

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

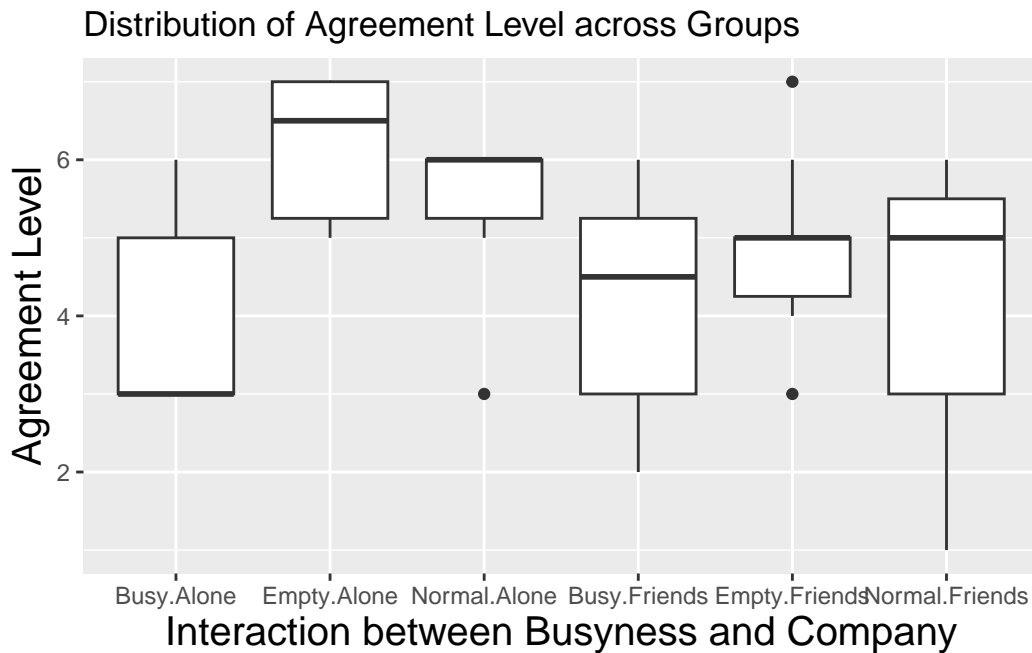
the dining hall closest to them, they are relatively hungry, and the meal is a meal they like, but not their favorite meal.

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”.

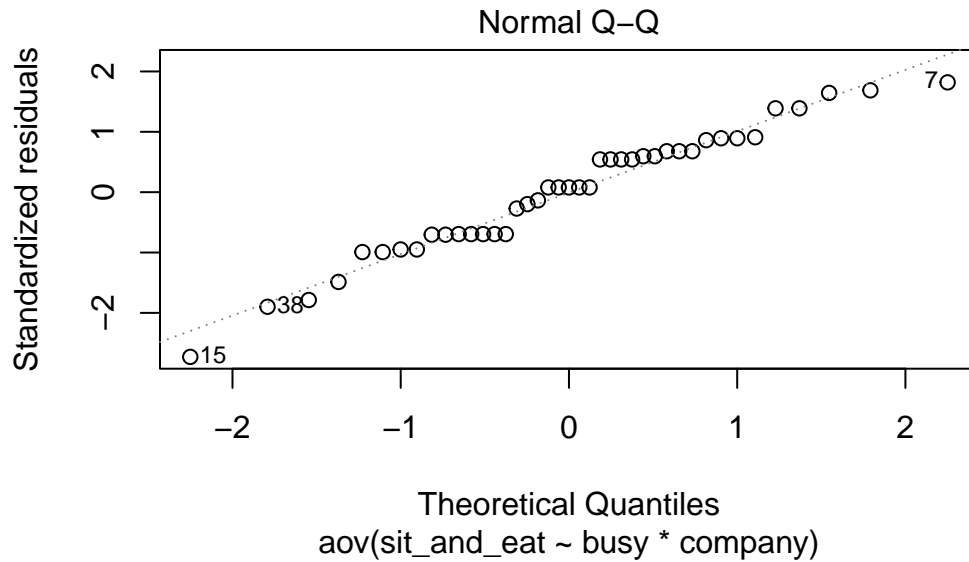
Results

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.

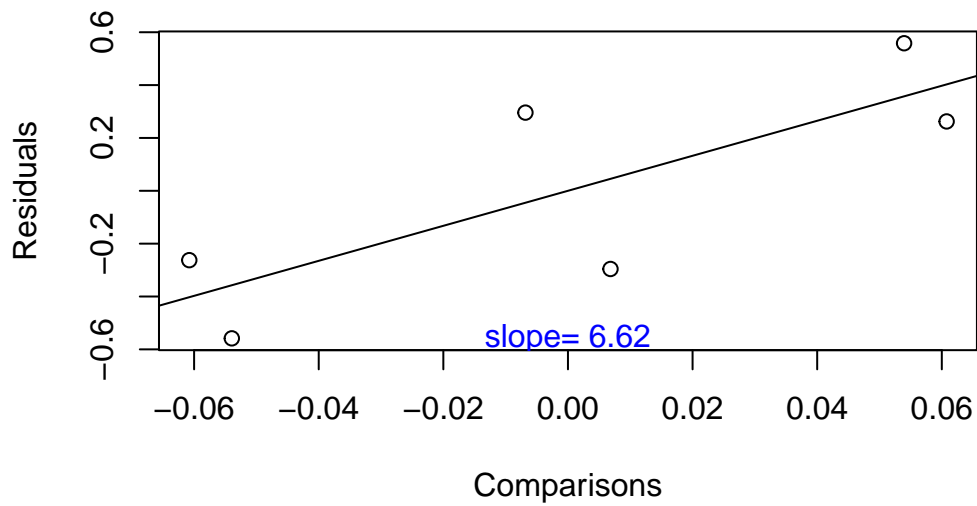
As seen below in our interaction plot and the standard deviation table for the `sit_and_eat` responses, we still have some violations of the equal variance conditions such that some interaction groups have more than twice the standard deviation of another.



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 $P=1-6.62$ which doesn't follow any of the transformation suggestions. Thus, the plot suggests a non-additive model and we will be using an interaction.

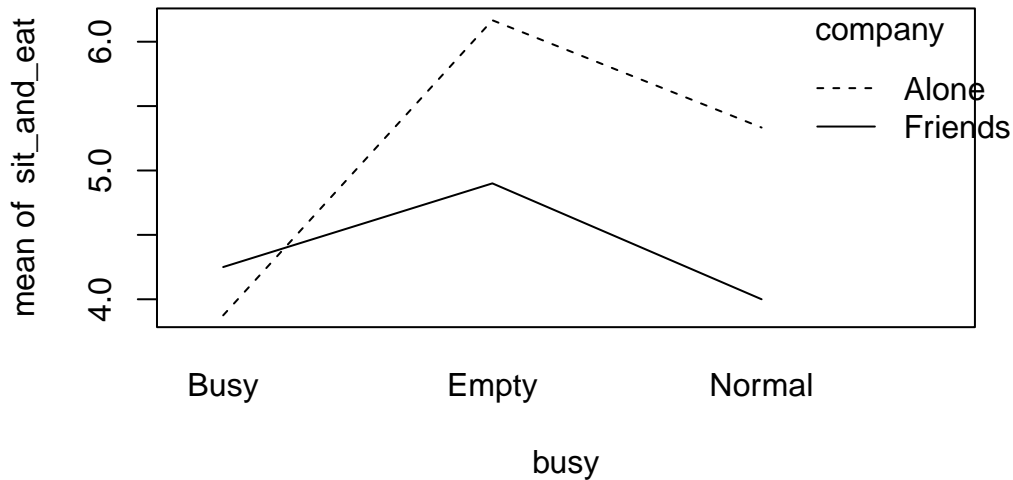


Now that we've looked at our pre-conditions and assessed that we need an interaction, we can fit our 2 way ANOVA. We can then see that we only have one significant coefficient with a p-value of 0.0306, **busy**. However, **company** and our interactive coefficient lack significant p-values.

	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

We can 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

We can look then at a Bonferroni confidence intervals for a more conservative look at which pairwise comparisons are significant. We only find $\mu_{\text{Busy.Alone}} - \mu_{\text{Empty.Alone}}$ to be significant. Thus we see more support for the idea that 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.

95% Bonferroni confidence intervals

	Diff	Lower	Upper	Decision
$\mu_{\text{Busy.Alone}} - \mu_{\text{Empty.Alone}}$	-2.29167	-4.5822	-0.00114	Reject H0
$\mu_{\text{Busy.Alone}} - \mu_{\text{Normal.Alone}}$	-1.45833	-3.74886	0.8322	FTR H0
$\mu_{\text{Empty.Alone}} - \mu_{\text{Normal.Alone}}$	0.83333	-1.61535	3.28201	FTR H0
$\mu_{\text{Busy.Alone}} - \mu_{\text{Busy.Friends}}$	-0.375	-2.49562	1.74562	FTR H0
$\mu_{\text{Empty.Alone}} - \mu_{\text{Busy.Friends}}$	1.91667	-0.37386	4.2072	FTR H0
$\mu_{\text{Normal.Alone}} - \mu_{\text{Busy.Friends}}$	1.08333	-1.2072	3.37386	FTR H0
$\mu_{\text{Busy.Alone}} - \mu_{\text{Empty.Friends}}$	-1.025	-3.0368	0.9868	FTR H0
$\mu_{\text{Empty.Alone}} - \mu_{\text{Empty.Friends}}$	1.26667	-0.9235	3.45683	FTR H0
$\mu_{\text{Normal.Alone}} - \mu_{\text{Empty.Friends}}$	0.43333	-1.75683	2.6235	FTR H0
$\mu_{\text{Busy.Friends}} - \mu_{\text{Empty.Friends}}$	-0.65	-2.6618	1.3618	FTR H0
$\mu_{\text{Busy.Alone}} - \mu_{\text{Normal.Friends}}$	-0.125	-2.99633	2.74633	FTR H0
$\mu_{\text{Empty.Alone}} - \mu_{\text{Normal.Friends}}$	2.16667	-0.83234	5.16568	FTR H0
$\mu_{\text{Normal.Alone}} - \mu_{\text{Normal.Friends}}$	1.33333	-1.66568	4.33234	FTR H0
$\mu_{\text{Busy.Friends}} - \mu_{\text{Normal.Friends}}$	0.25	-2.62133	3.12133	FTR H0
$\mu_{\text{Empty.Friends}} - \mu_{\text{Normal.Friends}}$	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. There is a large effect of moving from an empty dining hall to a busy dining hall on the level of agreement on the statement "I would sit down and eat at this dining hall".

[1] 0.9747661

For our **busy** variable, we get an R-squared of 0.1596802, 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, 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 since 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

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.