

# **EVALUATING INTERACTIVE VISUALIZATIONS IN DUAL RNA SEQUENCING**

Miles Gary<sup>1</sup>, Maherah Muqri<sup>1</sup>, Dr. Andrea Tartaro<sup>1</sup>, Dr. Jennifer T. Grier<sup>2</sup>, and Dr. Steven E. Fiester<sup>2,3</sup>

<sup>1</sup>Furman University Computer Science Department; <sup>2</sup>University of South Carolina School of Medicine Greenville; <sup>3</sup>Prisma Health Department of Pathology

## Introduction

ViBe-DRSapp (Figure 1) facilitates the analysis and visualization of dual RNA sequencing (dual RNA-seq) data. Our research contributes to the development of the ViBe-DRSapp:

**Aim 1**: Review the literature on evaluating bioinformatics tools to inform evaluation of ViBe-DRSapp.

**Aim 2:** Develop and pilot a usability protocol.

## **Evaluating Bioinformatics Tools**

- Biologists prefer user friendly, easy to access bioinformatics tools [1][2] (Figure 2), but usability testing is rarely done for bioinformatics tools [2].
- 2. Novices and experts have different needs when using bioinformatics tools [5] (Figure 4).
- Usability heuristics [6] (Figure 3) can be beneficial in evaluating bioinformatics tools [3]. Heuristics testing can address the needs of different skill levels [5] (Figure 4).
- 4. Usability testing can identify flaws in the software that may have been overlooked [2].

## Goals

### **One Application:**

• We found that biologists prefer an application that is simple and easy to download, so we found a way to access the application from a web interface.

### **User-Friendly:**

• We want to make ViBe-DRSapp as user-friendly as possible, so that people of all different skill levels can use and navigate easily.

### Compatible:

 We want to make sure that the app is usable on different devices and environments

## **Dual RNA Sequencing**

Dual RNA-seq allows researchers to sequence multiple organisms' transcripts simultaneously. Dual RNA-seq is a new technique and tools for analyzing and visualizing simultaneous data require programming. Our previous research developed ViBe-DRSapp to execute the processes for RNA-seq analysis, make interactive plots, and create a web framework for the displaying of the results.



## Bartlett et al. [1] Important Characteristics of Bioinformatics Tools

Mean rating (1=low, 7=high)
6.5
6.2
6.1
6.0
6.0
5.5

Figure 2. Rating of individual characteristics

Usability Study Feedback				
1. Help and Documentation	Implement help features, helpful error			
	documentation, explanations for parts of			
	ViBe-DRSapp, and a video running through			
	how to use the application.			
2. Navigation and Visibility	Viewing options on plots should be easier to			
	see-visible at all times, not just shown when			
	hovering over visual			
3. More Responsive Visuals	Add options to select a certain gene and			
	have a pop-up window where the user is			
	able to copy and paste the name of the gene			
	and data. Filter option for heatmaps.			
4. Clear and Comprehensible	Clear descriptions of features, explanatory			

### **Functional:**

• We want to users to be able to properly use the app the way it was intended and not worry about getting the wrong output or the application crashing.

### **Tested:**

• To improve the app, we want ViBe-DRSapp to go through usability testing, heuristic testing, and validation.

## Accomplishments

- Ran 3 usability studies with our protocol
- Ran a heuristic evaluation
- Filmed a video introducing ViBe-DRSapp to users
- Began the drafting and implementation of help messages, information about parts of the application, and instructions for download.

# References and Acknowledgements

1. Bartlett, Joan C, and Lorie A Kloda. 2011. "Why Choose This One? Factors in Scientists' Selection of Bioinformatics Tools." Vol. 16. https://eric.ed.gov/?id=EJ925570 2. Mirel, B. 2007. "Usability and Usefulness in Bioinformatics: Evaluating a Tool for Querying and Analyzing Protein Interactions Based on Scientists' Actual Research Questions." In 2007 IEEE International Professional Communication Conference, 1-8. https://doi.org/10.1109/IPCC.2007.4464064. 3. Mirel, B., & Wright, Z. (2009). Heuristic Evaluations of Bioinformatics Tools: A Development Case. In J. A. Jacko (Ed.), Human-Computer Interaction. New Trends (pp. 329–338). Springer Berlin Heidelberg. 4. Joan C. Bartlett, Yusuke Ishimura, and Lorie A. Kloda, "Scientists' preferences for bioinformatics tools: the selection of information retrieval systems." Proceedings of the 4th Information Interaction in Context Symposium, no. IIIX (2012) https://doi.org/10.1145/2362724.2362761 5. Homa Javahery, Ahmed Seffah, and Thiruvengadam Radhakrishnan, "Beyond power: making Bioinformatics tools user-centered." Communications of the ACM, no. 47 (2004) https://doi.org/10.1145/2362724.2362761 6. Nielsen, Jakob. "10 Usability Heuristics for User Interface Design." Nielsen Norman Group, April 24, 1994. https://www.nngroup.com/articles/ten-usabilityheuristics/

	4. cicar and com	
Met	nods	
Literature Review: We performed background research on evaluating bioinformatics tools to help us evaluate our own tool	Develop a usability protocol: We created a protocol to help aid in a user observation	12
Run a user observation study: We guided participants through using the ViBe- DRSapp	Interview participants to gather feedback: We conducted a post test interview to get participants' feedback	8 6
Improve the app: We analyzed the participants' feedback in order to improve the app	Heuristic Evaluation: We used Nielsen's 10 Heuristics for Usability to run a heuristic evaluation on the ViBe- DRSapp.	0 Help and Documentat

enough that users without a background in Dual-RNA seq should have no trouble using ViBe-DRSapp.

Figure 3: Usability Study Feedback

Heuristic Evaluation of ViBe-DRSapp



Help and Aesthetic and Consistency and Error Prevention Flexibility and Match Between Documentation Minimalist Design Standards Efficiency of Use System and Real World

#### Heuristic Evaluation of ViBe-DRSapp

Figure 4: Heuristic Evaluation of ViBe-DRSapp

We would like to thank our collaborators Jared Kohrt, Max Young, Nudrat Nawar, Daniel O. Boldt, and Jack Valbuena.

This project was supported in part by grants P20GM103499-20 (SC INBRE) and P20GM103499 from the National Institute of General Medical Sciences, National Institutes of Health. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. This work is partially supported by an ASPIRE grant from the Office of the Vice President for Research at the University of South Carolina. This work was also supported by the Furman Institute for the Advancement of Community Health, the Furman University Computer Science Department, and the Furman Summer Fellows Research Program.

# TEACHING GAME DEVELOPMENT & LOGIC WITH BOOLARIO

KHAMILAH NIXON | ANYA SOLODKY | AUSTIN MATHEWS DR. RAHAF BARAKAT | DR. CENGIZ GUNAY

### WHAT IS TAP?



The Technology Ambassador Program (TAP) is a project & research-based course at Georgia Gwinnett College that aims to teach students how to develop themselves professionally and inspire non-IT majors to consider and

encourage IT majors to broaden their horizons in the field of IT. TAP is not limited to only Information Technology students, this course welcomes students from all majors.

### **PROJECT DESCRIPTION**

Designed to educate non-IT students, beginner IT students, and children at young ages in a hand-on learning experience to teach them about basic programming and game development concepts, such as hitboxes and scripting in C#.

Boolario is a 2D platformer game, similar in style and design to Mario. The goal of Boolario is to traverse the map, designed to include obstacles and true and false coins. Boolario will teach players simple Logical specifically "AND" statements, and "OR" statements, as well as Boolean values through the coin collection system we implemented into the C# scripting.

### **IMPLEMENTED TECHNOLOGIES**



Unity and Visual Studio Code were utilized to program Boolario. Unity is a game engine that allows users to create various programs, not limited to video game creation, which are highly customizable with regards to scripting. Visual Code Studio is a code editor that allows the creation of

several C# scripts that link to the project through the Unity API to increase implementations and complexity to our game.

### RESULTS

Based on our results, we were overall successful in our ability to teach the desired IT concepts to a wide range of students.



### **ATTRIBUTIONS**

Special thanks to the STARS Computing Corps, the GGC TAP committee, and the School of Science and Technology for providing the resources for our team to design this outreach project for all Georgia Gwinnett College students and children of 18 years of age or younger.

GEORGIA GWINNETT COLLEGE | FALL 2021



### WORKSHOP DESCRIPTION



Two versions of Boolario were created:

The complete version to serve as a basis for comparison (displayed on our website).

The incomplete version to serve as a platform for students to learn about programming and game development concepts.

In the workshop, the user will not jump high enough to reach elevated platforms, and will also fall through the map.

The goal is to fix these errors by utilizing Unity and changing code in the scripts.

Users created a hitbox using Unity's Box Collider 2D and increased Boolario's jump height by

During the workshops, we observed that while a few students worked ahead, most required assistance and guidance. The attendees worked alone though collaboration was present.



# MACK Pages

### By: Mohfez Rahman, Ayesha Syeda, Carri Waller, Keyvan Shabani





### What is TAP?

The Technology Ambassador Program (STEC 4800) at GGC allows enrolled students to develop a project that they are in control of completely. They get full power to choose what technology they want to use, and how they want to develop the project. Each project has a goal to teach a new concept to the audience, and bring them a step closer to technology.

## Workshops

In our TAP Exposition, we help the audience to create their own personal webpage through a skeleton. During the classroom workshops, we showed students how the webpage is created by explaining HTML/CSS, and assisting them in designing their own cover page website.

## **Project Description**

Our project is a simple all-about-you page that can be customized with your choices. It is a 5-step diy cover page website that can be obtained with a QR code or NFC chip to share with others. The technologies we are planning to use are Github, QR codes and NFCs. We also have used an API to generate quotes with every page refresh.



## Results

#### Pre Survey:



\*Only 16/67 people answered this question because the rest of the participants said they had zero coding knowledge

#### Post Survey:



\*Everyone was asked this question

Overall, the introduction of new concepts and material was accepted and many requested more information/workshops. This webpage was a singular introductory class session to spark interest in designing or advancing a website, not to complete the entirety of one in an hour. Our surveys showed an increase in interest and a decrease in difficulty for students to code.



Georgia Gwinnett College School of Science & Technology



About Me



ation about you here! You can delete this and add anything you v

#### Quote of the Day

sion to be found playing small - in settling for a life that is less than the one you are capable of living

## **Project Goals**

The target of this project is for users to better understand or get introduced to QR code, NFCs, usage of API, and utilize HTML/CSS. An alternative goal is to invoke interest in the field of IT as a major or minor.







#### What is TAP

**TAP stands for the Technology** Ambassador program. TAP project goals is to increase the number of students who persist and pursue an IT major or minor, also developing leadership skills, communication, and technical skills.



### **OCEAN RESCUE**

#### Reminiscent of the cult classic game PACMAN.

Dr. Gunay, Dr.Barakat | | Haya Alghazouli, Jaeda Williams, Sara Alashqar, Ka'tiera Boone

Georgia Gwinnett College



#### Technologies We Used

**Scratch** which is a website that allows the user to use drag and drop coding in a fun and simplistic way to create games.

Makey Makey is a USB device that you can connect it to your game and plug it into your computer to make any object that is a conductor into a game controller





#### **Project Goals**

- To teach a few Coding fundamentals in both a simple and creative way through basic drag and drop coding.
- Expose non-IT students to the fun side of coding,
- •At the end of each workshop we hoped to increase the users understanding of the logic behind these coding principles, and their understanding of how and why these codes work in their games



#### Results

#### Workshops/Events

In our workshops, students created their own personalized version of OCEAN RESCUE, while using loops and If, then statements to get their own characters to move: Iteration to keep track of their scores, and block statements to get the randomized movement of their enemy sprites



https://github.com/TechAmbassadors-GGC/ocean-rescue



How do Intersecting Identities affect Participation in Undergraduate Computer Science? A Research Synthesis Abigail Grant and Dr. Andrea Tartaro



## INTRODUCTION

Research into the participation of women in computing has continued to be a main topic in the Computer Science (CS) community as we move towards inclusivity. Along with trying to learn more about participation of women, it is also important to look at participation rates with minority race groups, intersecting identities, and non-binary gender. Exploring these groups and their participation in computing will help to make the CS community more like the world we live in. Number of Articles Addressing Different Identity Categories by Year



Article Year	Critical Race Theory	ldentity Theory	Social Class Theory	Social Influence Theory	Intersectiona lity	Other
2011a						✓ 🗆
2011b						✓ 🗆
2014						
2019						
2020	✓ 🗆			✓□	✓□	✓ 🗆
2021					✓□	

## Future Research

## Intersectionality



Applying a sociological lens suggests different social identities intersect to create a unique experience of power and discrimination, called intersectionality, that could influence participation in CS. The identities included in this research are race/ethnicity, gender, LGBTQIA+, and social class. These identities can cause some students to have a different experience with CS studies Articles addressing Multiple Identities (||) or Intersecting Identities (&&)

Article Year	Race/Gender	Race/Class	Race/LGBTQIA+	Gender/LGBTQIA+	Gender/Class	Class/LGBTQIA+
2011a	I					
2011b						
2014	Π					
2019	&&					
2020	&&			&&		
2021	&&					

The research being conducted now is a great start to making the CS community diverse. In the future, more of an effort needs to be made to research from a broader view that is not binary when it comes to gender. It is important to step away from this traditional approach to make CS research more inclusive. There also needs to a push for more research conducted on participation rates of minority race groups and intersecting identities. Research about the social class was not mentioned in any of the articles analyzed for this project. Socioeconomics can impact if students are able to participate in computing as they might not have access to proper computing hardware and might be worried about joining CS because of a lack of funds. Understanding the different hardships that different students go through can help with creating opportunities like study groups or programming camps to get upcoming students to join and stay in Computer Science.

#### Number of Articles with Multiple or Intersecting Identities by Year

## **Research Methods**



## Acknowledgements & References

Furman Summer Research Fellows Program Furman University Computer Science Department

