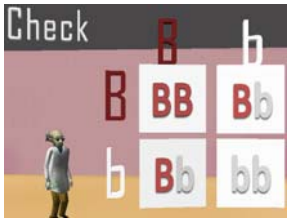
Creating Animations with Alice for Projects in all Disciplines

Susan H. Rodger
Duke University



NC CTE Summer Conference
July 16, 2014

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

Problems with Computer Science in Grades 1-12

1. Computer Science is not in many schools

   Few high schools teach AP computer science

   Fewer middle schools teach computing

   Not even required at the college level
2. Students don't know what it is

   Not keyboarding, PowerPoint, spreadsheets
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

Where does Computer Science fit in middle and high schools?

- Technology
- Science
- Mathematics
- Language Arts
- History
- Foreign Language
- Music
- Art

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

Greenfoot

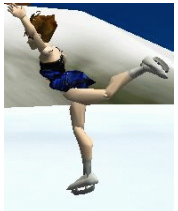
SCRATCH

Snap!

- Alice is easy to use, drag-and-drop, objects already exist
- Attractive to both girls and boys

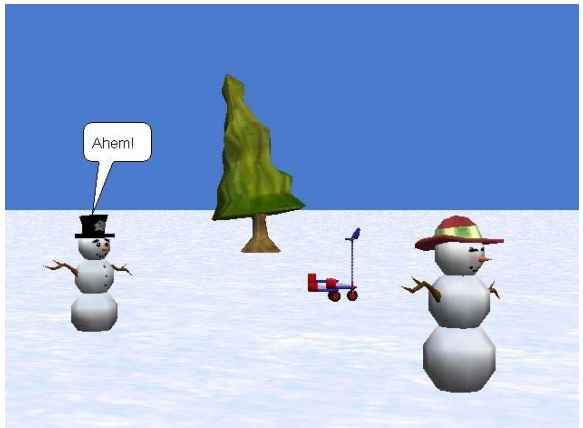
Success - Alice attracts diverse group

- 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
- Event again in 2008 ,2009, 2010, 2011, 2013, 2014



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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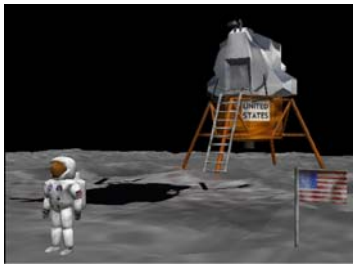
Bring on Alice Virtual Worlds!

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



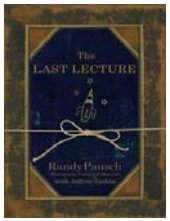
- Alice has the potential to excite kids about computer science in the same way that experiments excite kids about chemistry, physics and biology!

Alice Programming Language

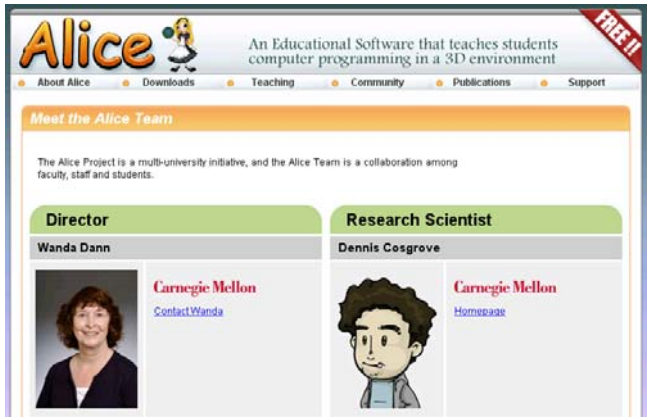
- Create interactive stories or games
- Learn programming in an easy way, drag-and-drop your code
- Problem solving with visual feedback
  - Logical thinking, Computational thinking
- Along the way, learn computer science concepts:
  - Loops, classes, methods, functions, arrays

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



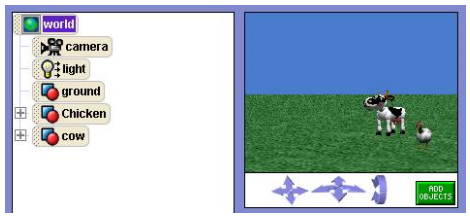
Faculty

Steve Cooper

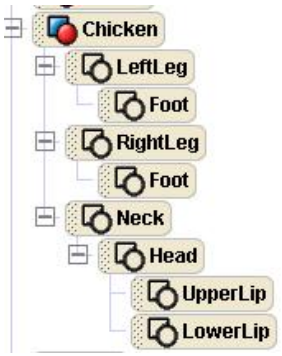
More on … Alice Programming Language

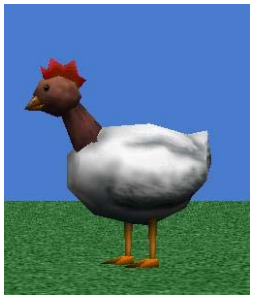
- Has libraries of 3D objects

- Keeps Track of objects you select



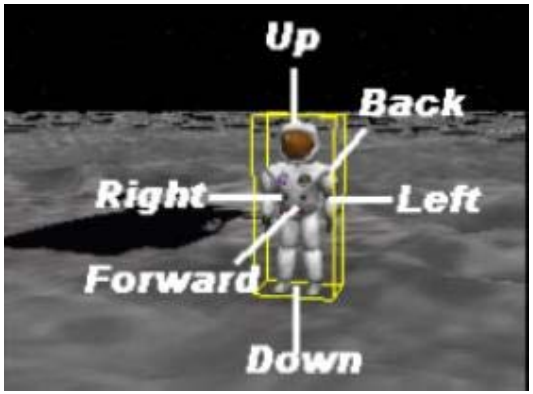
Objects Have Multiple Parts that are moveable





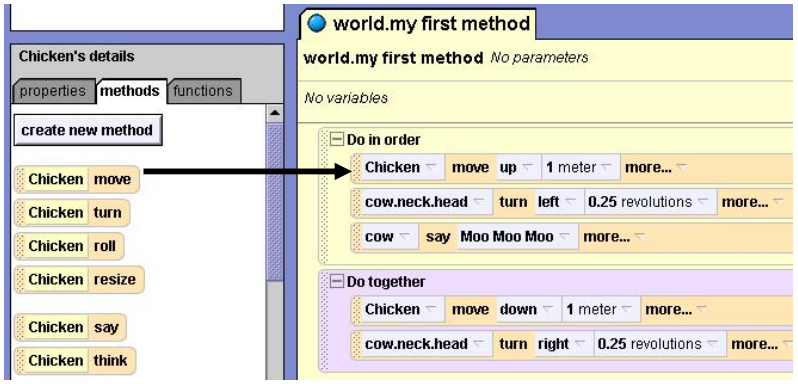
Object Position

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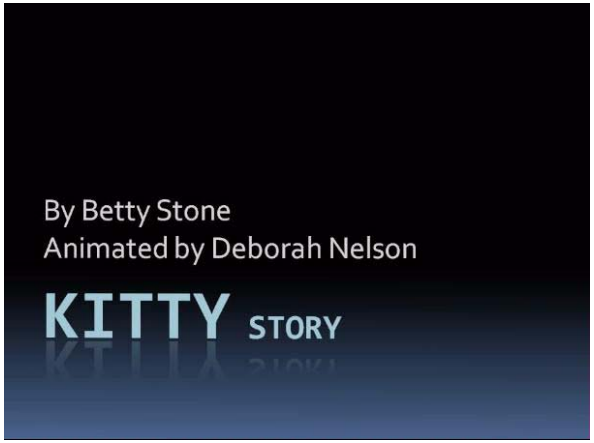
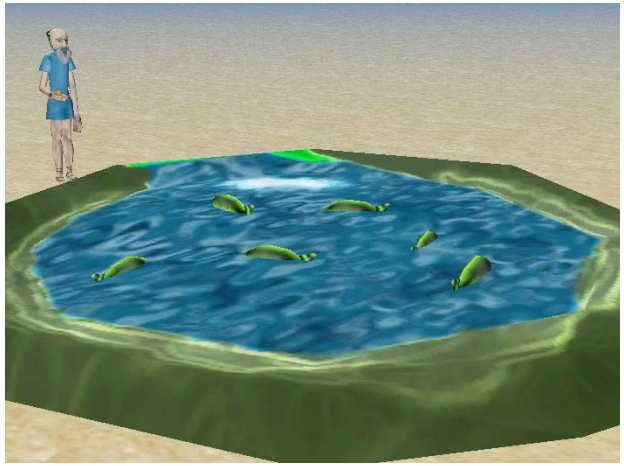
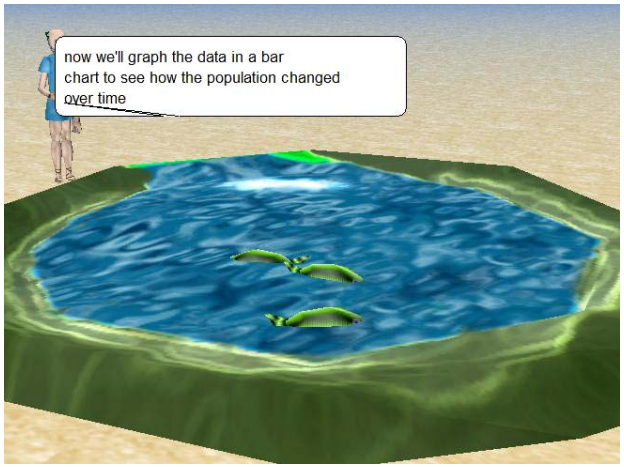
Alice Demo: Kitty Story – children's book on handicapped child

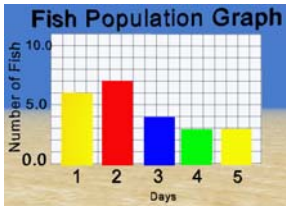


Science – Population Change



Science – Population Change (end)





Science Example
How a volcano is formed

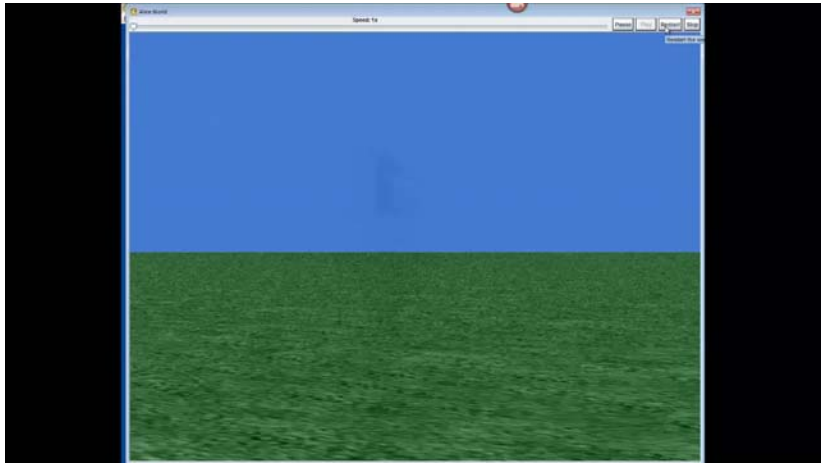
Biology – Punnett Squares

Foreign Language simple

Cooking Spanish – More detailed

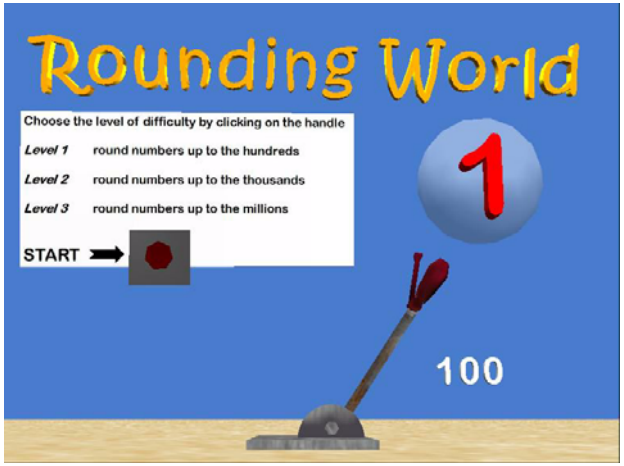
Cooking Spanish – setting the table

Keyboarding

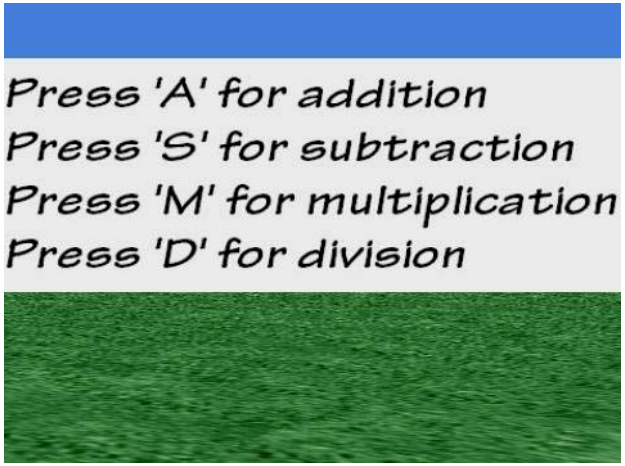


Focus on math
Math Example – Plotting Numbers

Math Example – Rounding Numbers



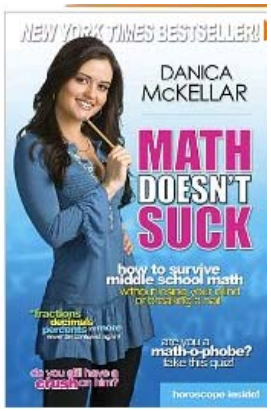
Math Example - Fractions

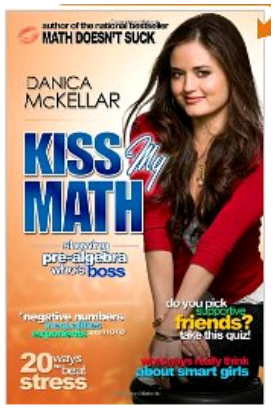


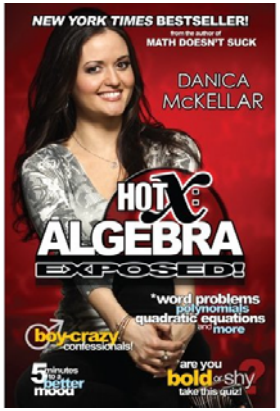
Math Example – Order of Operations

Math Stories to Attract Girls

- Danica McKellar







Math Story on Fractions

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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
  - First week Teach Alice, Practice
  - Second week - Develop Lesson Plans
  - One-week follow-up workshop the following summer
  - Summers 2008-2015, funding for lodging
- Main Sites:
  - Duke University, Durham, NC
  - Charleston/Columbia, SC
  - San Jose, CA (starting 2014)

Integrating Computing into all Disciplines

- Teachers attending are from all disciplines:
  - Language Arts
  - Mathematics
  - Science
  - History
  - Foreign Language
  - Music, Art
  - Media, Technology
  - Business

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.

Curriculum Materials

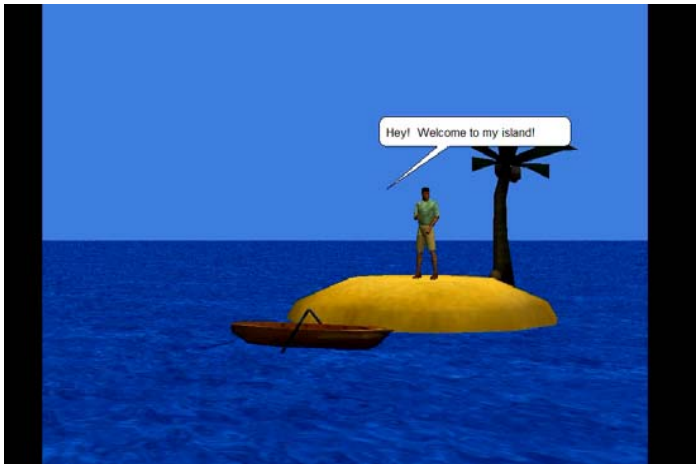
- Over 90 tutorials available for free
- Beginner, advanced, challenges, projects
- Paper handouts and video

Getting Started Tutorials

- One-hour tutorial
  - Covers placing objects, setting camera views, basic commands, writing methods and events
- 3 versions of it – pick story your students will like

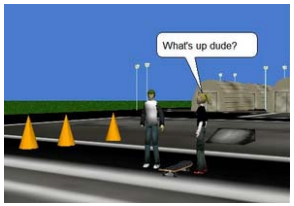


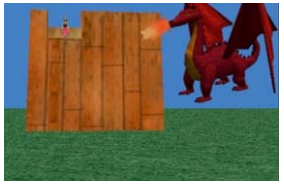
Getting started tutorial One Hour



3-4 Part getting started tutorials

- One long story in three or four parts (about 3 hours)
- 4 stories to pick from




Getting Started Tutorial – 3 part

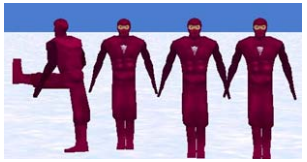
Example: Getting Started Tutorial teaches:

- 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

Topical Tutorials – CS Topics

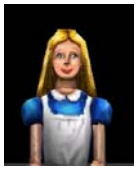
- Who is taller? Making decisions
  - conditional
- Making a fancier chicken
  - Inheritance

- How to get all ninjas to kick at the same time
  - List



- How to visit all your friends
  - Making methods flexible - parameter

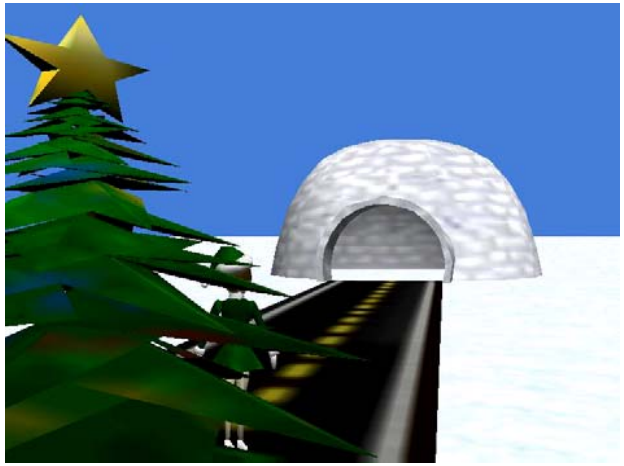
Animation Tutorials



- Camera
- Lighting
- Adding images and sound
- Invisible objects
- Changing scenes
- Putting real people in Alice

Sample tutorial: Scene Change

New Tutorial – Camera views following a person



Sample Project Tutorials

- Discipline Specific
- Sample games

Tutorial for Project: Book Report

Tutorial for Simple Game – Control boat, earn points

Tutorial for Adventure Game – Find objects in order

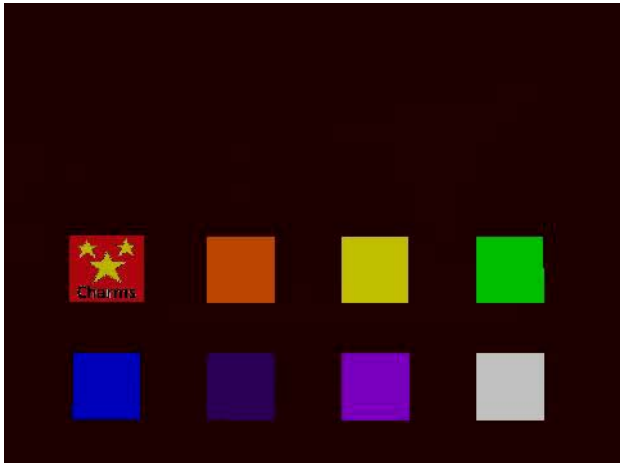
Challenges

- A world that is mostly built
- Has missing pieces (challenges)

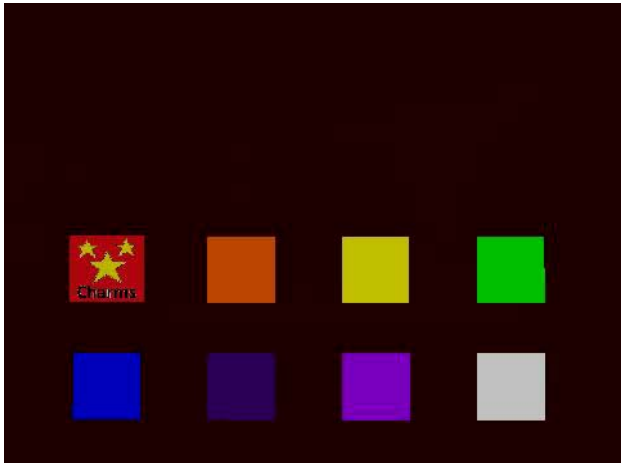
Harry Potter Challenge

- Mix of programming and math challenges

Harry Potter – Math/computing
Level 1 Charms - before



Harry Potter – Math/Computing
Level 1 Charms - after



Other Example Challenges

Boat

Calculator

Enhanced Calculator!

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Versions of Alice

- Alice 2.4 - WE WILL USE THIS VERSION
  - Good for Middle School/High School introduction to programming
  - Supported, will be around for awhile, very stable
- Alice 3
  - Good for full High School programming course to lead into a Java course
  - Released two 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

Fun with Alice

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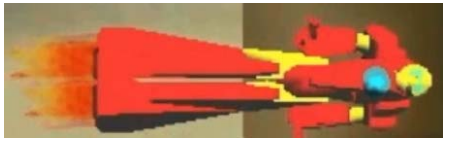
What a middle school kid can do with Alice – from teacher Chari Distler

What a 6th grader can do with Alice - teacher Chari Distler

No Superheros in Alice



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?