

Senior Project Proposal

Department of Computer Science

Calvin University

Title: Experiments in Sorting

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Mentor: Dr. Adams

Honors Project: No

Vision and General Overview of Proposal

Background and Problem

During 2019-20, senior Nate Herder built *audio-visualizations* for several sorting algorithms. This team project builds on Nate's work. The team will work with Prof. Adams to devise and run experiments using 4 groups:

1. a control group that will just run traditional sorting programs, with no audio or visual enhancements.
2. a treatment group that will run sorting programs with audio enhancement.
3. a treatment group that will run sorting programs with visual enhancement.
4. a treatment group that will run sorting programs with audio and visual enhancements.

Following the experiment, the group-members will be assessed on their understanding of the sorting algorithms, to see if any significant differences exist between the groups. The experiment will be run both semesters, in the hopes that sufficient data will be collected to provide interesting results. The student team will help design the experiment, run it, create the assessment instrument, and evaluate the results.

Brief Description of Solution Being Provided

The solution obtained through these experiments will be an answer to our driving question; *Does changing the sensory feedback for sorting algorithms impact the students' understanding of those sorting algorithms?*

If there is significant difference in how the students understand the sorting algorithms between the four experimental groups, then that knowledge can be used going forward for how computer science educators teach sorting algorithms.

Your Interest and Qualifications

All of the group members, Bryan, Joshua and Bryce took CS 374 (High Performance Computing) in the Fall of 2019 and are interested in effective sorting algorithms and the libraries the team will implement and utilize in this project.

Review of Relevant Design Norms

Integrity	We will remain ethical in how we conduct our experiments; approval for these experiments has been acquired from Calvin's IRB (Institutional Review Board).
Stewardship	If we teach students to use more efficient sorting algorithms, then the environmental impact of sorting will be less than if they use inefficient algorithms.

Mentor Selection, Expert User and Collaboration

Our mentor for this project will be Professor Adams, who supervised Nate Herder's work last year and came up with the idea for the experiments, and who also has considerable experience in high performance computing.

Nate Herder might be consulted on his work as needed.

Research Question

1. Does the addition of audio feedback improve student understanding of sorting algorithms?

2. Does the addition of visual feedback improve student understanding of sorting algorithms?
3. Does the addition of both audio and visual feedback improve student understanding of sorting algorithms? And if so, how does it compare to one and two?

(begin here, think about it a little more, our experiments will create and answer some of these questions)

Development Approach

Form testable hypotheses, design experiments to test those hypotheses, collect data during/from the experiments, analyze the data, and then draw conclusions. Repeat for both semesters.

Quality Assurance

Critical Delivery Dates

Identify milestones here. Timeline. Something every two weeks. Clearly identifiable goals for every two weeks to see if we are on track.

Add milestones backward starting with May 1. (anticipate any snags)

Oct. 1: Project Proposal finished.

Oct. 15: Getting TSGL, TSAL, and Nate's Hierarchy installed and working. (Some flex here, may not be trivial.)

Nov. 1: Get experiment organized and in place.

Nov. 15: Experiment Finished. (Send out quiz Nov. 30?)

Experiment ran into technical difficulties due to file system emergency.

Dec. 1: Midterm Report due.

Feb. 2: Start working on graphical experimental programs.

Feb. 15: Determine if any changes are needed to experiment.

March 1: Experiment organized and in place.

March 15: Experiment finished.

April 1: Send out quiz.

April 15: Analyze data from all experimental and control groups. (i.e., quiz responses)

May 1: Project completed.

May 6(ish): Project presented.

May 15: Final Report submitted.

Reviews

Adams will be reviewing the initial experimental design for Fall 2020. We also have one experiment review milestone included in late February in case we want to make any changes to the experiment for Spring 2021.

Testing

This project does not involve writing code, so code-testing won't really play a part. However, we will need to analyze the data collected each semester to see if we get any significant results.

Resources

Resource	Source/Provider	Cash Cost
TSGL/TSAL	GitHub	\$0
Nate Herder's Class Hierarchy	GitHub	\$0
R / RStudio	Calvin RStudio server	\$0
Total Cash Cost	-----	\$0

Risk Analysis

Risk	Exposure Analysis	Mitigation Strategy
Do you have a dependency on others completing work for your project to be a success?	<discuss the likelihood of this happening, or enter N/A>	<discuss how you will manage this issue if the exposure is significant>
Is there any doubt about the availability of financial resources?	NA	“
Do you have a dependency on an expert user to provide advice and who may not always be available at critical times?	Nate Herder	“
If success depends on experimental results, are there any barriers to completing the experiment?	Getting enough participants. Covid shutting down in-person plans.	Motivations, incentives, etc that we can provide. Online version of experiment.
Will this project involve new skills for you?	“	“
Will there be anything preventing you from investing at least six hours a week on this at a minimum?	“	“
Is there any potential of physical resources you have listed of not being available?	“	“

Pandemic related risks?	Limited number of seats in the lab. (18)	“
Other	“	“

Appendix A

Test Plan

*****Not applicable to this project*****

1 https://digitalcollections.dordt.edu/cgi/viewcontent.cgi?article=2949&context=pro_rege