Final Project

AJ Neff

2025-04-10

Does purposeful dog training relate to human-dog physical acvtivity, fitness, and dog cognition?

Project Info

The analysis performed in this project is to compare fitness testing for both human and dog participants, as well as the cognitive results for the dog participants.

Methods

We recruited dogs and their human companions for testing. 13 humans (age: 42±18 years;1M/12F) were tested for fitness (6 minute walk, chair stand, handgrip test) and asked a questionnaire about physical activity with their dog and the Dog Executive Function Scale (DEFS). Training volume calculation included formal training and sport involvement. Dogs(N=19; age: 4±3years; 10M/9F) were also tested for fitness (percent fat, back up, squat progression test) and cognition (object choice, unsolvable task).

The unsolvable task is a 60 second task where the dog cannot access a treat in a box. They are being evaluated for time trying to get the treat (att_task), looking at the owner (gaze_owner), or walking away (walk_away). This is a cognitive test.

The DEFS is for measuring executive function of the dog. The higher the score, the better the executive function.

Analysis

```
# reading in packages
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ----------------------- tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.1
## v ggplot2   3.5.1     v tibble    3.2.1
## v lubridate 1.9.4     v tidyr     1.3.1
## v purrr     1.0.4
## -- Conflicts ---------------------------------------- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```r
library(ggplot2)
library(dplyr)
library(readr)

# read in the data
Dog_Data <- read.csv("Reproducibility Project.csv")

activity_summary <- Dog_Data %>%
  group_by(owner) %>%
  summarise(
    Avg_Cardio_Hrs = mean(Hrs_Cardio, na.rm = TRUE),
    Walks_Per_Week = mean(Walk_P_Week, na.rm = TRUE),
    Vigorous_Days = mean(Vig_Day_P_Wk, na.rm = TRUE),
    Moderate_Days = mean(Mod_day_wk, na.rm = TRUE)
  )

print(activity_summary)
```

```
## # A tibble: 13 x 5
##    owner Avg_Cardio_Hrs Walks_Per_Week Vigorous_Days Moderate_Days
##    <int>          <dbl>          <dbl>         <dbl>         <dbl>
## 1      1              1              1             0             0
## 2      2              1            1.5             2             4
## 3      3            3.5              7             3           5.5
## 4      4              4              7             3             7
## 5      5              4              3             0             0
## 6      6              4              6             2             4
## 7      7            2.5              3             4             4
## 8      8            3.5              7             2             4
## 9      9              4              7             5             2
## 10    10              4              0             3             0
## 11    11              4              7             5             5
## 12    12              3              7             0             3
## 13    13              3           4.75             2           2.5
```

```r
ggplot(Dog_Data, aes(x = Walk_min_day)) +
  geom_histogram(binwidth = 10, fill = "#69b3a2", color = "black", boundary = 0) +
  labs(
    title = "Distribution of Daily Walking Time",
    x = "Minutes Walked per Day",
    y = "Number of Dogs"
  ) +
  theme_minimal()
```
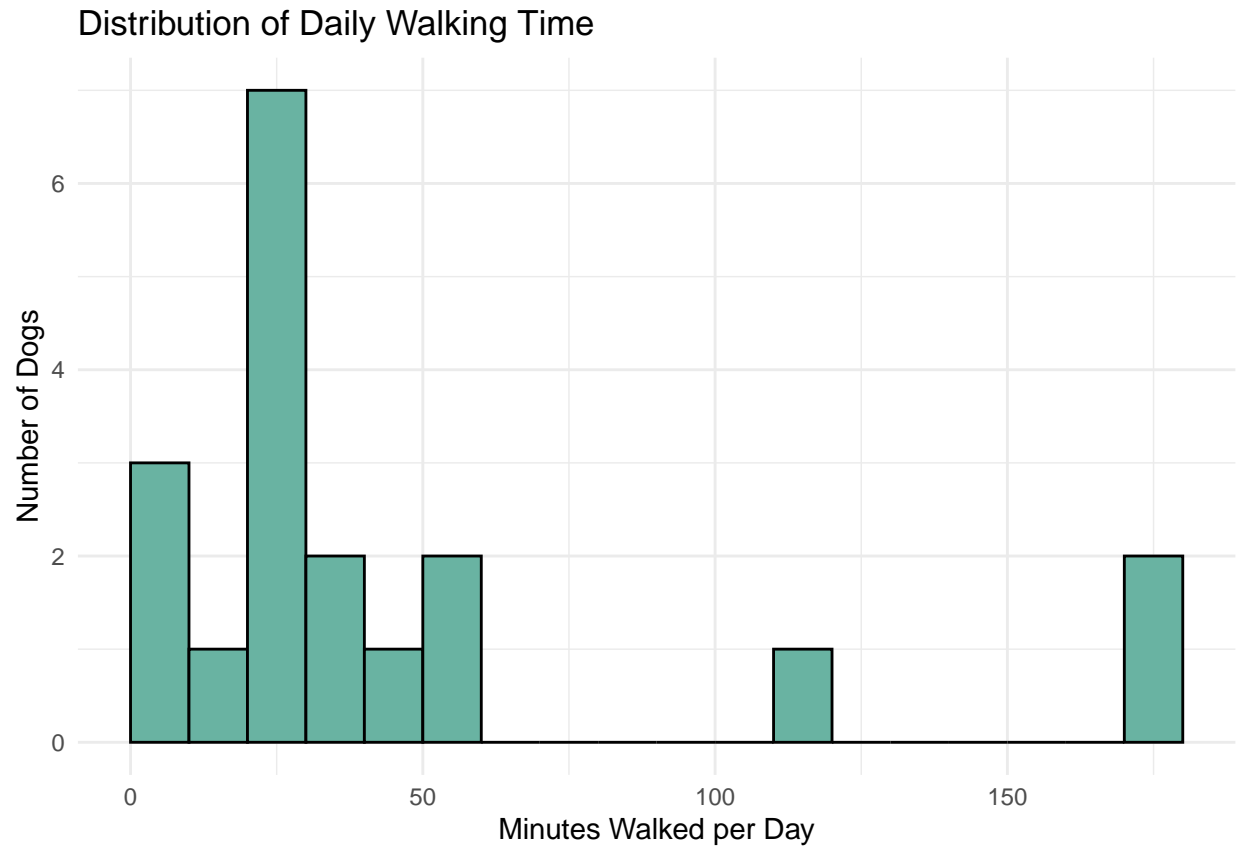
Distribution of Daily Walking Time

This is analyzing the results for the Unsolvable Task and the DEFS results. It shows that the less time spent gazing at the owner during the Unsolvable Task, the higher the DEFS score of the dog.

```r
ggplot(Dog_Data, aes(x = gaze_owner, y = DEFS)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE) +
  labs(
    title = "Gaze at Owner vs Dog Executive Function Scale (DEFS)",
    x = "Time Spent Gazing at Owner (sec)",
    y = "DEFS"
  ) +
  theme_minimal()
```
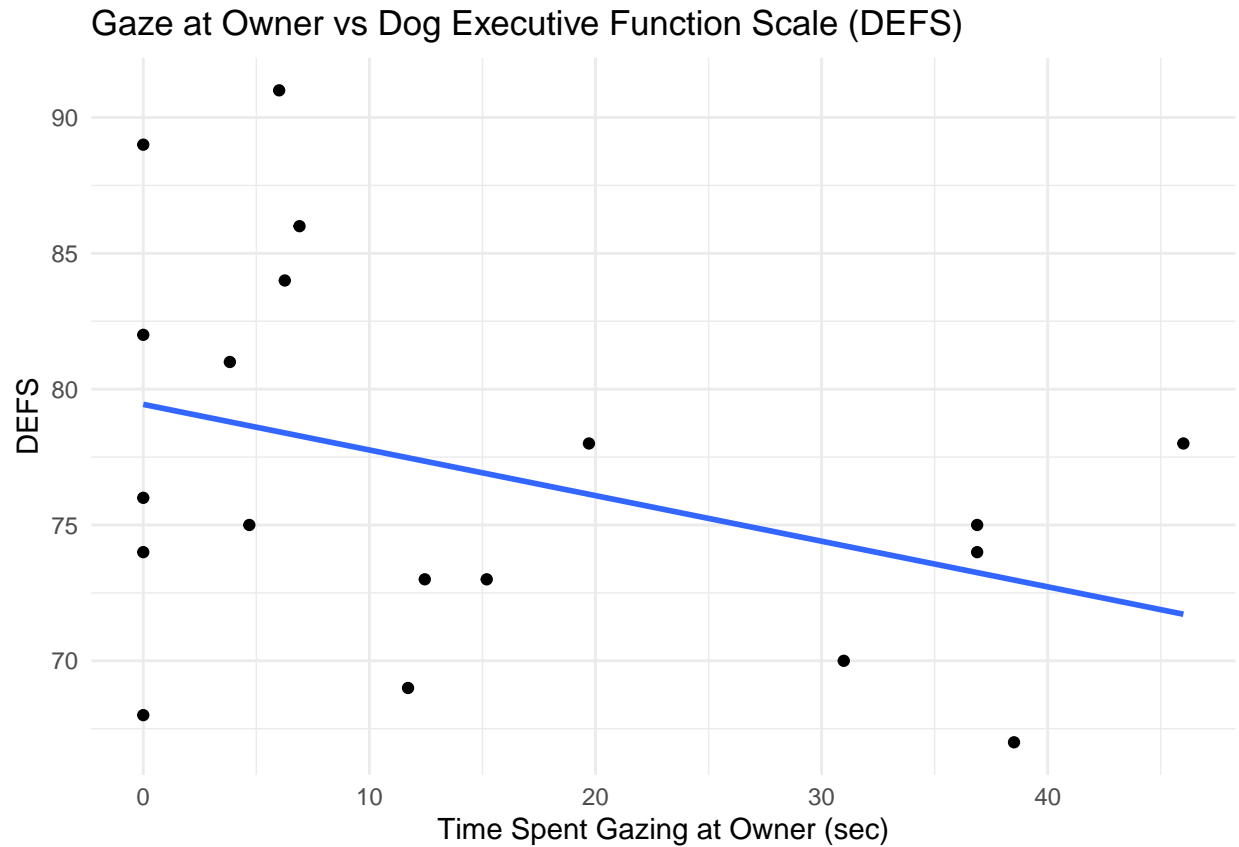
```
## `geom_smooth()` using formula = 'y ~ x'
```

Gaze at Owner vs Dog Executive Function Scale (DEFS)

This is analyzing the results for the Unsolvable Task and the DEFS results. It shows that the more attention on task during the Unsolvable Task, the higher the DEFS score of the dog.

```r
ggplot(Dog_Data, aes(x = att_task, y = DEFS)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE) +
  labs(
    title = "Attention on Task vs Dog Executive Function Scale (DEFS)",
    x = "Attention on Task (sec)",
    y = "DEFS"
  ) +
  theme_minimal()
```
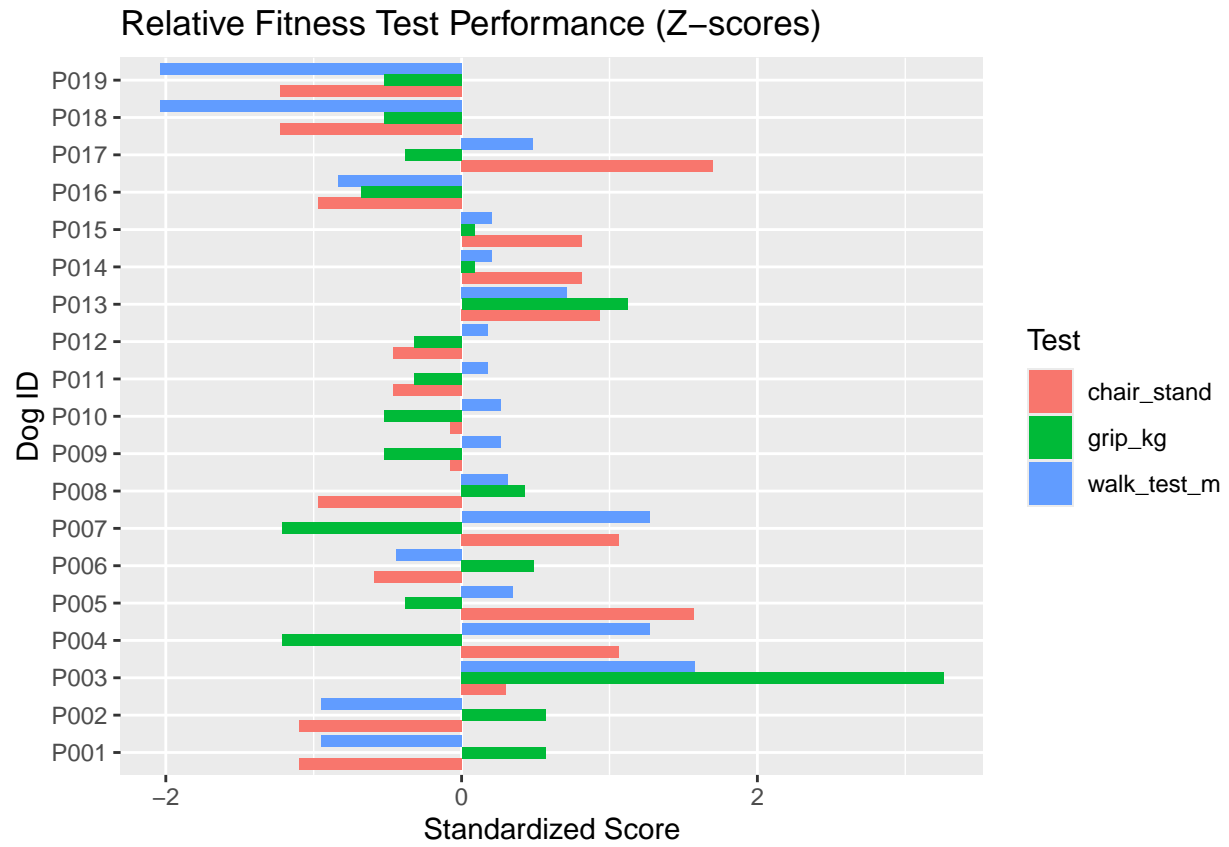
```
## `geom_smooth()` using formula = 'y ~ x'
```

Attention on Task vs Dog Executive Function Scale (DEFS)
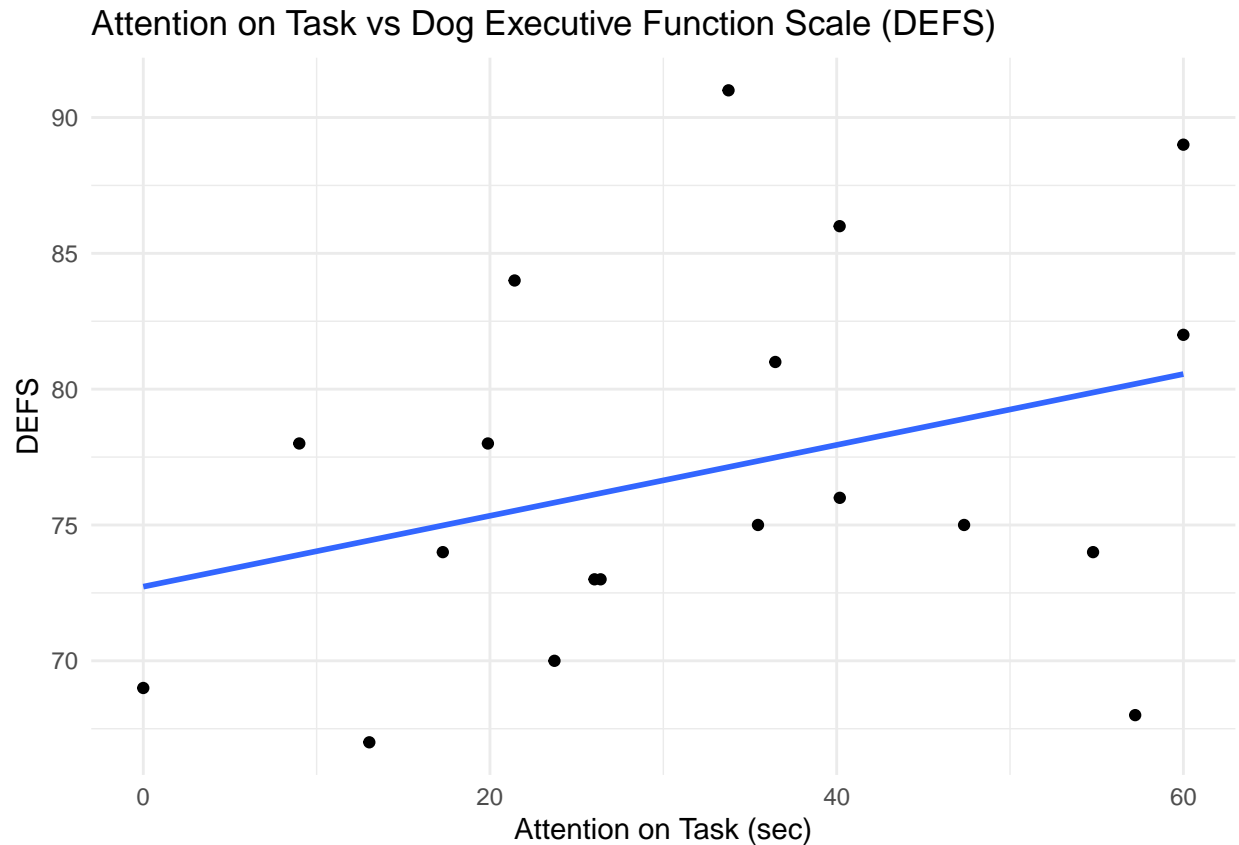
Reshape and standardize the data comparing the human test results.

```r
fitness_z <- Dog_Data %>%
  select(dog, walk_test_m, chair_stand, grip_kg) %>%
  pivot_longer(cols = -dog, names_to = "Test", values_to = "RawScore") %>%
  group_by(Test) %>%
  mutate(Z_Score = (RawScore - mean(RawScore, na.rm = TRUE)) / sd(RawScore, na.rm = TRUE))

# Plot
ggplot(fitness_z, aes(x = dog, y = Z_Score, fill = Test)) +
  geom_col(position = "dodge") +
  labs(
    title = "Relative Fitness Test Performance (Z-scores)",
    x = "Dog ID",
    y = "Standardized Score"
  ) +
  coord_flip() # horizontal bars for clarity
```

Relative Fitness Test Performance (Z–scores)

link to my github