

Boidr analysis

Load libraries, install boidr

```
source("./R/helpers.R")
source("./R/directions_angles.R")
```

get flocking data

```
# boid_data <- flock_return(no_iter = 8000, init_boids = 256, save_locations_path = data_folder, sample_rate = 32)
boid_data <- flock_detailed(no_iter = 32000,
                           init_boids = 512,
                           save_locations_path = "", # data_folder,
                           sample_rate = 32,
                           init_width = 4000,
                           init_height = 4000,
                           sensory_distance = 50,
                           allignment_coef = .02,
                           allignment_trs_coef = 1.15,
                           cohesion_coef = 0.002,
                           cohesion_trs_coef = .95,
                           separation_coef = 4.1,
                           separation_trs_coef = .3,
                           min_speed = .5,
                           max_speed = 2.,
                           max_steering = .65,
                           dbscan_clustering = T)
```

visualize

```
direction_data_by_boid <- boid_data %>%
  group_by(id) %>%
  summarise(
    headings = get_headings(x, y)
  ) %>%
  summarise(
    bearings = get_bearings(headings),
    # as bearings are calculated from pairs, to map them one to one, throw away the headings of t_0 to t_1
    headings = headings[2:length(headings)]
  ) %>%
  ungroup(id)
```

```
## 'summarise()' has grouped output by 'id'. You can override using the '.groups'
## argument.
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## argument.
```

```

print("range of bearings:")

## [1] "range of bearings:"

range(direction_data_by_boid$bearings)

## [1] -179.9807  179.9798

print("range of headings:")

## [1] "range of headings:"

range(direction_data_by_boid$headings)

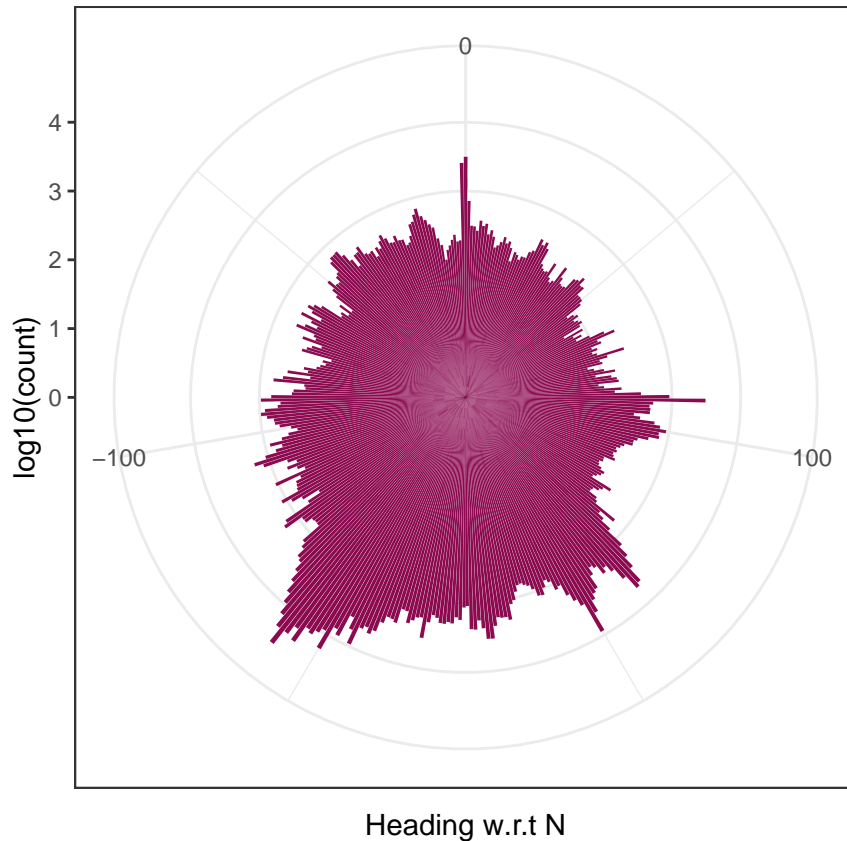
## [1] -179.9995  179.9995

headings_binned <- direction_data_by_boid %>%
  mutate(
    headings = round(headings, 0)
  ) %>%
  group_by(headings) %>%
  summarise(
    count = length(id)
  ) %>%
  select(heading = headings, count = count)

bearings_binned <- direction_data_by_boid %>%
  mutate(
    bearings = round(bearings, 0)
  ) %>%
  group_by(bearings) %>%
  summarise(
    count = length(id)
  ) %>%
  select(bearing = bearings, count = count)

ggplot(headings_binned, aes(x = heading, y = log10(count))) +
  coord_polar(theta = "x", start = pi) +
  geom_bar(stat = "identity", fill = "deeppink4", width = .9) +
  # geom_hline(yintercept = seq(0, 500, by = 100), color = "grey80", size = 0.3) +
  # scale_x_continuous(breaks = 0:24, expand = c(.002,0)) +
  labs(x = "Heading w.r.t N") +
  theme_bw()

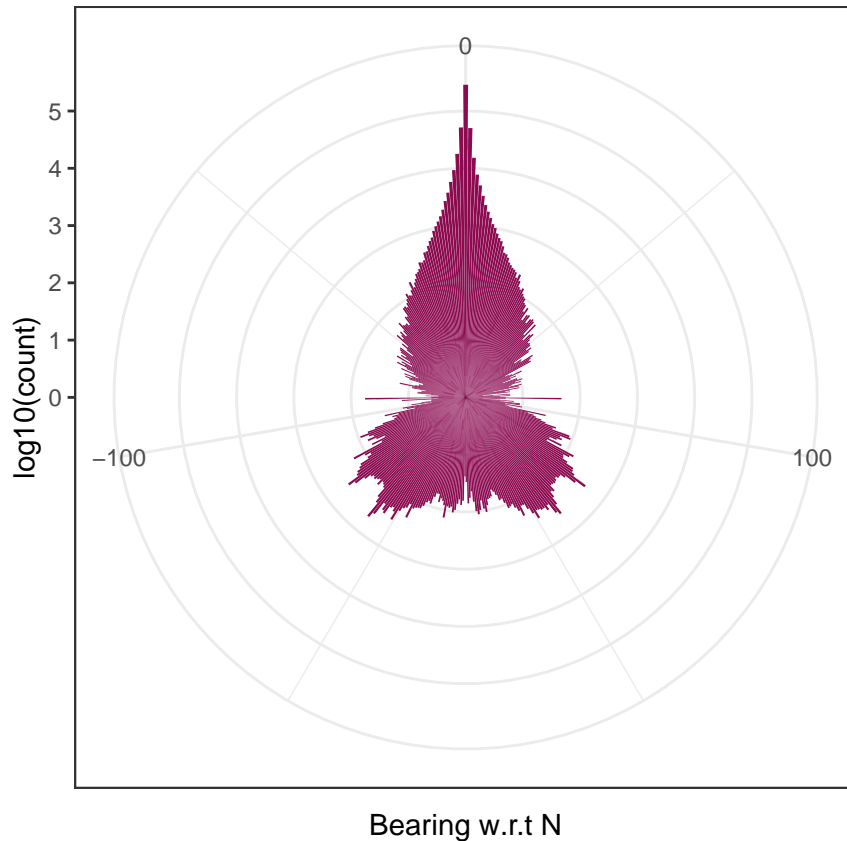
```



```
summary(direction_data_by_boid %>% select(-id))
```

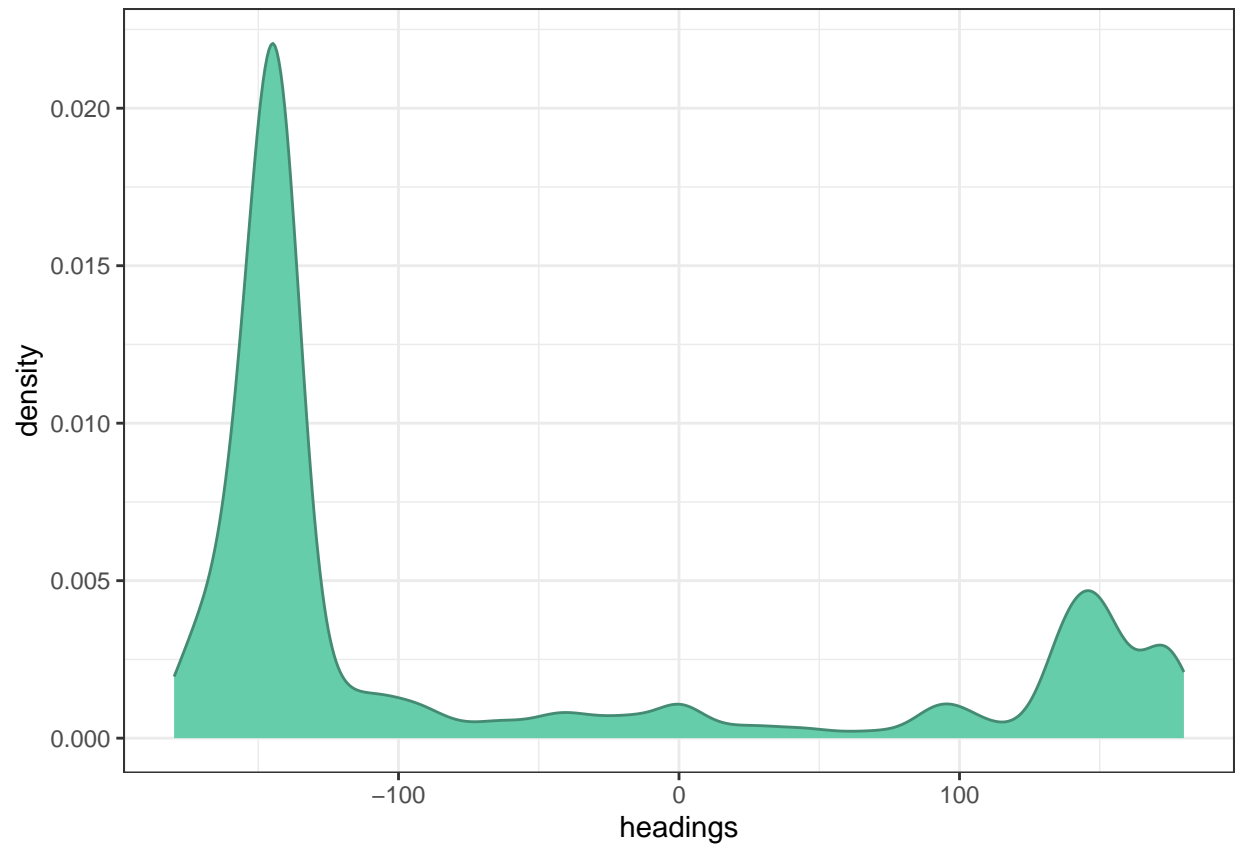
```
##      bearings      headings
## Min.   :-179.98070 Min.   :-180.00
## 1st Qu.: -0.39934 1st Qu.: -148.03
## Median :  0.00000 Median : -141.22
## Mean   : -0.07623 Mean    : -66.51
## 3rd Qu.:  0.33719 3rd Qu.:  10.81
## Max.   : 179.97976 Max.    : 180.00
```

```
ggplot(bearings_binned, aes(x = bearing, y = log10(count))) +
  coord_polar(theta = "x", start = pi) +
  geom_bar(stat = "identity", fill = "deeppink4", width = .9) +
  # geom_hline(yintercept = seq(0, 500, by = 100), color = "grey80", size = 0.3) +
  # scale_x_continuous(breaks = 0:24, expand = c(.002, 0)) +
  labs(x = "Bearing w.r.t N") +
  theme_bw()
```

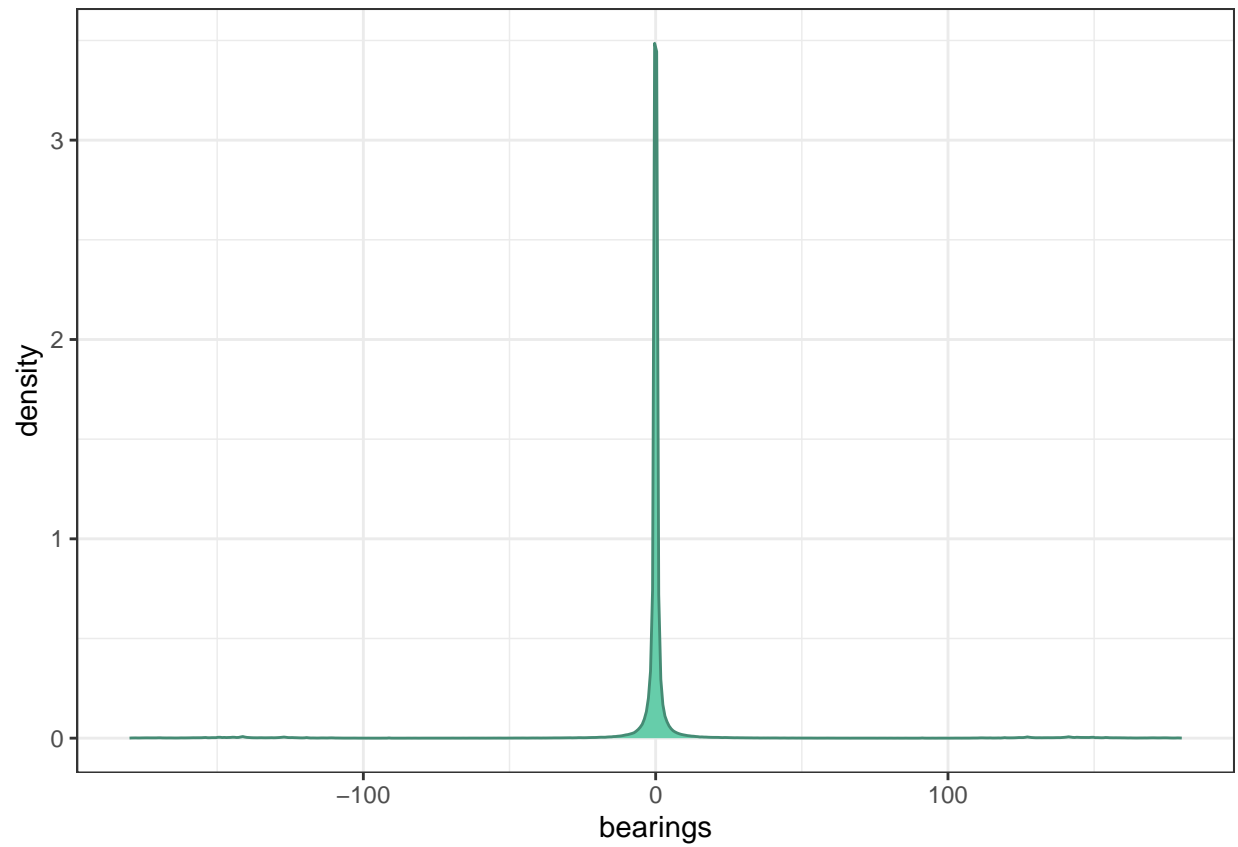


The symmetry here is fascinating, after investigation I am confident in the bearings function. A naive explanation would be the boid's tendency to over react and then over correct, e.g., when it wants to avoid a boid in front of him slightly on the left, it will turn abruptly to the right, then starts to be attracted again towards the same boid.

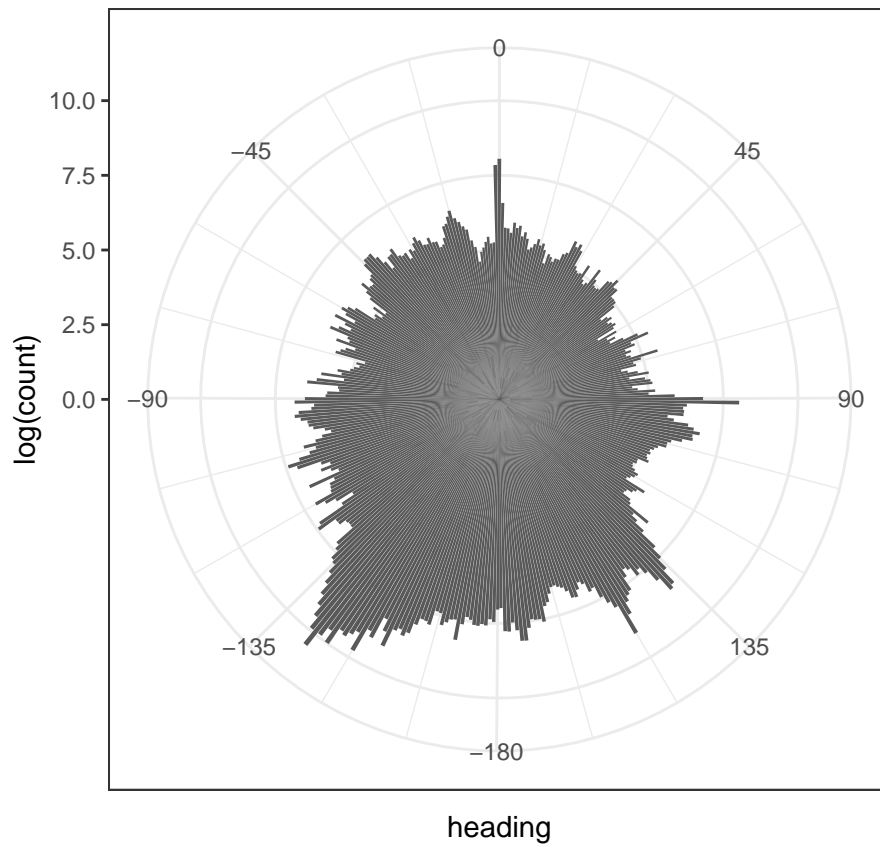
```
ggplot(direction_data_by_boid, aes(x=headings)) +
  # coord_polar(theta = "x", start = pi) +
  geom_density(color="aquamarine4", fill="aquamarine3") +
  theme_bw()
```



```
ggplot(direction_data_by_boid, aes(x=bearings)) +  
  geom_density(color="aquamarine4", fill="aquamarine3") +  
  theme_bw()
```



```
ggplot(headings_binned) +  
  geom_col(aes(x = heading, y = log(count))) +  
  scale_x_continuous(  
    breaks = seq(-180, 179, 45),  
    minor_breaks = seq(-180, 179, 15)  
  ) +  
  # coord_polar() +  
  coord_polar(theta = "x", start = pi) +  
  theme_bw()
```



```
ggplot(headings_binned) +
  geom_col(aes(x = heading, y = count)) +
  scale_x_continuous(
    breaks = seq(-180, 179, 45),
    minor_breaks = seq(-180, 179, 15)
  ) +
  # coord_polar() +
  coord_polar(theta = "x", start = pi) +
  theme_bw()
```

