

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/>>

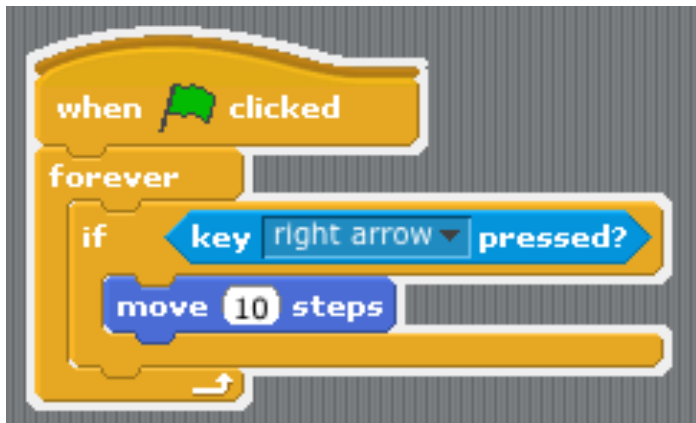
SCRATCH



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

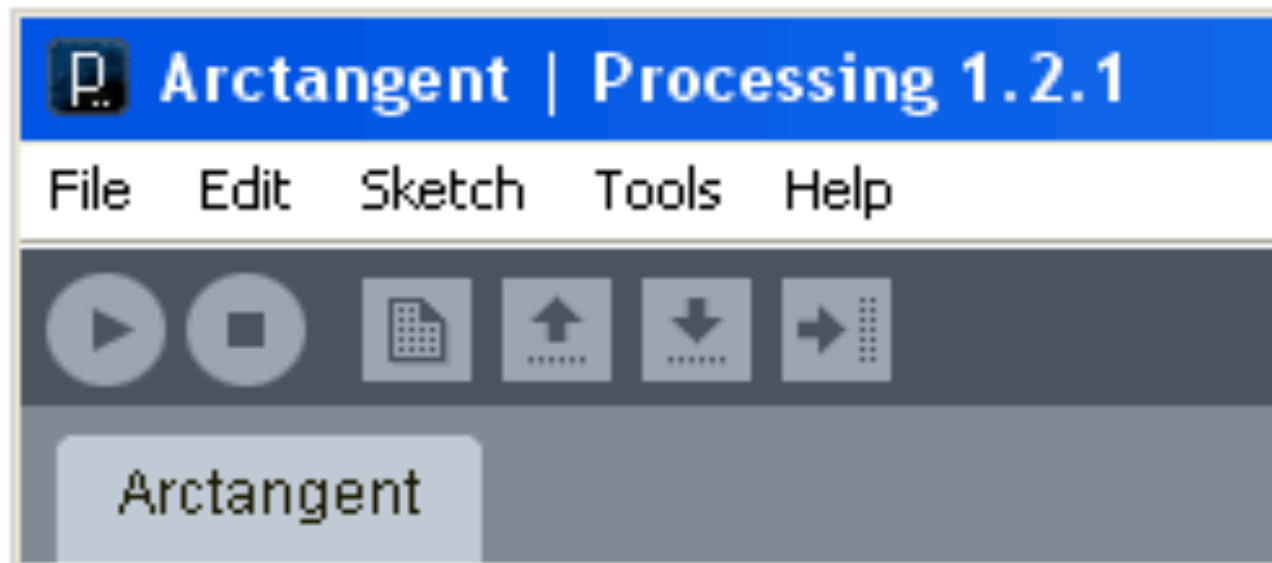
A screenshot of the DrJava Interactions Pane. The pane has three tabs: 'Interactions', 'Console', and 'Compiler Output'. The 'Interactions' tab is selected. The text inside the pane shows a sequence of Java code snippets entered at the prompt '>'. The first snippet is 'int i = 5', followed by 'i', which returns the value '5'. The next snippet is 'i = i + 2', followed by '7'. The final snippet is 'Math.pow(i, 2)', which returns '49.0'. The pane also shows a welcome message and the working directory path.

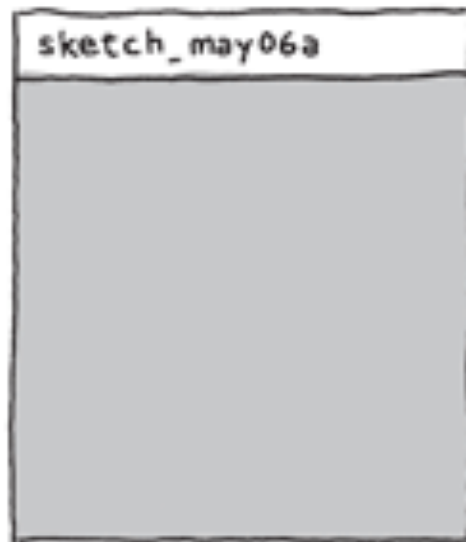
```
Welcome to DrJava. Working directory is I:\Documents and Settings\Administrator
> int i = 5
> i
5
> i = i + 2
7
> Math.pow(i, 2)
49.0
> |
```



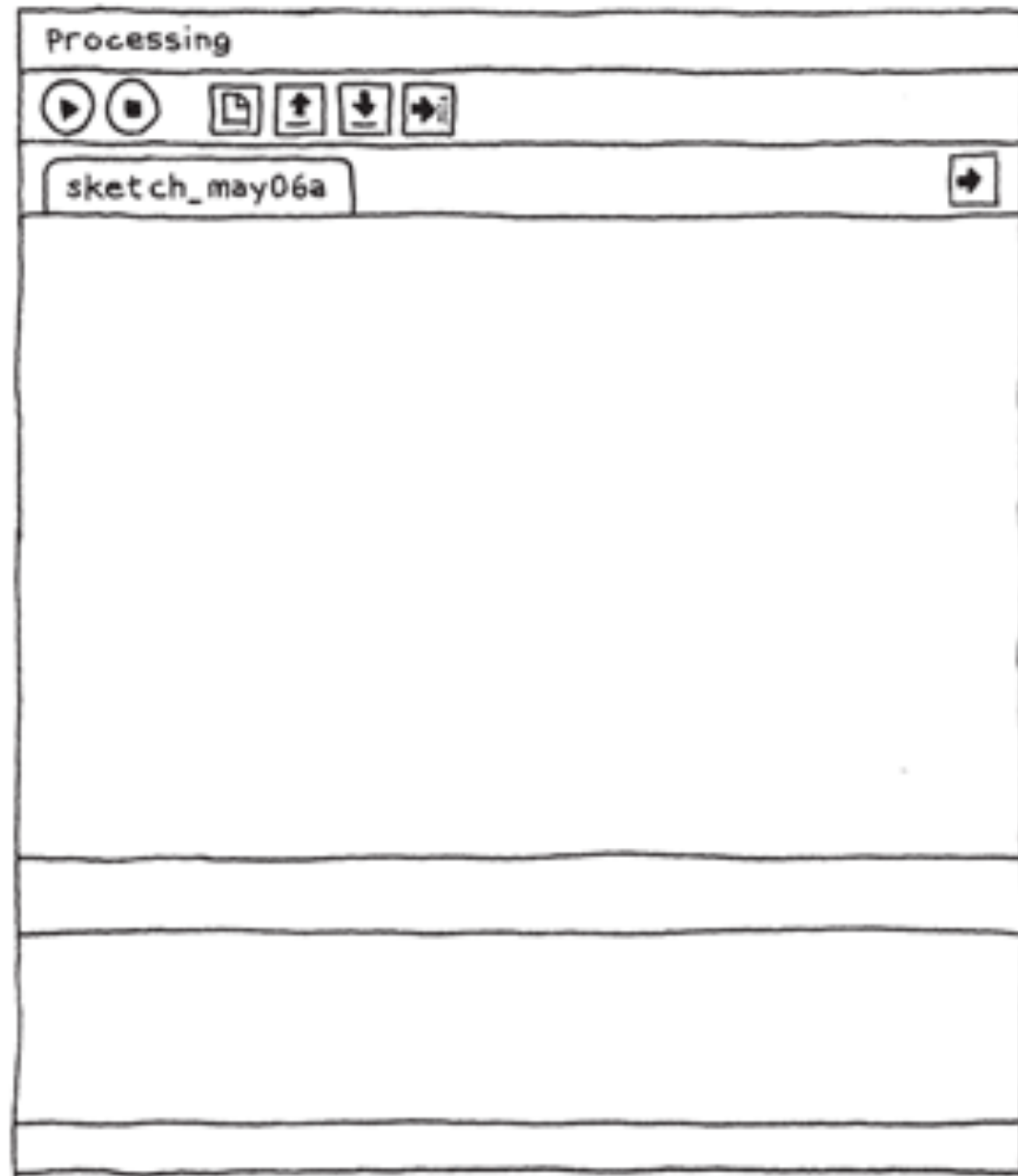
Processing

Simple
Visual Feedback
Cross Platform





Display window



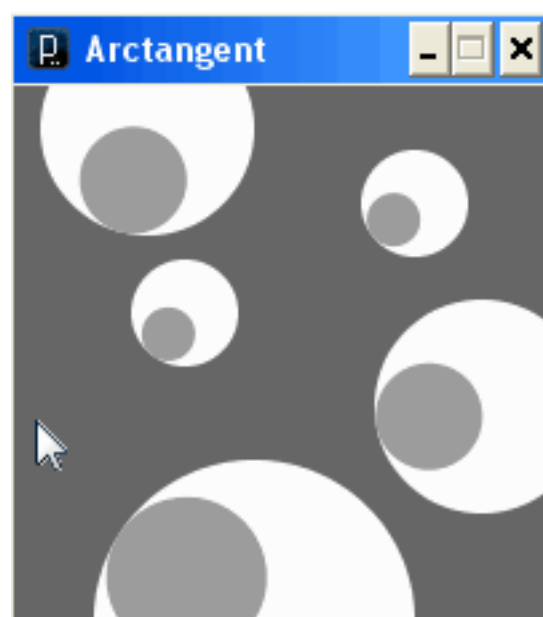
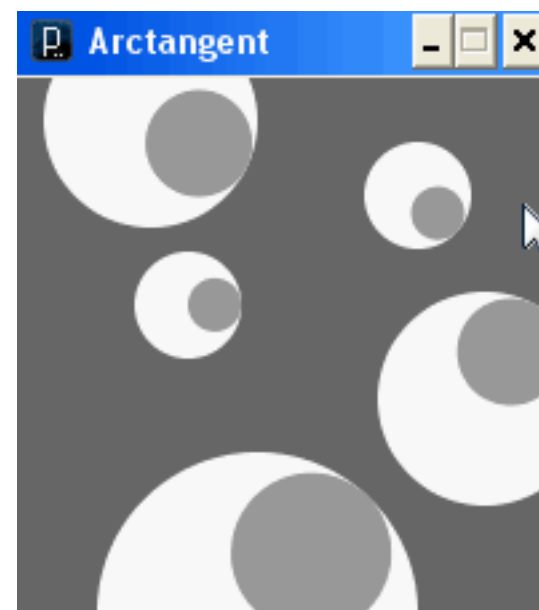
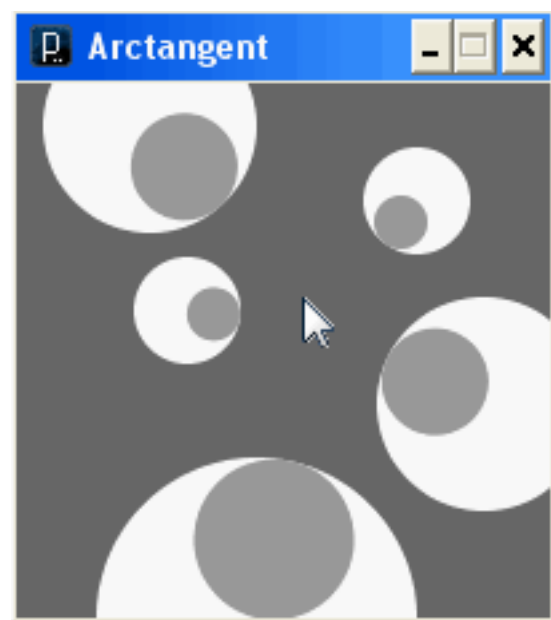
Toolbar

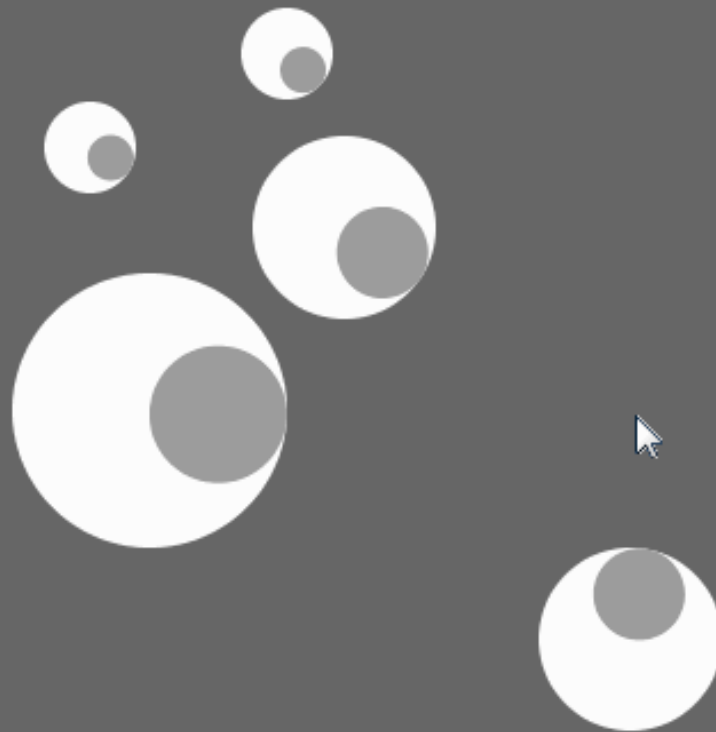
Tabs

Text
editor

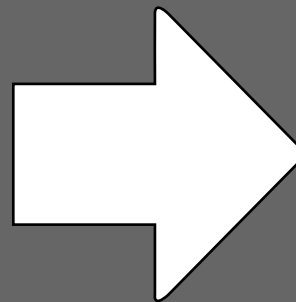
Message
area

Console

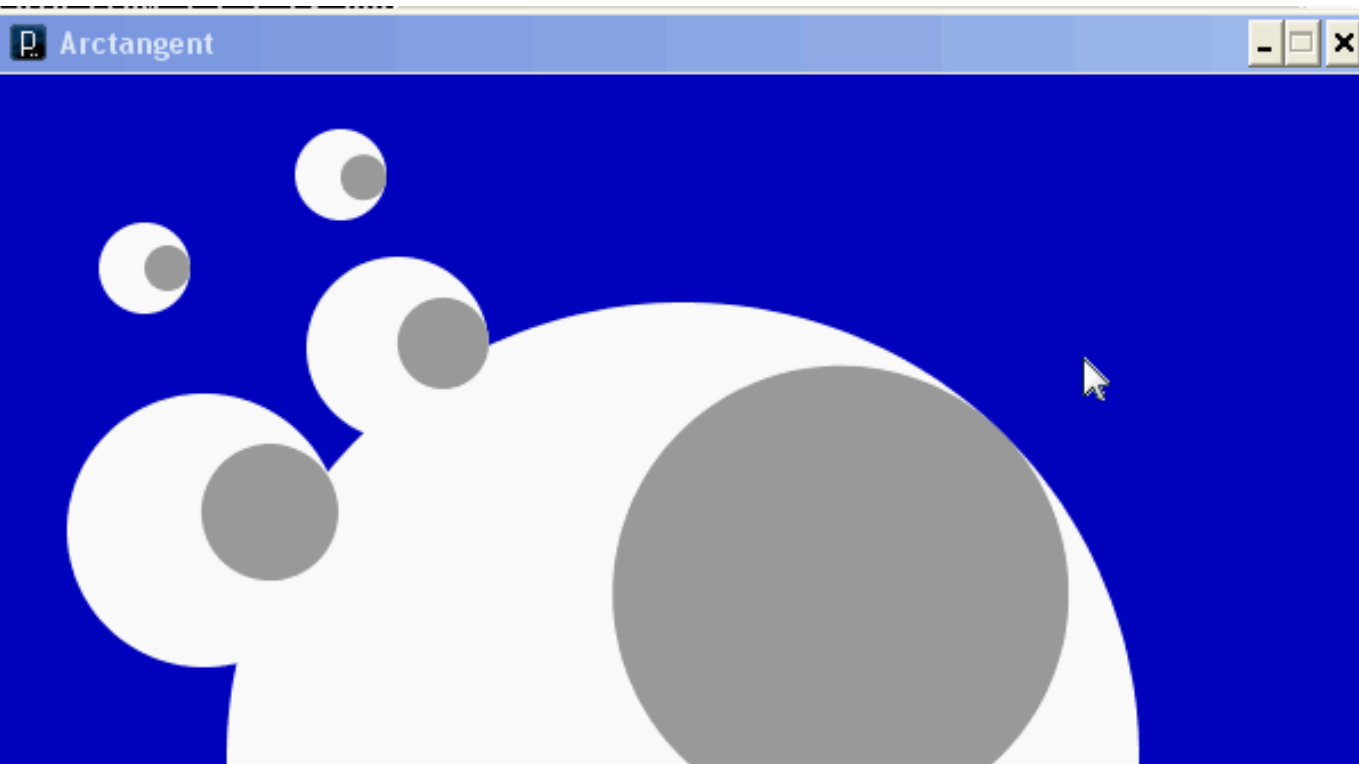




```
void setup()
{
  size(200, 200);
  smooth();
  noStroke();
  e1 = new Eye( 50, 16, 80);
  e2 = new Eye( 64, 85, 40);
  e3 = new Eye( 90, 200, 120);
  e4 = new Eye(150, 44, 40);
  e5 = new Eye(175, 120, 80);
}
```

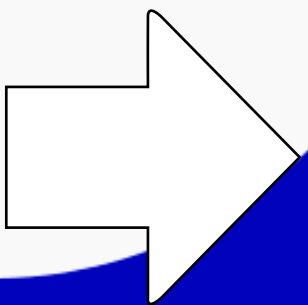


```
void setup()
{
  size(600, 600);
  smooth();
  noStroke();
  e1 = new Eye( 300, 300, 80);
  e2 = new Eye( 64, 85, 40);
  e3 = new Eye( 90, 200, 120);
  e4 = new Eye(150, 44, 40);
  e5 = new Eye(175, 120, 80);
}
```



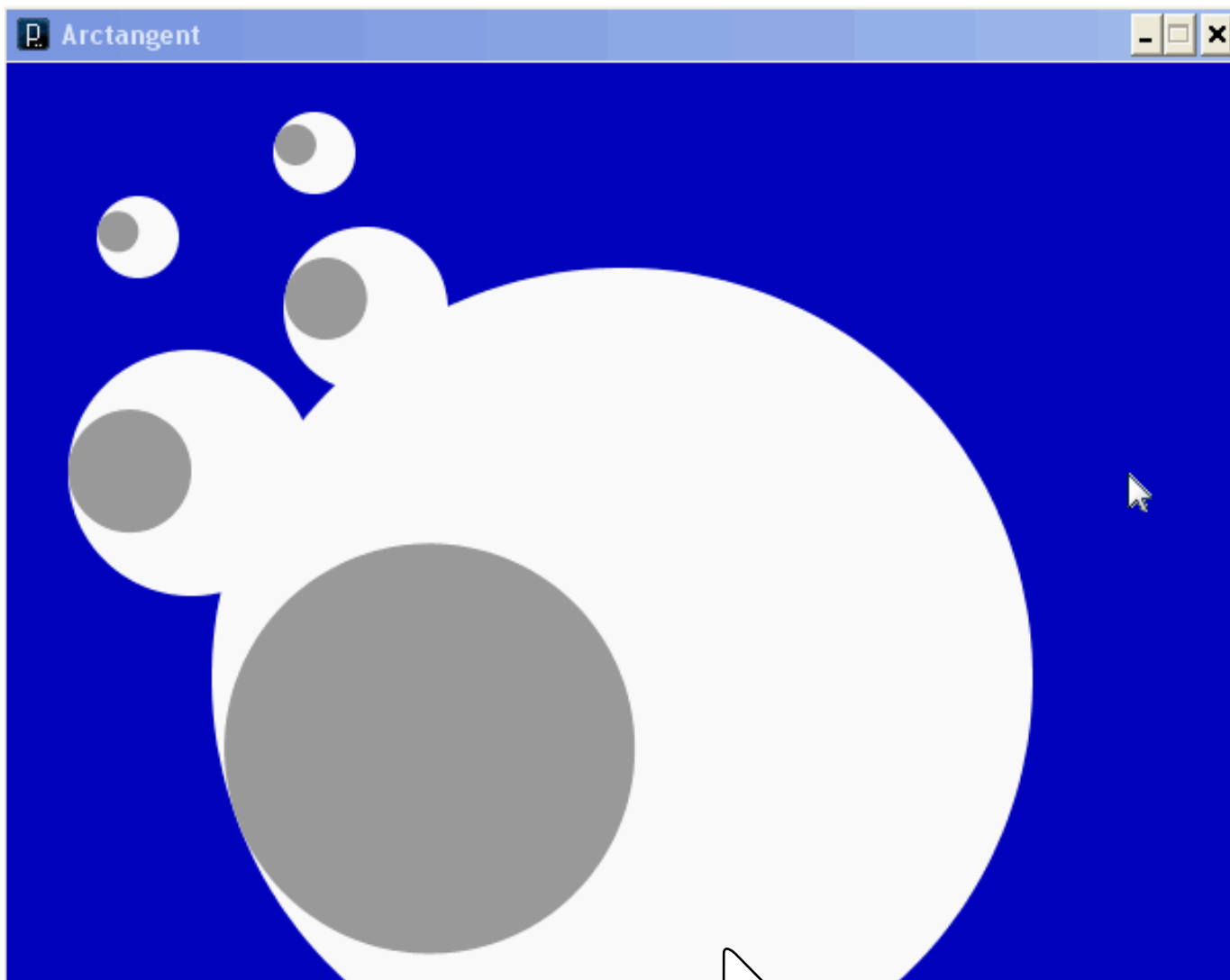
```
void setup()
{
  size(600, 600);
  smooth();
  noStroke();
  e1 = new Eye( 300, 300, 80);
  e2 = new Eye( 64, 85, 40);
  e3 = new Eye( 90, 200, 120);
  e4 = new Eye(150, 44, 40);
  e5 = new Eye(175, 120, 80);
}

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

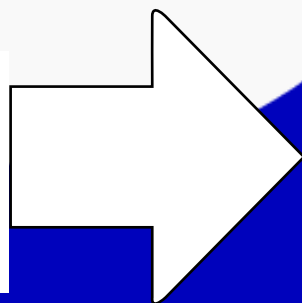


```
void setup()
{
  size(600, 600);
  smooth();
  noStroke();
  e1 = new Eye( 300, 300, 400);
  e2 = new Eye( 64, 85, 40);
  e3 = new Eye( 90, 200, 120);
  e4 = new Eye(150, 44, 40);
  e5 = new Eye(175, 120, 80);
}

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

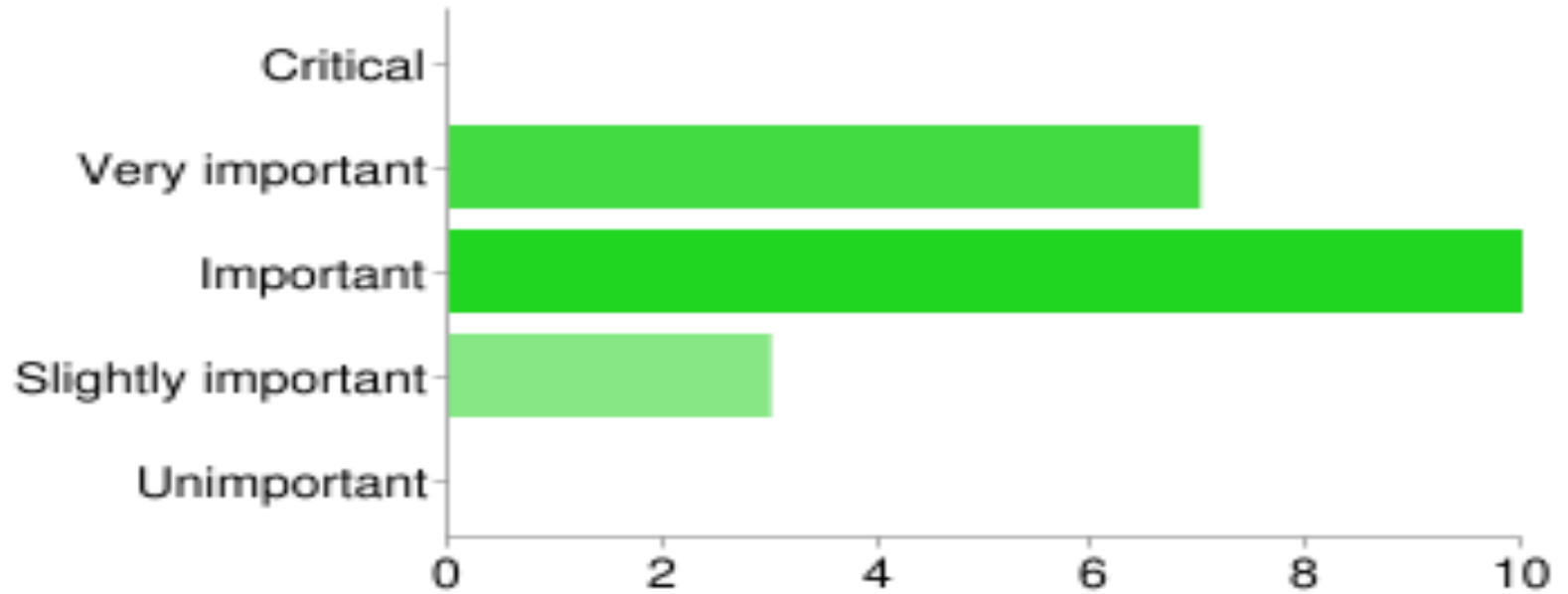
Part of Boston's initiative to increase the interest and participation of women in science, technology, and scientific research.

Participating schools:

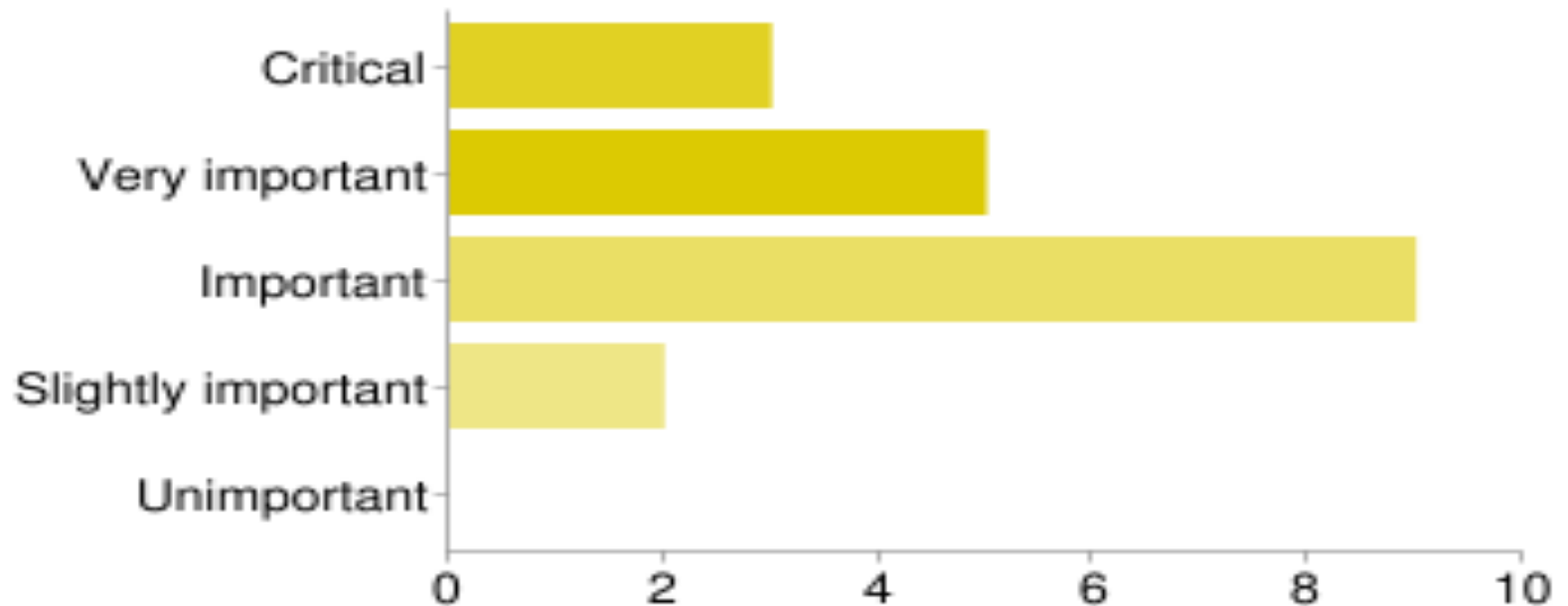
UMass Boston, Harvard University, Boston University, Northeastern University, and Wentworth Institute of Technology

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

Before

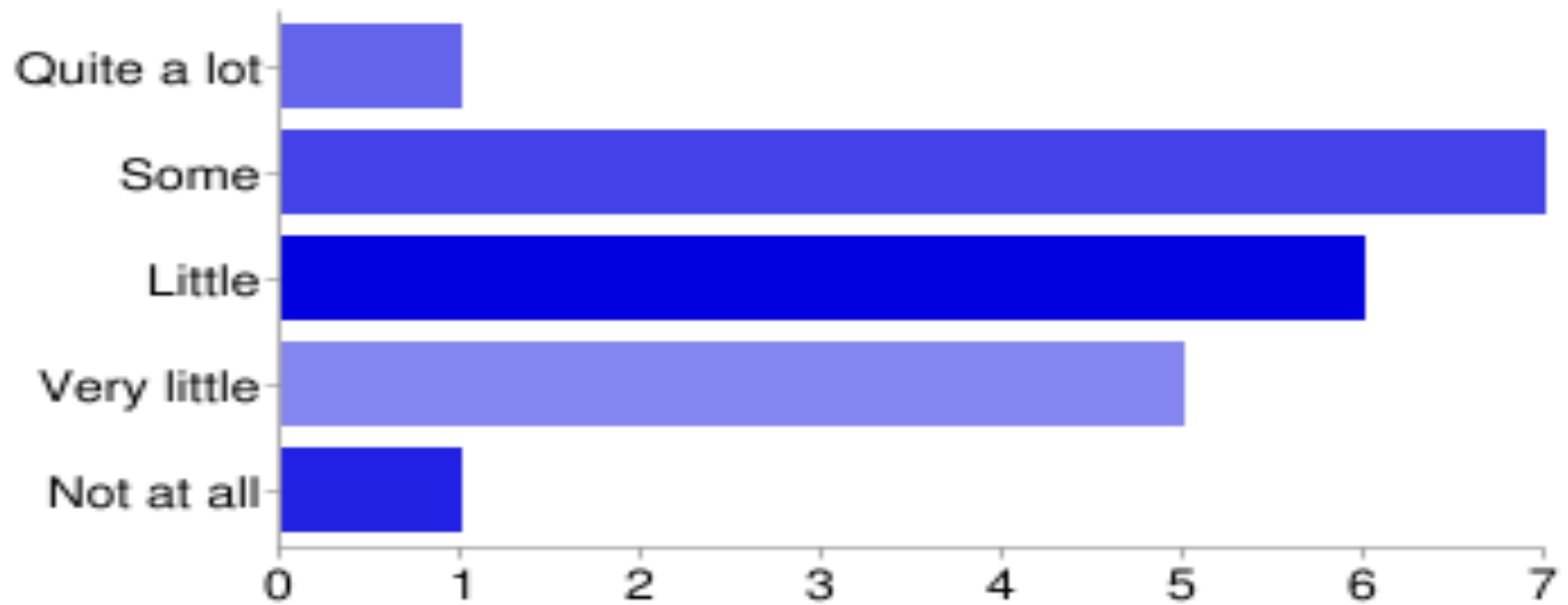


After

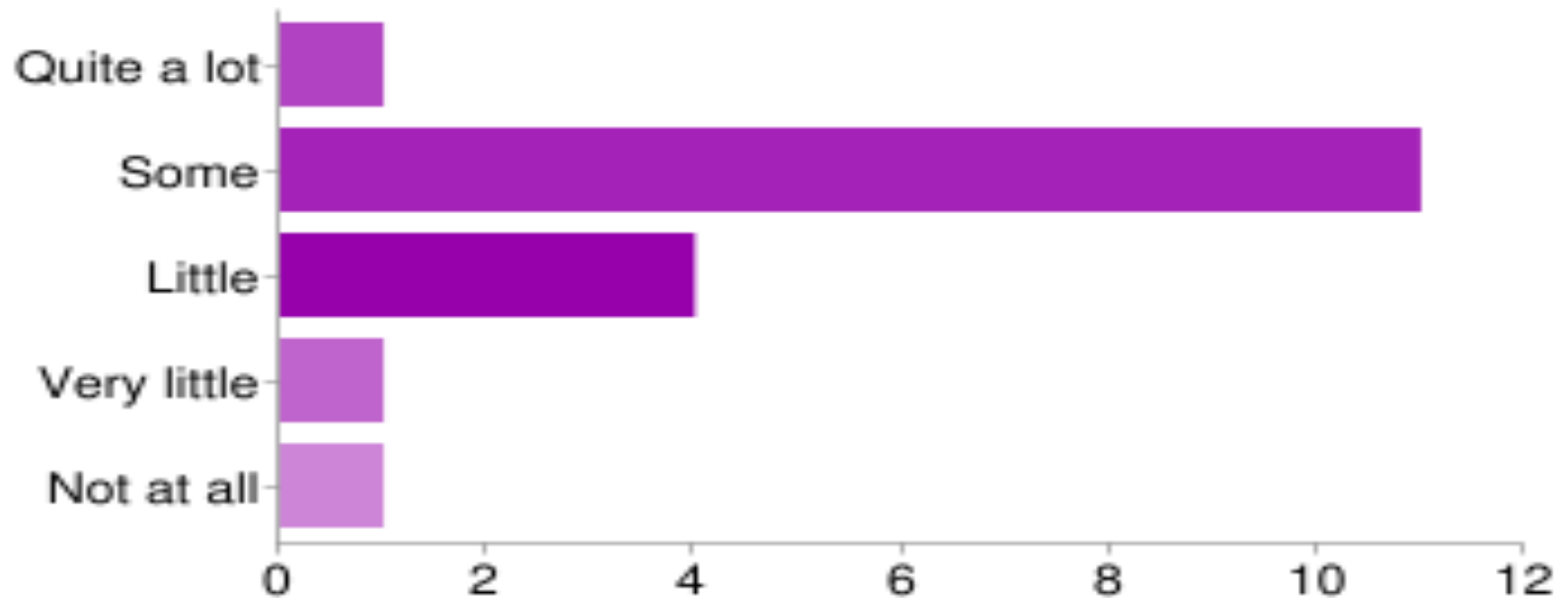


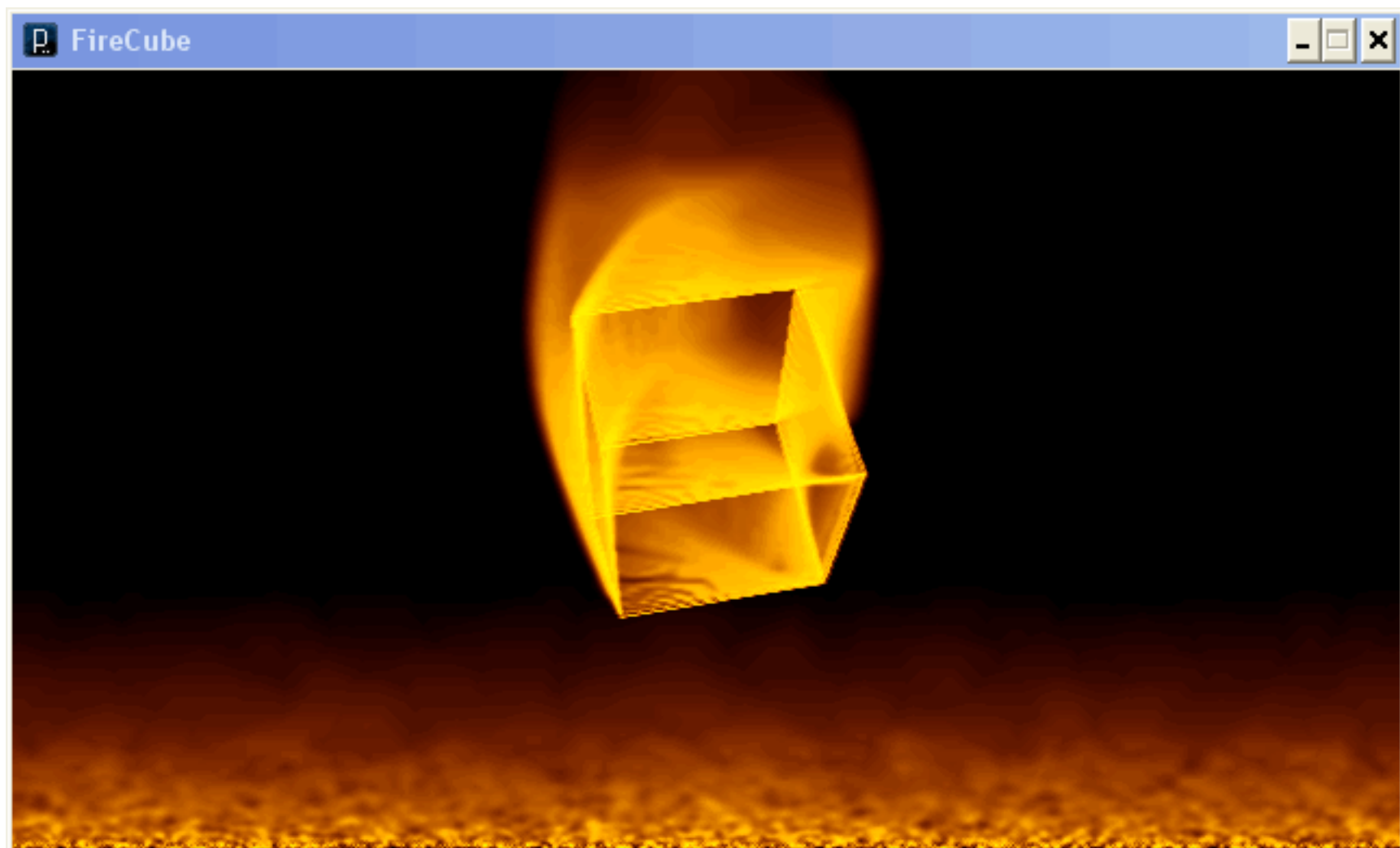
Are you interested in Computer Science?

Before

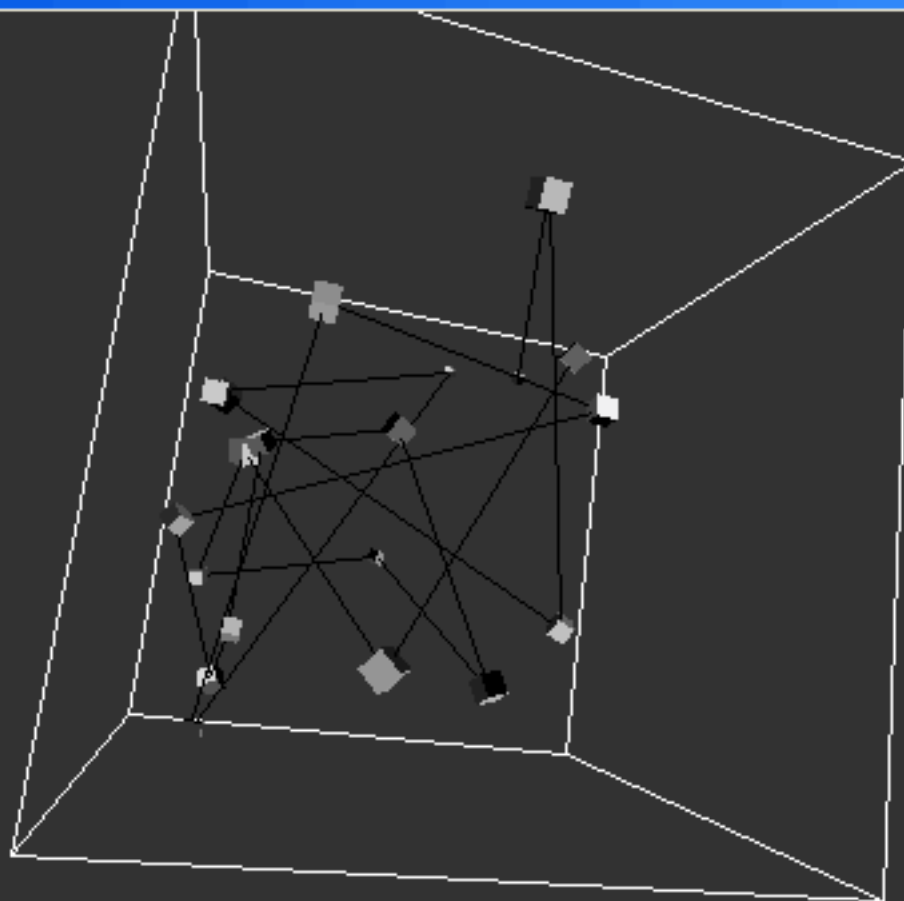


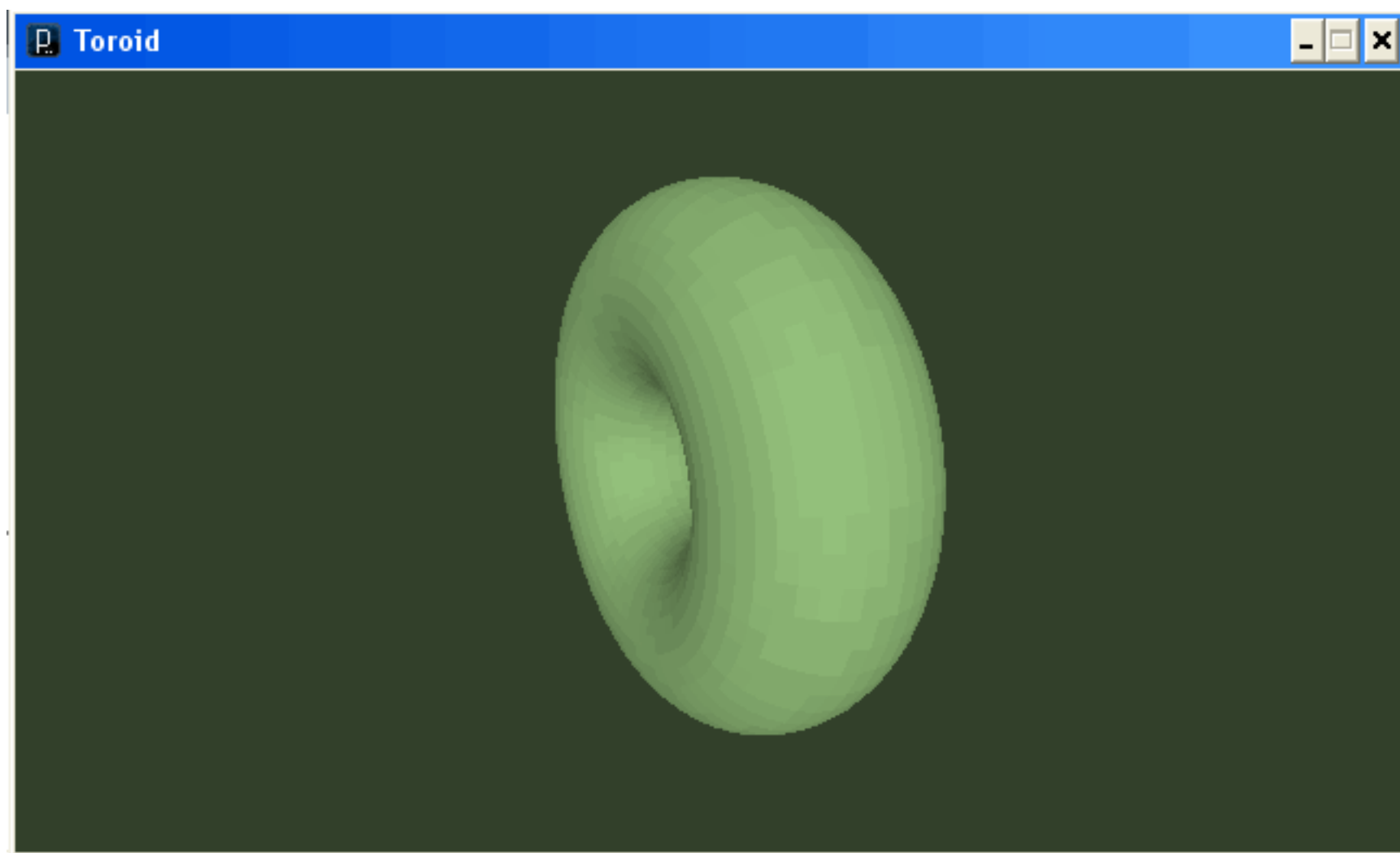
After





CubesWithinCube







Arduino

An Open-Source Hardware / Software Kit

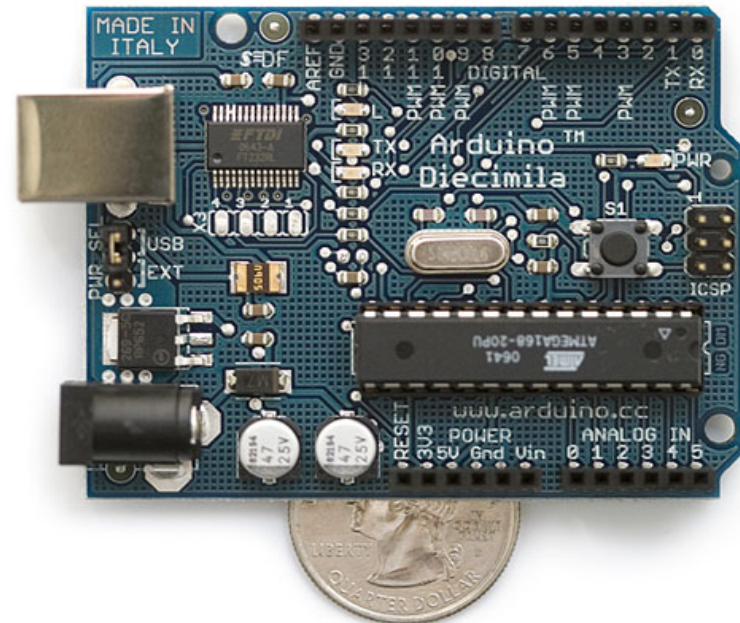
A screenshot of the Arduino IDE interface. The title bar reads 'Arduino - 0011 Alpha'. The menu bar includes 'File', 'Edit', 'Sketch', 'Tools', and 'Help'. Below the menu bar is a toolbar with icons for running, saving, and other functions. The main text area contains the 'Blink' sketch code. The code is as follows:

```
/*  
 * Blink  
 * The basic Arduino example. Turns on an LED on for one second,  
 * then off for one second, and so on... We use pin 13 because,  
 * depending on your Arduino board, it has either a built-in LED  
 * or a built-in resistor so that you need only an LED.  
 * http://www.arduino.cc/en/Tutorial/Blink  
 */  
  
int ledPin = 13;           // LED connected to digital pin 13  
  
void setup()               // run once, when the sketch starts  
{  
  pinMode(ledPin, OUTPUT); // sets the digital pin as output  
}  
  
void loop()               // run over and over again  
{  
  digitalWrite(ledPin, HIGH); // sets the LED on  
  delay(1000);               // waits for a second  
  digitalWrite(ledPin, LOW);  // sets the LED off  
  delay(1000);               // waits for a second  
}
```

Done compiling.

Binary sketch size: 1098 bytes (of a 14336 byte maximum)

22



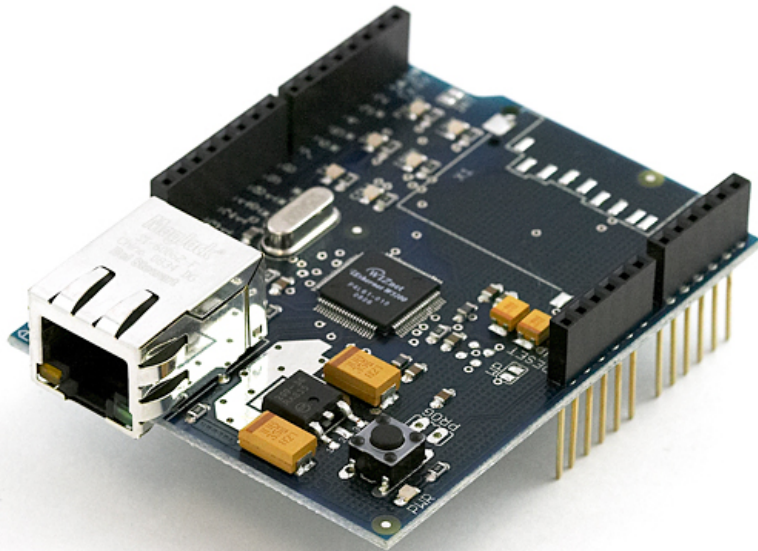
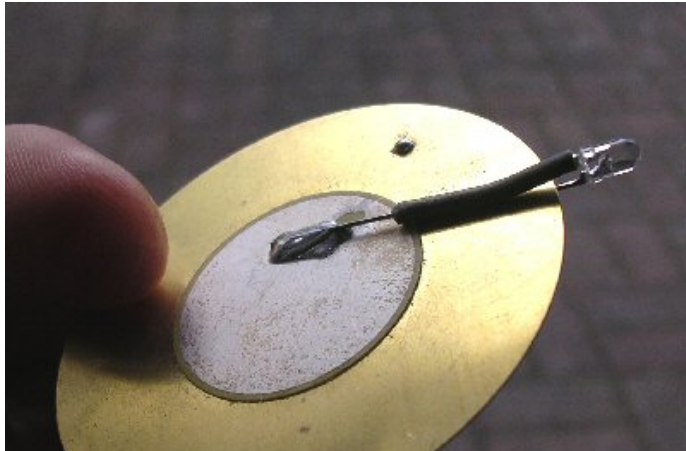
The Arduino

- 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

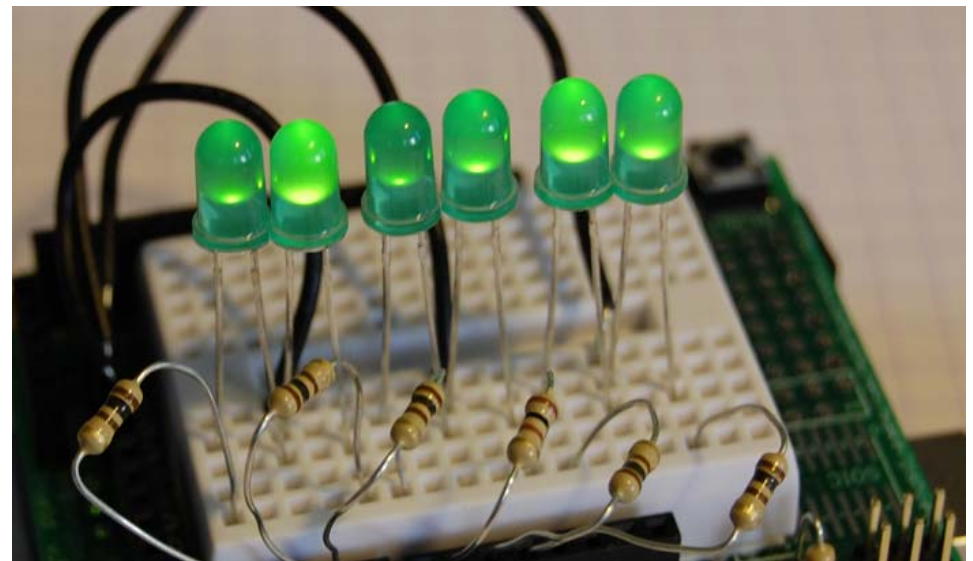
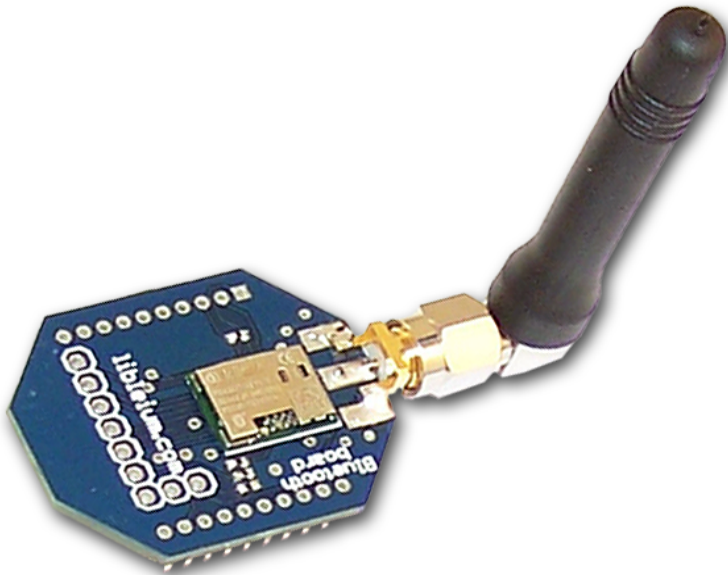
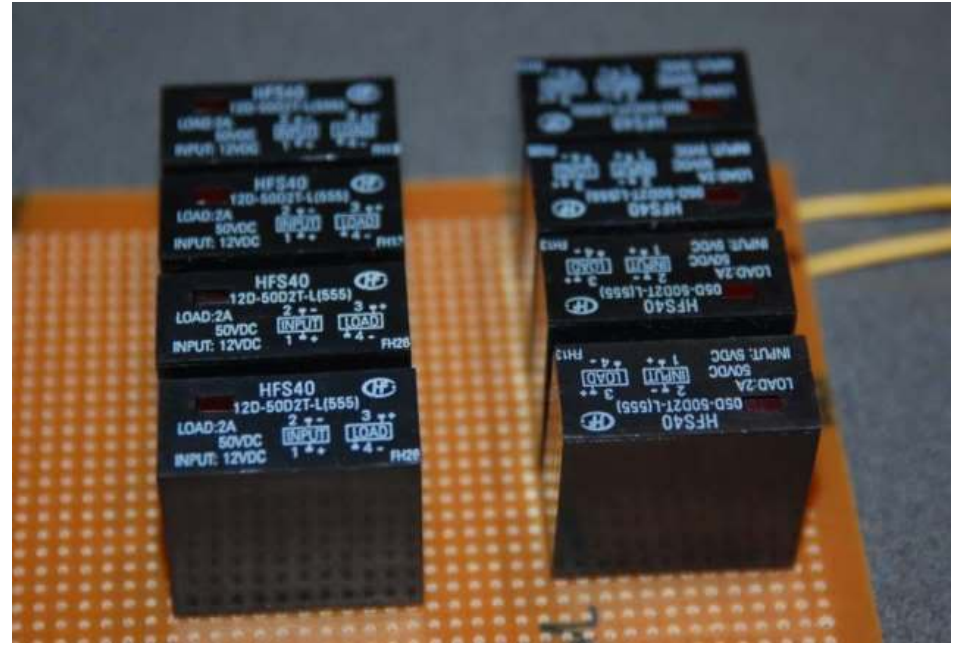
Perks

- 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

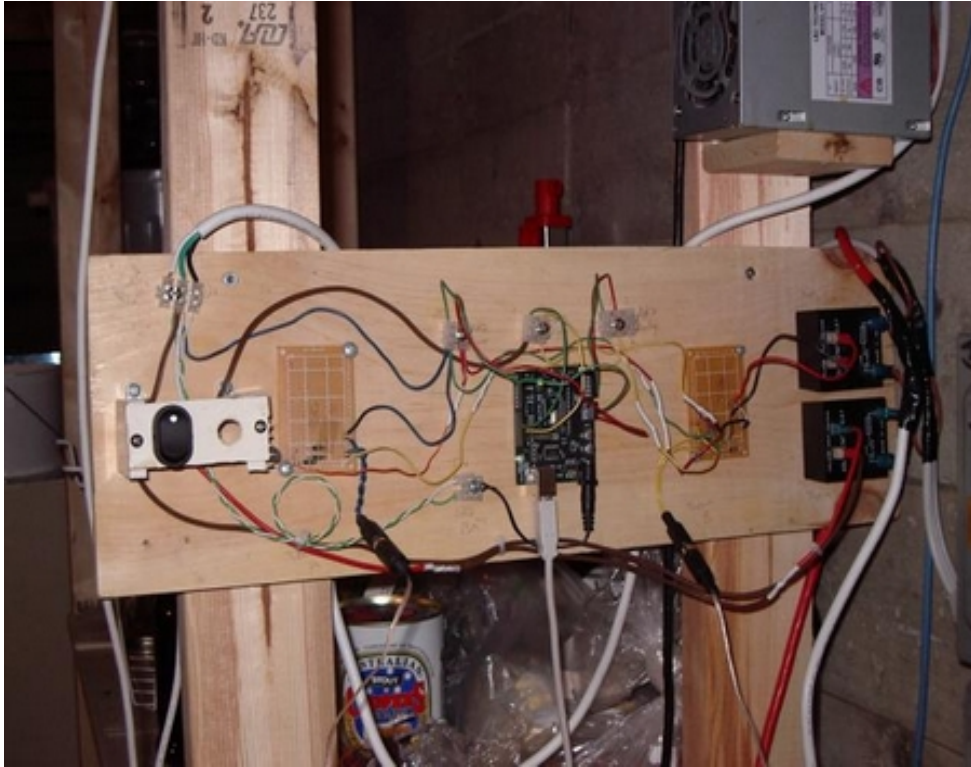
Example Input Devices



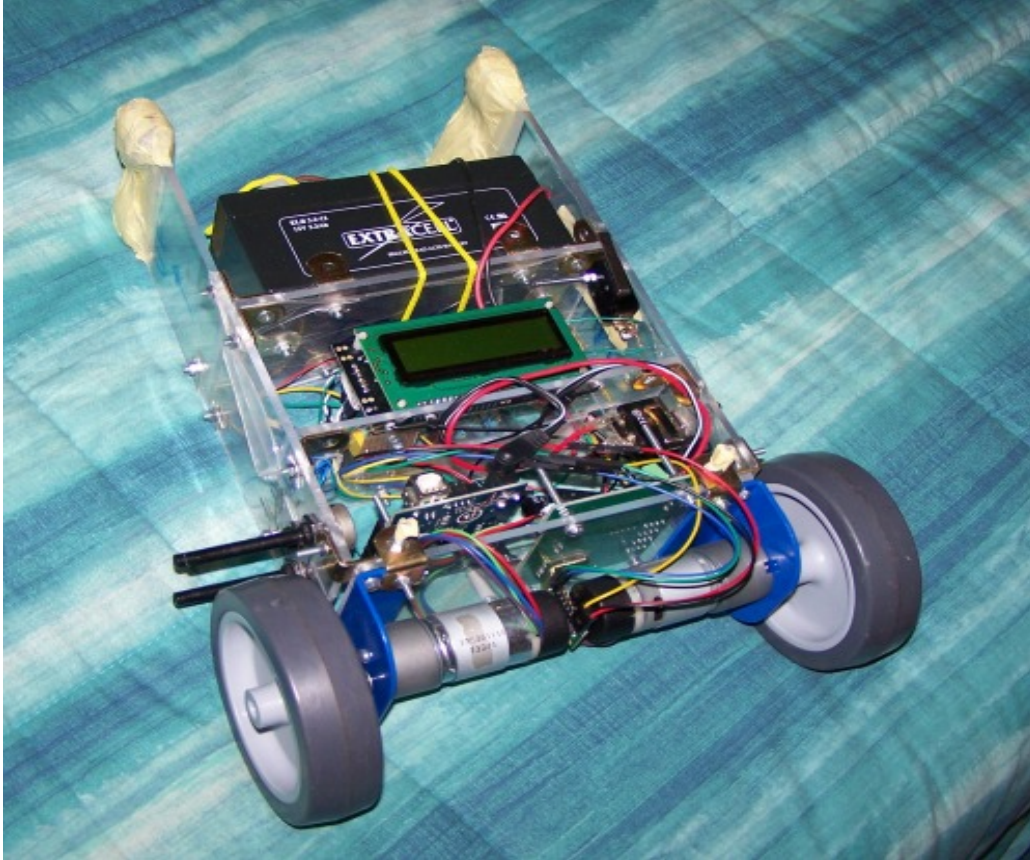
Example Output Devices



Example Arduino Applications



Example Arduino Applications



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