Final Report

Team #51

There Is No Yellow

Melrose High School

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“There is No Yellow.”

Executive Summary:

My project is connected to the fact that there are no yellow pixels on a computer or television screen. All colors are made up of combinations of red, green, and blue pixels which are grouped sided by side in repeating patterns. As these three colors of pixels are turned on and off in various combinations, they make it possible for a monitor or screen to show millions of color combinations. All based on the RGB values.

Since there is no yellow, and it is made up of various combinations of the RGB values, it can be seen that there are any number of ways to make up countless shades and hues of yellow colors. Since this can be easily coded into a computer program that will cause a monitor to display these various combinations, there are opportunities to use this measurable and repeatable process in a research situation where test subjects determine how quickly they can detect these subtle changes.

I developed a computer program that does just this. It allowed me to test individuals on their perception skills. I surveyed the participants to allow them to be sorted by four factors: age, gender, eye color, and career/interests. I used these categories to do a statistical analysis to determine if any of these factors showed a significant chance of causing any differences.

Problem Statement:

Hypothesis: **“Some people will be better able to detect changes in colors than others”.** This ability can be analyzed based on one of four personal factors of the test subjects. ‘Age’, ‘Gender’, ‘Eye color’, and ‘Career / Interests’.

My problem statement is: “Will some people be better able to detect color differences than others, based upon one of the following factors: age, gender, eye color, or career/interests?”

Method / Computational Model:

As stated, I tested how different people were able to perceive tiny differences in color samples presented to them. This was done by using a computer screen that flashes four squares of a certain color on the screen, and then makes subtle changes to one area, bit by bit. A research subject would then indicate when they were able to see the change, and the computer kept track of how many changes were made before the correct 'color changing area' was located. This information was used to make other comparisons. For example: Do females do better than males? Does eye color have any effect? Is there an 'age effect' on the outcome? Are people from different jobs and industries show any differences in their abilities to detect color changes? These are the types of information that I did a statistical analysis of in order to complete this project. I followed protocols to ensure that human testing was done by the book, and adhered to ISEF regulations.

My computer model was developed using NetLogo. It has the capability of showing colors based upon the RGB values, and it is one that I have some prior experience with. I was able to build the model, and use it to test the subjects. The programming structure is not very involved, but it matched what was needed for the project at hand.

Results / Conclusion:

I was able to design and build the computer assisted portion of the project, and it is able to make those small changes to one portion of the screen as described before. It also scores the person on how successfully and quickly they DID select the correct 'color changing' portion of the screen. During testing, we found that I need to make the color areas smaller, closer together, and have a better metered rate of change be presented. After these changes, it gave the test subject volunteers a more comfortable experience, and helped to keep the results more accurate by not adding in the variable of 'subject reaction time' to the study.

I looked into the best types of statistical analysis to use with this project, to give an idea of how meaningful the results actually are. I ended up using the included statistical analysis tools provided

within Microsoft's Excel program to do T-tests on the data to determine if there is any statistical differences within the data collected. With all of the data I was able to collect around my home and school, the low p values suggest that there is none, or that they are not significant. I intend to look into 'stronger' statistical tests to double check this outcome, and hopefully my next year's math class will give me some help with this.

Results / Verification:

I expected to see a statistical difference in the ability of people with specific characteristics to notice a change in color. As a guess, I expected it to be better for females (who tend to be more 'fashion and beauty' conscious) and for those in jobs where color is more important (artists and fashion designers).

However, the results I obtained did NOT support my earliest hypothesis. I now have to report that there is no significant change in the ability of individuals to perceive a color change based upon gender, eye color, age, or career.

The results I obtained check out with and agree with further research I did that suggested that eye color and gender had no influence on color perception in humans. Therefore it looks like I can assume that my results are verified and that I was wrong.

Major Achievement:

This was one of my first true 'research oriented' science projects, and it taught me many of the basics of how the process operates.

References:

1 – YouTube video: "There is NO Yellow"
2 – Google search: "Color Perception by Different Animals."
3 – Google search: "Human Color Perception."
4 – Book: "The Human Eye". Mathew Harper.
5 – Article: "Vision". Isaac Asimov. "The Human Body"

Attachments:

1 A) Data Matrix Form.

Data Matrix
Color Change Pixel Values by Category and Pixel Color

Test	Gender M - F	Eye Color Bl - Brw	Age Y – T – A - S	Career Pro - Non	Patch #	# Changes	R-Change	G-Change	B-Change
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Gender *= Male or Female* ***Eye Color*** *= Blue or Brown*

Age *= Youth (9-12) Teen (13-19) Adult (20-64) Senior (65+)* ***Career****= Pro color oriented or Not*

1 B) Micosoft Excel T-Test: T.TEST Function:

Returns the probability associated with a Student's t-Test. Use T.TEST to determine whether two samples are likely to have come from the same two underlying populations that have the same mean.