CS 4065/6065 Assignment 1 Report

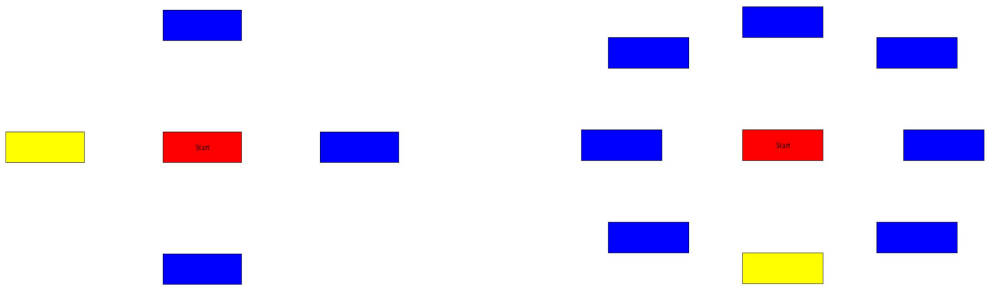
Alexander LeBlanc 3534398
Ayoola Nurudeen Etiko 3598133

Introduction

One important facet of HCI research is Graphical User Interface (GUI) usability and operability. When designing GUIs for end users, one must ensure that the interface is both intrinsically easy to understand and operate. A user should not find the interface laborious to navigate, and it should be something that one can become easily proficient in using after a short period of usage. As a result of these paradigms, it is important for us to study average user reaction times and click accuracy to determine what affects the efficiency at which people can utilize GUI's.

One major detriment to a user interface design can be the overcrowding of on screen elements. If a user is presented with too many different choices and stimuli at once, their reaction time may be slower as they have more things to process before making a decision. In addition to this, if a user is provided with an overwhelming number of options, they may be more likely to make an error while selecting input. In this report we will study the correlation between the number of elements on screen and the reaction time of a user, as well as the error rate of said user.

Methods

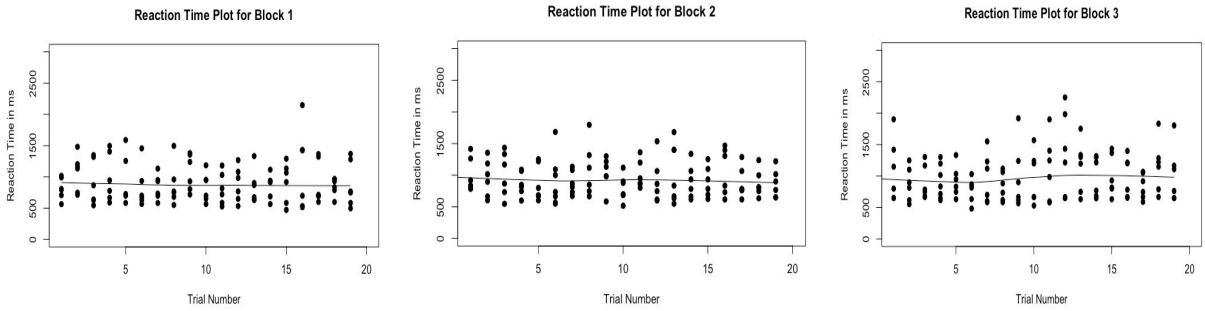


We designed a system that would allow us to collect user interaction time data as well as user interaction errors simultaneously without being distracted by outside elements. Using the GUI design language Processing (and the Minnin audio library), we created a simple user interface that asked participants to complete three different trial blocks, each with different numbers of elements to interact with. The participants chose to begin a block of testing by pressing the red start button in the center of the screen, and then were presented with several rectangles whose number varied with each test block (two target rectangles in block one, four target rectangles in block two, and eight target rectangles in block three). One of the rectangles in the given group would be yellow (this is the target which the participant needed to click to pass

the trial), and the rest would be blue (these would be unclickable), providing the participant with different levels of visual stimuli to parse. The participants were permitted to rest between blocks of testing to ensure that fatigue would not factor into their results.

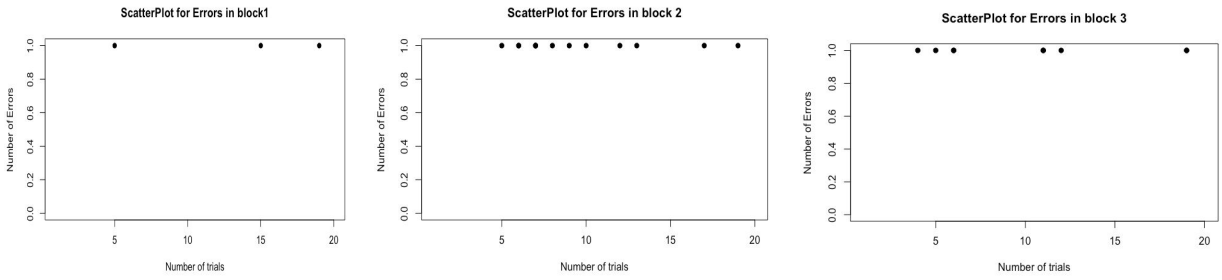
We collected the times for each individual trial from each participant, as well as the error clicks that occurred during any given trial. Using the data collected, we created scatter plots for each testing block, using two different graphs to show the time and error data. We also used bar graphs to compound the data from all of the tests to show the differences between times and errors collectively. All statistical data was run through R to create the different graphs and plots below.

Results

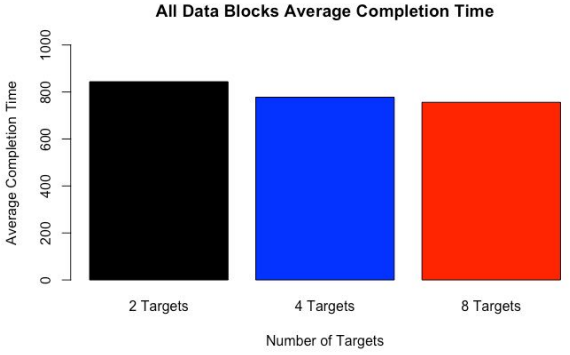


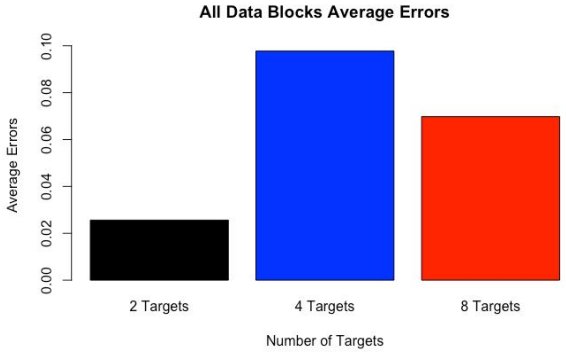
Through analysing our results one can observe a noticeable difference between trial blocks. We theorized that the time would have an upwards trend as users had to compete with a more populated interface. However, examining the data shows that the test with the highest completion time was block one, which had two UI elements to choose from. The average completion time data trended downwards as we added more elements, and the lowest completion times were recorded in block three which had eight UI elements.

Upon further reflection of our hypothesis, we realized that this result may be related to the participants becoming accustomed to the system. We failed to account for the fact that as a user continues to repeat the same action for a period of time, they will become more proficient at performing that action. We theorize that if a user was asked to perform all three test blocks multiple times, we may see the time data either unify, or trend upwards in the direction as we originally expected.



We can observe from the scatter plots that the data from the earlier tests were more uniform however. This may correlate with the error data we were also able to collect from the tests. We can see that the number of errors produced by the tests have an upward trend as originally theorized (the test with the lowest errors is the first test, followed by the third and then the second with significantly higher values). This follows our hypothesis that the more on screen elements there are, the more errors the end user will run into while attempting to use the system.





Reflection

From the above results we are able to say that the more interactive elements there are on a GUI, the more errors a user is likely to make while using it. Though further testing would be required to explain the spike caused by the second test when compared to the first and third, the results were conclusive in showing that as more elements are added to a GUI, a user is significantly more likely to make errors. This shows us how important simple layouts are when designing GUI's.

We are also able to conclude that despite the increase in the number of elements, users are also able to adapt to a system and grow more proficient over time. Since the average completion time decreased over the number of tests, we are able to observe from this that instead of taking longer times due to dealing with more elements, users were able to become more proficient in the sample task. This is a good reminder that HCI systems should be masterable, and have ways for proficient users to work more efficiently.

Implications for Future Work

The data collected from this experiment can be used for designs of interfaces where reaction time of a user is very important to the usage of the software or hardware, it could also be used for feedback detecting systems. Where these systems let the user know their action has been responded to by providing feedback. After thorough investigation, we were accustomed to the fact that the more familiarity the user had with the system the faster they were able to react to the stimuli of the color change. Creating a positive correlation in terms of user usability and reaction times.

The accumulated data showed some interesting results which can be justified, though conducting another study where the users complete this trial multiple times would be useful as the trend of learning does not discount the idea that a more cluttered interface causes lower user

interactions. It would also be useful to conduct another study with participants randomly selected ranging from participants with no knowledge of computer usage to experts in order to observe how both new users and existing users are affected. Both of these extra studies mentioned would help give a clearer and more precise judgment on the results accumulated from the experiment.