

SA1 TIME SERIES Q14

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READING THE DATA

Import

```
print(head(ratexplo_data))
```

```
## # A tibble: 6 x 3
##       ID Stimuli Time
##   <dbl> <fct>   <dbl>
## 1     1   Shape     2
## 2     2   Shape  0.75
## 3     3   Shape  1.25
## 4     4   Shape     1
## 5     5   Shape  1.5
## 6     6   Shape  1.25
```

1. Summary of ANOVA: Effect of Oil Type on Mileage

```
print(anova_summary)
```

```
##           Df Sum Sq Mean Sq F value    Pr(>F)
## Stimuli      2  44.53   22.263    62.09 6.53e-12 ***
## Residuals    33   11.83    0.359
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Findings:

According to our ANOVA results, we saw that the time spent in three different treatments is **statistically significant**. As such, with an **F-value of 62.09** and a highly significant **p-value of 6.53e-12**, this shows that there's a probability that one of the different treatments such as **shapes, patterns, or pictures** implicates that rats exhibit various levels of exploratory behavior.

```
if (anova_summary[[1]]["Pr(>F)"][1, 1] < 0.05) {
  cat("There is a significant difference in time spent among the treatment conditions.\n")
} else {
  cat("There is no significant difference in time spent among the treatment conditions.\n")
}
```

```
## There is a significant difference in time spent among the treatment conditions.
```

2. POST-HOC

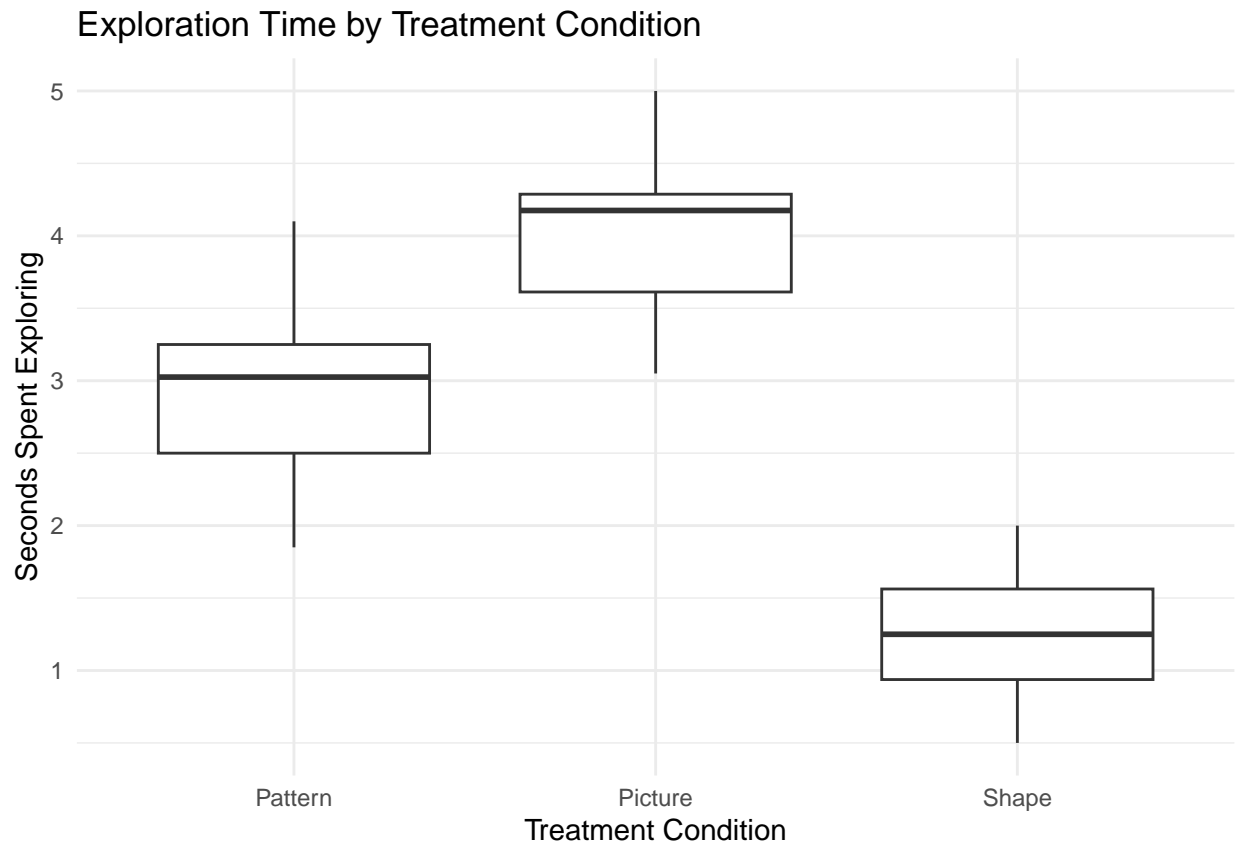
```
if (anova_summary[[1]]["Pr(>F)"][1, 1] < 0.05) {  
  posthoc_results <- TukeyHSD(anova_results)  
  print(posthoc_results)  
}  
  
## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##  
## Fit: aov(formula = Time ~ Stimuli, data = ratexplo_data)  
##  
## $Stimuli  
##  
##           diff      lwr      upr      p adj  
## Picture-Pattern 1.066667 0.4668045 1.666529 0.0003414  
## Shape-Pattern -1.637500 -2.2373622 -1.037638 0.0000004  
## Shape-Picture -2.704167 -3.3040289 -2.104304 0.0000000
```

Findings:

According to our **Tukey post-hoc analysis**, there are also **significant differences** in the time spent on three different treatments. The results we obtained show an **average increase of 1.07 seconds** in the *Picture* condition compared to the *Pattern* condition, with a **p-value of 0.00034**. On the other hand, *Shape* decreased by **1.64 seconds** compared to *Pattern* with a **p-value of 0.0000004**. Lastly, there is a decrease of **2.70 seconds** in *Shape* compared to *Picture*, with a **p-value of 0.0000000**. This implies that the type of visual stimulus indeed **significantly influences the exploratory behavior** of the rats, with *Picture* being the **most effective** and *Shape* appearing to be the **least effective**.

3. Boxplot Time vs Treatment Condition

```
ggplot(ratexplo_data, aes(x = Stimuli, y = Time)) +  
  geom_boxplot() +  
  labs(title = "Exploration Time by Treatment Condition",  
        x = "Treatment Condition",  
        y = "Seconds Spent Exploring") +  
  theme_minimal()
```



Findings:

Our boxplot shows that the **"Picture"** treatment is associated with the **most time spent** compared to the other two treatments, with a median of approximately **4 seconds**. However, **"Shape"** shows the **lowest exploration** among the three treatments, with a median of less than **2 seconds**. **"Pattern"**, on the other hand, falls in between the two treatment conditions.

ANALYSIS AND CONCLUSION

In this scenario, we are required to analyze the data using one of the **ANOVA types** to compare the number of seconds the rats spent exploring the experimental chamber with the images. Additionally, we need to determine if there is a **significant difference** in time spent between the three treatment conditions: *shapes*, *patterns*, and *pictures*.

Among the results, our analysis shows that the three treatments of visual stimulus **indeed** contributed a significant impact on their exploration behavior. According to our findings, **Pictures** show the **most exploratory behavior** in rats, followed by *patterns* and lastly, *shapes*. This points to the possibility that various appearances, some more engaging than others, can affect rats' exploratory behavior.