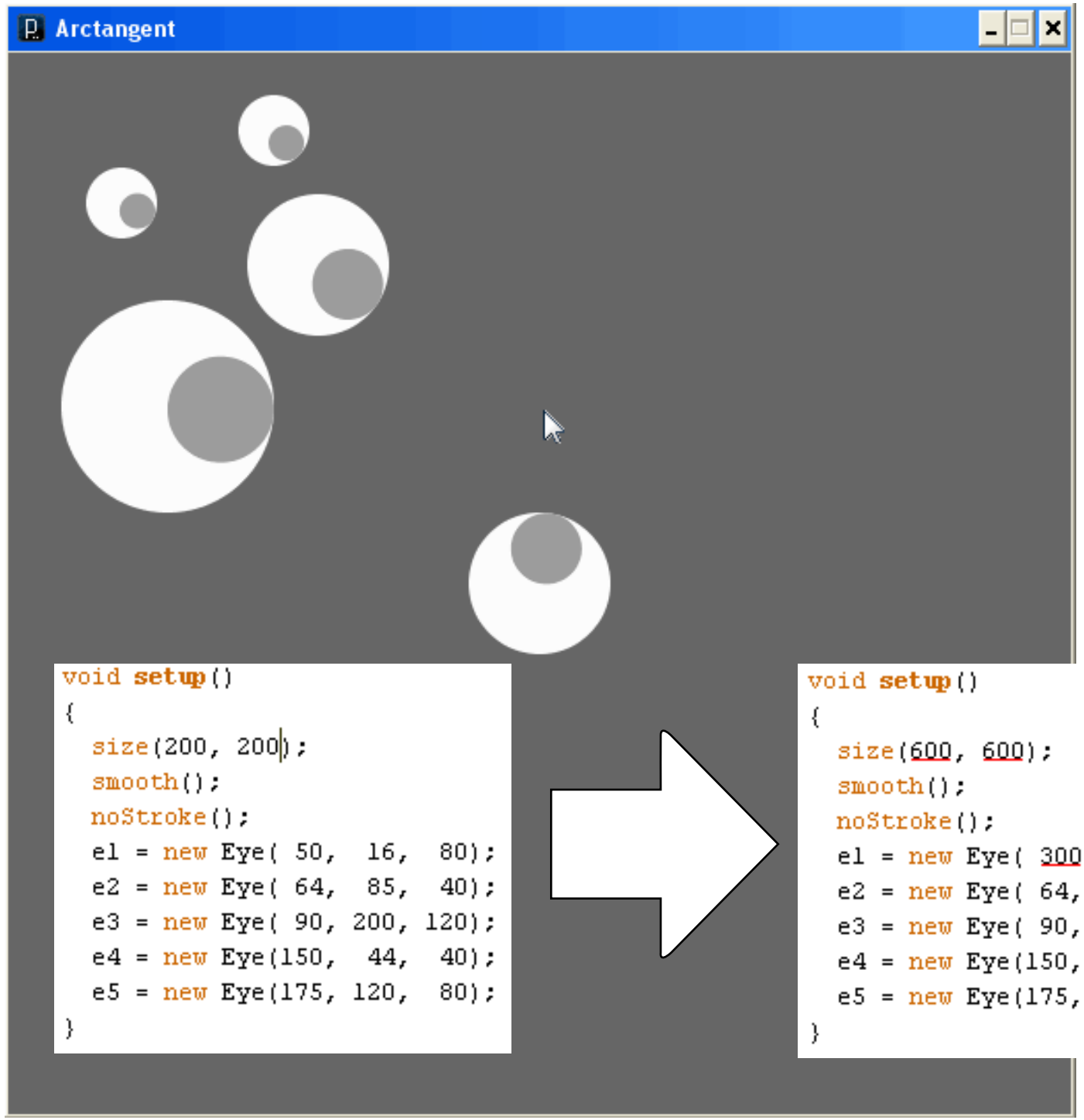


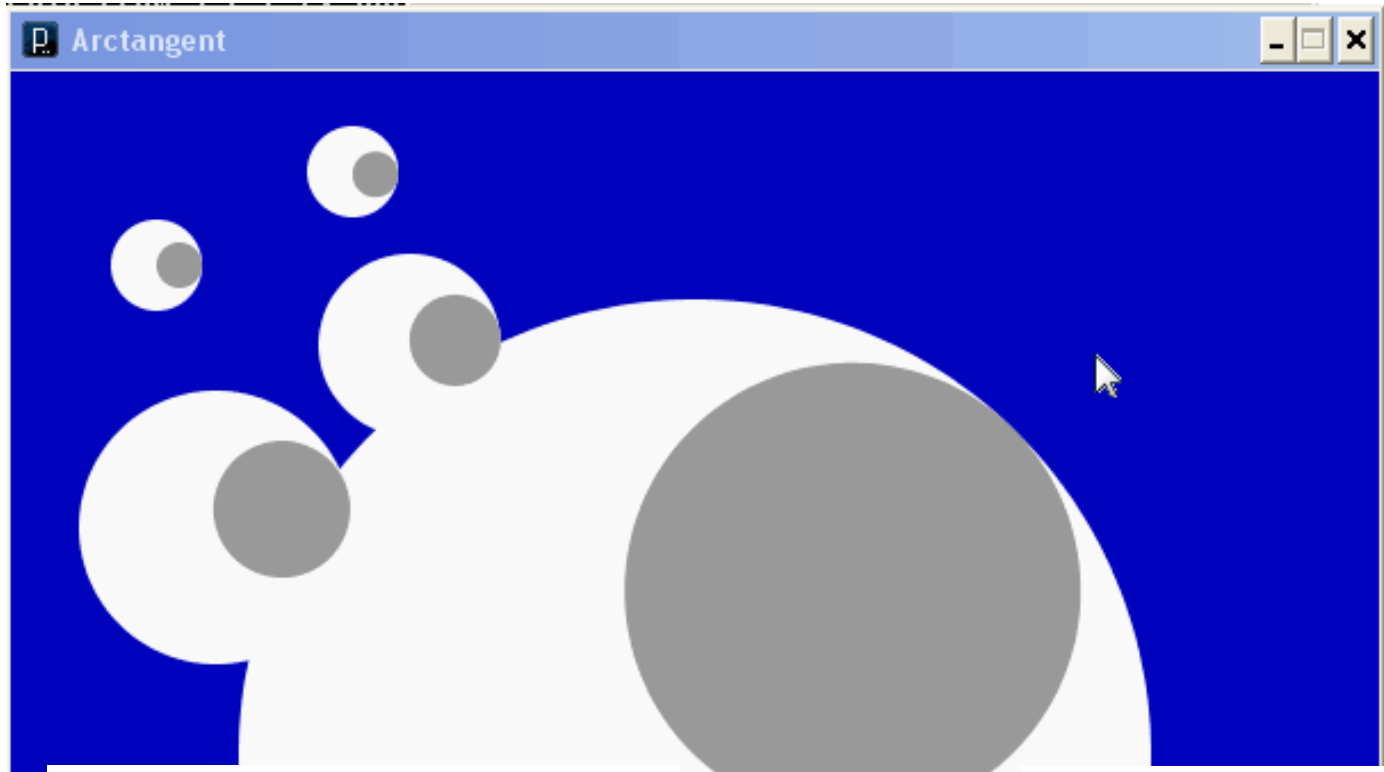
http://processing.org/learning/gettingstarted/


Arctangent


Arctangent


Arctangent


Arctangent
void setup()
{
size(200, 200);
smooth();
noStroke();
e1 = new Eye(50, 16, 80);
e2 = new Eye(64, 85, 40);
e3 = new Eye(90, 200, 120);
e4 = new Eye(150, 44, 40);
e5 = new Eye(175, 120, 80);
}
void setup()
{
size(600, 600);
smooth();
noStroke();
e1 = new Eye(300, 300, 80);
e2 = new Eye(64, 85, 40);
e3 = new Eye(90, 200, 120);
e4 = new Eye(150, 44, 40);
e5 = new Eye(175, 120, 80);
}

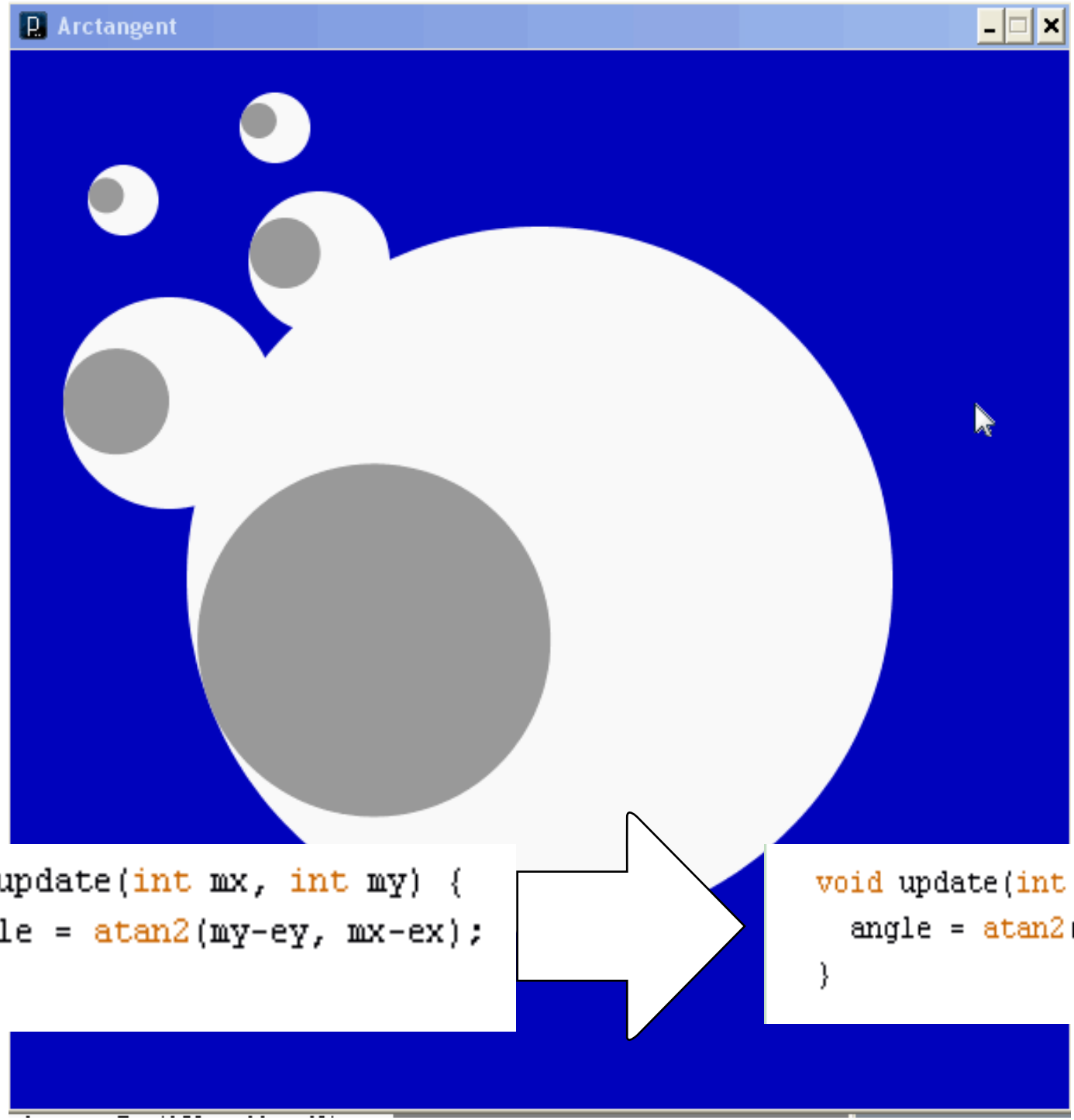



```
void setup()
{
  size(600, 600);
  smooth();
  noStroke();
  e1 = new Eye( 300,  300,  80);
  e2 = new Eye( 64,  85,  40);
  e3 = new Eye( 90, 200, 120);
  e4 = new Eye(150,  44,  40);
  e5 = new Eye(175, 120,  80);
}

void draw()
{
  background(102);
```

```
void setup()
{
  size(600, 600);
  smooth();
  noStroke();
  e1 = new Eye( 300,  300,  400);
  e2 = new Eye( 64,  85,  40);
  e3 = new Eye( 90, 200, 120);
  e4 = new Eye(150,  44,  40);
  e5 = new Eye(175, 120,  80);
}

void draw()
{
  background(700);
```




```
void update(int mx, int my) {
  angle = atan2(my-ey, mx-ex);
}
```

```
void update(int mx, int my) {
  angle = atan2(-(my-ey), -(mx-ex));
}
```

Tech Savvy Camp July 29 2010

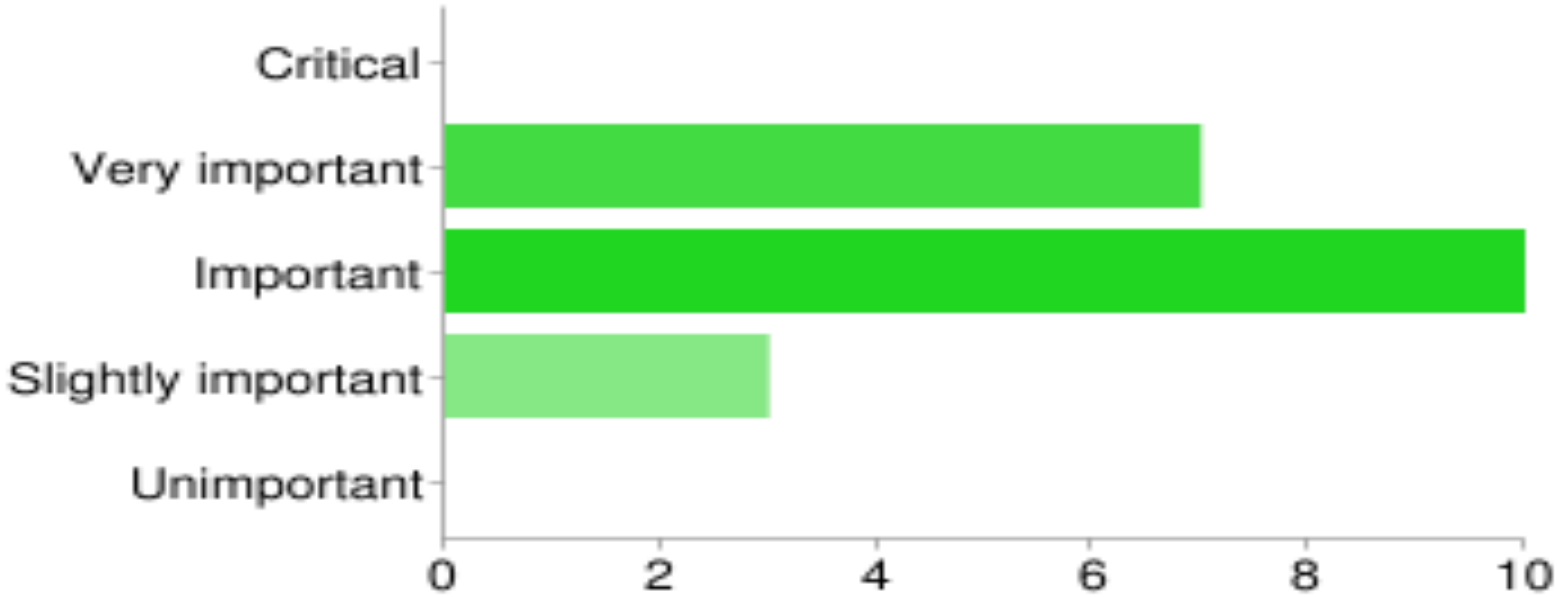
20 female sixth, seventh, and eight graders

Part of Boston's initiative to increase the interest and participation of women in science, technology, and scientific research.

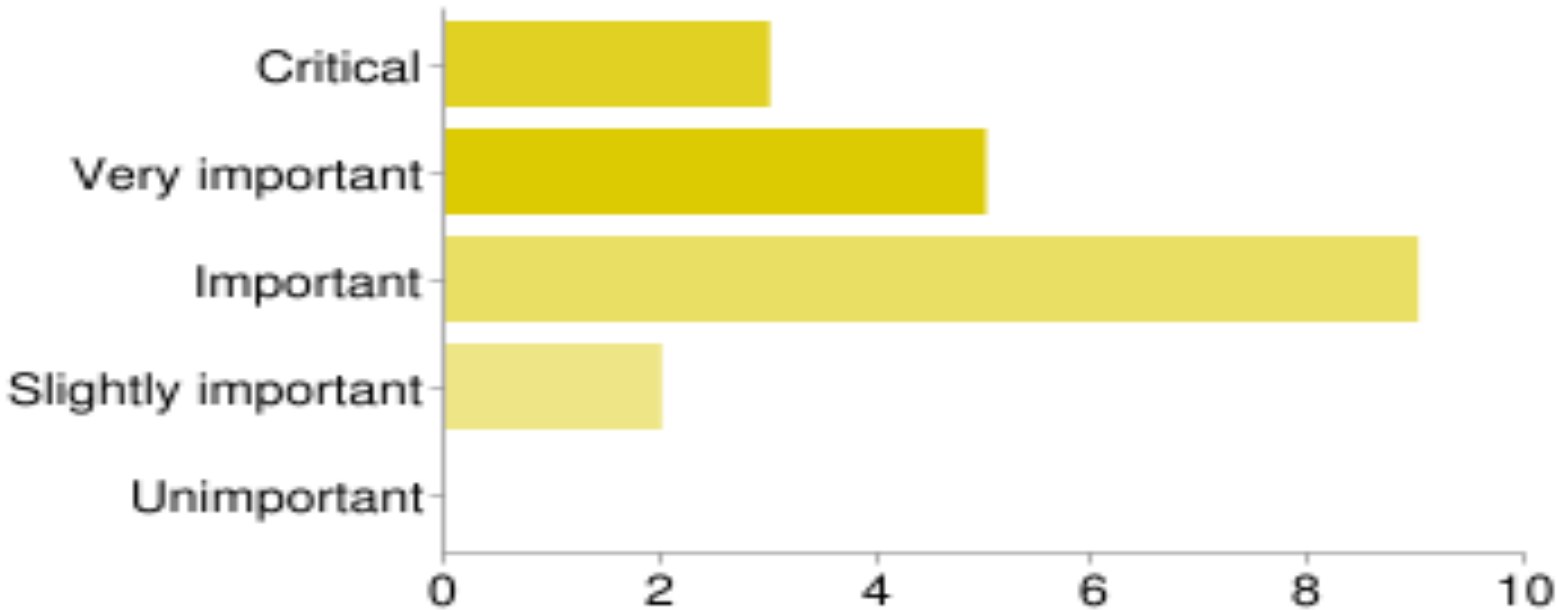
Participating schools:
UMass Boston, Harvard University, Boston University, Northeastern University, and Wentworth Institute of Technology

How important do you think Computer Science is in your life?

Before

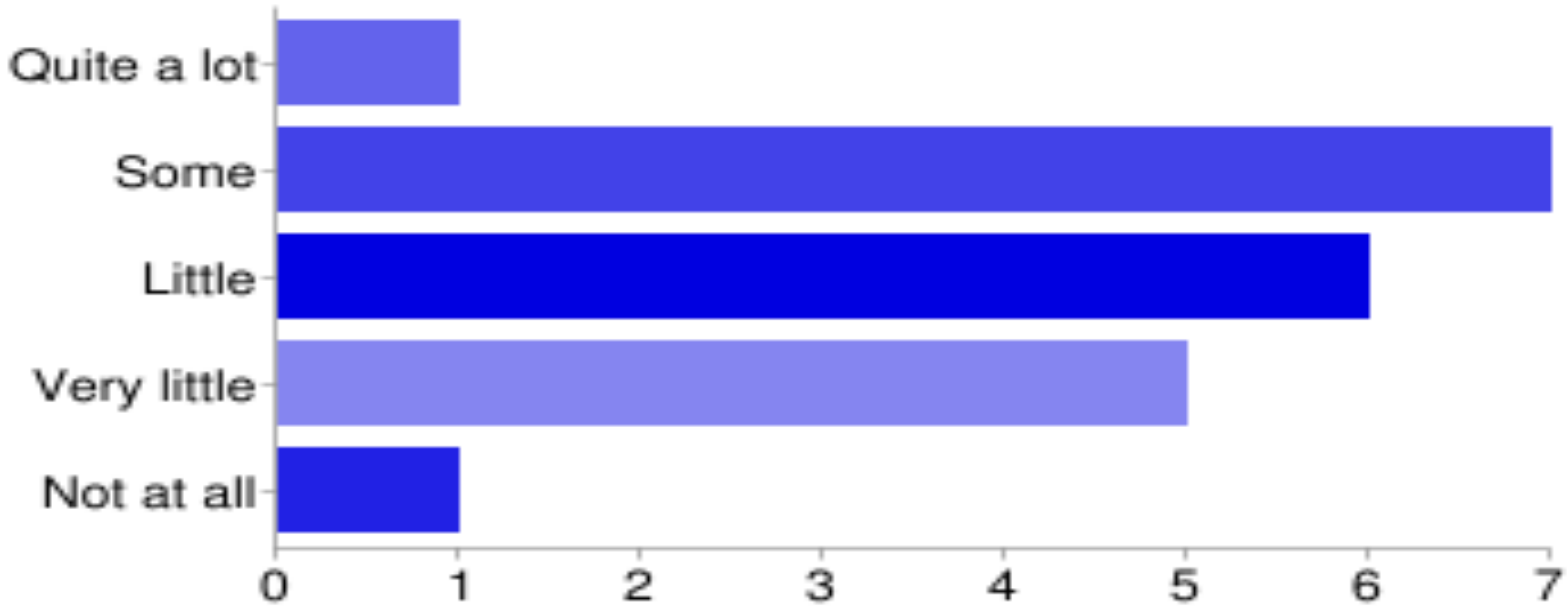


After

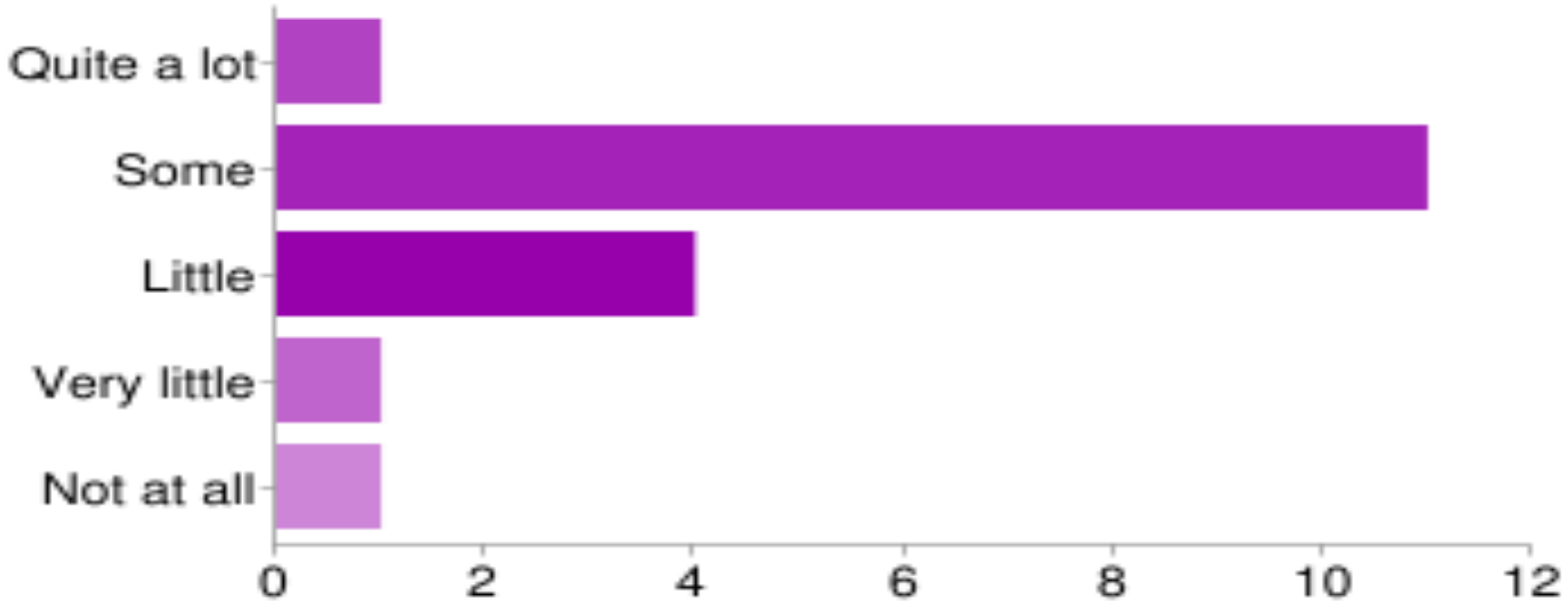


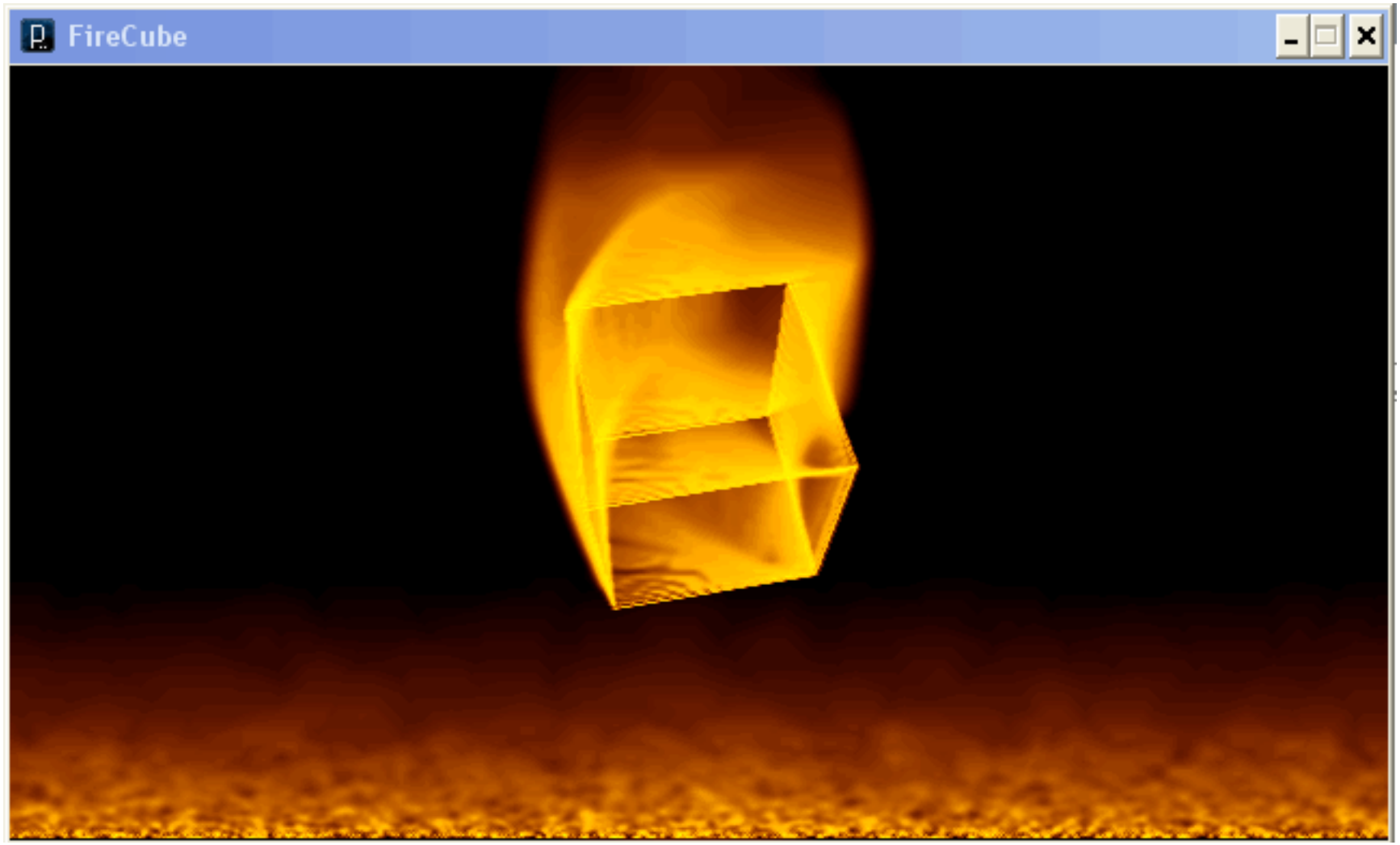
Are you interested in Computer Science?

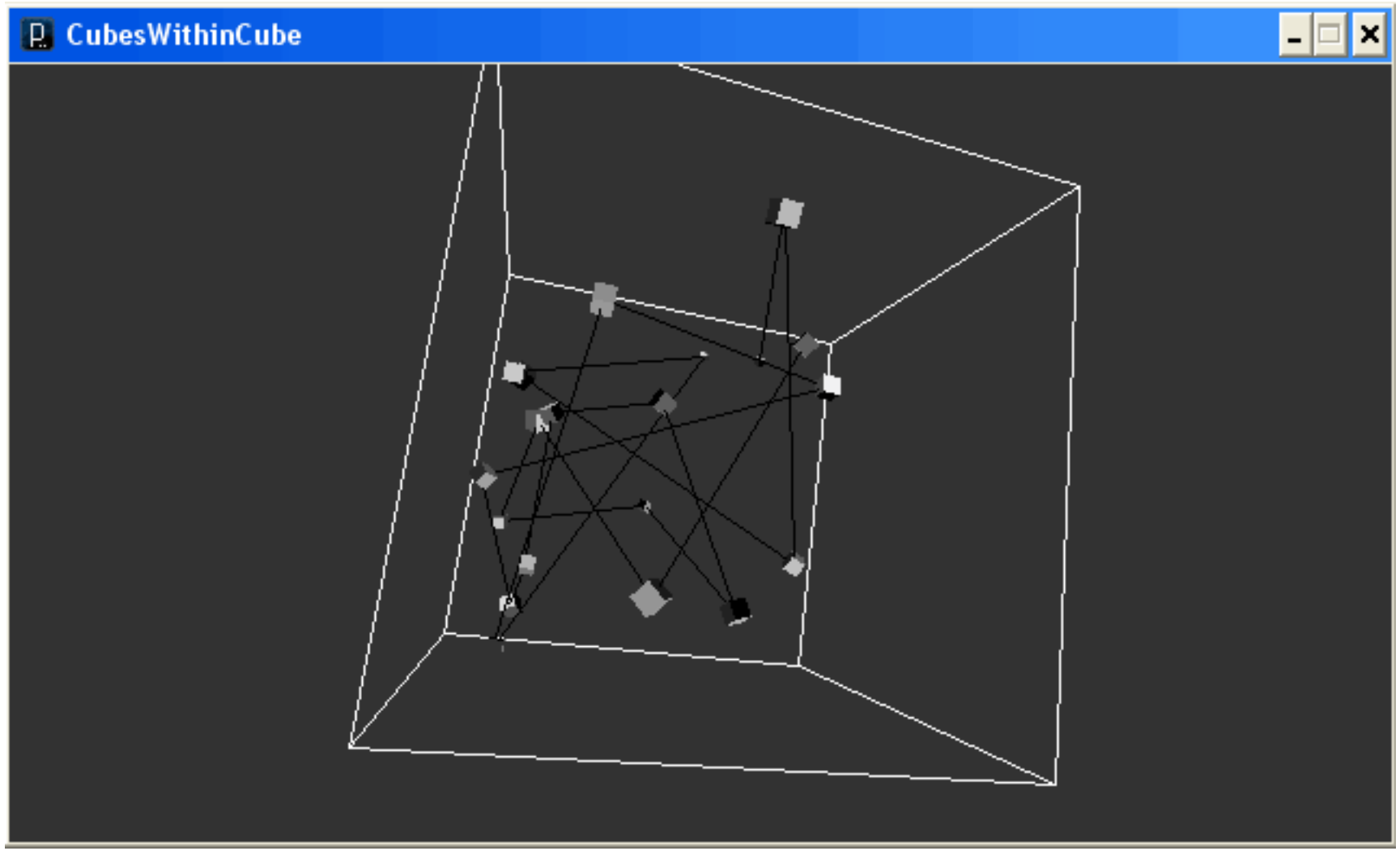
Before

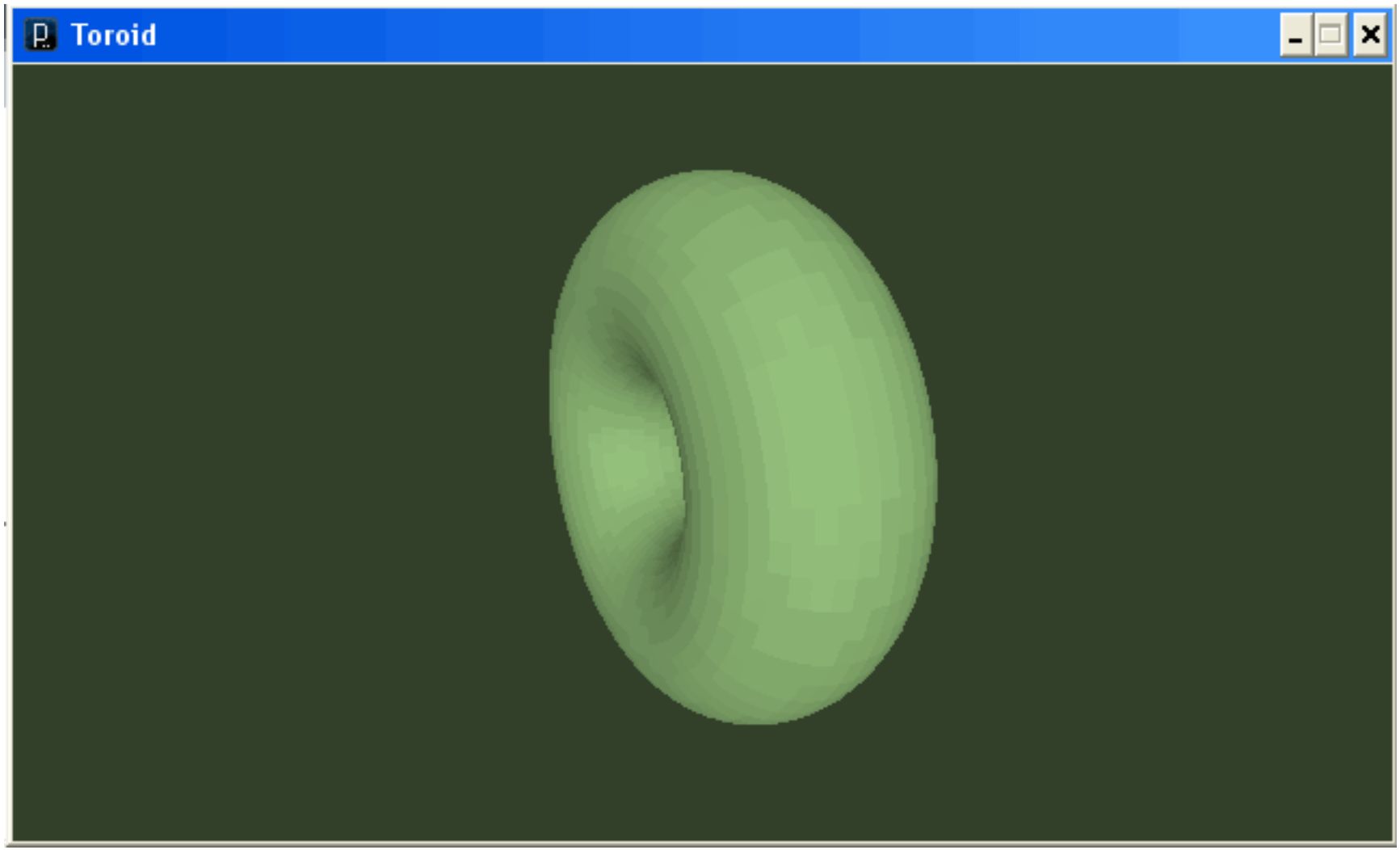


After




FireCube


CubesWithinCube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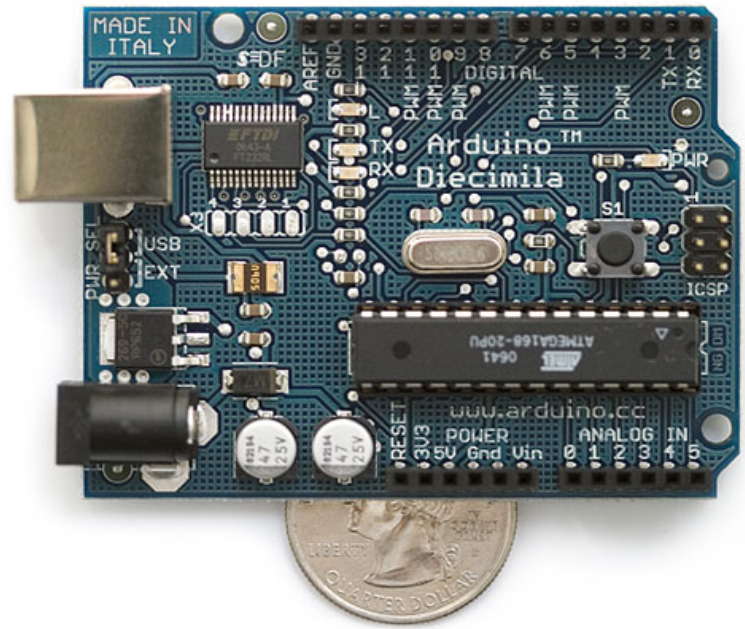
Arduino

An Open-Source Hardware / Software Kit



The Arduino

- Open source hardware / software package

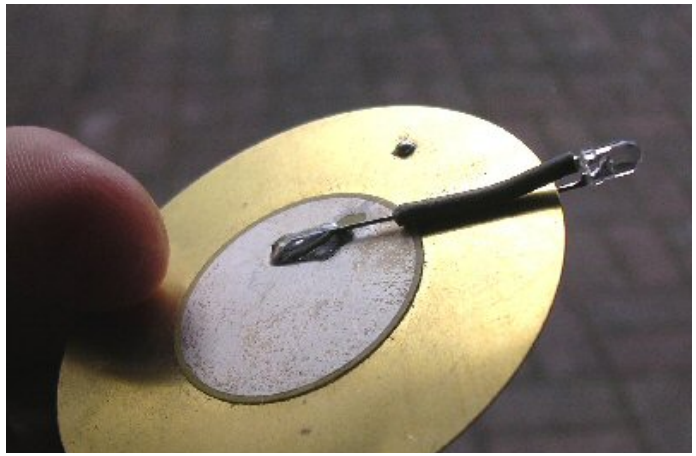
  - Hardware
    - 14 digital ins / outs
    - 6 analog ins / outs
    - 5 volts
    - Can run on A/C power, or connection through USB
    - Persistent memory
    - Expandable, through use of "shields"

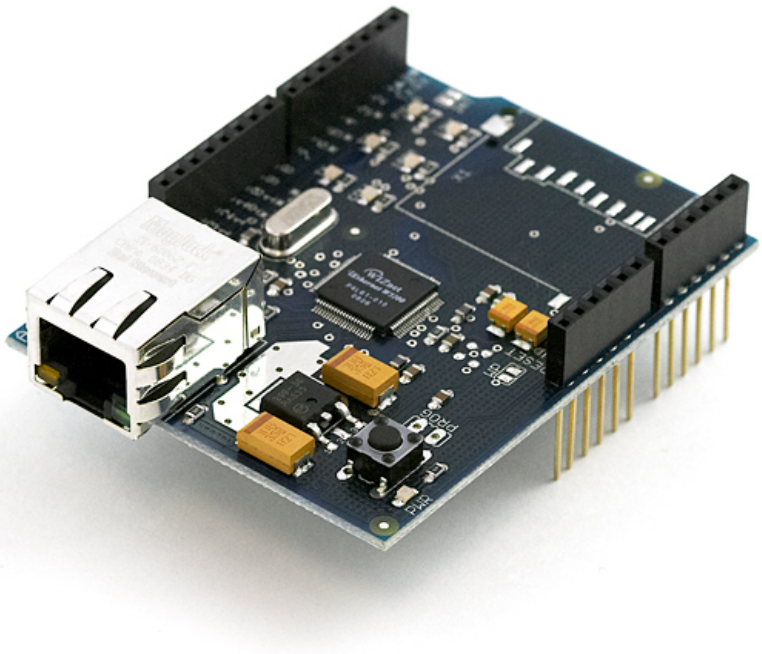
  - Software
    - C-like language
    - Free IDE

Perks

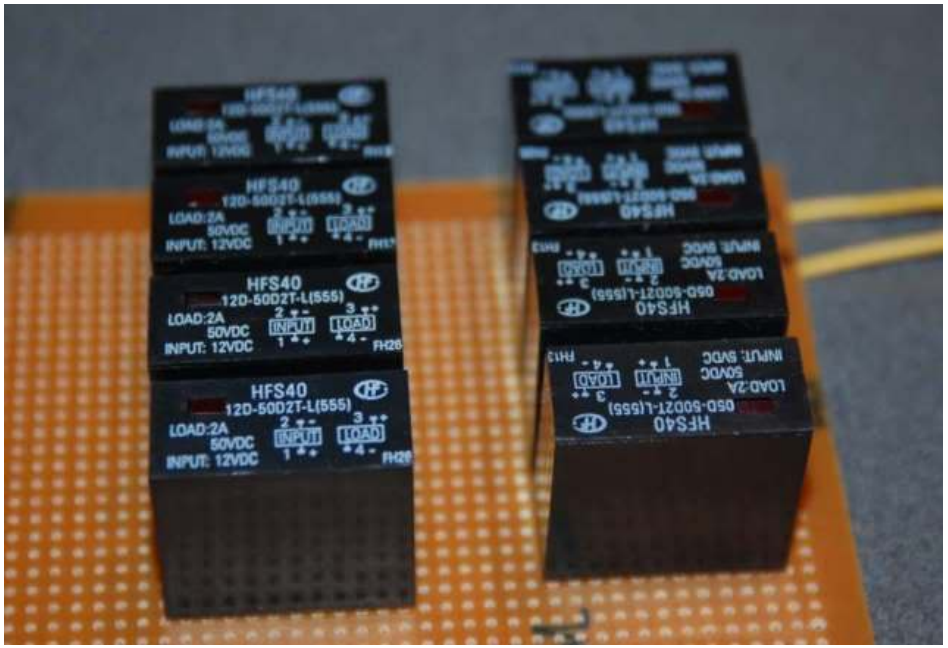
- Cheap and Safe
- Skills required are transferable to real life programming
- Not too difficult
- Very flexible / extendable
- No moving parts
- All-in-one package
- Fun and interactive programming experience

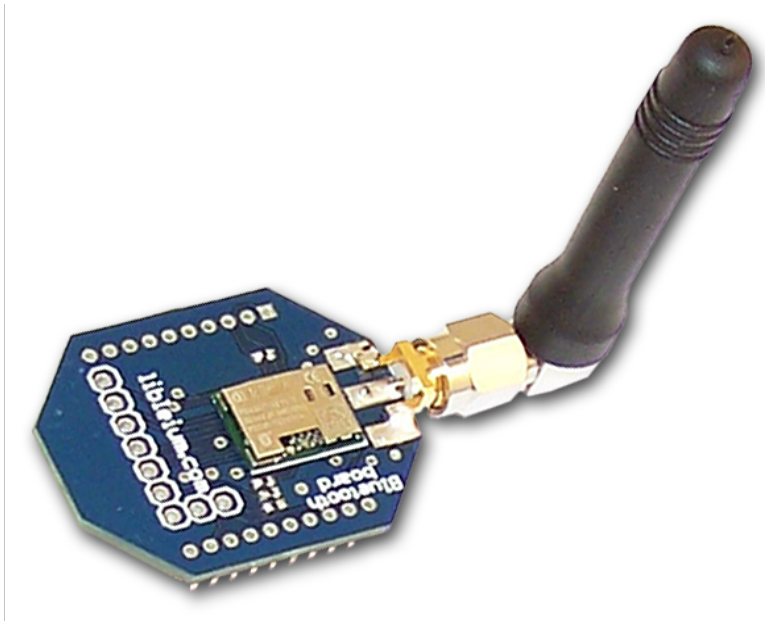
Example Input Devices

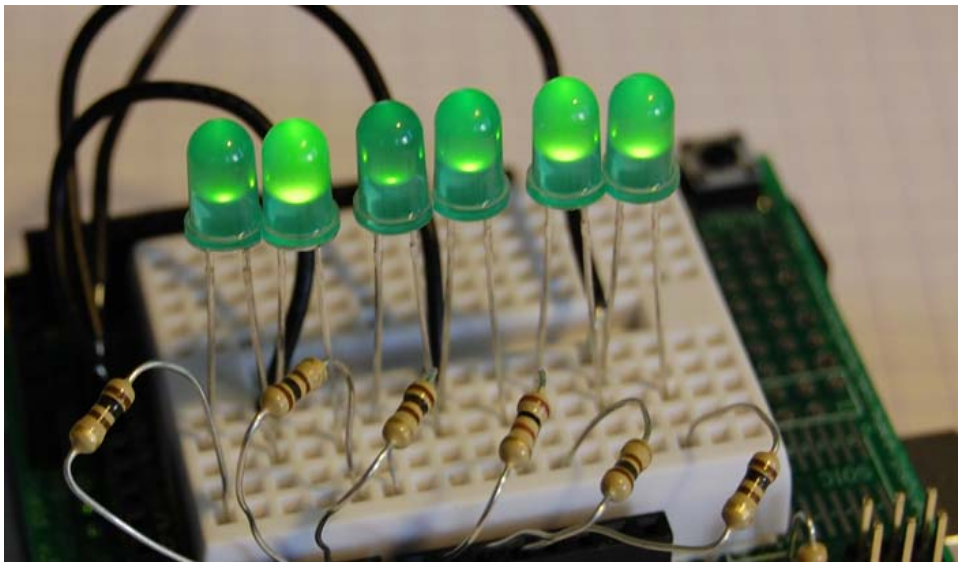




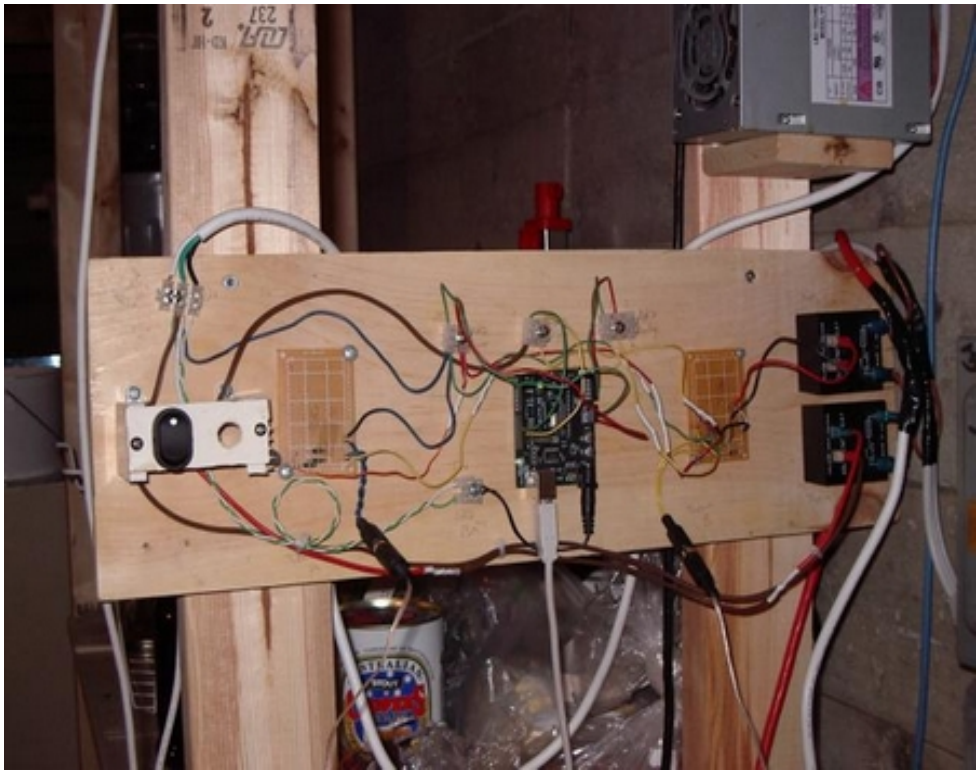
Example Output Devices







Example Arduino Applications



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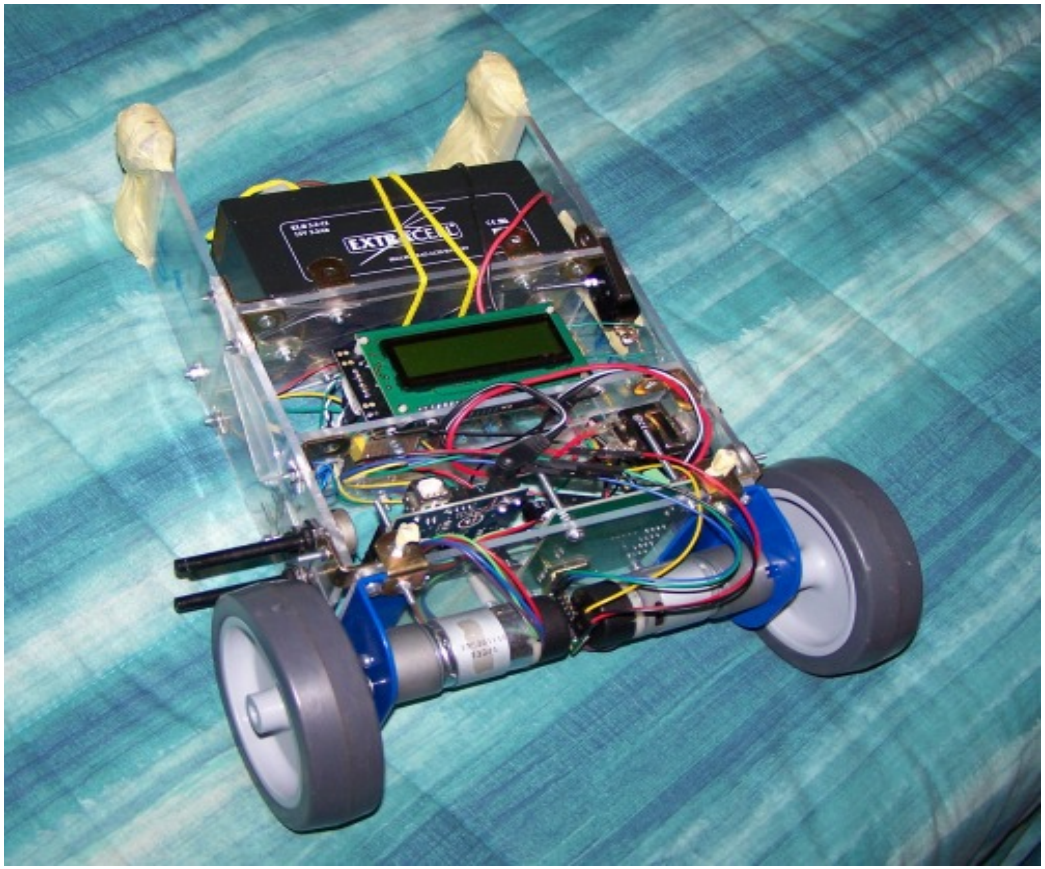

References

"Occupational Outlook Handbook, 2010-11 Edition". Bureau of Labor Statistics. **http://www.bls.gov/oco.** Retrieved 2010-10-26.

Using Game Creation for Teaching Computer Programming to High School Students and Teachers (M. Al-Bow, D. Austin, J. Edgington, R. Fajardo, J. Fishburn, C. Lara, S.T. Leutenegger, S. Meyer), Proc. of Innovation and Technology in Computer Science Education (ITiCSE) 2009