Creating Animations with Alice for Projects in 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

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

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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

- Scratch
- Greenfoot
- LEGO
- Snap!

• 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 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
  - K-12 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, 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

The Alice Team
- Director: Wanda Dann
- Research Scientist: Gamli Geoghega
- Faculty: Steve Cooper

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

Kitty Story
By Betty Stone
Animated by Deborah Nelson

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

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

Science Example
How a volcano is formed

Science – Population Change (end)
Biology – Punnett Squares

Foreign Language simple

Cooking Spanish – More detailed

Cooking Spanish – setting the table
Keyboarding

Harry Potter – Math/computing
Level 1 Charms - before

Harry Potter – Math/Computing
Level 1 Charms - after

Harry Potter – Math/Computing
Level 7 Herbology

*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.
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

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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
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

Tutorial for Simple Game – Control boat, earn points

Tutorial for Adventure Game – Find objects in order
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### 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

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### Let’s build an Alice World

![Alice World Image]

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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?