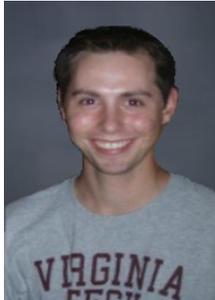# Game2Learn: Bunny Arrayser

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Introduction

The number of students enrolling and graduating with computer science degrees is declining all across the country, despite an increase in the demand for jobs in computing. The computer science major also has attrition rates as high as 30 – 40%, and most students drop the major after taking the CS1 or CS2 classes. New, interactive, and fun ways to teach the basic concepts of computer science are needed to hold student interest and increase enrollment in this important field of study.

Bunny Arrayser is a game designed to teach the concepts of 'arrays', 'for loops,' and 'nested for loops' to students taking the introductory computer science courses (CS1 or CS2). The game is designed to present important class material in a way that is fun, yet challenging, to students.

Background

Game2Learn, a division of the UNCC gaming lab, started in the summer of 2006 and has produced a number of works with similar motivation and ideas as *Bunny Arrayser*. One of these works was a game called *Saving Sera,* where the player completes a number of quests on their journey to save princess Sera. Each quest teaches a different concept, including loops.

The students involved in Game2Learn in 2006 created the foundational concepts on which *Bunny Arrayser* was

Background Cont.

modeled. Some of these concepts included:

- Interactive visualization of code is both engaging and effective for learning
- The games should provide enough realistic and complex interaction for real learning
- Clear instructions and game goals must be provided and accessible throughout the game.
- Feedback related to learning.

Research

- Week 1: Began working in XNA developing simple games. Researched C# code and XNA framework.
- Week 2: Brainstormed possible ideas for an educational game. Researched what concepts are important in CS1 and CS2. Read related works.
- Week 3: Outlined the concept for *Bunny Arrayser,* including levels and learning goals.
- Weeks 4 – 7: Game Development.
- Weeks 8 – 9: Initial user testing, game modifications, bug repairs
- Week 10: User logging, final reports.

The *Bunny Arrayser* start screen

Impact

Bunny Arraser is a new, fun way to teach the concept of arrays to beginners in Computer Science. It encompasses all of the crucial elements needed to understand arrays in an interactive, visual way. Allowing the user to see array declarations and the effects of a loop visually helps them to understand the concepts more completely.

On top of its educational value, *Bunny Arrayser* is fun to play. Allowing students to experiment with arrays in a fun, stress free environment, is a step in helping to curb some of the high attrition rates in Computer Science. With more games and activities like *Bunny Arrayser, Saving Sera,* and other Game2Learn projects, Computer Science will become a more enticing field to upcoming students.

Through research and testing, *Bunny Arrayser* was designed with the following features to help in the learning process:

- Detailed instructions available at all times.
- Visual representation of coding concepts.
- Error recognition, and correction opportunities.
- Penalties for guessing, rewards for careful consideration.
- Complex tasks that require thinking and building upon previous tasks.
- Random placement, allowing for unlimited replay.

A screenshot of Bunny Arrayser: Students use loops to solve this problem

Conclusions

- Gaming can visually express CS concepts in ways other media cannot
- Conventionally "boring" subject matter can be presented in fun, exciting ways and with new metaphors.
- Importance of user testing
  - Unpredictability of users requires games to be versatile in handling errors.
- Game instructions are often overlooked by users. A carefully scripted instruction sequence with concise information is crucial.
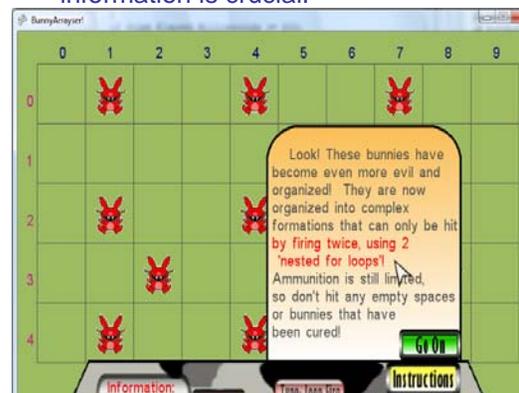
Instructions on Bunny Arrayser

Future Work

There are a number of things that could be continued on with *Bunny Arrayser:*

- Launch user studies to determine the effectiveness of *Bunny Arrayser* as a learning tool.
- Add more levels, including an array of arrays level.
- Launch *BA* from another game, namely *Cappella's Song.*
- Clean up the code through the addition of more classes to make it more usable and readable.