

## Colored Images

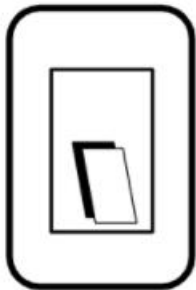
### Your Tasks

- ☐ Get introduced to how computers store colors
- ☐ Get Acquainted with the pixelation widget
- ☐ Explore more shades of color
- ☐ Create all the 3-bit color combinations
- ☐ Apply sampling to create an image with more shades of color
- ☐ Complete the reflection
- ☐ Receive credit for this lab guide

### ☐ Get introduced to how computers store colors

In the last lesson, we used 1 bit for each pixel. That meant we had only two choices for each pixel, black and white.

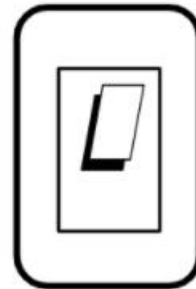
When the bit was “off”



0

black pixel

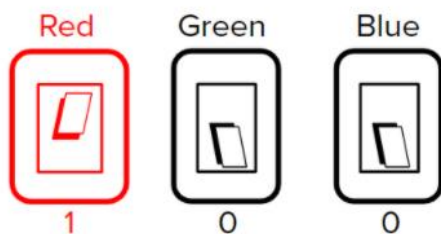
When the bit was “on”



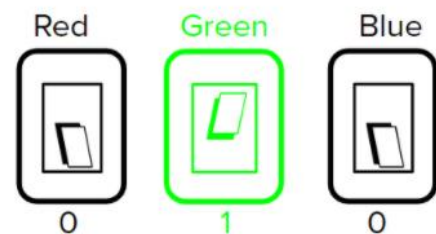
1

white pixel

Today we will use 3 bits for each pixel. Each bit will control a different color of light: Red, Green, and Blue



Turning on just the red bit  
makes a **RED** pixel



Turning on just the green bit  
makes a **GREEN** pixel

How many different colors can be stored with 3 bits?

## ❑ Get acquainted with the color pixelation widget

In the lab we will be using the color pixelation widget. If you haven't already done so,

- Navigate to <http://studio.code.org> to create an account
- Join this course. You will need to get the course code from Ms. Pluska

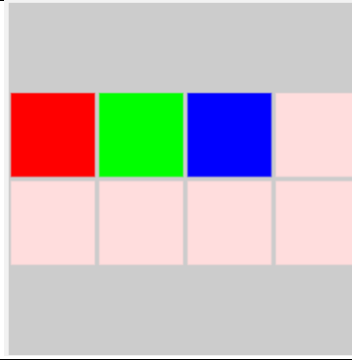
To learn more about the color pixelation widget watch the video below,



To get started with the pixelation widget Navigate to <https://studio.code.org/s/csp1-2021/lessons/8/levels/2>

<p>Just like before, use the sliders to adjust image width, height, and bits per pixel.</p> <p>The Bits per pixel is the number of bits required to represent our colors. Set this value to 3.</p>	A screenshot of the "Color Pixelation Widget" interface. It features three sliders: "Image width" set to 4, "Image height" set to 2, and "Bits per pixel" set to 3. Below the sliders, there are two radio buttons: "Binary" (selected) and "Hexadecimal".
<p>The first row of binary numbers in the console represent the width of the image. The second row represents the height. The third row represents the number of bits per pixel.</p> <p>Below the first three rows you can begin encoding the colors for each square.</p>	A screenshot of a console window showing four lines of binary code. The first three lines are "0000 0100", "0000 0010", and "0000 0011". The fourth line is "100 010 001". A red circle is drawn around the first three lines, and a red arrow points from the text in the left column to the first line of the console.

With three bits we can create  $2^3$  or 8 different colors. Figure out what these colors are and complete the grid.



### □ Explore more shades of color

In this portion, you will use 2 bits to control each color of light. This will be 6 bits total for each pixel.

Red 00 Green 00 Blue 00



Black Pixel  
000000



Red 01 Green 00 Blue 00



Dark Red Pixel  
010000



Red 10 Green 00 Blue 00



Red Pixel  
100000



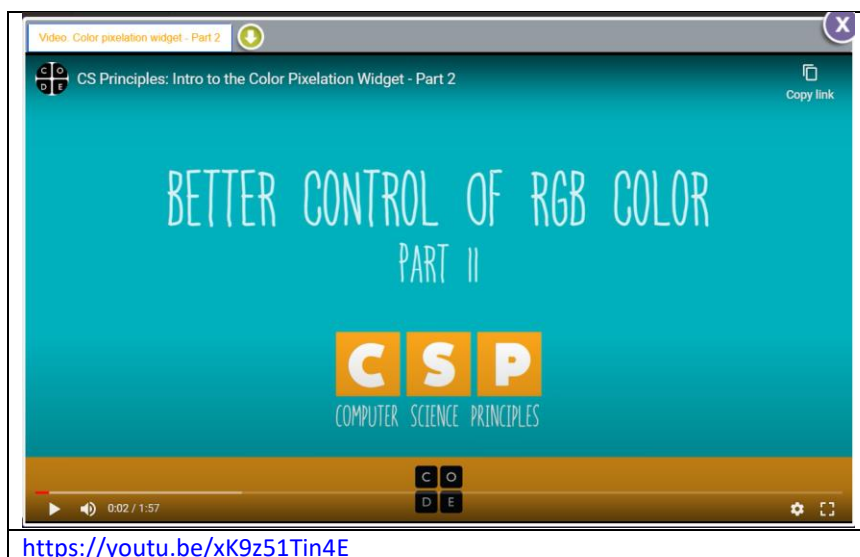
Red 11 Green 00 Blue 00



Bright Red Pixel  
110000



Navigate to <https://studio.code.org/s/csp1-2021/lessons/8/levels/4> and watch the video to learn how to create more colors



<https://youtu.be/xK9z51Tin4E>

Now you will use 6 bits to represent each color. The first 2 represent red, the next 2 green, the last 2 blue.

Image width: 4

Image height: 3

Bits per pixel: 6

Binary: ☒ Hexadecimal: ☐

```

0000 0100
0000 0011
0000 0110
000000 010000 100000 110000

```

All the possible shades of red have been completed for you. Create all the possible shades of green and blue.

## □ Create all the three-bit color combinations

Navigate to the next stage

Now you will use 9 bits to represent each color. The first 3 represent red, the next 3 green, the last 3 blue.

Image width: 8

Image height: 3

Bits per pixel: 9

Binary: ☒ Hexadecimal: ☐

```

0000 1000
0000 0011
0000 1001
00000000 00100000 01000000 01100000 10000000 10100000 11000000 11100000

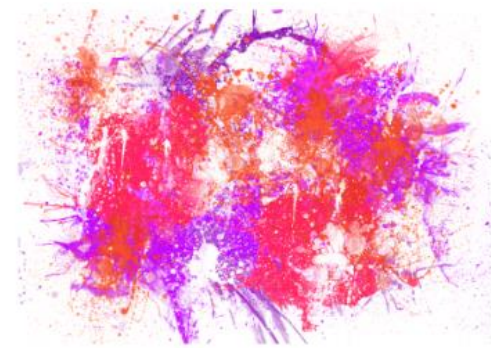
```

All the possible shades of red have been completed for you. Create all the possible shades of green and blue.

## □ Apply sampling to create an image with more shades of color

Navigate to the next stage

Pick a selection from one of the images below.



Navigate to the next stage (stage 8). Use sampling to match the color pattern as best you can using the widget. Don't worry if it doesn't match exactly! Remember, you can adjust the settings of the widget using the sliders, so you can experiment with using even more bits per pixel!

Compare the quality of your image with your partner. Click the "save image" button, then copy and paste your image into one of the boxes below. Have your partner do the same.

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## □ Complete the reflection

1. Which statement about analog and digital images is true?
  - With advances in technology, digital images look exactly like the analog images they represent
  - Sampling an analog image more frequently produces a digital image with a better representation
  - Analog images come from data that is measured at regular intervals
  - Digital images come from data that is measured continuously
2. Describe how the process of sampling, RGB pixels, and binary sequences work together to display a digital color image.

3. Computers actually use 24 bits to represent each color. How many shades of each color are there. How many different colors total can be created with 24 bits?

## □ Complete the Receive credit for this lab guide

Submit this portion of the lab to Pluska to receive credit for the lab guide.