Are Dogs Colorblind?

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Acknowledgements

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Purpose

The purpose of my experiment is to determine if dogs are color-blind.

Hypothesis

If I put green paper around a jar and orange paper around another jar, then the dog will not go to any color the most because dogs can't see the difference between orange and green, even though I trained the dog to go to the green jar.

Background Research

Do dogs only see in black and white? Is that a myth? If so what colors do dogs actually see? Although dogs don't see in black and white, they do have a limited range of color. What is the reason for this? Well, it comes down to something called cones and rods. Cones are color receptors located in the retina of the eye and they collect the wavelengths of light. After collecting the light, cones transmit the color to the brain and the brain interprets the color. This is how people identify the particular wavelengths of light. (Stromberg, 2013), (Coren, 2008), (Lee, Orwig, Ludacer, 2017), (Hogeback, 2020), (Bauhaus, 2018),

A dog's eyes only have two cones or color receptors which makes it see less colors on the color spectrum than humans. Humans have three cones which allow them to perceive more colors on the color spectrum. Dogs can only observe purple, grey-brown, blue, and a little bit of yellow. In fact, a dog's vision is comparable to a person with red-green color blindness. (Stromberg, 2013), (Meyers, 2019), (Wolchover, 2012), (Bauhaus, 2018),

So, in comparison to dogs what colors can humans see? Humans can see the colors of the rainbow. People can see more colors than dogs because they have three cones whereas dogs only have two. This allows humans to detect more colors on the color spectrum.(Stromberg, 2013), (Coren, 2008), (Bauhaus, 2018),

Humans that are color-blind can only identify a certain amount of colors on the color spectrum. This is because one or more of their cones, or color receptors in the retina is missing or deformed. There are two types of color blindness; red-green color blindness, and yellow-blue color blindness. People with red-green color blindness can see all of the colors on the color spectrum except for green and red. Humans with yellow-blue color blindness can see colors on

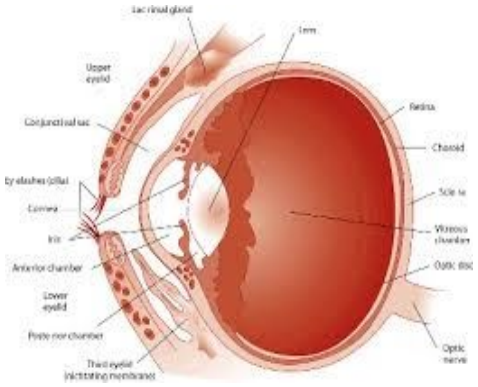
the color spectrum except for yellow and blue. In comparison with a dog's vision the red-green colorblindness is the most similar to what colors dogs see everyday. (Wolchover, 2012), (UN, 2019), (Bauhaus, 2018),

Another object in the dog's eye that affects its vision is rods. Rods are photoreceptors that are located in the retina. Cells in the retina that give a reaction to light in the retina are photoreceptors.The number of rods that are in the retina determines how well someone can see in the dim and lower light. Because dogs have more rods than humans they have better night vision. This is why dogs are such exceptional hunters. (UN, Rods and Cones), (UN, Are Dogs Colorblind), (Lee, Orwig, Ludacer, 2017), (UN, 2019), (Dog Hugging Person, Do Dogs only see in Black and White), (Land, Photoreception)

This is how a dog's eyes work:

First, the canine's eye lets in the light from the pupil. The object in the eye that can lengthen and shrink is called the iris and it mandates how much light that is allowed in. After this, light goes through the translucent lens and cornea which sets the vocal point on the retina. This is the light-sensitive surface and it accommodates color-sensitive cones and movement and brightness sensitive rods. The cones and rods convert light to electric communication which are delivered to the brain. (Roberts, 2009)

Dog's Eye Example:



(Gellat, 2018)

There have been many experiments to test if dogs are color blind or not. One of these experiments is done by the professor, Jay Neitz, who tested the theory of color blindness in dogs. Professor Neitz had three equally sized circles on a wall. He lit up the circles in different colors and tested three dogs. Jay Neitz's experiment went something like this, the dogs were put in a room and they were asked to touch a circle on the wall, if they touched the different color circle then they would get a treat. After he trained the dogs to go to the specific circle then he started mixing up where the circle was located. He came to the conclusion that dogs can indeed see colors on the color spectrum, but they are dichromatic. Being dichromatic means that dogs can only see two of the three primary or main colors on the color spectrum. This is because they only have two cones. Generally most humans can see all three of the primary colors (red, blue, and yellow). (Neitz, Geist, Jacobs, 1989)

Another experiment was done by Italian scientists. In their examination they had multiple dogs with different screens with images of animals in motion.These images were set to different colors and were shown in different colors to the dogs numerous times. The scientists came to the conclusion that when the cut was moving on the screen and the cat was red on a green landscape the dogs did not react. This is due to the fact that dogs can not distinguish

between green and red. However, when the screen displayed a black cat moving against a white landscape it prompted more reactions from the dogs. (London, 2017)

In conclusion, dogs aren't color blind, as was originally thought. However, they do have a limited range of color. Dogs have less cones than humans which causes dogs to not be able to see all of the colors on the color spectrum. Dogs do however have more rods than humans and this allows them to have better night vision than humans. This, along with many other variables makes them avid hunters. Dogs are dichromatic and can only see blue, purple, yellow, and grey. They also have red green colorblindness or deuteranopia. Jay Neitz and many others have done experiments on dogs to determine what they can and cannot see and this will help expand people's knowledge on dogs and their vision. (Neitz, Geist, Jacobs, 1989), (London, 2017)

(Lee, Orwig, Ludacer, 2017), (Hogeback, Are Dogs really Color-Blind),(Roberts, 2009), (Meyers, 2019), (UN, Are Dogs Colorblind)

List of Materials

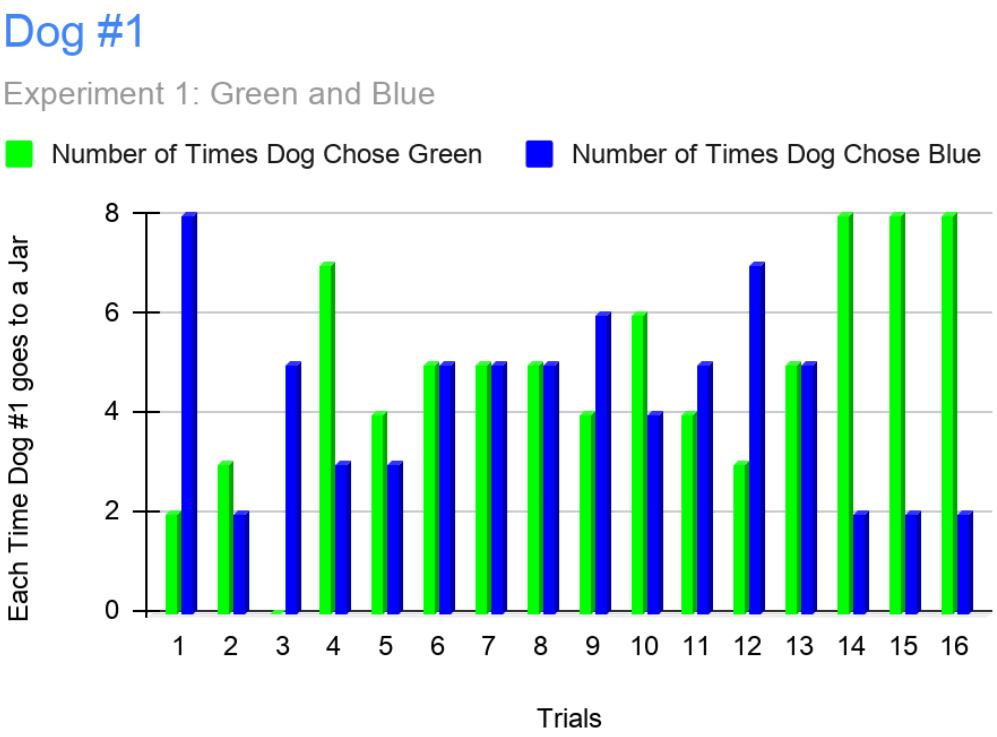
- ❑ Scissors
- ❑ Tape
- ❑ 2 or more Glass Jars
- ❑ Green Paper
- ❑ Blue Paper
- ❑ Orange Paper
- ❑ Treats
- ❑ Black and White camera
- ❑ 2 Dogs
- ❑ Six different or more types of multicolored paper

Procedure

To set up this experiment, first you need six different colors of paper. After you have collected the paper, lay the multicolored sheets of paper on an even surface. Then take a black and white photo of the different sheets of paper. After the photo has been taken look at the photo and see which two slips of paper look the most similar in black and white coloring. Then looking at the photo again find the one color that looks different from the rest of the slips of papers. After that take the three colors that match the best description, I choose (green, blue, and orange), and grab at least two clear jars. Next take one of the similar colors and the one different color and cut the paper so you can wrap the two different sheets of paper around two different jars, then tape them. When you have your different jars set up it's time to start testing your experiment. To start testing if a dog is colorblind, find a closed off room with little distractions for your dog, grab treats and a notebook to record which color the dog goes to and then put the two different colored jars on the opposite sides of the room. Next grab your dog and have him go to one jar, on one side of the room. If your dog goes to the jar that has a similar color to another slip of paper give him a treat, if your dog goes to the jar that looks different than all of the slips of paper say no and don’t give him a treat. Repeat this experiment ten times in a session. Repeat the different sessions until your dog goes to the similar jar eight times out of ten, three sessions on a row. Once you do this, it's time to start the second trial of this experiment, first you wrap the similar piece of paper that you didn’t use in your first experiment on a new or pre existing jar from the first experiment. Then you add the other similar colored slip of paper that you used in the first experiment. Put these two jars at opposite sides in a room and see which side the dog goes to, give the dog a treat if he goes to the same color that you used in the first experiment, don’t give him a treat if he goes to the other color. This is the experiment if your dog is colorblind, because

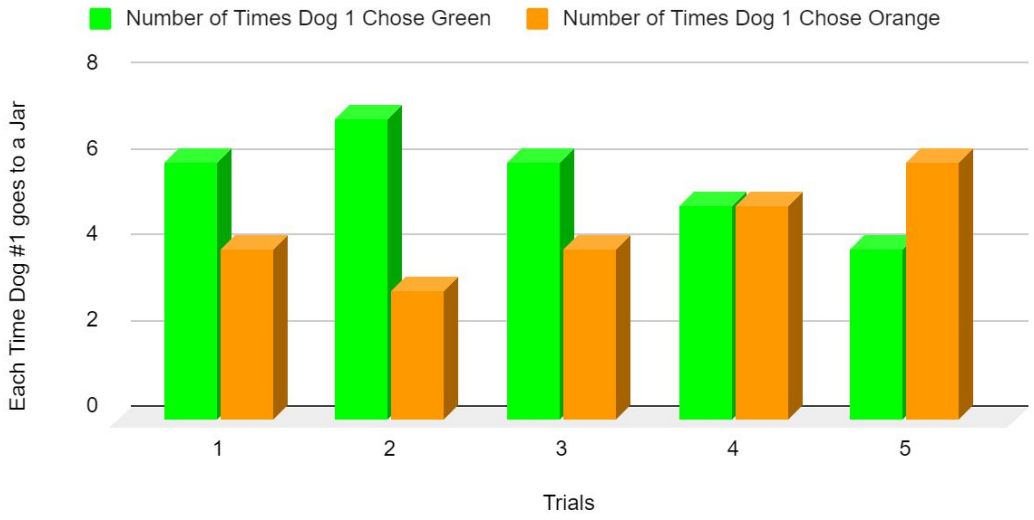
the colors of the two paper are similar in black and white then they will be harder to distinguish from, and if your dog isn't color blind then they will be able to tell the difference between the two colors. Test your dog for at least three different segments and when you get your final results you will be able to tell if your dog is colorblind. If your dog went to the color in the first experiment more than he is not colorblind, if he went to the second paper more than he might be. These were the steps to test if your dog is color blind.

Data and Graphs



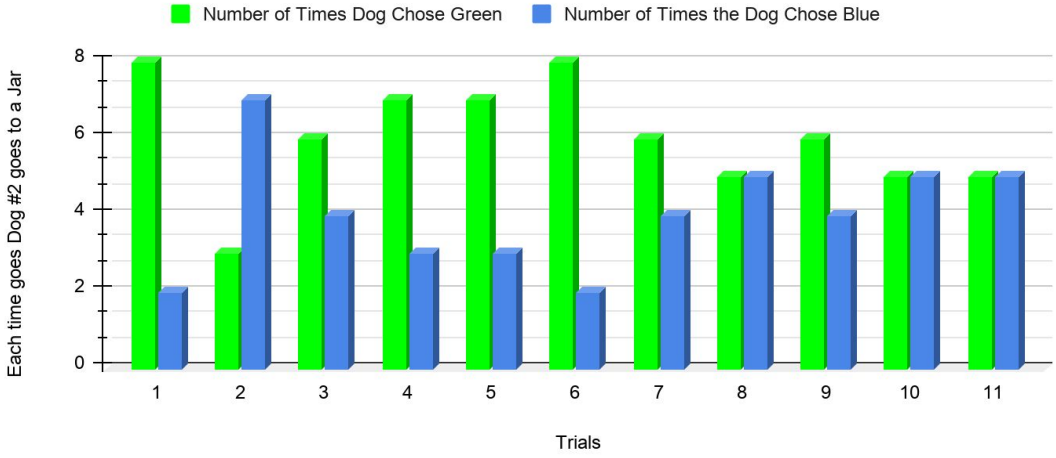
Dog #1

Experiment 2: Green and Orange



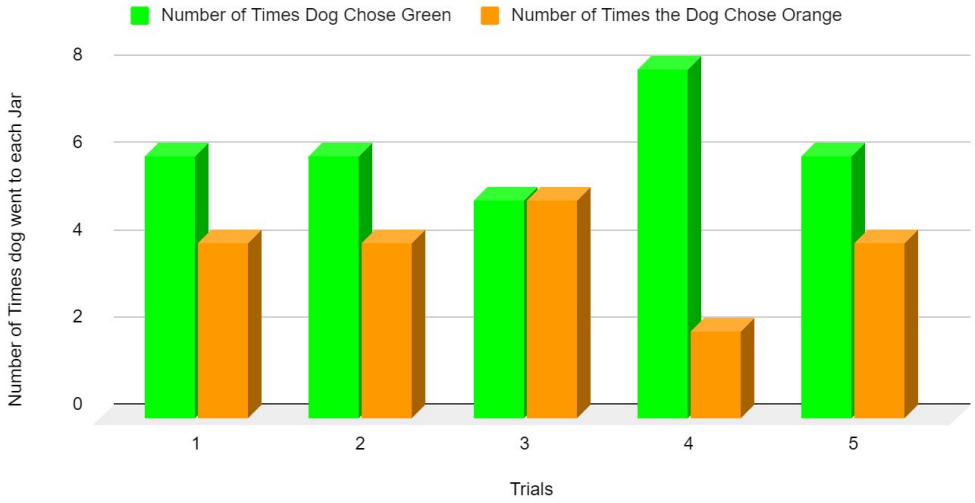
Dog #2

Experiment 1: Green and Blue



Dog #2

Experiment 2 Green and Orange:



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Results

My results concluded that in the first part of the experiment when dogs were asked to distinguish between blue and green colored jars that they were eventually able to grasp the experiment and began to go only to the green jar or mostly to the green jar. After they understood the first part of the experiment, I moved onto the second part where they were able to still distinguish green from orange most of the time.

Conclusion

My hypothesis: If I put green paper around a jar and orange paper around another jar, then the Dog will not go to any color the most because dogs can't see the difference between orange and green, even though I trained the dog to go to the green jar, my hypothesis is incorrect. The dogs still went to green more in experiment two, even though according to my research dogs are colorblind and can't see the difference between green and orange. This concludes that my hypothesis was incorrect and the data went against what my research was saying. This proves that dogs aren't color blind.

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