Creating Animations with Alice for Projects in all Disciplines

Susan H. Rodger
Duke University

NC CTE Summer Conference
July 24, 2013

Supported by the National Science Foundation Collaborative Grant NSF 1031351, CRA distributed mentor awards, and Faculty Awards from International Business Machines.
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
Three Problems with Computer Science in K-12

1. Students don’t know what it is
   Not keyboarding, PowerPoint, spreadsheets

2. Computer Science is not in many schools
   Few high schools teach AP computer science
   Fewer middle schools teach computing

3. Where are the women and minorities?
   Number of underrepresented groups in computer science is low
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 Computer Science into K-12

• 10,000 teachers – NSF
  – Computing for Everyone (CE21)
  – New AP Principles course

• 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

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

• Attractive to both girls and boys
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 4\textsuperscript{th}-6\textsuperscript{th} 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

– K-12 Teachers can help expose students to CS
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
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, Computational 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
More on ... 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
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
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.
Let's look at your x-ray Kitty.

Sometimes Her mom takes her to the Doctor so that she can check out her knee. Sometimes that hurts a bit and sometimes it doesn’t.
At night, her mom or dad puts leg splints on her knees. Kitty does not like this one little bit! She does a good job of crying.
Science – Population Change
now we'll graph the data in a bar chart to see how the population changed over time
Science Example
How a volcano is formed
Biology – Punnett Squares
¡Bienvenido al programa de cocinar!
Cooking Spanish – More detailed

Vamos a hacer pan de plátanos!
Cooking Spanish – setting the table
Keyboarding
Harry Potter – Math/computing
Level 1 Charms - before
Harry Potter – Math/Computing
Level 1 Charms - after
Hailey Programmer and the Goblet of Java

You will receive a password at the end of each level that will be used to unlock the next level. WRITE THESE DOWN!
If this is your first time playing, select Charms.
Focus on math

Math Example – Plotting Numbers

I am going on a bike ride
Math - Percentages
Math Example – Random Sample

**INSTRUCTIONS**

- Today we are going to learn about probability and sampling by looking at two boxes containing red and blue balls.
- In a **simple random sample**, each ball has an equal probability of being selected, regardless of box.
- In a **stratified random sample** of these marbles, each ball has an equal probability of being selected—once a box is selected, we choose balls from that box only.
- Type **S** to see a simple random sample or **T** to see a stratified random sample.
Math Example – Rounding Numbers

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
Math Example - Fractions

Press 'A' for addition
Press 'S' for subtraction
Press 'M' for multiplication
Press 'D' for division
Math Example – Order of Operations
Math – Negative Soccer
Math Stories to Attract Girls

• Danica McKellar
Math Story on Fractions
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
Adventures in Alice Programming
Grades 5-12 Outreach

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

• 2-week Teacher workshops
  – Over 200 teachers, middle school, high school, some elementary
  – All disciplines
  – Teach Alice, Develop Lesson Plans
  – One-week followup workshop
  – Summers 2008-2015, funding for lodging

• Main Sites:
  – Duke University, Durham, NC
  – Charleston/Columbia, SC
  – San Jose, CA (starting 2014)
Free Curriculum Materials/Lesson plans

• Over 60 free Alice Tutorials (from getting started to specific topics, sample projects)
• Teacher lesson plans available
• Most students use Alice for projects – instead of poster, report

• 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
New getting started tutorial

Hey! Welcome to my island!
Getting Started Tutorial – 3 part
Example: Getting Started Tutorial teaches:

- Placing objects
- Moving objects
- Setting up Camera tripods and moving between views
- Using built in methods and writing your own
- Gluing objects together
- Adding sound, 2D pictures to enhance world
Sample tutorial: Scene Change
New Tutorial – Camera views following a person
Tutorial on CS concepts – properties and functions
Tutorial for Project: Book Report

Charlotte's Web
by E.B. White

Click
Tutorial for Simple Game – Control boat, 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!
Tutorial for Adventure Game – Find objects in order
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
Versions of Alice

• Alice 2.3 - WE WILL USE THIS VERSION
  – Good for Middle School/High School introduction to programming
  – Supported, will be around for awhile, stable

• Alice 3
  – Good for full High School programming course to lead into a Java course
  – Released last summer, still improving it

• StoryTelling Alice - Caitlin Kelleher
  – Written as prototype, not supported
  – PhD Thesis under Pausch
  – Now developing Looking Glass
Let’s build an Alice World
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
What a middle school kid can do with Alice – from teacher Chari Distler
What a Middle school kid can do with Alice – from teacher Chari Distler
Conclusions and Future Work

• Teachers using Alice in lots of disciplines
  – 1-2 classes in Alice to get students started
  – Students can explore further on their own
  – Teachers excited - see different ways to use it
• Projects best for integrating into a course
• More extensive use of Alice
  – Media/Business Technology - pairing up with teachers in other disciplines
  – Introductory computing class
• Workshops through 2015, Alice Symposium 2013
• Other formats for tutorials?
Adventures in Alice Programming web site

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

Questions?