paired_t_test_output

Katherine Jin – 505650329

12/3/2024

```
library(readxl)
setwd("/Users/katherinejin/Desktop/STATS 140XP")
data2 <- read_excel("NASA_Astronaut2-6-2020.xlsx", sheet = 2)
colnames(data2)
```

```
## [1] "Astronaut"       "MRD1- R Avg (E)" "MRD1- R Avg (S)" "MRD1- L Avg (E)"
## [5] "MRD1- L Avg (S)" "PTB R (E) Avg"   "PTB R (S) Avg"   "PTB L (E) Avg"
## [9] "PTB L (S) Avg"
```

```
# Perform paired t-tests
t_test_MRD1_R <- t.test(data2$`MRD1- R Avg (E)`, data2$`MRD1- R Avg (S)`, paired = TRUE)
t_test_MRD1_L <- t.test(data2$`MRD1- L Avg (E)`, data2$`MRD1- L Avg (S)`, paired = TRUE)
t_test_PTB_R <- t.test(data2$`PTB R (E) Avg`, data2$`PTB R (S) Avg`, paired = TRUE)
t_test_PTB_L <- t.test(data2$`PTB L (E) Avg`, data2$`PTB L (S) Avg`, paired = TRUE)
# Print the results
print(t_test_MRD1_R)
```

```
##
##  Paired t-test
##
## data:  data2$`MRD1- R Avg (E)` and data2$`MRD1- R Avg (S)`
## t = 1.0667, df = 17, p-value = 0.301
## alternative hypothesis: true mean difference is not equal to 0
## 95 percent confidence interval:
##  -0.1330550  0.4051994
## sample estimates:
## mean difference
##       0.1360722
```

```
print(t_test_MRD1_L)
```

```
##
##  Paired t-test
##
## data:  data2$`MRD1- L Avg (E)` and data2$`MRD1- L Avg (S)`
## t = 0.96056, df = 17, p-value = 0.3502
## alternative hypothesis: true mean difference is not equal to 0
## 95 percent confidence interval:
##  -0.1634864  0.4367734
## sample estimates:
```

```
## mean difference
##       0.1366435
```

```
print(t_test_PTB_R)
```

```
##
##  Paired t-test
##
## data:  data2$`PTB R (E) Avg` and data2$`PTB R (S) Avg`
## t = -12.718, df = 17, p-value = 4.114e-10
## alternative hypothesis: true mean difference is not equal to 0
## 95 percent confidence interval:
##  -4.467065 -3.195880
## sample estimates:
## mean difference
##       -3.831472
```

```
print(t_test_PTB_L)
```

```
##
##  Paired t-test
##
## data:  data2$`PTB L (E) Avg` and data2$`PTB L (S) Avg`
## t = -11.419, df = 17, p-value = 2.14e-09
## alternative hypothesis: true mean difference is not equal to 0
## 95 percent confidence interval:
##  -4.374424 -3.010085
## sample estimates:
## mean difference
##       -3.692255
```

Choice of Testing

To determine whether gravity affects eyelid and eyebrow heights, we chose to perform paired t-tests on the measurements of astronauts' eyes on Earth and in space. The paired t-test is appropriate here because it compares two related samples, in this case, the same astronauts measured under two different conditions (Earth and space). The procedure involved calculating the differences between the paired measurements of MRD (Margin to Reflex Distance) and PTB (Pupil to Bottom of Brow) for each astronaut and then testing whether the mean of these differences is significantly different from zero.

Paired T-Test Result

The results of the paired t-tests showed that the differences in MRD (Margin to Reflex Distance) measurements were not statistically significant according to large p-value. This indicates that there is no strong evidence to suggest that gravity affects the distance from the margin of the eyelid to the center of the pupil. However, the PTB (Pupil to Bottom of Brow) measurements did show significant differences, suggesting that gravity may influence the position of the eyebrow relative to the pupil, causing the eyebrow to be lower on earth comparing to in space.

Interpretation and Futher Implications

These findings suggest that while the absence of gravity in space does not significantly alter the position of the eyelid, it may have an impact a lower position of the eyebrow. This has implications for both health monitoring and the design of space suits and equipment. However, the study's limitations include the small sample size and the potential for measurement errors. Future research could expand the sample size. Additionally, these results could be utilized in fields such as ophthalmology and plastic surgery to better understand how gravity influences facial anatomy and to develop treatments or interventions that account for these effects.