Busyness and Company's Affect on Dining Hall Attendance

Mini Project 2

Lessly Ortiz, Elysia Pil, Sophia Silovsky

Introduction

Humans are dependent on food, it's a fact of life. In fact, fMRI data has found that both food and social situations both influence brain activity in the substantia nigra (Kingsland). Just as we need food, we need people. However, different variables can affect whether or not a person will get the food they need. We decided to investigate what variables affect an individual's decision to eat, and what variables make them inclined to eat at a non-convenient dining hall. We base our hypothesis off of current research on group-based social psychology. People are more likely to conform when with friends, even if they're in an environment they do not want to be in (Walden University).

Our research question is: Does dining hall capacity and company affect whether or not a person goes to eat at that dining hall? Our alternative hypothesis is that as the busyness of a dining hall increases, you are less likely to stay at the dining hall if you are alone. However, you are more likely to stay if you are with friends. Our alternative hypothesis states that there will be some change in a group's likelihood to leave a dining hall based on the busyness of the dining hall and whether an individual was alone or with friends.

Methods

For the treatment, we randomly assigned six groups of Smith students to see one of three dining hall images and one of two vignettes. The images represented the three levels of our variable "Busyness": empty, normal, busy. The images were of three Smith dining halls containing increasing amounts of people. The vignettes contained the same text, except for one line affirming the experimental, categorical "Busyness" variable and one line stating whether a person was going to a dining hall alone or with friends. The line stating whether a person was alone or with friends represents our second experimental, continuous variable "Company". To account for response variability, in the vignettes we stated that the response taker will eat at

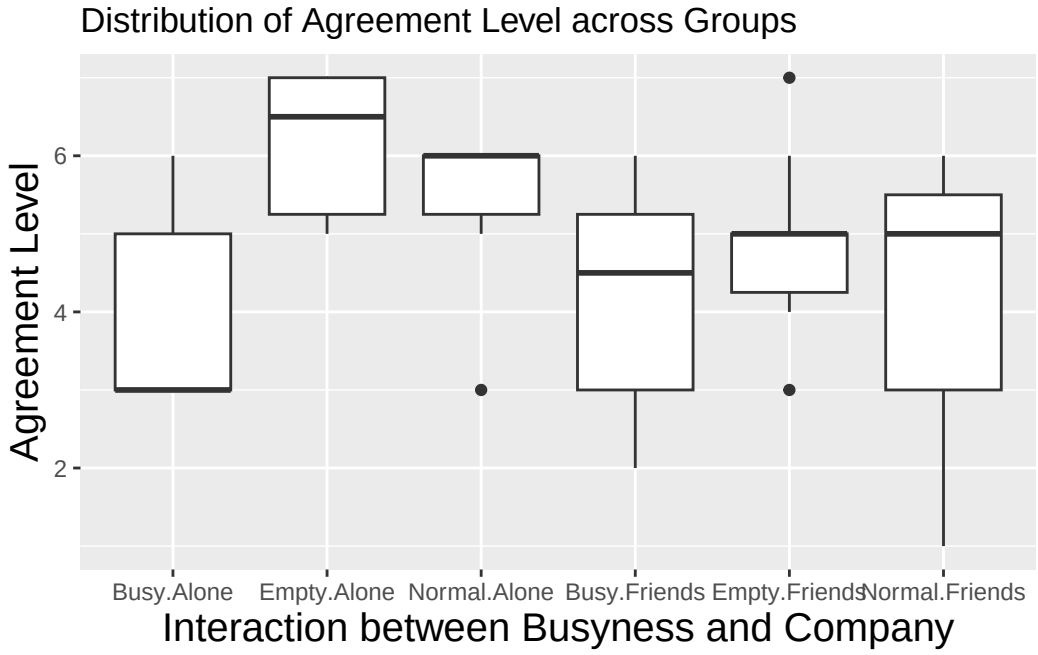
the dining hall closest to them, they are relatively hungry, and the meal is a meal they like, but not their favorite meal.

After the survey taker saw one of the images and read one of the vignettes, they were asked how much they agree with four statements on a seven point Likert Scale from Strongly Disagree to Strongly Agree. This was our continuous dependent variable. The statements were "I would sit down and eat at this dining hall", "I would go find a new dining hall to have dinner at", "I would take the food to go", and "I would enjoy eating at this dining hall". For the sake of simplicity, this report will only go over the results of the statements, "I would sit down and eat at this dining hall".

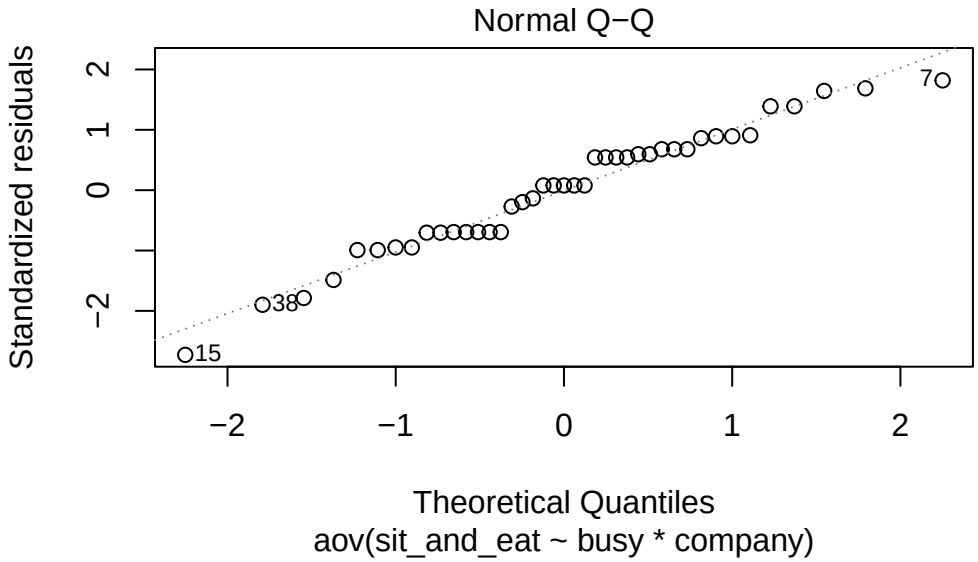
Results

For our analysis, we will be focusing on the `sit_and_eat` response. This is because our 3 other response groups, `find_new_dining grab_n_go enjoy_eating`, all showed significantly more violations of pre-condition checks such as the equal variance condition.

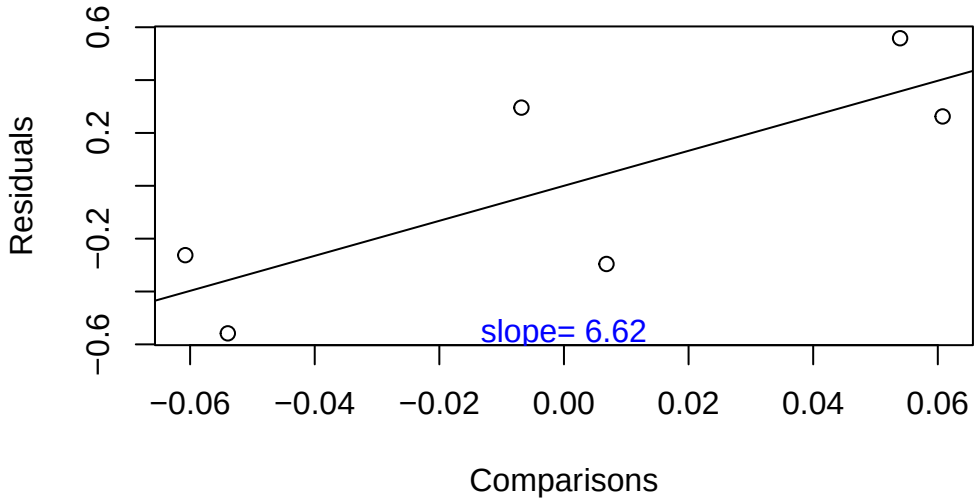
As seen below in our interaction plot and the standard deviation table for the `sit_and_eat` responses, we still have some violations of the equal variance conditions such that some interaction groups have more than twice the standard deviation of another.



As for the normality condition, we do not see any significant violations from looking at our normal Q-Q plot. Our points fall relatively along the reference line and suggest a normal distribution of our residuals.



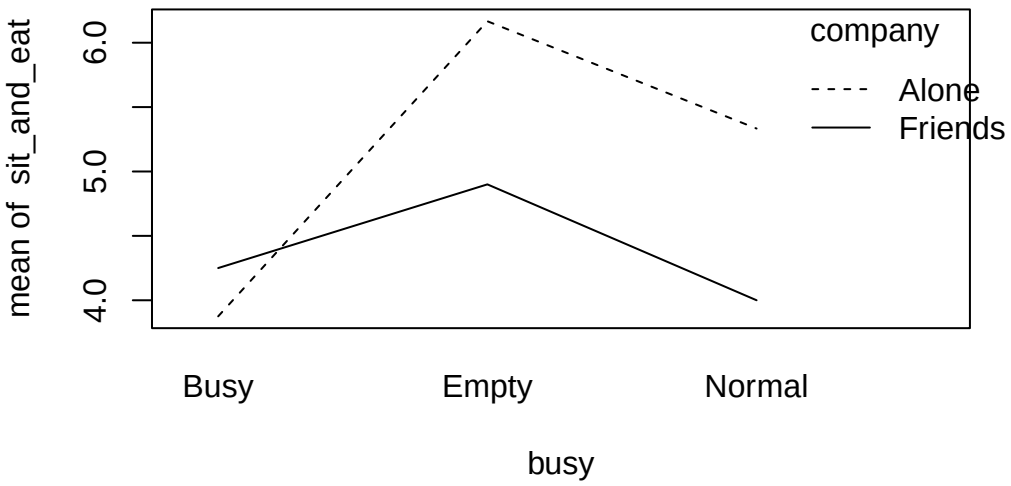
Furthermore, we can look at the Tukey non-additivity plot to double check for evidence of an interactive effect between company and business. As we can see, the points fail to fall along the reference line. We end up with a slope of 6.62 which results in a P=1-6.62. After trying a few different data transformations, none of the attempts improved our results. Thus, the plot suggests a non-additive model, and we will be using an interaction.



Now that we've looked at our pre-conditions and assessed that we need an interaction, we can fit our 2 way ANOVA. It shows that we only have one significant coefficient with a p-value of 0.0306, `busy`. However, `company` and our interactive coefficient lack significant p-values. This suggests that we can reject the null hypothesis for our busyness variable. In other terms, the difference in means between busy dining halls and empty dining halls is statistically significant. For the other variables and the interaction, the null hypothesis is supported.

```
             Df Sum Sq Mean Sq F value Pr(>F)
busy          2  13.98   6.992   3.858 0.0306 *
company       1   3.59   3.590   1.981 0.1681
busy:company  2   6.54   3.272   1.805 0.1794
Residuals    35  63.44   1.813
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Next, we then look at the interaction plot for the mean responses of `sit_and_eat` by `busy` and `company` treatment groups. The plot suggests the effect of the company an individual has, is dependent on the busyness level, most specifically when its the highest level of busyness.



We can now look at the Tukey HSD to find significant pair-wise comparisons of our variables' levels. For `busy`, we see a significant pairwise comparison for when we go from empty to busy dining halls meaning responses are significantly different when we switch between these levels, regardless of company. Our interaction variable also has a significant pairwise comparison for Empty:Alone-Busy:Alone meaning when a person is alone in a dining hall, their response depends and differ significantly based on whether a dining hall is busy or empty.

```
  Tukey multiple comparisons of means
    95% family-wise confidence level

Fit: aov(formula = sit_and_eat ~ busy * company, data = df_dropped)

$busy
                   diff        lwr       upr     p adj
Empty-Busy    1.3125000  0.1475933 2.4774067 0.0243477
Normal-Busy   0.8263889 -0.5464668 2.1992446 0.3158819
Normal-Empty -0.4861111 -1.8589668 0.8867446 0.6646329

$company
                    diff       lwr       upr     p adj
Friends-Alone -0.5775794 -1.431544 0.2763849 0.1784656

$`busy:company`
```

```
                                    diff        lwr       upr     p adj
Empty:Alone-Busy:Alone         2.2916667  0.1007084 4.4826249 0.0359624
Normal:Alone-Busy:Alone        1.4583333 -0.7326249 3.6492916 0.3596662
Busy:Friends-Busy:Alone        0.3750000 -1.6534332 2.4034332 0.9931369
Empty:Friends-Busy:Alone       1.0250000 -0.8993407 2.9493407 0.6008322
Normal:Friends-Busy:Alone      0.1250000 -2.6215115 2.8715115 0.9999926
Normal:Alone-Empty:Alone      -0.8333333 -3.1755662 1.5088996 0.8890735
Busy:Friends-Empty:Alone      -1.9166667 -4.1076249 0.2742916 0.1152330
Empty:Friends-Empty:Alone     -1.2666667 -3.3616234 0.8282901 0.4654722
Normal:Friends-Empty:Alone    -2.1666667 -5.0353044 0.7019710 0.2309072
Busy:Friends-Normal:Alone     -1.0833333 -3.2742916 1.1076249 0.6726906
Empty:Friends-Normal:Alone    -0.4333333 -2.5282901 1.6616234 0.9885265
Normal:Friends-Normal:Alone   -1.3333333 -4.2019710 1.5353044 0.7263943
Empty:Friends-Busy:Friends     0.6500000 -1.2743407 2.5743407 0.9088207
Normal:Friends-Busy:Friends   -0.2500000 -2.9965115 2.4965115 0.9997702
Normal:Friends-Empty:Friends  -0.9000000 -3.5705564 1.7705564 0.9096142
```

For a more conservative look at which pairwise comparisons are significant, we can look then at a Bonferroni confidence intervals. We only find muBusy.Alone-muEmpty.Alone to be significant. Thus, we see more support for the idea that when a person is alone in a dining hall, their response of agreement differs significantly based on whether a dining hall is busy or empty.

```
95% Bonferroni confidence intervals

                                      Diff    Lower    Upper  Decision
muBusy.Alone-muEmpty.Alone       -2.29167  -4.5822 -0.00114 Reject H0
muBusy.Alone-muNormal.Alone      -1.45833 -3.74886   0.8322    FTR H0
muEmpty.Alone-muNormal.Alone      0.83333 -1.61535  3.28201    FTR H0
muBusy.Alone-muBusy.Friends        -0.375 -2.49562  1.74562    FTR H0
muEmpty.Alone-muBusy.Friends      1.91667 -0.37386   4.2072    FTR H0
muNormal.Alone-muBusy.Friends     1.08333  -1.2072  3.37386    FTR H0
muBusy.Alone-muEmpty.Friends       -1.025  -3.0368   0.9868    FTR H0
muEmpty.Alone-muEmpty.Friends     1.26667  -0.9235  3.45683    FTR H0
muNormal.Alone-muEmpty.Friends    0.43333 -1.75683   2.6235    FTR H0
muBusy.Friends-muEmpty.Friends      -0.65  -2.6618   1.3618    FTR H0
muBusy.Alone-muNormal.Friends      -0.125 -2.99633  2.74633    FTR H0
muEmpty.Alone-muNormal.Friends    2.16667 -0.83234  5.16568    FTR H0
muNormal.Alone-muNormal.Friends   1.33333 -1.66568  4.33234    FTR H0
muBusy.Friends-muNormal.Friends      0.25 -2.62133  3.12133    FTR H0
muEmpty.Friends-muNormal.Friends      0.9 -1.89193  3.69193    FTR H0
                                Adj. p-value
```

```
muBusy.Alone-muEmpty.Alone           0.049793
muBusy.Alone-muNormal.Alone          0.790053
muEmpty.Alone-muNormal.Alone                1
muBusy.Alone-muBusy.Friends                 1
muEmpty.Alone-muBusy.Friends           0.1863
muNormal.Alone-muBusy.Friends               1
muBusy.Alone-muEmpty.Friends                1
muEmpty.Alone-muEmpty.Friends               1
muNormal.Alone-muEmpty.Friends              1
muBusy.Friends-muEmpty.Friends              1
muBusy.Alone-muNormal.Friends               1
muEmpty.Alone-muNormal.Friends       0.436218
muNormal.Alone-muNormal.Friends             1
muBusy.Friends-muNormal.Friends             1
muEmpty.Friends-muNormal.Friends            1
```

The effect of going from an empty dining hall to a busy dining hall (using Tukey HSD CI) comes out to 0.9747661. Based on Cohen's effect size, there is a large effect. The large effect supports that the significance we have found has practical significance and that there is a strong relationship between the busyness of a dining hall and whether not someone will choose to eat there.

```
[1] 0.9747661
```

For our `busy` variable, we get an R-squared of 0.1596802. This means about 16% of the variation of the level of agreement is explained by the busyness of the dining hall.

```
[1] 0.1596802
```

For our `company` variable, we get an R-squared of 0.04100514, so about 4% of the variation of the level of agreement is explained by the company of the individual. However, since the company variable is not significant, we currently do not have evidence that the amount of the variation explained by the company of the individual is significant.

```
[1] 0.04100514
```

For our `interaction` variable, we get an R-squared of 0.07470017, about 7% of the variation of the level of agreement is explained by the interaction between the busyness of the dining hall and the company of the individual. However,like the company variable, the interaction is not significant; we currently do not have evidence that the amount of the variation explained by the interaction between company and busyness is significant.

```
[1] 0.07470017
```

Conclusion

So after all this, we reconsider the question, Does dining hall capacity and company affect whether or not a person goes to eat at that dining hall? Overall, our data supports that there is a significant relationship between busyness of a dining hall and a decision to eat there, regardless of company. There is no significant data to suggest that there is an interaction effect or that company has an effect on a decision to eat at a dining hall. Potential limitations are sample size, utilizing a convenient sample, and the balance of number of participants per treatment group as true balanced randomization in Qualtrics is difficult with such a small sample. Since our sample is only Smith students, we cannot generalize our findings on the general population. We could improve our study by altering the photos we chose to use as part of the busyness variable. Because we only had 3 dining halls, the specific ones we could find photos for might have an effect on responses as participants could have certain preferences between all the different dining halls. Future research could include if different meal times showed different results, if there is a numerical "limit" of number of friends that sways decisions one way or another, or if the individuals personal relationship with food has any correlation with agreeableness.

Resources

Kingsland, James. Loneliness and Hunger Share a Home in the Brain. Medical News Today. 29 Nov. 2020.

Why Do People Act Differently in Groups than They Do Alone. Walden University.