What Is Alice?

- A modern programming tool
  - 3-D graphics
  - 3-D models of objects
- Animation
  - Objects can be made to move around virtual world (a simulation or video game)
- Developed at Carnegie Mellon University
- At Duke – Use Alice in CompSci 4

The Power of Alice

- Automatically keeps track of 3-D objects
  - What objects are in the virtual world
  - Types of objects
  - Positions of objects in the world

Classes and Objects

- Classes
  - In Alice, classes are predefined as 3D models
- Objects
  - An object is an instance of a class
    - Class: Chicken
    - Objects: Chicken, Chicken2, Chicken3
Objects in Alice

- Objects already exist
- Objects have parts

Galleries of 3D Objects

- Sources of 3D objects
  - Local gallery – comes with Alice
  - Alice web gallery

Object Position

- Objects
  - Are positioned in 3D space
  - Have six degrees of freedom

Program an Object
Methods

- Built-in methods
- Write class methods
- Write world methods

Inheritance

- Dragon
- FlyingDragon

Example

- Princess on balcony needs to be rescued
- Other characters: dragon and knight

Events

- Default event
- Other events
Example

• People are trapped in a burning building
• Select which person will be rescued

Three Events

• The argument sent to parameters depends on which person is mouse clicked

```
<table>
<thead>
<tr>
<th>Events</th>
<th>World</th>
</tr>
</thead>
<tbody>
<tr>
<td>When</td>
<td>is clicked on</td>
</tr>
</tbody>
</table>
| do     | firsttruck | randomGarret 
|        | savePerson | randomGarret 
|        | whichFloor | burningBuilding | firstFloor |
|        | whichPerson | randomGarret |
|        | howFar     | 3 |
```

• Note - we positioned fire truck so distance from floor X is X meters (to floor 3 is 3 meters)

Example

• Zeus was a powerful god in Greek mythology. When Zeus was angry, he would shoot a thunderbolt out of the heavens to strike anyone who got in the way
• The user will choose the philosopher who will be the next target of Zeus’ anger.

Storyboard

• Possible design – method with Object parameter named who, for object clicked

```
Event: an object is mouse-clicked

Event handler: shootBolt

Parameter: who – object clicked

Do in order

prepare to strike object that was clicked

thunder plays and lightning strikes object clicked

lightning is repositioned for next strike
```

• The actions in storyboard are complex
• Break actions into simpler steps using stepwise refinement
Collections

• In some animations, several objects must perform the same actions
  – Example: marching band marching
• It is convenient to collect all objects into a group (collection)
  – Major benefit – write code for all the objects in the group (rather than separate code for each object)

Creating Lists

• In Alice, a list can be a list of numbers, or a list of objects, or a list of colors, etc.
• Let’s create a list of chickens

Creating Lists (cont)

Create List (cont)

• Type in name
• Select type
• Select “make a list”
• Add chickens to list (click “new item” 4 times)
• Result is:

Programming with a List

• Can “iterate through a list”
  – Do something to each item in the list
    • In order (use “For all in order”)
    • All together (use “For all together”)
Example/Demo: Iteration in Order

For each chicken in order
chicken says “hello”
For each chicken in order
chicken turns its head and neck around

Example/Demo: Iteration Together

For all chicken together
chicken says “hello”
For all chicken in together
chicken turns its head and neck around

Example - Sort animals by height

Start

Put Tallest two in place …

All in place!

Arrays in Alice

- In Alice, array is a data structure to organize objects or information
- An array is not visible, it is a way of organizing
- But….
  - Alice has a 3D model to help you “see” the array
Example – Create a visualization of an array of people

- Add 5 people to the world
- Add an array visualization
- Not an array yet, must add people to the array
- Positions in array numbered starting with 0

Initialize array - Add Alice to Array in position 0

- Alice automatically moves to the 0 position!

Add Soldier to the Array

- Soldier moves automatically to position 1 (which is the 2cd position)!

Add RandomGuy, Skater and Rockette

- The array initialization is complete!

- Set isVisible for arrayVisualization to false
- Array not seen
Setting elements in array

• Objects in an array are called elements

• Use “let” to set a position in an array

• Using “let”.

Why use Alice?

• There are very few women in computer science
  – Not uncommon to have 20% or fewer women in a course
  – Nationwide CompSci enrollments are down
    • Dot com burst
    • Outsourcing

Does Alice attract females?

• Build stories and interactive games

• Current two year study – several universities

• At Duke
  – CompSci 4 Spring 2005
    • 22 preregister, 30 enroll (12 female + 3 African Amer.)
  – CompSci 4 Fall 2005
    • 20 preregister, 31 enroll (17 female – one is African Amer.)

• Advertised in school paper
  • picture of ice skater
  • Web site of animations

Duke Emerging Scholars in CS

• New program to try to attract women in CS

• Collaborative effort – 7 other universities
  – UW Madison, Purdue, Georgia Tech, Rutgers, Beloit, Duke, Loyola, UW Milwaukee

• At Duke
  – One-year program
  – Take CompSci 4, CompSci 6, CompSci 18S
Alice Software – is free!

- Runs on Mac and PC
- CompSci 4 web site
  www.cs.duke.edu/courses/fall05/cps004/rodger/
- Textbook available
  - Learning to Program with Alice by Dann, Cooper, and Pausch
- Download from web
  www.alice.org