Outlook

Team 7 Data

From Claire Clampett <claire.clampett@duke.edu>
Date Mon 9/22/2025 9:41 AM
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1 attachment (15 KB)
CirclePlots.pdf;

Team 7 — Rohil, Kathleen, Renee, Claire

Light on (Group 1)

- ```
  Mean angle:  331.206
  Mean vector length (r):  0.7980567
  Rayleigh test p-value:  0.15156
  ```

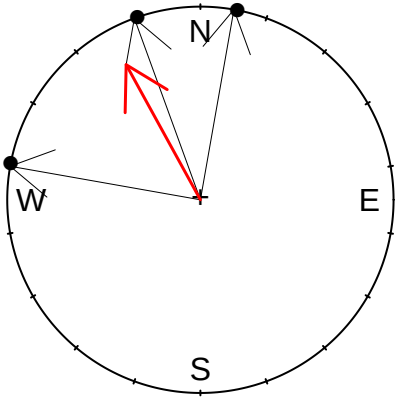
Light off (Group 2)

- ```
  Mean angle:  61.05325
  Mean vector length (r):  0.2754972
  Rayleigh test p-value:  0.8233026
  ```

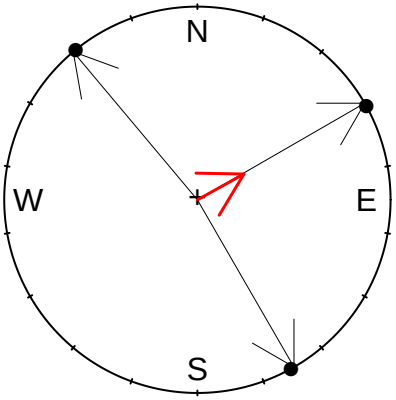
```
     Watson's Two-Sample Test of Homogeneity

Test Statistic: 0.0787
P-value > 0.10
```

The results between groups might have differed because of variable experimental conditions: different lighting, positioning within the room, etc. In a future experiment, we would ensure that the pillbugs were of the same developmental stage and the same species, and in a dark room with no other light sources.

Group 1



Group 2



Team #4: Allison Lee, Annie Nam, Austin Sun, Khang Huynh

INDIVIDUAL GROUP DATA

Results:

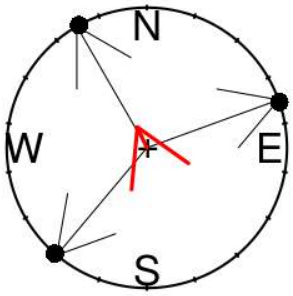
Group 1

```
Mean angle:  335.3217
Mean vector length (r):  0.1621428
Rayleigh test p-value:  0.9354331
```

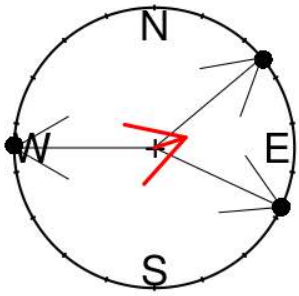
Group 2

```
Mean angle:  71.86838
Mean vector length (r):  0.2358276
Rayleigh test p-value:  0.8676819
```

Group 1



Group 2



Results Statement:
Results may have differed across teams because the roly polys' species, developmental stage, and amount/position of light were not controlled for. To improve the experimental design, we would ensure that the roly polys are of the same lineage (ideally, the same generation/age as well) and the room is completely dark (blackout curtains, dark settings during transportation, etc.). We would also increase the sample size and do multiple trials per pillbug.

Group 9: Charlie, Mia, Yuchen, and Demi

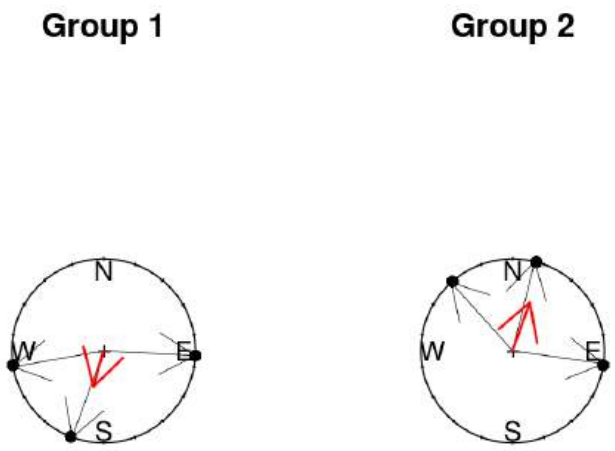


Fig 1. Circular plots of experimental (1) and control (2) groups.

Results:

Group 1

```
Mean angle:  195.7247
Mean vector length (r):  0.403666
Rayleigh test p-value:  0.6538037
```

Group 2

```
Mean angle:  19.68032
Mean vector length (r):  0.5573104
Rayleigh test p-value:  0.432223
```

Watson's test to compare two groups

```
     Watson's Two-Sample Test of Homogeneity

Test Statistic: 0.0787
P-value > 0.10
```

Table 1. Rayleigh tests, mean angles, mean resultant vectors, and Watson's test of experimental (1) and control (2) groups.

Discussion

Despite the P-value on the Watson test and mean resultant vector showing a non-statistically significant difference between groups, there is still a general trend. We think lack of control for outside lighting and minimal adjustment time could have affected the results.

Group 9: Charlie, Mia, Yuchen, and Demi

To correct for the restrictions of the classroom, we could create a darker and more controlled environment and limit the amount of light and have a more standardized sample (same size, species, age, time of collection, development stage, habitat).

Kyra, Rohinee, Ethan, and Vickie

Results:

Between the two groups, the control group had a stronger mean vector length with 0.9 and a better p-value compared to the experimental group that is close to 0.05 at 0.06. The experimental group had a weak mean vector length, and the p-value is very very above 0.05 at 0.7. This means that the experimental group had stronger data to support their movement paths after the cup was removed and the pill bugs could move away freely.
Results may have differed between groups because of the inconsistencies in pill bug species and developmental stages during collection. Furthermore, there may have been differences due to natural light from the windows or light from the projector at the front of the class affecting each experiment differently depending on their location in the room.
Future exploration could correct for natural room lighting and stressful environments experienced by the pill bugs by repeating this experiment in a fully dark room and allowing the pill bugs to acclimatize for a longer period below the cup before releasing them.

Team Data:

Results:

Group 1

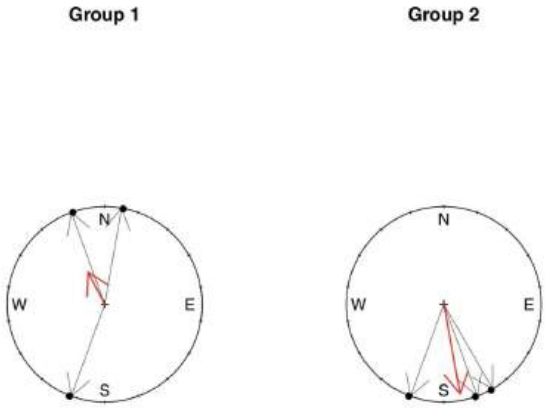
```
Mean angle:  332.6038
Mean vector length (r):  0.3697366
Rayleigh test p-value:  0.7015169
```

Group 2

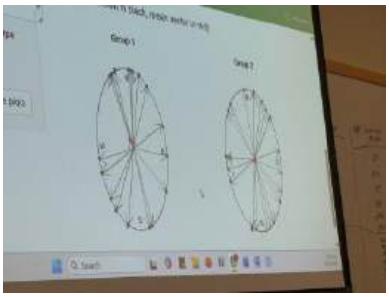
```
Mean angle:  169.6783
Mean vector length (r):  0.9301899
Rayleigh test p-value:  0.06228516
```

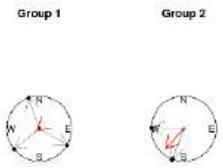
Watson's test to compare two groups

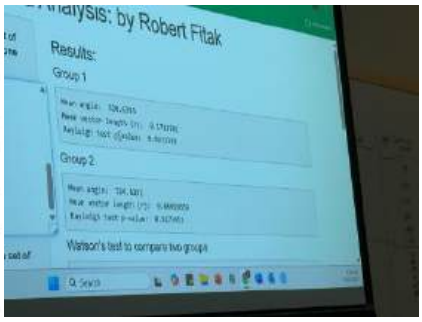
```
     Watson's Two-Sample Test of Homogene

Test Statistic: 0.1528
0.05 < P-value < 0.10
```



Louis, Shanell, Andri, Sara (Group 8)





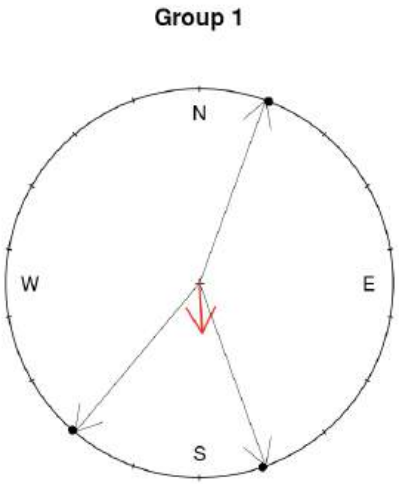


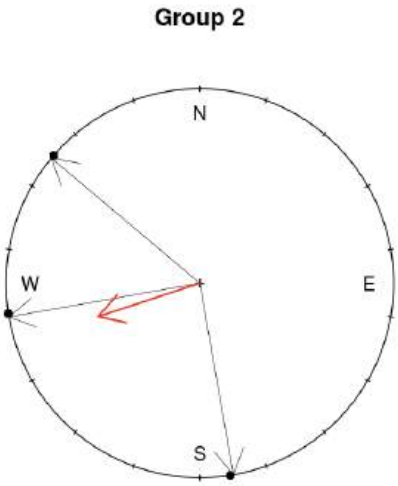
For our data, the group in the light had a mean angle of 230 degrees with a vector length of 0.105 and a p = 0.972, and the group in the dark had a mean angle of 222 degrees with a vector length of 0.841 and a p = 0.118, meaning each result was insignificant.

For the group data, the group in the light had a mean angle of 321 degrees with a vector length of 0.172 and a p = 0.497, and the group in the dark had a mean angle of 125 degrees with a vector length of 0.061 and a p = 0.918, meaning each result was insignificant.

Particularly for the group data, although the results were insignificant, it seems the light condition group favored directions away from the light. Some of the restrictions of the class included the light pollution, limited sample size, limited orientation time, and various species and developmentally aged bugs. To address this, increased sample size, a more dark room, longer orientation time, and a consistent species may reveal a more true depiction of the effect.

Group 5 Data:
Catie Barry, Vicky Gorman, Ricky Jiang, and Ariha Mehta





Group 1 = light on
Group 2 = light off

Results:

Group 1

```
Mean angle:  176.9175
Mean vector length (r):  0.2557181
Rayleigh test p-value:  0.8460443
```

Group 2

```
Mean angle:  251.8948
Mean vector length (r):  0.5531211
Rayleigh test p-value:  0.4381121
```

Watson's test to compare two groups

```
     Watson's Two-Sample Test of Homogeneity

Test Statistic: 0.0787
P-value > 0.10
```

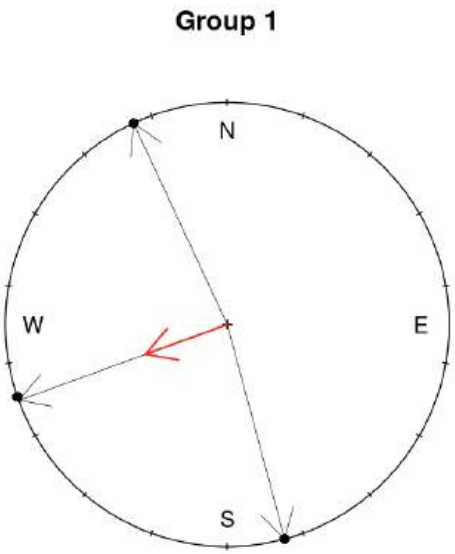
We do not see a significant difference between the group with the lights on and the group with the lights off. The mean angle for Group 1 was around 176°, the mean vector length at 0.256, and the Rayleigh test p-value of 0.846. The Rayleigh test suggests that the distribution is uniform (mean angle and mean vector length are not statistically significant). For group two, their mean angle was around 252°, the mean vector length at 0.553, and the Rayleigh test p-value of 0.438. The Rayleigh test similarly suggests that the distribution is uniform. The p-value for Watson's test was > 0.10, suggesting that there is no significant difference between the two groups.

The reason why our data differed from the whole class's data may be due to having different light sources from outside the class, affecting the roly polys (ex., We're in the back of the class, away from the windows, vs another group closer to the window where there's natural sunlight). Another reason may be that the pill bugs were in different stages of development and possibly even different species (ex,. some of our rolly pollys were quite smaller than the others).

In the future, we will do this in a completely dark room, and also give the animals more time to adjust to the light. To add on to this, we could test the same roly poly in the light and dark, and test if there are any individual differences (given a sufficient break for the roly poly between tests). We would also limit the potential effects of transporting the animals, which could have jarred the roly polys.

Meredith Beatty, Caroline Metz, Syeda Aafreen, Romit Chunduri

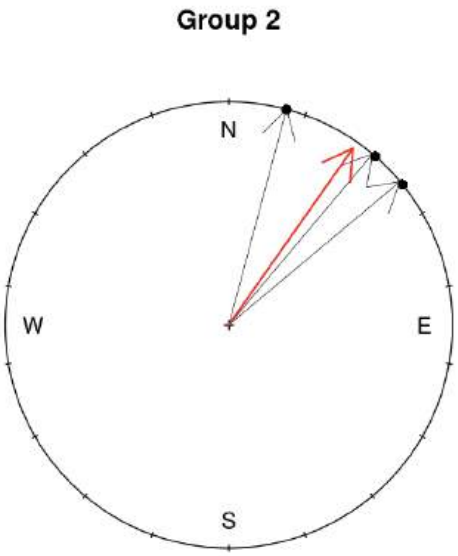
INDIVIDUAL Light ON:



Group 1

```
Mean angle:  250
Mean vector length (r):  0.3914372
Rayleigh test p-value:  0.6711597
```

INDIVIDUAL Light OFF:



Group 2

```
Mean angle:  35.07808
Mean vector length (r):  0.9672719
Rayleigh test p-value:  0.04551571
```

Class Data

Results:

Group 1

```
Mean angle:  324.5115
Mean vector length (r):  0.2404026
Rayleigh test p-value:  0.2114301
```

Group 2

```
Mean angle:  146.764
Mean vector length (r):  0.0864719
Rayleigh test p-value:  0.8199317
```

Watson's test to compare two groups

```
     Watson's Two-Sample Test of Homogeneity

Test Statistic: 0.1432
P-value > 0.10
```

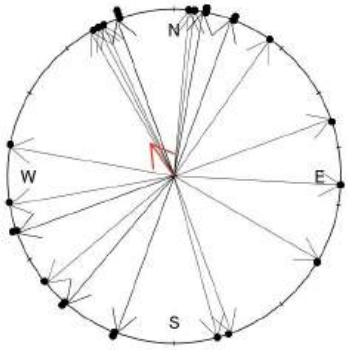
Group 1 is Class Light ON.

Group 2 is Class Light OFF.

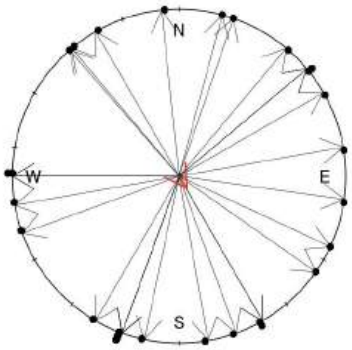
Plots

(data points shown in black, mean vector in red)

Group 1



Group 2



Questions:

1) The data for group one with the light on had a mean vector length of .39, a mean angle of 250, and a p-value of .67 which shows data that is not significant. For group two with light off, we had a mean vector length of .96, a mean angle of 35, and a p-value of .045 which shows significant data on a direction.
2) One way to improve this experiment would be to close the windows to eliminate extra sources of light that could have impacted which ways the rollypolys move. In addition, we could have conducted more trials with the rollypollys to improve the accuracy of the data.

Team 2: Leo Sanabria, Jadelyn Ding, Avari Wang

Group Data:

Group 1- Experimental

Mean angle: 5.10

Mean vector length: 0.90

Rayleigh test p-value: 0.076

Group 2- Control

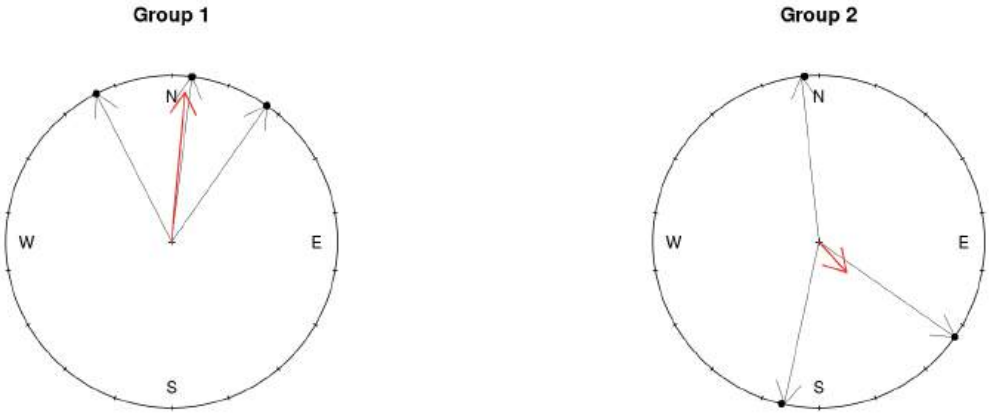
Mean angle: 137.7

Mean vector length: 0.25

Rayleigh test p-value: 0.851

Plots

(data points shown in black, mean vector in red)



Results Statement:

The results did not show a significant difference between the two groups, as neither p-value was below 0.05. The different results between our experimental and control group may indicate that the pillbugs exhibit phototaxis behavior, where their orientation was consistently away from the light (mean angle = 5.10) while their orientation was uniform/more random without light. However, given the small sample size and insignificant results, this is not conclusive.

For the control groups, although we turned off the light source, it is possible that the pillbugs still could have detected diffused light from the windows even for this control trial, and this light may have skewed their reactions. In order to fix this issue, we could create an environment in complete darkness to conduct the control trials in.

Additionally, the pill bugs could have been at different developmental stages and from different species, to fix this, we could ensure that they are raised in a controlled environment.

Group 6: Natasha Murugan, Anne Sacks, Issac Jung, Michelle Moon

Group 6 Data:

Results:

Group 1

```
Mean angle:  342.2397
Mean vector length (r):  0.5578769
Rayleigh test p-value:  0.4314281
```

Group 2

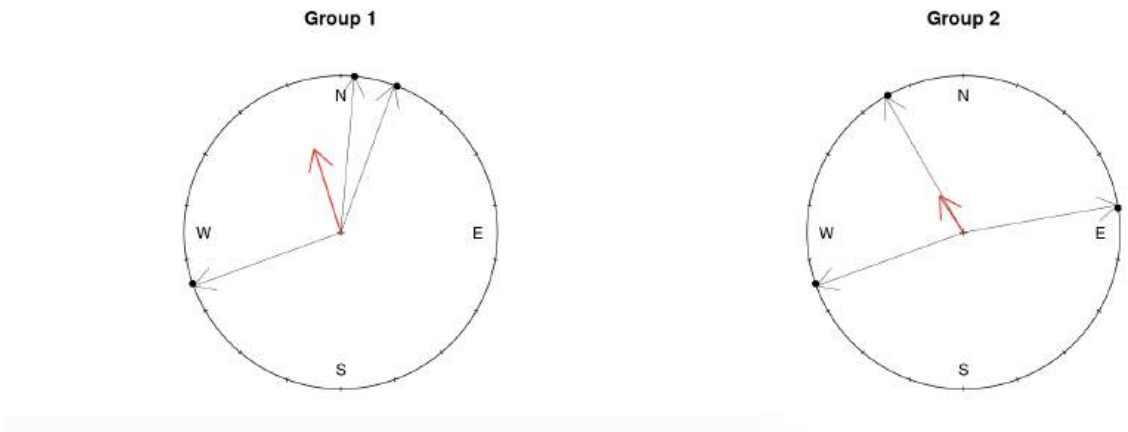
```
Mean angle:  326.8948
Mean vector length (r):  0.277617
Rayleigh test p-value:  0.8207972
```

Watson's test to compare two groups

```
     Watson's Two-Sample Test of Homogeneity

Test Statistic: 0.0787
P-value > 0.10
```

Plots

(data points shown in black, mean vector in red)



Team & Class Data Results:

Compared to the class data, we observed a similar mean angle in Group 1 (320° (class) vs 340° (our group)). However, in Group 2 we observed a different mean angle (140° (class) vs 326° (our group)). The mean vector length was significantly shorter in the class data. The class data might have had a shorter mean vector length due to all the variation between groups. All the data for the class and our group were not significant as we observed a p-value greater than 0.05 for the Rayleigh test results.

The results between the groups potentially differed because of the presence of outside light sources (e.g., light from the windows) and overstimulation of the pillbugs because of transportation exhaustion. To control for these extraneous variables, pillbugs should be kept in a dark room without any light for 1 day to help them acclimate, ensuring that the dark room is devoid of any extraneous light sources. Also, we noticed that the pillbugs were different sizes and thus showed different energy levels. To adjust for these differences, we could try and use similar size pillbugs or the same pillbug with sufficient time for rest in between trials.
The overall result of the class indicates that pillbugs more commonly moved away from the light, which may be due to the presence of light leading to drier conditions. Pillbugs respirate through gills which require moisture and humidity. The presence of light may signal to pillbugs that they are in an environment with low humidity–prompting them to move away from the light into a darker and more humid area.