Keys Le

5/15/20

Lab 5 Descriptive Statistics

Lab5 Factorial ANOVA

A 2x3 factorial ANOVA was fit to these data about the effects of two types of reinforcement schedules and three types of reinforcers on the arithmetic problem-solving performance of a sample of 66 second-grade students. The second-graders were randomly assigned to six combinations of reinforcement schedules with a total of 11 in each group. Those data include 66 causes and three variables. The first factor was of two schedules (random or spaced) (*M* = 1.50, *SD = 0.50*, min = 1, max = 2). The second factor was of three types of reinforcers (token, money, or food) (*M* = 2.00, *SD* = 0.82, min = 1, max = 3). The dependent variable was an arithmetic problem-solving test (*M* = 29.18, *SD* = 6.91, min = 12, max = 45). The students were to study arithmetic problem-solving under these six conditions and take a test at the end of the three weeks of the material they studied. The main effect for schedule was significant, *F*(1, 66) = 25.04, *p* < .05, *η2* = .16, partial *η2* = .29. The main effect for reinforcers was significant, *F*(2, 66) = 31.86, *p* < .05, *η2* = .40, partial *η2* = .51.The interaction between schedule and reinforcers was significant, *F*(2, 66) = 4.78, *p* = .01, *η2* = .06, partial *η2* = .14. Refer to table 1 for values.

Referencing table 2, the findings show significant interactions. Simple effects test was conducted on the comparing groups. Significant difference was found in schedule impacts on level of money and token. There is no impact on schedule type on level of food. Reference figure 1.

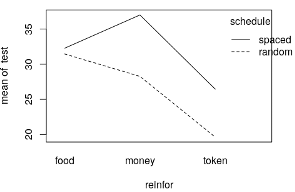
Table 1. *ANOVA Table*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Df | Sum Sq | Mean Sq | F value | P value |
| Schedule | 1 | 490.909 | 490.909 | 25.039 | 0.000 |
| Reinforcer | 2 | 1249.182 | 624.591 | 31.857 | 0.000 |
| Interaction | 2 | 187.364 | 93.682 | 4.778 | 0.012 |
| Residuals | 60 | 1176.364 | 19.606 |  |  |

*Note:* Interaction is schedule:reinforcer

Table 2. *Fixed Reinforcer across Schedule*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Value | Df | Sum of Sq | F | P value |
| Food | -0.818 | 1 | 3.682 | 0.188 | 0.666 |
| Money | -8.727 | 1 | 418.909 | 21.366 | 0.000 |
| Token | -6.818 | 1 | 255.682 | 13.041 | 0.001 |
| Residuals |  | 60 | 1176.364 |  |  |



*Figure 1.* Fixed Reinforcer across schedule

Syntax:

learning\_data = read.csv("Arithmetic\_Learning.csv")  
summary(learning\_data)

reinfor schedule test   
 food :22 random:33 Min. :12.00   
 money:22 spaced:33 1st Qu.:25.00   
 token:22 Median :29.00   
 Mean :29.18   
 3rd Qu.:34.00   
 Max. :45.00

with(learning\_data,table(reinfor,schedule))

schedule  
reinfor random spaced  
 food 11 11  
 money 11 11  
 token 11 11

with(learning\_data, interaction.plot(reinfor,schedule,test))

A screenshot of a cell phone

Description automatically generated

aov\_1 = aov(test ~ schedule + reinfor + schedule:reinfor,  
 contrasts=list(schedule=contr.sum,  
 reinfor=contr.sum),  
 data=learning\_data)  
aov\_1

Call:  
 aov(formula = test ~ schedule + reinfor + schedule:reinfor, data = learning\_data,   
 contrasts = list(schedule = contr.sum, reinfor = contr.sum))  
  
Terms:  
 schedule reinfor schedule:reinfor Residuals  
Sum of Squares 490.9091 1249.1818 187.3636 1176.3636  
Deg. of Freedom 1 2 2 60  
  
Residual standard error: 4.427873  
Estimated effects may be unbalanced

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Df | Sum Sq | Mean Sq | F value | Pr(>F) |
| schedule | 1 | 490.909 | 490.909 | 25.039 | 0.000 |
| reinfor | 2 | 1249.182 | 624.591 | 31.857 | 0.000 |
| schedule:reinfor | 2 | 187.364 | 93.682 | 4.778 | 0.012 |
| Residuals | 60 | 1176.364 | 19.606 |  |  |

simple\_reinfor = testInteractions(aov\_1,fixed='reinfor',across='schedule',  
 adjustment='holm')  
knitr::kable(simple\_reinfor,digits=3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Value | Df | Sum of Sq | F | Pr(>F) |
| food | -0.818 | 1 | 3.682 | 0.188 | 0.666 |
| money | -8.727 | 1 | 418.909 | 21.366 | 0.000 |
| token | -6.818 | 1 | 255.682 | 13.041 | 0.001 |
| Residuals |  | 60 | 1176.364 |  |  |