Integrating Animation and Computer Programming with Alice into All Disciplines

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Outline

• Motivation for Integrating Computer Science into K-12
• Introduction to Alice
• Discipline Specific Projects
• Getting Started – Curriculum Materials
• Demo – Build an Alice World
• Conclusion and Future Work
Computer Science
What? When? Where?

• What?
  – Not just using a computer, but problem solving
  – Not just writing a program, but an efficient one

• When? Relatively new field
  – only about 60 years old…
  – Compare to math, physics

• Where does it fit in Middle and High Schools?
  • Technology
  • Science
  • Mathematics
  • Language Arts
  • History
  • Foreign Language
  • Music
  • Art
Why Schools Should Teach Computer Science (CS) – (from NCWIT.org)

- Computer Science gives students vital 21st century skills
  - C.S. underlies most innovation today

- C.S. means rewarding careers
  - Predicted shortage of technical jobs in the future
  - Wide range of options in CS (health, environment, finance, arts, security ...)

- C.S. is more than just technology
  - CS teaches design, logical thinking and problem solving
Efforts to get CS into K-12

• 10,000 teachers – NSF – Computing for Everyone (CE21)

• Computer Science Teachers Association
  – csta.acm.org
  – CSTA K-12 Computer Science Standards
    • Outlines topics for each grade level

• Adventures in Alice Programming Project
  – supported by NSF ITEST and IBM
Why Alice?

• Lots of other great tools for teaching programming

  Greenfoot

• Alice is easy to use, drag-and-drop, objects already exist

• Attractive to both girls and boys
Computer Science Declining Enrollments, Few Women

Figure 1. Computer Science Listed as Probable Major Among Incoming Freshmen
Source: HERI at UCLA
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
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
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
— CTE Teachers can help expose students to CS
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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

Meet the Alice Team

The Alice Project is a multi-university initiative, and the Alice Team is a collaboration among faculty, staff and students.

Director
Wanda Dann

Carnegie Mellon
Contact Wanda

Research Scientist
Dennis Cosgrove

Carnegie Mellon
Homepage

Faculty
Steve Cooper
Alice Programming Language

- Has libraries of 3D objects
- Keeps Track of objects you select
Objects Have Multiple Parts that are movable
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
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Language Arts – Animate a story

By Betty Stone
Animated by Deborah Nelson

KITTY STORY
Science – Population Change
Science – Population Change (end)
Science Example
How a volcano is formed
¡Bienvenido al programa de cocinar!
Cooking Spanish – More detailed

Vamos a hacer pan de plátanos!
Cooking Spanish – setting the table
Math Example – Plotting Numbers

I am going on a bike ride
Math Example – Rounding Numbers

Rounding World

Choose the level of difficulty by clicking on the handle

Level 1  round numbers up to the hundreds
Level 2  round numbers up to the thousands
Level 3  round numbers up to the millions

START → 100
Technology - Keyboarding
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Adventures in Alice Programming
Grades 5-12 Outreach

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

• Summers 2008-2015
• 3-week Teacher workshops
  – Over 150 teachers, mostly middle school, some high school
  – All disciplines
  – Taught them Alice, Developed Lesson Plans
• Main Sites:
  – Durham, NC
  – Charleston/Columbia, SC
  – Oxford, Mississippi
Targeting all subject teachers

• Subject teachers using Alice
  – Language Arts
  – Mathematics
  – Science
  – History
  – Foreign Language
  – Music, Art
  – Media, Technology
  – Business

• middle school and high school, some elementary
Using 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.
Our Free Materials Over 60 Tutorials

1. Getting started tutorials
   – 1-4 hours

2. Tutorials on CS topics
   – Methods, conditionals, lists, etc
   – Variables (timers/scores).

3. Animation tutorials
   – Lights, camera, scene change, billboards, invisible objects

4. Project tutorials
   – Short projects, longer projects, games
Getting Started Tutorial – 1 hour
New getting Started Tutorial – 3 part
What does such a tutorial teach?

• Placing objects
• Moving objects
• Setting up Camera tripods and moving between views
• Using built in methods and writing your own
• Glueing objects together
• Adding sound, 2D pictures to enhance world
Project: Book Report

Charlotte's Web
by E.B. White
Project History Report
New Scene Change
New Project - Space
New Project – Keyboarding Game
Simple Game – Control, earn points

To win this game, you must steer the boat through each ring and beat the clock. You receive one point for each ring, and there are 10 rings, so if your score is less than 10 at the end, you lose!
Adventure Game – Find objects in order
New Project - Astroids

welcome to asteroids.

You must navigate the asteroid field. Do whatever is necessary to survive.

Use the arrow keys to steer. Use the space bar to shoot.

Good luck.
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Let’s build an Alice World
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Conclusions and Future Work

• Curriculum Materials and Teachers Lesson plans – FREE on our web site
• Teachers excited - see different ways to use it
• Projects best for integrating into a course
• Multimedia/Business Technology seems the best place for more extensive teaching of Alice
  – Pair up with teachers in other disciplines
• Future
  – Summer Workshops through 2015
  – Alice Symposium 2013
  – Other formats for tutorials?
Adventures in Alice Programming web site

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

Questions?