

Pillbug Class Results

2022-10-26

Overview

These are the results of the data taken by the class to test for phototaxis in pillbugs.

There are two experimental groups—The light on group, (where the light was turned on), and the light off group, (where the light was turned off). The goal of the light-off control group was to ensure that any orientation seen in the light-on group was due to the presence of the light, and not a feature of the experimental setup (ie, the bugs were orienting away from the students).

Students measured the direction the bug moved in relative to the lamp (the light source), which was randomly positioned, and relative to the room, where their orientation arena was positioned such that 0 was pointing towards the back of the room. This allowed them to additionally test whether the animals were orienting with respect to an external cue in the room. To get the animal's orientation with respect to the light source, students transformed their data by taking the Lamp-Position minus the direction the bug moved in. This turned the data from 0 to 360 (where 0 is the front of the room) into -180 to 180 (where 0 is the direction of the lamp).

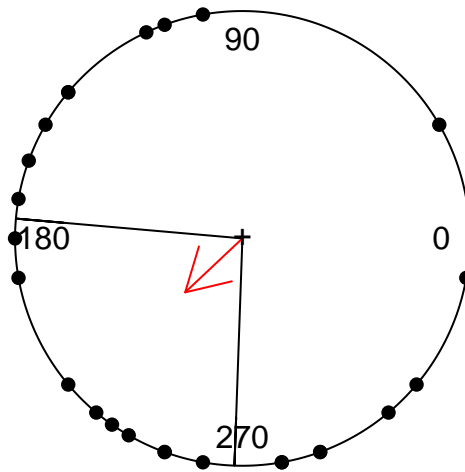
This resulted in four different analyses: 1. In the light-On group a. The direction the bugs moved in with respect to the lamp b. The direction the bugs moved in with respect to the room 2. In the light-off group a. The direction the bugs moved in with respect to the lamp b. The direction the bugs moved in with respect to the room

The results for these analyses are shown below.

On Condition,

Relative to the Light Source

ON: Rel to Light



$P=0.048$, $R=0.34$, $\text{mean}=224$

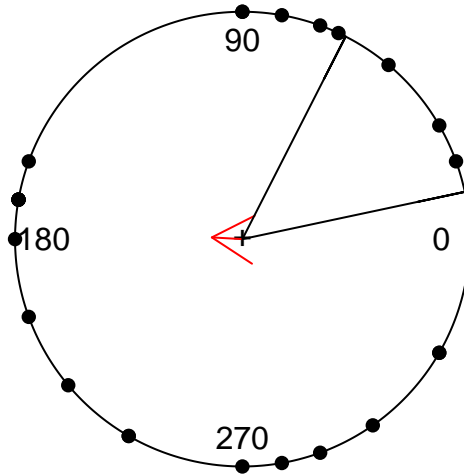
These results show a significant orientation from the experimental light-on group with respect to the light source. The light source is at position 0, and black dots show the animal's direction upon exiting the arena.

A rayleigh test of uniformity had a p-value less than 0.05 ($p=0.048$), and thus we reject the null hypothesis and say that the pillbugs were not uniformly oriented. The mean resultant vector ($r=0.34$, length of red arrow) shows a large amount of spread in the animal's orientation. The mean angle of the pillbugs orientation is 224 degrees (red arrow direction), plus or minus ~45 degrees (black lines)

Thus we would conclude that the pillbugs were exhibiting behavior consistent with Negative Phototaxis.

Relative to the Room

ON: Rel to Room



$P=0.64$, $R=0.134$, $\text{mean}=176$

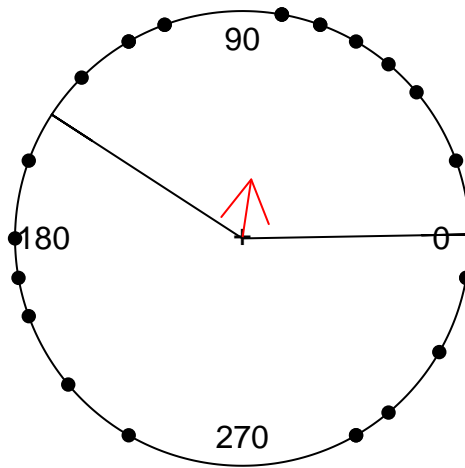
These results do NOT show a significant orientation from the experimental light-on group with respect to the room. The light source is at position 0, and black dots show the animal's direction upon exiting the arena.

A rayleigh test of uniformity had a p-value greater than 0.05 ($p=0.64$), and thus we cannot reject the null hypothesis that the pillbugs are uniformly oriented. The mean resultant vector ($r=0.134$, length of red arrow) shows an extremely large amount of spread in the animal's orientation. The mean angle of the pillbugs orientation is 176 degrees (red arrow direction), plus or minus ~ 120 degrees (black lines, larger angle)

Off Condition

Relative to the Light Source

OFF: Rel to Light



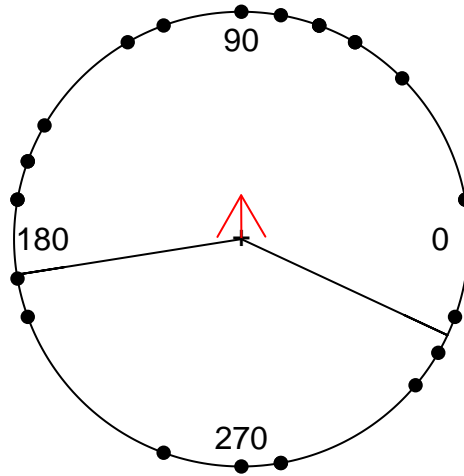
$P=0.16$, $R=0.26$, $\text{mean}=81$

These results do NOT show a significant orientation from the control light-off group with respect to the light source. The front of the room is at position 0, and black dots show the animal's direction upon exiting the arena.

A rayleigh test of uniformity had a p-value greater than 0.05 ($p=0.16$), and thus we cannot reject the null hypothesis that the pillbugs are uniformly oriented. The mean resultant vector ($r=0.26$, length of red arrow) shows a large amount of spread in the animal's orientation. The mean angle of the pillbugs orientation is 81 degrees (red arrow direction), plus or minus ~70 degrees (black lines)

Relative to the Room

OFF: Rel to room



$P=0.38$, $R=0.19$, $\text{mean}=90$

These results do NOT show a significant orientation from the control light-off group with respect to the room. The front of the room is at position 0, and black dots show the animal's direction upon exiting the arena.

A rayleigh test of uniformity had a p-value greater than 0.05 ($p=0.34$), and thus we cannot reject the null hypothesis that the pillbugs are uniformly oriented. The mean resultant vector ($r=0.19$, length of red arrow) shows an extremely large amount of spread in the animal's orientation. The mean angle of the pillbugs orientation is 90 degrees (red arrow direction), plus or minus ~100 degrees (black lines, larger angle)