Adventures in Alice Programming

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www.cs.duke.edu/csed/alice

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Outline

• Motivation and background
• Introduction to Alice Programming
• Alice in Duke Course
• Alice Examples and Lesson Plans in K-12
• Usage of Alice by K-12 Students
• Summary

Computer Science Declining Enrollments, Few Women

Many students don’t know what Computer Science is when they come to college!

• Not taught in middle schools and many high schools
• What they think it is:
  – “keyboarding, spread sheets, word processing....”
• VERY EXCITING ........ NOT!
If taught, how do we introduce CS?

```java
public class Simple {
    public static void main(String[] args) {
        System.out.println("Hello World!");
    }
}
```

- Write a calculator
- Write a banking program
- Etc...

Why Can’t the Introduction of Computer Science be exciting?

- Programming – it’s always been
  - Hands-on
  - Interactive
  - Frustrating!
- What’s missing?
  - Not Getting Exciting Results
    - Easily, right away
  - Too textual-based, including errors
  - Not appealing to today’s kids in which media and technology are a part of their life!

Bring on Alice Virtual Worlds!

- Alice is
  - Hands-on!
  - Interactive!
  - Visual!
  - Less Error prone
  - Exciting Results right away!

- Alice has the potential to excite kids about computer science in the same way that experiments excite kids about chemistry, physics and biology!

Alice Programming Language

- Create interactive stories or games
- Learn programming in an easy way, drag-and-drop your code
- Problem solving with visual feedback
  - Logical thinking
- Along the way, learn computer science concepts:
  - Loops, classes, methods, functions, arrays
Alice Developed by Randy Pausch

- Carnegie Mellon University
- Virtual Reality Researcher
- Wrote the Last Lecture
- Died of Pancreatic Cancer in 2008

The Alice Team – Alice is free!
www.alice.org

Alice Demo: Kitty Story – children’s book on handicapped child

By Betty Stone
Animated by Deborah Nelson

Kitty Story

Let’s visit Little Kitty the kitty. She lives with her Daddy, her Mommy, and her sister, Moon Song.
Alice Programming Language

- Has libraries of 3D objects
- Keeps Track of objects you select

Objects Have Multiple Parts that are moveable

Object Position

- Objects
  - Are positioned in 3D space
  - Have six degrees of freedom
Alice Code is Easy to Learn

Select Code, Drag-and-Drop code in program

Play Alice Animation

• Chicken rises, cow turns head and talks

Versions of Alice

• Alice 2.2
  – Good for Middle School/High School introduction to programming and for college as intro to programming
  – Supported, will be around for awhile
• Alice 3
  – Good for High School / College programming course to lead into a Java course
  – IN BETA VERSION NOW – still buggy
• StoryTelling Alice - Caitlin Kelleher
  – Written as prototype, not supported
  – PhD Thesis under Pausch

CompSci 4 – Alice Class at Duke

• Full semester course on Alice for non-majors
• Lecture for 10-20 minutes
• Students work on problem with computers in pairs
• Bring students back together
Success - Alice attracts diverse group
- 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 – 1 African Amer.)
  - CompSci 4 Fall 2006 – 2 sections
    - 64 students, 33 female, 7 African Amer.
  - CompSci 4 Fall 2007 – 2 sections
    - 84 students - > 50% female
  - CompSci 4 Fall 2008 – 2 sections
    - 100 students - > 50% female
  - Same for Spring 2009, Fall 2009...
  - Advertised in school paper
    - picture of ice skater
    - Web site of animations

Concepts in Duke Alice course
- Classes, objects, methods, parameters
- Inheritance
- Storyboards
- Conditionals, looping constructs
- Random numbers
- Events
- Recursion
- Arrays, Lists

Example – while loop

Example - Inheritance
- Start with a chicken object
- Rename it to TalentedChicken
  - Change its color
  - Resize it larger
  - Add new methods (jump, go around an object)
  - Add events for this chicken
- Save this new class TalentedChickent that inherits from the Chicken class
List Example - Sort animals by height

Example with ArrayVisualization
Swapping two elements in an array
- Swap the objects at positions 0 (fanDancer) and 3 (duckPrince)
- Add in an ObjectVisualization, this is like a variable for an object. (same folder where ArrayVisualization is)

Put Tallest two in place ...

All in place!

Swapping objects at 0 and 3 (cont)
- Only one element at a time can be in a slot in the array. To swap two elements, you have to move one of them out temporarily.
- Move object at index 0 to objectVisualization (this frees up slot 0)

Swapping objects at 0 and 3 (cont)
- Now you can move the item in slot 3 over to slot 0 (note the duckPrince moved over)
- Now slot 3 is empty
Swapping objects at 0 and 3 (cont)

- Now move the object that was originally in slot 0 and was saved temporarily in the ObjectVisualization, over to slot 3

Array Example

- Shuffle Array
- Sort Array – sort by heights

Games Created by Duke CompSci 4 Students

- Non-majors
- Most never programmed before
- Final projects after 10 weeks of Alice
- 50% of students are women
- Spring 05, Fall 05, Fall 06, Fall 07, Fall 08, Spring 09, Fall 09

Game: Candyland

Select girl and boy to play
Click on red and green buttons to move them.
Game: Frogger – Get frog across road

Game: Eragon
4 tasks to win the game

Game: Tic Tac Toe

Game: Dating Game

Game: DDR
Click on arrow keys, Player moves foot to square
Game: Rumble Putt

Game: Sarah Palin’s Seaplane Adventure

Sarah Palin’s Seaplane Adventure (cont)

Game: Scarab Beetles take over
Problem – Few students major in CS

- Students come to college with their mind made up on their career! This choice is based on what they know.
- Students don’t know what computer science is when in middle and high school
- They like Alice, but not staying with computer science

Where could Alice help in decisions?

- Students in middle school are starting to form decisions on careers
- They have exposure to Teachers, Doctors, Astronauts, etc.
- They learn about Biology, Physics, Chemistry
  – BUT DON’T KNOW WHAT COMPUTER SCIENCE IS
  – THEIR EXPOSURE is SPREAD SHEETS, POWERPOINT, etc.

Success - Alice Excites 4th-6th Grade Girls

- Duke Femmes Event, April 07
- 60 girls – 4 groups of 15
- Taught them Alice for an hour
- Handout to take home

Thank you from 4th Grade Girl

Dear Susan,
Thank you for showing me the Alice program. I think it’s really cool! I met my mom to download it, and I’ve created snow world. Again, I think Alice is really cool and thank you for showing it to me.
Adventures in Alice Programming

Grades 5-12 Outreach

www.cs.duke.edu/csed/alice/aliceInSchools

Adventures in Alice Programming

- Integrate Alice into high school and middle schools by training teachers
- Six sites:
  - Durham, NC
  - Charleston, SC
  - Virginia Beach, VA
  - Denver, CO
  - Oxford, MS
  - San Jose, CA
- Durham site focuses on Middle Schools in NC
  www.cs.duke.edu/csed/alice/aliceInSchools

Duke: Adventures in Alice site

- Summer 2008 and 2009
  - 1-week and 3-week Teacher workshops
    - Over 130 teachers, mostly middle school, some high school
    - Only a few had ever programmed before
    - Taught them Alice, Developed Lesson Plans
  - 1-week middle school camps
    - Taught Alice
    - Lots of time to build their own Alice worlds

Targetting all subject teachers

- Subject teachers using Alice
  - Language Arts
  - Mathematics
  - Science
  - History
  - Foreign Language
  - Music, Art
  - Media, Technology
  - Business
- Mostly Middle school, some Elementary, and some high school subject teachers (physics, chemistry, etc)
How to Use Alice in Middle/High Schools

• Teachers
  – Examples in lecture
  – Make interactive quizzes
  – Make worlds on concepts for students to view

• Students
  – Projects (in place of a poster, a model)
  – To take or build quizzes
  – To view and answer questions about a world
  – Older students can do more with Alice.

Free Materials - Introductory Tutorials

1. Simple, Short (15 min) tutorials to try Alice
   – Add an object, use built-in methods

2. One hour starting tutorials
   – Writing methods, simple events, camera control

3. Four part tutorials if more time/more detail
   – More detailed on placement of objects, writing methods, events, camera control
   – Animating a skateboarder
   – Adding sound and images

Many short tutorials on CS Topics

• CS Topics
  – Programming – sequential and “at the same time”
  – Methods (teaching characters how to walk)
  – Events (buttons and birds)
  – Looping
  – Conditionals (making a choice)
  – Functions (how tall are you)
  – Lists (objects moving in unison)
  – Variables (timers/scores)

Other “Fun” Topics Blended in

• Storyboards
• Changing camera views
• Scene changes and lighting
• Fading in/out
• Making Billboards
• Making objects invisible and visible
• Sounds
• Glueing objects to others
Game: Break the Pinata
- Timer/Score

Alice examples: Science Example:
How volcanoes form

How a volcano is formed (cont)
And emerges above the ocean as an island.

Math Example:
Teacher Lesson Plan on quadrant plane
- Click on lighthouse
- Enter x, y position
- Objects randomly move
Magic Tree House Quiz
Famous Children’s Book Series

5. What type of tree is the treehouse on?
- maple
- oak
- a magic tree of no special type
- elm
- I don’t know

Score 5.0

Other Ideas for Projects

- Story from Ancient Egypt
- Spanish Quiz in which you see a word and have to click on the object the word represents
- Animate a scene from a book you have read or a poem you have written
- Create a world about school safety
- Memory game – remember a random color sequence
- Math Quiz – Answer the questions

Alice worlds for these and more are on our website.

Other Teacher Lesson Plans

- Math
  - Finding surface area
  - Rate of Change and Slope
- Science
  - Create a food chain
  - Sun, Earth and Moon system
  - Tornados
  - Physics – Newton’s law of gravity
  - Alternative Energy

Other Teacher Lesson Plans (cont)

- History/Social Studies
  - The continents – view world and answer questions
  - Animated overview of Japan
  - Animated overview of Egypt
- English
  - Write and animate a poem
  - Animate a poem or scene from a story
  - Write a movie trailer
Developed special Alice worlds or classes
- Superground class – has all the grounds and tutorial explains how to fade in and fade out
- Quiz classes – template for making quizzes OR use the quiz tutorial

Alice with K-12 students in a camp. What type of objects did they use?
- Girls top five
  - People, animals, environments, nature, 3D-text
- Boys top five
  - Vehicles, people, buildings, scifi, special effects

Typical Boy Example

Girl Examples – Dancing chicken
Girl Example 2 - Egypt

Girl Example 3 – Attack of the lemurs

Girl Example 4 - carnival

Girl Example 5 – rescue baby
How did the Students use Alice?

- Examined worlds to see which concepts they used

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<th>3+ times</th>
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Summary - Alice can introduce and excite students about computer

- Integrate Alice into all disciplines, all levels (K-12 and college)
- Alice can be used for projects
  - To tell stories
  - To solve problems
  - All while learning about programming concepts
- Older students can go more in depth with Alice
- All our materials are Free (over 40 tutorials, videos, sample Alice worlds, links to materials for Duke class)
  - www.cs.duke.edu/csed/alice/

Web site

- Adventures in Alice Programming
  - www.cs.duke.edu/csed/alice

Questions?