Skin Cancer: It's Probably Too Late!

Final Report

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Team #79

Mountain Elementary

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Introduction

The main reason that we decided to do our project on skin cancer was because thousands of people die from it each year. There are many different kinds of skin cancer that can have different impacts on the body. The way skin cancer works is after one cell is mutated into cancer, it quickly reproduces and can spread throughout the body. If this growth of cancer is not stopped then it can get in to the vital organs and it can kill you. Because of the dangers of skin cancer, we wanted to find a solution to this terrible cancer.

Problem Summary

Thousands of people die of skin cancer each year, not just in the United States, but all over the world. In our project, we wanted to model skin cancer and its effects on different types of skin, with and without sunscreen. Skin cancer is the most common type of cancer in the world, and has some ways of prevention. We wanted to model some of these solutions, along with the effects. We wanted to observe the relationship between the amount of melanin in the skin, the sun protection factor of the sunscreen, and the amount of time it takes for the cells to mutate.

Research

Light

Light is electromagnetic radiation that travels in waves from both natural and artificial sources. The wavelength and frequency of a light wave help to determine its position on the spectrum, which is the scale of light based on frequency. The types with higher frequencies are plotted on the far right of the spectrum, and the lower at the left. The types of radiation at the far right of the spectrum (UVA, UVB, and UVC) are more dangerous and are more likely to cause skin cancer at a quicker rate. UVB is the worst.

Sunscreen

The main purpose of sunscreen is to block or scatter the harmful UV rays emitted by the sun. Sunscreen can prevent sunburn and skin cancer. For most people a sufficient sun protection factor or SPF is 30. An SPF of 30 blocks or scatters about a 97% light. This is sufficient protection for most people at most elevations, but if you do need higher SPF do not waste your money on sunscreen over 50 SPF. After you get to 50 SPF the protection cannot get much higher.

You may want to avoid nanoparticle sunscreen as it is new technology and could be hazardous. If you want to see if the sunscreen has nanoparticle in it you can look on the package. Scientists are working to find other new technology for sunscreen that will hopefully be safer than the nanoparticle sunscreen.

Skin

Your skin is the largest organ of your body and is defined as "the soft outer covering of vertebrates". There are three layers to the skin, the epidermis, the dermis and the hypodermis. The epidermis is where the melanin is. Melanin is what gives the skin it pigmentation and acts as a natural defense against all forms of UV light. The dermis, beneath the epidermis, contains tough connective tissue. The hypodermis is made of fat and connective tissue.

Skin Cancer

Skin cancer is caused by the breakage of DNA. The breakage of DNA is caused by overexposure to high-frequency types of radiation.There are 5 stages of skin cancer.

Stage 0 is when the cancerous cells are contained within the epidermis.

Stage 1 is when the cancerous cells grow deeper into the, skin but have not left the dermis.

Stage 2 is not much different from stage 1, but it has a higher risk factor.

Stage 3 cancerous cells have not yet reached the vital organs.

Stage 4 is the final stage where the cancerous cells have reached the vital organs.

Experiment

One of our teammates, Summer, did a science fair project on what is the best SPF sunscreen. She put different SPF's of sunscreen on hotdogs and put them under a sunlamp. She tested SPF 4,30,70, 100 and no sunscreen. She found that 30 SPF worked the best. Her experiment gave us first hand information to include in our project.

SpaceLand

The Program we used to model skin cancer from sunlight exposure was StarLogo TNG. Please see Appendix 1 for program and Appendix 2 for SpaceLand.

In SpaceLand, the first thing that happens is the creation of the sun. It is a yellow sphere, set in the center at an altitude of 30. Next, the four types of skin are stamped, starting in the bottom corner of SpaceLand.The four types of skin are Dark, Dark with Sunscreen, Fair with Sunscreen, and Fair. When you click Run, the sun hatches photons, which are simulated as small indigo spheres. When the photons hit the skin, they reduce the immunity level of that type of skin based on the X coordinate that the photon hit. As the immunity levels decrease, they eventually hit zero, at which point they begin to turn pink, representing mild sunburn. When the immunities hit negative ten, they turn red, for severe burn, and black for cancer at negative twenty.

Program

Please see Appendix 1 for program and Appendix 2 for SpaceLand.

Skin Cells Agents

In our original program we were going to have going to have each skin cell an agent, but StarLogo has a 4,095 agent limit. This meant that SpaceLand would fill halfway with skin cells and one photon at a time. To fix this problem we now have one skin cell that stamps the patch colors, depending on the coordinates, different colors.

Immunity Levels of skin

The way the immunity levels are simulated are the more photons that hit the skin the lower the immunity levels will sink and the more likely the skin will be infected with cancer if more photons hit it. If the skin gets infected with skin cancer it will be stamped with a black to represent skin cancer. The skin is different colors depending on if it has sunscreen and if it has high pigmentation. When the photons hit the skin, it lowers the immunity different amounts *(see* validation *pg 18)*

Photons and Sun

At the beginning of Set Up, the sun is created as a yellow ball at an altitude of 30. It hatches the photons, which have a specific procedure. In this procedure, the photons travel down from random X and Y coordinates at the same altitude as the sun. When they come in contact with the skin, they test the X coordinate so that they can tell which type of skin they are in. If the immunity of that type of skin is below zero, the color will change accordingly.

Color Changes

This section of the program is what simulates the gradual burning and mutating of the different types of skin, represented by a change in color. When the photons hit the skin, they test which type of skin they are in. Then, they test to see if the color of that type of skin is still the original color. If it is, and the immunity level of that type of skin is at zero or below, it stamps that cell light pink, representing a mild sunburn. If the cell is already pink, and the immunity is below negative ten, the cell is stamped red, representing severe sunburn. The same procedure happens if the skin is already red and the immunity is below negative twenty, but it is stamped black, representing cancer.

Appendix 1- BlockLand

Set up the sun and immunities.
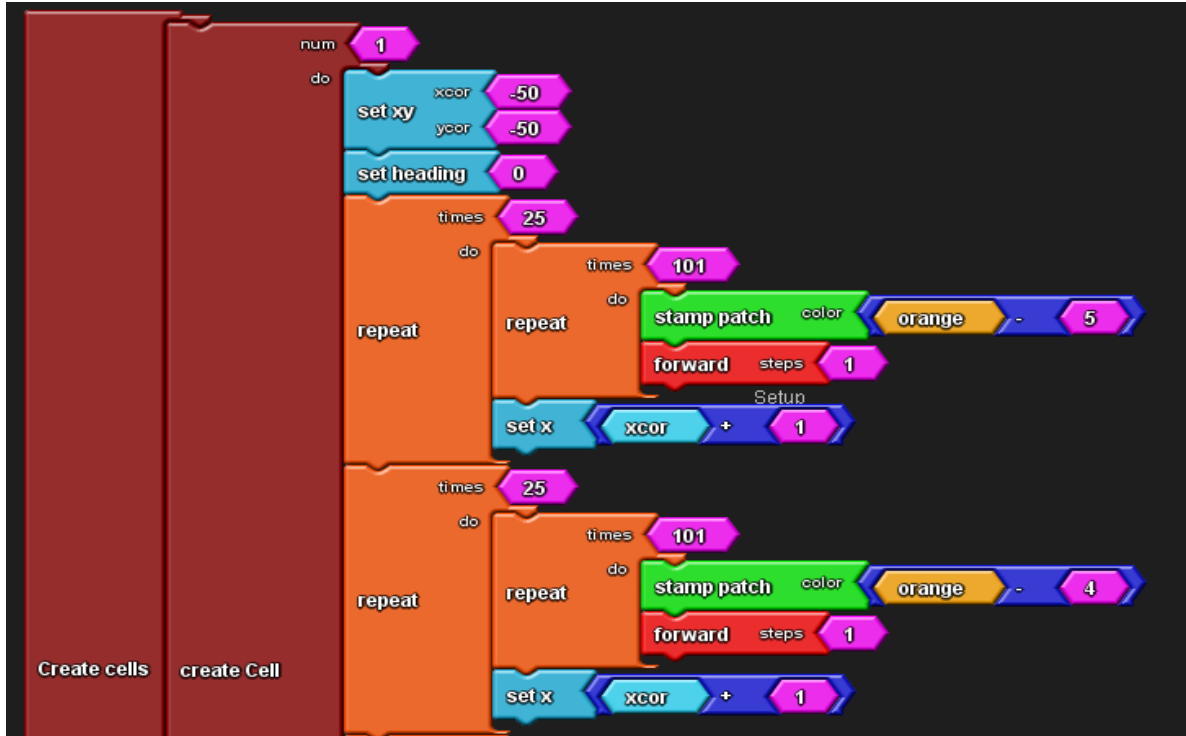
Creating Dark Skin and Dark Skin + Sunscreen
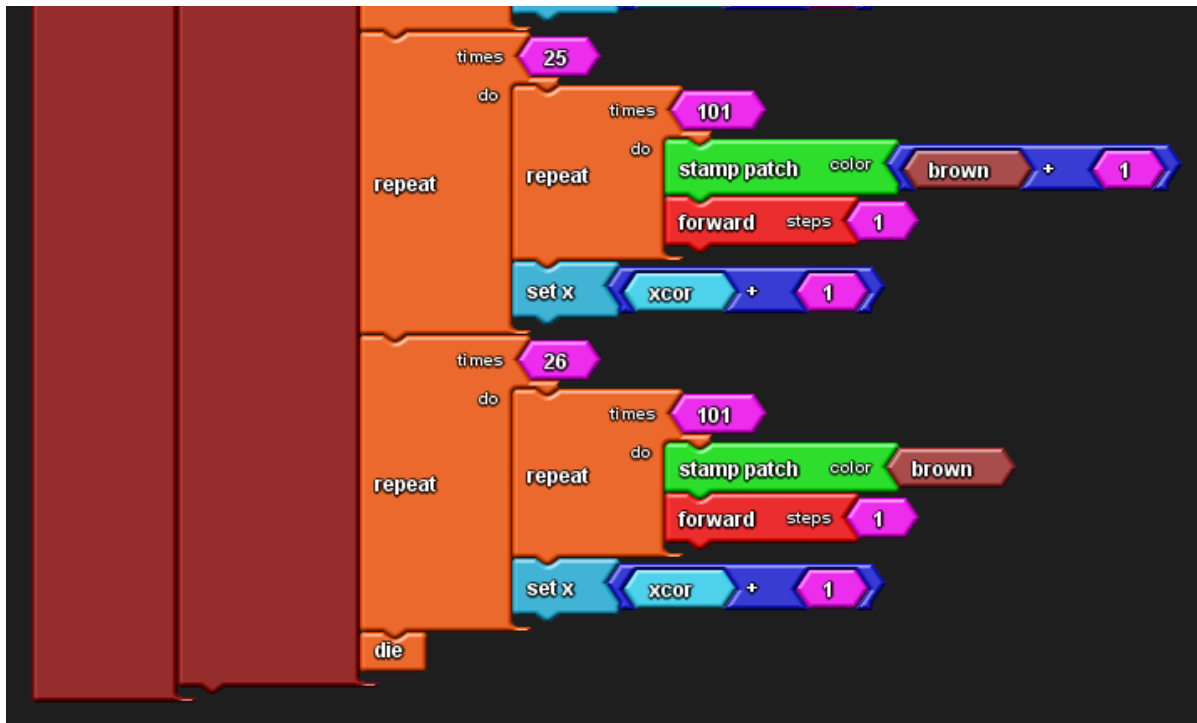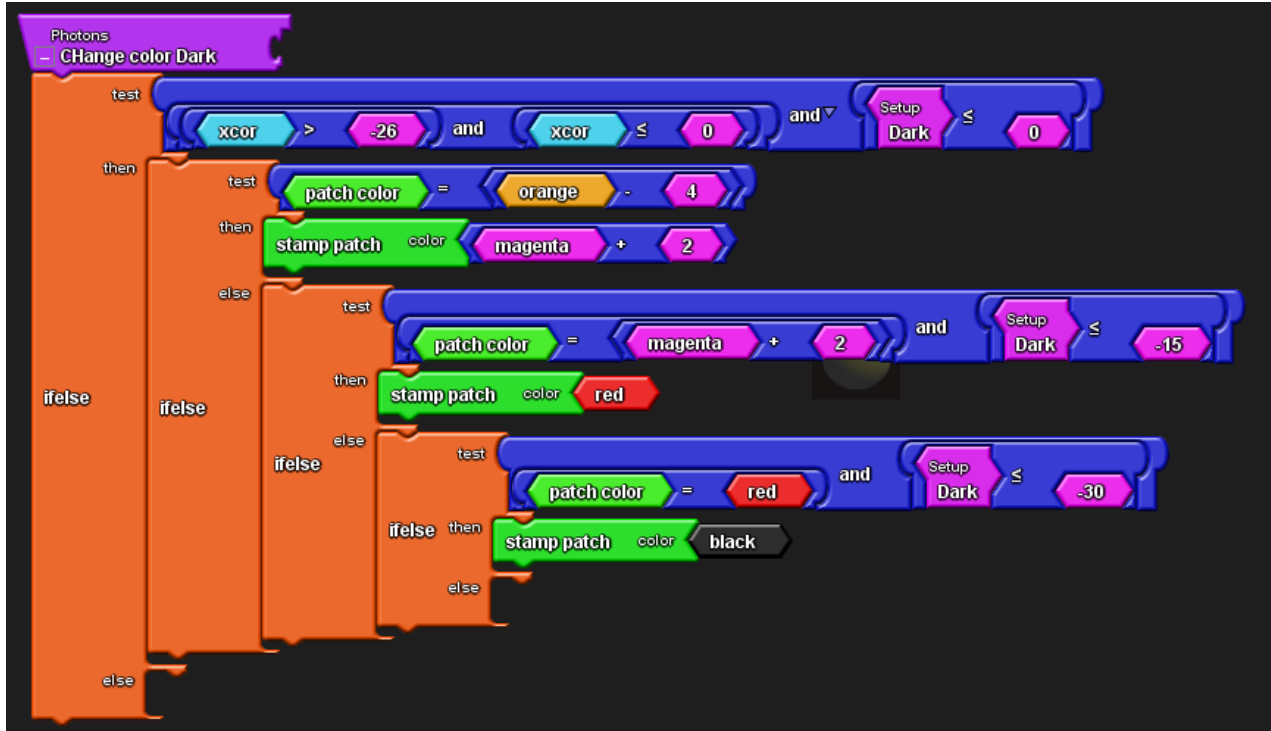

Creating Fair Skin and Fair Skin + Sunscreen
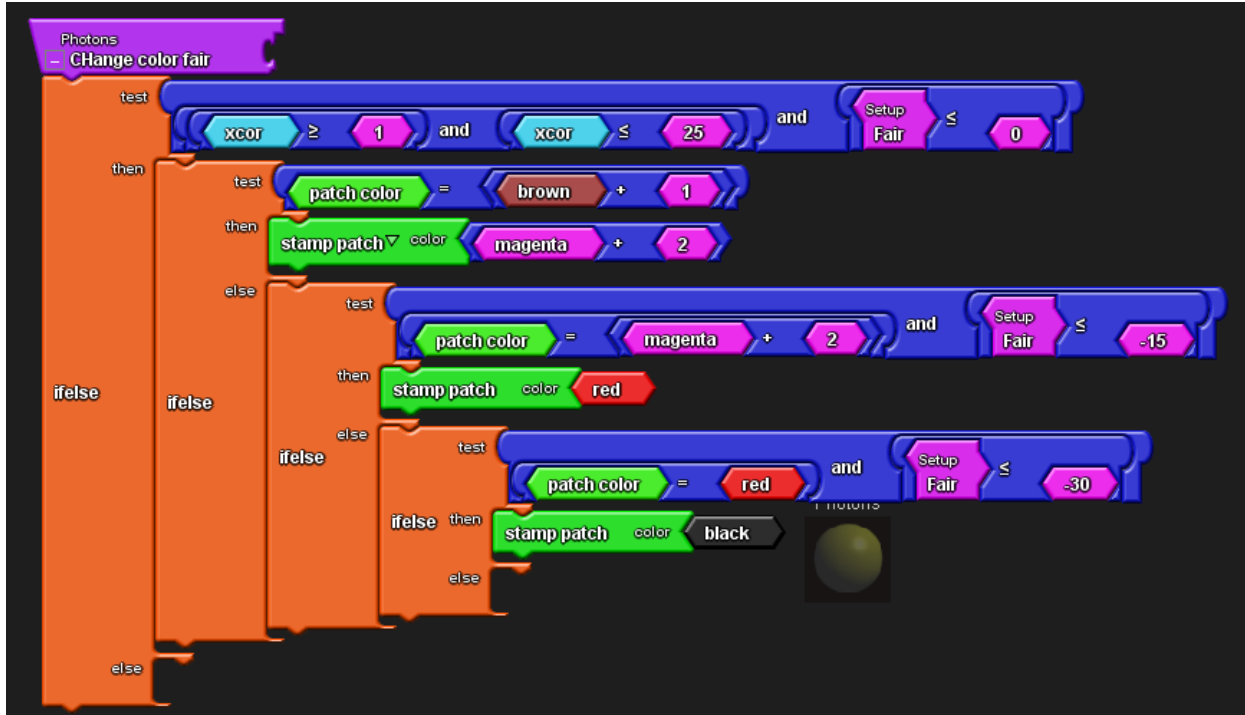
Creating Photons
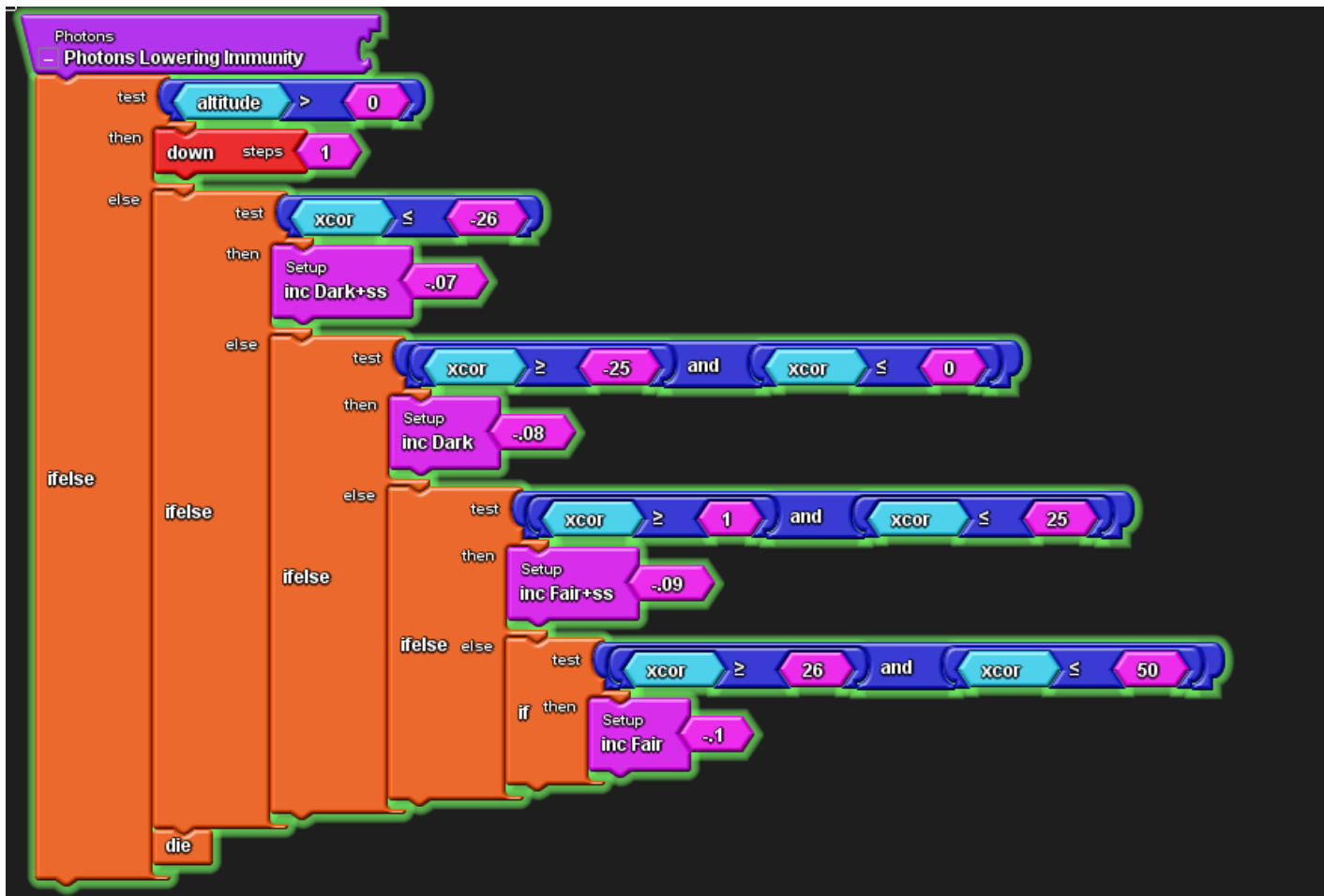
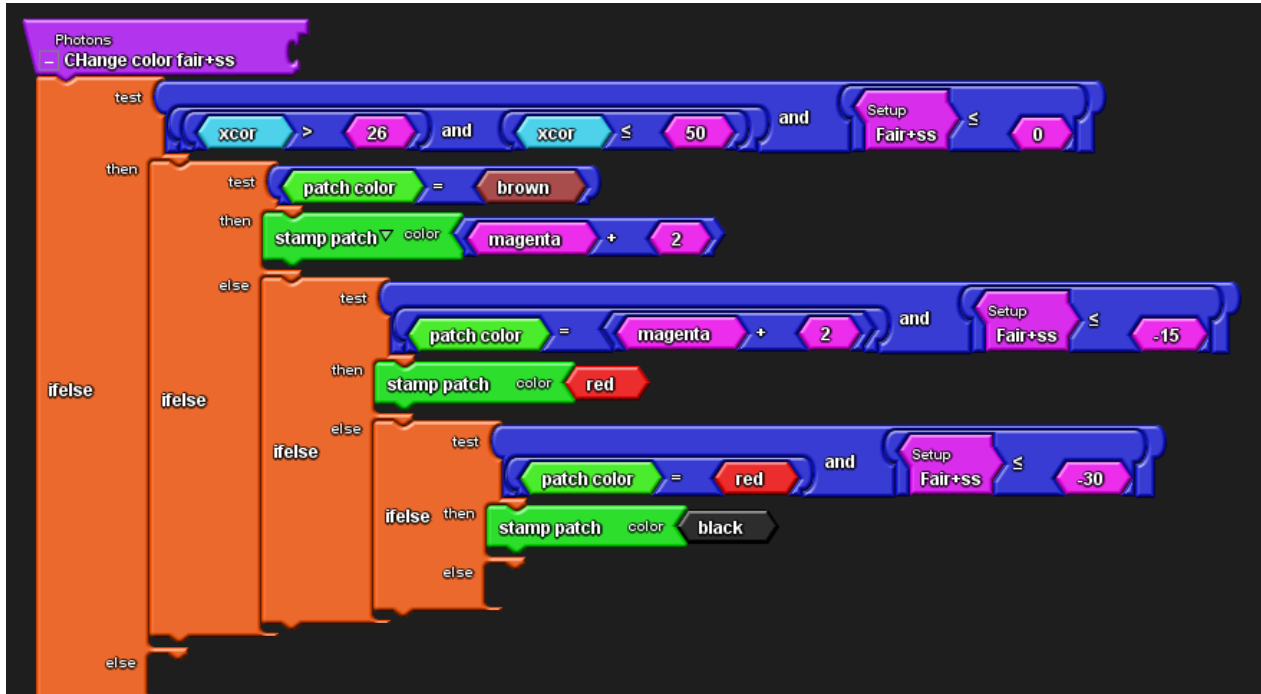Photons going down and lowering immunities.
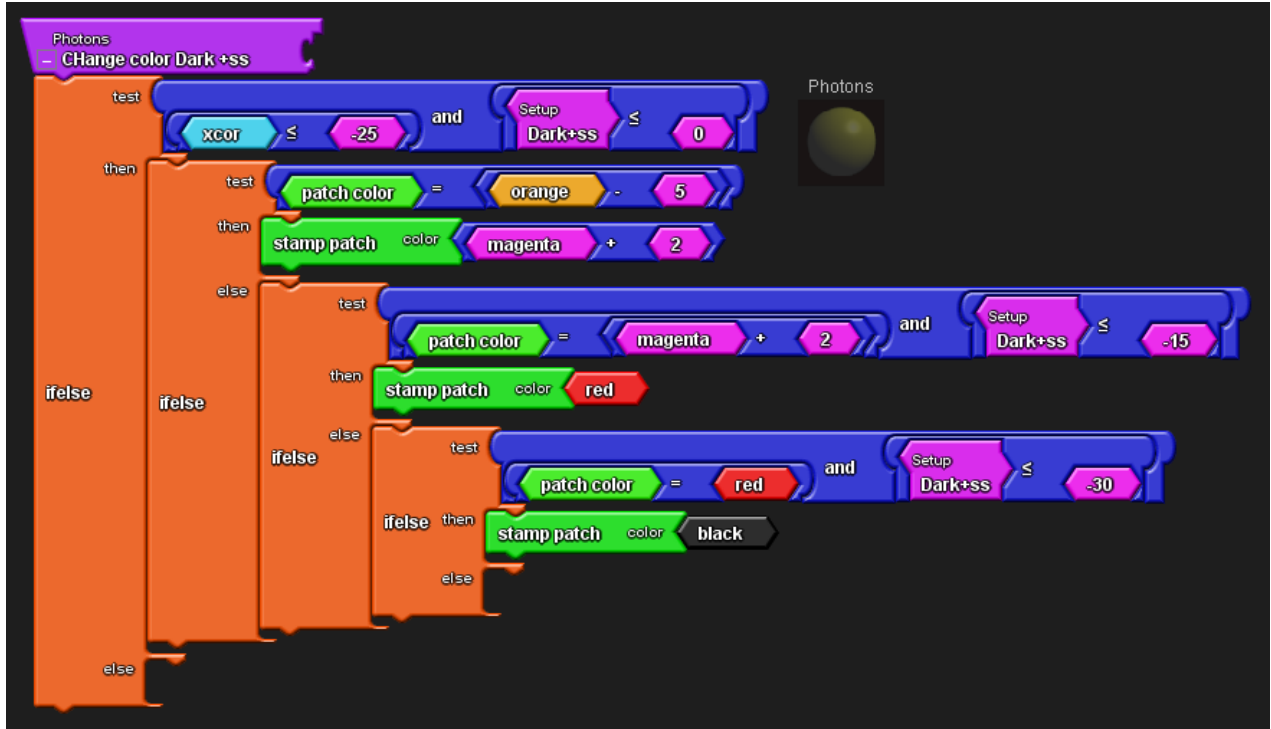
Photon test if in Dark + Sunscreen area and change color

Photon test if in Dark area and change color

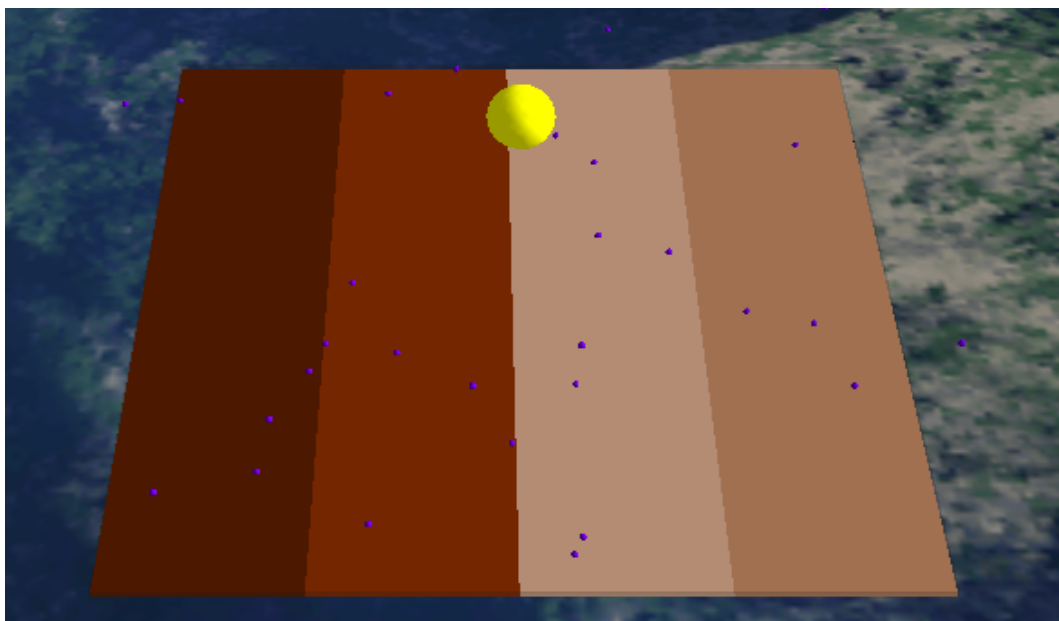Photon test if in Fair + Sunscreen area and change color
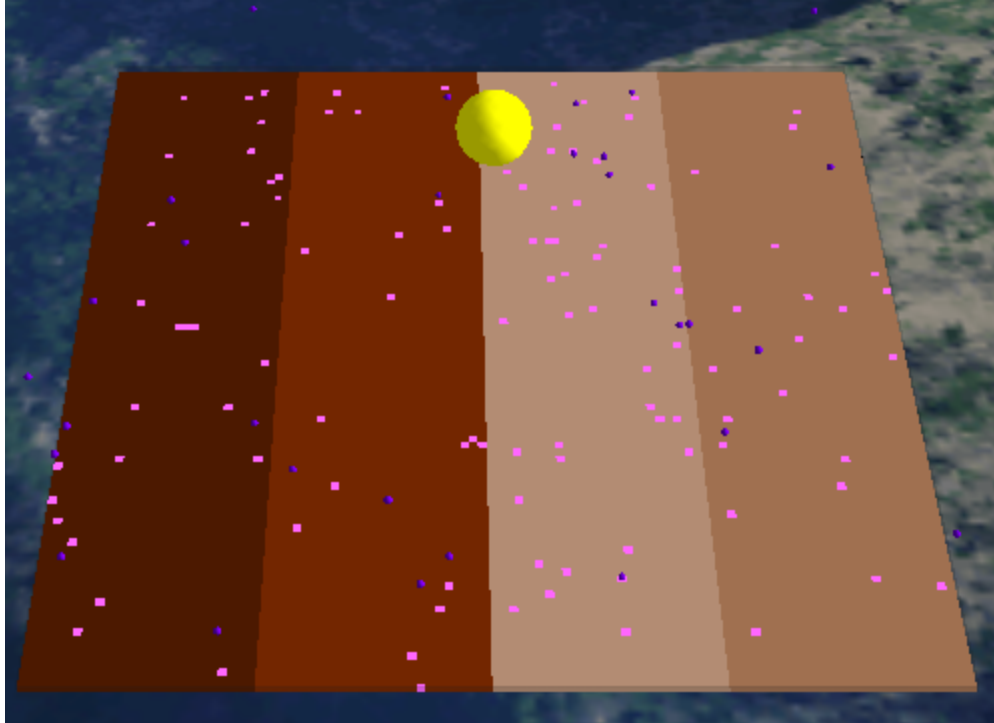

Photon test if in Fair area and change color
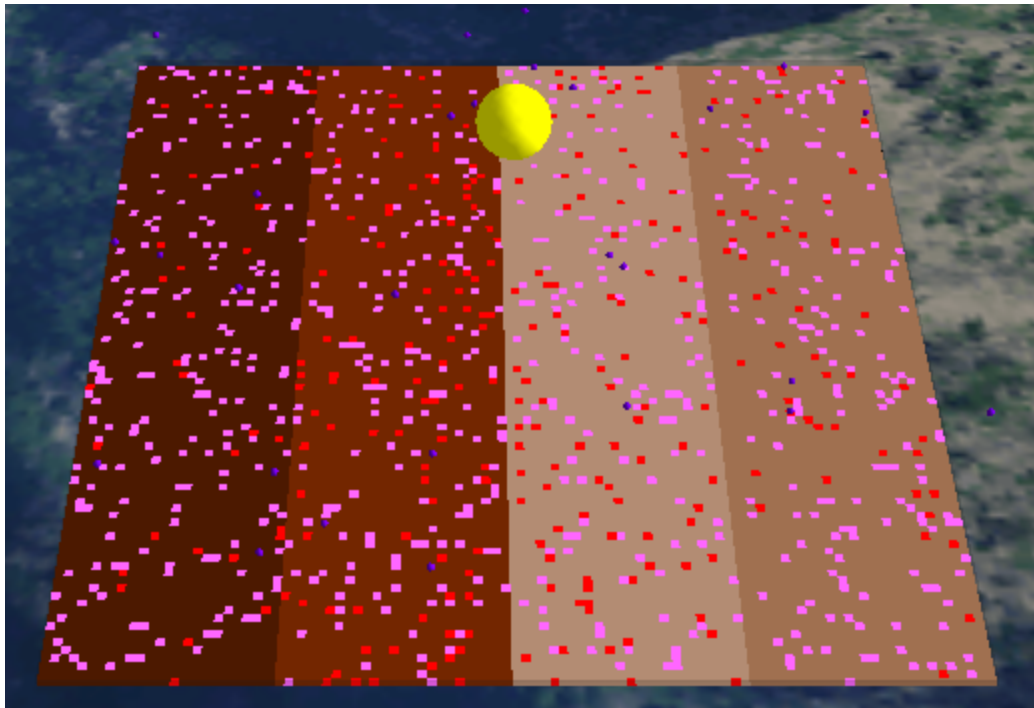
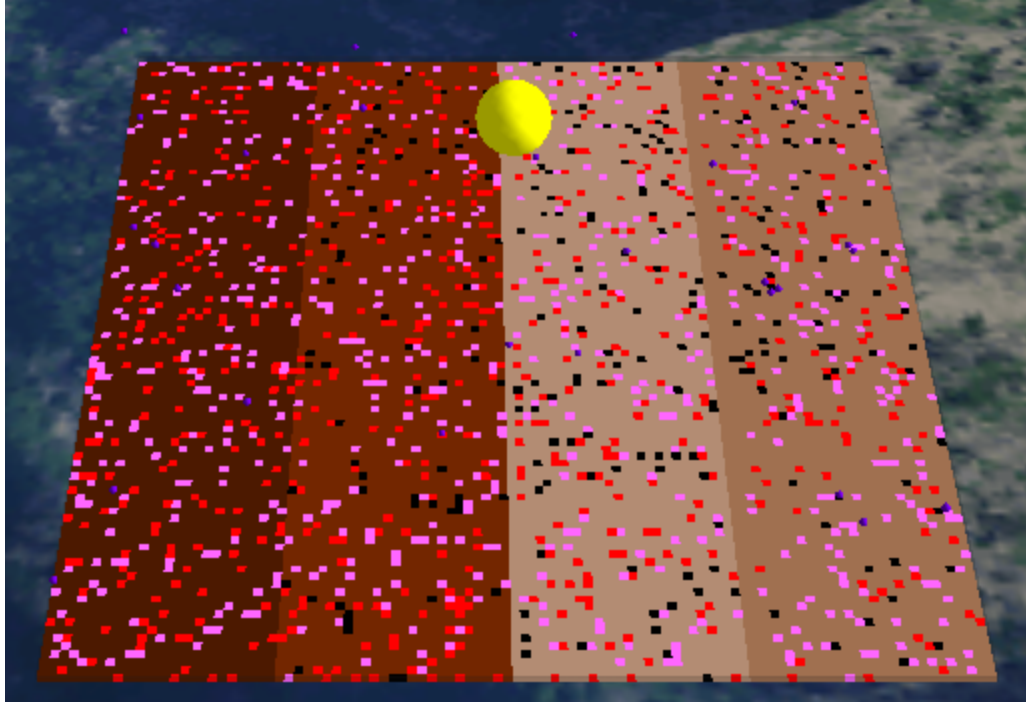## *Appendix 2- SpaceLand*

After Setup

Running at first

Starting to get sunburns

Getting severe sunburns

Getting skin cancer

Results

Validation

Summer's experiment helped us determine the values of the immunity levels. In her experiment, she concluded that skin with sunscreen will take about twice as long to burn as skin without sunscreen. If we assume that the ratio would stay the same all the way until cancer, then the skins with sunscreen should decrease half as much per photon as the skins without sunscreen. Thus, the fair skin's immunity decreases by sixteen hundredths per photon, and the fair skin with sunscreen only decreases by eight hundredths per photon. The dark skin decreases by seven hundredths per photon, and the dark with sunscreen by thirty-five thousandths.

Conclusion

In the end of our experiment we concluded that skin cancer can occur from too much time in the sun with little or no sunscreen.Skin cancer can injure and possibly kill you. Even if you do decide to wear sunscreen if the SPF is too low than you could quite possibly get sunburn and skin cancer. So if you want to lower your chances of getting skin cancer there are two main things that you can do in order to do this: one you can wear sunscreen when you are going outside for more than 15 minutes in the day, two you should never ever use tanning beds. These are great ways to prevent skin cancer.

Acknowledgements