Engaging Middle School Teachers and Students with Alice in a Diverse Set of Subjects

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Outline

• Motivation and background
• Adventures in Alice Programming overview
• Middle School Alice Tutorials
• Middle School Alice Examples and Lesson Plans
• Usage of Alice by Middle School Students
• Summary and Future Plans
Computer Science Declining Enrollments, Few Women

Figure 1. Computer Science Listed as Probable Major Among Incoming Freshmen
Source: HERI at UCLA
How do we Introduce and Teach Science?

• Physics – experiments

• Chemistry - experiments

• Biology - experiments
We don’t introduce Computer Science in K-12!

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

```
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.
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.
More on “What is Alice?”
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
  – Supported, will be around for awhile

• Alice 3
  – Good for full High School programming course to lead into a Java course
  – NOT READY – ROUGH BETA VERSION NOW

• StoryTelling Alice - Caitlin Kelleher
  – Written as prototype, not supported
  – PhD Thesis under Pausch
CompSci 4 – Alice Class at Duke

• 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
  - Advertised in school paper
    - picture of ice skater
    - Web site of animations
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
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

Score: 4.0

Game: DDR

Click on arrow keys, Player moves foot to square
Game: Dating Game

Questions:
1 2 3 4

Choose Contestant!
Game: Rumble Putt

Rumble Putt
By Greg Halperin
Game: Sarah Palin’s Seaplane Adventure

TODD'S SNOW MACHINE HAS BROKEN DOWN... AND IT'S UP TO YOU TO SAVE HIM!

SARAH PALIN'S SEAPLANE ADVENTURE

INSTRUCTIONS  PLAY  CREDITS

TAKING FLIGHT
Sarah Palin’s Seaplane Adventure (cont)
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Transition to K-12
Alice into K-12

• Non-majors course at Duke
  – Popular, fills up with seniors
  – College students pretty set with their major before they come
• Students in middle school are starting to form decisions on careers
• They have exposure to Teachers, Doctors, Astronauts, etc.
  – BUT DON’T KNOW WHAT COMPUTER SCIENCE IS
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 and 2009
Dear Susan,
Thank you for showing me the Alice program. I think it's really cool. I got my mom to download it, and I've created a show world. Again, I think Alice is really cool and thank you for showing it to me.
From [Name]
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
  - 3-week Teacher workshop
    - 35 teachers, mostly middle school, some high school
    - Only a few had ever programmed before
    - Subjects: english, math, science, history, art, technology
    - Taught them Alice, Developed Lesson Plans
  - Two one-week middle school camps
    - Taught Alice
    - Lots of time to build their own Alice worlds
  - Overlap between the two
  - Followup Teacher workshop Summer 09
How to Use Alice in Middle 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 quizzes
  – To view and answer questions about a world
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Three Introductory Tutorials

1. Simple, Short (15 min) tutorial to try Alice
   – Add an object, use built-in methods
2. One hour tutorial for younger kids
   – Writing methods, simple events, camera
3. Four part tutorial for middle school kids
   – More detailed on placement of objects, writing methods, events, camera control
   – How to put a person on a horse
   – Answer a cell phone
Many short tutorials on CS Topics

- Programming – sequential and “at the same time”
- Methods
- Events
- Looping
- Conditionals (making a choice)
- Functions (compute and return an answer)
- Lists
- Variables (timers/scores)
Other “Fun” Topics Blended in

- Storyboards
- Changing camera views
- Scene changes and lighting
- Making Billboards
- Making objects invisible and visible
- Sounds
- Glueing objects to others
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Today, we are going to see how HOT SPOT volcanoes form.
Deep under the earth's crust, heat from the core makes the mantle move like a lava lamp.
How a volcano is formed (slide 3)

Over thousands of years, the volcano builds up...
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
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
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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
SciFi, vehicles, fire
More fire
And more fire
And more fire!
Girl Examples – Dancing chicken
Girl Example 2 - Egypt

behind me is where mummies lie.
Girl Example 3 – Attack of the lemurs

Hello! I'm the chief of this island, and we welcome you.
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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<td>26%</td>
</tr>
<tr>
<td>color property</td>
<td>66%</td>
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</tbody>
</table>

CS Topics

Basic topics
Feedback from Parents

• “[My daughter] thoroughly enjoyed her week with you. It was a great experience!”

• “I’m convinced. Kids like Alice and Alice is a good way to teach kids programming. [My son] is doing my python course and he’s not all that interested in python and never touches it between the courses. However, in the evenings when he comes home from the Alice course, he works on his Alice worlds.”
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Summarizing

• We developed
  – Tutorials
  – Examples of possible use in Middle Schools
• Teachers developed
  – Lesson Plans for history, science, math, language arts, art, and technology
  – Animation Fair
• Middle School Students
  – Were engaged, developed their own worlds
  – Animation Fair
  – Difficult to get away from the computer

All materials are on our website.
Followup

- Teachers use Alice during the school year
- Followup 2-3 day workshop in Summer 2009
  - June 15-16

- Visited one of the schools
- Presenting at the local public school technology day
Alice Symposium and workshops in 2009

• June 17, 2009 – Alice Symposium
  – Submit papers by March 15th

• Three one-week Alice workshops
  – June 22-26
  – June 28- July 2
  – July 6-10

• Two day followup Alice workshop
  – June 15-16
Results of our workshop this summer

• Teachers are very excited about Alice
• Teachers want many specific models built
• We are developing classes that could be helpful to teachers
  – Quiz class
  – Timer and Score class
  – Super ground class
Web site

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