

DO BIRDS REALLY PREFER RED CARS?

An Introductory Lesson Using Statistical Analysis

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Abstract

Birds have excellent color vision. They can see ultraviolet (UV) light and have at least four kinds of cones in the retinas of their eyes. Cones are photoreceptors that aid in color vision. In contrast, humans can't see UV light and only have 3 types of cones in their retinas.

Introduction

Birds have excellent color vision. They can see ultraviolet (UV) light and have at least four kinds of cones in the retinas of their eyes. Cones are photoreceptors that aid in color vision. In contrast, humans can't see UV light and only have 3 types of cones in their retinas.

Seeing color helps birds recognize food and danger. Seeing color also helps them select a mate.

Not only do birds have extremely well developed color vision, but they have really accurate vision as well. They can focus well, and can see long distances.

Background

A Bethesda-Chevy Chase High School science teacher has two cars; a red one and a white one. The teacher noticed that the birds "pooped" much more frequently on her red car. Both cars are parked under trees on her street. Even though she varies the parking spot of the two cars, the birds seem to find her red car with much greater frequency. Knowing that birds have accurate vision, and excellent color vision, she wondered if they were really selecting her red car to "poop" on.

Purpose

To find out if birds really prefer red cars over white cars to "poop" on.

Materials

2 sheets of construction paper; 1 red, 1 white
4 anchors of each paper
meter sticks

Procedure

We will simulate red and white cars by using red and white construction paper.

1. Students will work in pairs. Both students should initial the two sheets of construction paper.
2. Select a tree around campus and place your two sheets of construction paper under each tree. Each sheet should be the same distance from the trunk of the tree. Use the meter stick to measure.
3. After the time frame determined by the teacher, go get your construction papers and tally the number of “poops” on each one.
4. Record your results on the chalkboard in the front of the classroom, and copy the information on the Data Table #1.
5. In the “Sign Test” column, mark a “+” if there were more “poops” on the red paper than on the white paper. Mark a “-” if there were less “poops” on the red paper than on the white paper, and mark a “0” if there was no difference in the number of “poops” on the red and white papers.

Student Names	# Of “Poops” On Red Paper	# Of “Poops” On White Paper	Sign Test “+”, “-“ Or “0”
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

6. Fill in the following table using the results from Data Table #1.

Total # Of “+” Results (Pluses)	Total # Of “-” Results (Minuses)

Notice: Results that showed no difference are ignored.

7. On the overhead “Table for the Sign Test at the alpha level of .05”, find the square that corresponds to the number of pluses and minuses and place a check next to the statement that pertains.

_____ Reject H_0

_____ Fail to Reject H_0

Analysis

1. The null hypothesis (H_0) is a hypothesis that states that there is no difference in the results. Write a H_0 for this experiment by finishing the statement:
 - a. There is no difference in the amount of bird “poops” as seen on.....
2. Write a H_0 for each of the following situations. Use the example in the previous question.
 - a. Ari thinks that more mice are caught in traps baited with chocolate than in traps baited with cheese.
 - b. Eliana thinks that more boys go to the B-CC HS soccer games than girls.
 - c. Tanya wants to know if there is a difference in the number of tobacco seeds that sprout in darkness or in light.
 - d. Anton wants to know if the leaves on the south side of trees are bigger than the leaves on the north side.
3. According to the results of the Sign Test, do you think that the birds are “pooping” more frequently on the teacher’s red car?
4. There are many statistical tests used to see if there is enough reason to reject the null hypothesis. The test is selected according to the type of experiment and the kinds of data collected. In this experiment, the Sign Test was used because the same variable was used in two samples and the data were paired.
 - a. What was the variable?
 - b. How were the data paired?
5. What do you think should be the next step in investigating the teacher’s problem?

Conclusion

Write a paragraph summarizing what you discovered in this experiment.

Vocabulary Builders

1. Birds have 4 types of cones and are called tetrachromatic. Humans have 3 types of cones. What do you think they are called?
2. What is a photoreceptor?

Connections *Textbook Research

1. List the following in order from shortest to longest wavelength:
Visible light, UV, Infrared
2. Describe how the human eye works.

Teacher's Notes

MSDE Core Learning Goals

Goal	Expectations	Indicator	At Least:
1	2	1	Identify and pose answerable scientific questions
		2	Formulate and test a hypothesis
		3	Select appropriate equipment
	3	1	Develop skills in using field equipment
	4	1	Use analyzed data to evaluate a hypothesis
		5	Choose appropriate summary statistics
	5	2	Use tables, graphs to display data

MCPS Outcomes: 1, 4, 6, 8

Objectives

1. Learn to write a null hypothesis
2. Gather and report data in an organized manner
3. Analyze data using appropriate statistics

Advanced Preparation

- Select Field area for students
- Have sufficient numbers of red and white construction papers for the pairs of students
- Have anchors to hold papers in place during the duration of experiment
- Have chart ready on chalkboard
- Have an Overhead of Sign Test ready for projector. A possible source for the overhead is: Ambrose III, Harrison, W. and Katherine Peckham Ambrose. A Handbook of Biological Investigation. Winston Salem: Hunter Textbooks, Inc. 1995. p.50.

Time frame

2 class periods. (Lab investigation, discussion of results.)

Class Level

All