Beer Preferences for Thursday Night Football: A Blanced Incomplete Block Design Experiment

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Abstract

Introduction

American football has immensely grown in popularity in recent years. Along with the growth of a national sport comes an increase in social gatherings and alcoholic beverage enjoyment. Weekly Thursday night football games are broadcast on national television and each Thursday, Matthew's house hosts a watch party along with his roommates. The group enjoys consuming a wide variety of beer, ranging in type and brand. This setting became ideal to test the following research question: What is the beer type that is most favored among the group of friends? Since each individual holds their own inherent biases toward beer, a Balanced Incomplete Block Design (BIBD) is a perfect experimental design. Here, the participants' preferences for beer are blocked, allowing the effects of beer type to be highlighted without the unwanted effect of the nuisance factor. The data collected will be the participants' ratings of beers, which differ in type and flavor. The "Balanced Incomplete" part of the experiment comes from the fact that alcohol impairs judgement, so the amount given to the participants should be limited.

Methods

Everything was randomized before starting the experiment. With simple R code and using a `set.seed(530)` we were able to get a correct BIBD set up.

Participants	I	II	III
1	C	B	D
2	B	C	A
3	D	A	C
4	D	B	A

We then randomized the assignments of beer types to the letters and the order of participants, using the same `set.seed(530)`.The table below is of treatment assignments and order assignments

trts	beers	rank	participants
A	Siera	1	Zach
B	Coors	2	Jon
C	Guinnes	3	Nolan
D	Pliny	4	Benni

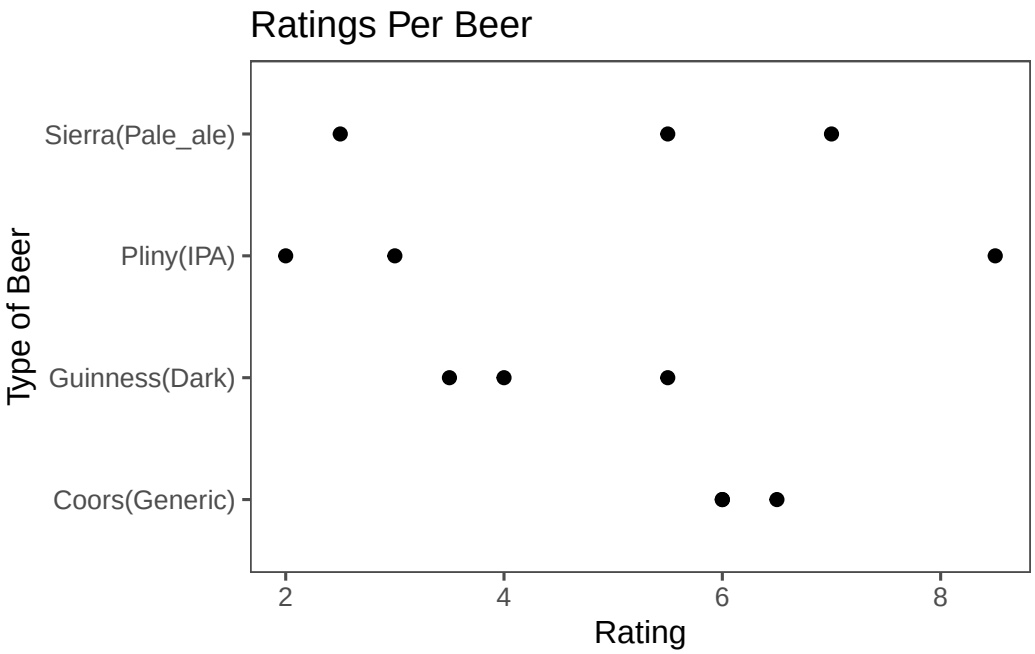
The experiment was conducted inside of Matthew's room. Participants were blind folded before entry into the room, they were seated down and told the following:

> You will be offered three beers during the experiment. You will drink a glass of water, then taste the beer. After tasting you will rate the beer on a scale from 1 to 10. 1 meaning "I never want to drink this again", 5 meaning "this is an okay beer, and 10 meaning "I want a whole glass of this beer right now". Half points are allowed.

Results

Table 3: Beer Ratings by Participant

Beers	Nolan	Jon	Beni	Zach	Row Means
Sierra(Pale_ale)	NA	5.5	7	2.5	5.00
Coors(Generic)	6	6	NA	6.5	6.17
Guinness(Dark)	5.5	3.5	4	NA	4.33
Pliny(IPA)	3	NA	8.5	2	4.50
Column Means	4.83	5	6.5	3.67	NA



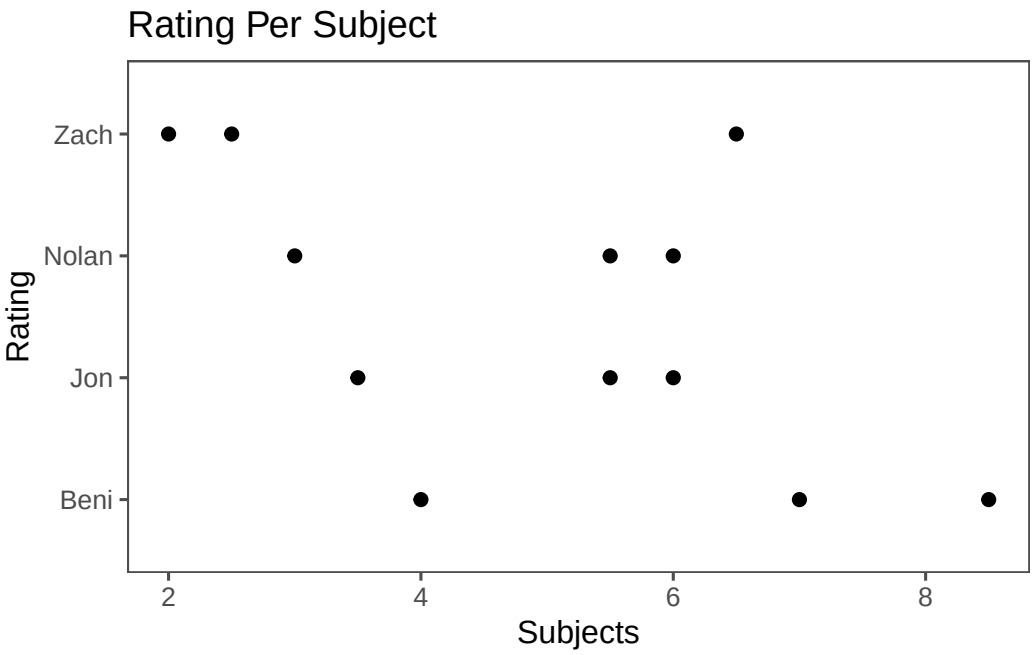


Table 4: ANOVA Table for Linear Model

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
names	3	12.16667	4.055556	1.197212	0.4001761
beers	3	14.39583	4.798611	1.416564	0.3414684
Residuals	5	16.93750	3.387500	NA	NA

Conclusion

Appendix

Code Used

Libraries Used

```
library(tidyverse)
library(ggthemes)
library(tidyr)
library(knitr)
```

Data Code

```
# Data input
beers <- c("Sierra(Pale_ale)", "Coors(Generic)", "Guinness(Dark)", "Pliny(IPA)")
Nolan <- c(NA, 6, 5.5, 3)
Jon <- c(5.5, 6, 3.5, NA)
Benni <- c(7, NA, 4, 8.5)
Zach <- c(2.5, 6.5, NA, 2)

raw_data <- data.frame(beers, Nolan, Jon, Benni, Zach)

# Data Cleaning

pivoted_raw_data <- pivot_longer(raw_data,
                         cols=-beers,
                         names_to = "names",
                         values_to = "rating")

cleaned_data <- pivoted_raw_data %>%
  drop_na(rating)
```

```
#Table
col_means <- round(colMeans(raw_data[, -1], na.rm = TRUE), 2)

raw_data_with_col_means <- rbind(raw_data, c("Mean", col_means))

row_means <- round(apply(raw_data[, -1], 1, mean, na.rm = TRUE), 2)

raw_data_with_means <- cbind(raw_data_with_col_means, Row_Mean = c(row_means, NA))
```

```
raw_data_with_means %>%
  kable(
    caption = "Beer Ratings by Participant",
    col.names = c("Beers", "Nolan", "Jon", "Beni", "Zach", "Row Means"),
    align = "c"
  )
```

Randomization Code

```
# Computing the BIBD matrix
trts <- c("A", "B", "C", "D")
set.seed(530)
t(replicate(4, sample(trts, 3, replace = FALSE)))

# Randomly matching treatments to the letters
brands <- c("Pliny", "Coors", "Siera", "Guinnes")
shuffled_brands <- sample(brands)
assignments <- data.frame(trts, shuffled_brands)

#Randomizing the order of participants/blocks
boys <- c("Zach", "Jon", "Nolan", "Benni")
rank <- 1:4
shuffled_names <- sample(boys)
order <- data.frame(rank, shuffled_names)
```

Plots

```
cleaned_data %>%
  ggplot(aes(x = rating,
             y = beers))+
  geom_point(size = 2)+
  theme_few()+
  ggtitle("Ratings Per Beer")+
  ylab("Type of Beer")+
  xlab("Rating")
```

```
cleaned_data %>%
  ggplot(aes(x = rating,
             y = names))+
  geom_point(size = 2)+
```

```
theme_few()+
ggtitle("Rating Per Subject")+
xlab("Subjects")+
ylab("Rating")
```