Homework Assignment #9

KEY

DUE: 11/08/2019

Instructions

Complete the following assignment in R Markdown. You may submit your assignment as a pdf, html, or Word document.

Data for this Assignment

We are going to revisit a data set that we have previously explored in HW #2 from the Arndt Lab. The data are provided on Canvas. Below is a summary of the data set:

This study examined how metaphoric descriptions of immigrants (e.g. a wave of immigrants) could affect people's attitudes towards a border wall. There are three variables in this dataset:

- Wall Support: A composite score of three items scored on a scale of 1 (strongly disagree) to 7 (strongly agree)
- Trump Support: A single item scored on a scale of 1 (strongly disagree) to 5 (strongly agree)
- Metaphor Description: A categorical variable where 0 = non-metaphor description and 1 = metaphor descripton

This time we are going to consider 'metaphor description' as the independent variable, 'wall support' as the outcome, and 'Trump support' as a covariate.

```
library(readxl)
HW9 <- read_excel("~/Box Sync/PSYCH 8710 GLM/Datasets/Psych Faculty datasets/Arndt Lab/arndt lab dataset
```

Questions

1. Construct a contrast-coded predictor for the independent variable, 'metaphor description' (1 point).

```
HW9$metaphor_desc.f <- factor(HW9$metaphor_desc)
contrasts(HW9$metaphor_desc.f) <- contr.helmert(2)
print(attributes(HW9$metaphor_desc.f))
```

```
## $levels
## [1] "0" "1"
##
## $class
## [1] "factor"
##
## $contrasts
##   [,1]
## 0   -1
## 1    1
```

2. Write the equations for a model comparison that tests whether the covariate is related to the contrast coded predictor (2 points). **Model Comparison**

$$\text{Model C (Compact Model): } Y_{trump} = \beta_0 + \epsilon_i$$
$$\text{Model A (Augmented Model): } Y_{trump} = \beta_0 + \beta_1 \lambda_{metaphor} + \epsilon_i$$

3. Conduct a statistical test to determine whether the covariate is related to the predictor variable. Tell me what you would conclude. (2 points)

```
ModelCov <- lm(trump_support ~ metaphor_desc.f, data = HW9)
summary(ModelCov)
```

```
##
## Call:
## lm(formula = trump_support ~ metaphor_desc.f, data = HW9)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -1.244 -1.244 -1.129  0.871  2.871
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)        2.18636    0.05681  38.487   <2e-16 ***
## metaphor_desc.f1 -0.05733    0.05681  -1.009    0.313
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.533 on 727 degrees of freedom
## Multiple R-squared:  0.001399,   Adjusted R-squared:  2.549e-05
## F-statistic: 1.019 on 1 and 727 DF,  p-value: 0.3132
```

4. Write out the equations for a model comparison testing the hypothesis that metaphor description is a significant predictor of wall support, ignoring the covariate for this analysis. (2 points) **Model Comparison**

$$\text{Model C (Compact Model): } Y_{wall} = \beta_0 + \epsilon_i$$
$$\text{Model A (Augmented Model): } Y_{wall} = \beta_0 + \beta_1 \lambda_{metaphor} + \epsilon_i$$

5. Conduct a statistical test of this hypothesis. Tell me what you would conclude. (2 points)

```
ModelA1 <- lm(wall_support ~ metaphor_desc.f, data = HW9)
summary(ModelA1)
```

```
##
## Call:
## lm(formula = wall_support ~ metaphor_desc.f, data = HW9)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.1622 -1.8289 -0.8289  2.1711  3.9309
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)        3.11564    0.07682  40.557   <2e-16 ***
```

```
## metaphor_desc.f1  0.04655    0.07682   0.606    0.545
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.074 on 727 degrees of freedom
## Multiple R-squared:  0.0005047,  Adjusted R-squared:  -0.0008701
## F-statistic: 0.3671 on 1 and 727 DF,  p-value: 0.5448
```

6. Write out the equations for a model comparison testing the hypothesis that metaphor description is a significant predictor of wall support. This time include the covariate in the analysis. (2 points) **Model Comparison**

$$\text{Model C (Compact Model): } Y_{wall} = \beta_0 + \beta_1 X_{trump} + \epsilon_i$$
$$\text{Model A (Augmented Model): } Y_{wall} = \beta_0 + \beta_1 X_{trump} + \beta_2 \lambda_{metaphor} + \epsilon_i$$

7. Conduct a statistical test of this hypothesis. Tell me what you would conclude. (2 points)

```
ModelA2 <- lm(wall_support ~ trump_support + metaphor_desc.f, data = HW9)
summary(ModelA2)
```

```
##
## Call:
## lm(formula = wall_support ~ trump_support + metaphor_desc.f,
##     data = HW9)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.7661 -0.6523 -0.2094  0.4577  5.3477
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)       0.62499    0.07220   8.657  < 2e-16 ***
## trump_support     1.13917    0.02704  42.122  < 2e-16 ***
## metaphor_desc.f1  0.11186    0.04145   2.698  0.00713 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.118 on 726 degrees of freedom
## Multiple R-squared:  0.7098, Adjusted R-squared:  0.709
## F-statistic: 887.8 on 2 and 726 DF,  p-value: < 2.2e-16
```

6. Calcuate the group means for metaphor description (1 point).

```
library(pastecs)
by(HW9$wall_support, HW9$metaphor_desc, stat.desc)
```

```
## HW9$metaphor_desc: 0
##      nbr.val     nbr.null       nbr.na          min          max
##  357.0000000    0.0000000    0.0000000    1.0000000    7.0000000
##        range          sum       median         mean      SE.mean
##    6.0000000 1095.6666667    2.3333333    3.0690943    0.1087303
## CI.mean.0.95          var      std.dev     coef.var
##    0.2138345    4.2205559    2.0543992    0.6693829
## ------------------------------------------------------------
## HW9$metaphor_desc: 1
```

```
##      nbr.val     nbr.null       nbr.na          min          max
##  372.0000000    0.0000000    0.0000000    1.0000000    7.0000000
##        range          sum       median         mean      SE.mean
##    6.0000000 1176.3333333    2.3333333    3.1621864    0.1084723
## CI.mean.0.95          var      std.dev     coef.var
##    0.2132976    4.3770389    2.0921374    0.6616110
```

7. Calculate the *adjusted* group means for metaphor description from the model with the covariate. Describe the difference between the sample means calcluated above and the adjusted means. Explain why they are different (3 points).

```
library(effects)
```

```
## Loading required package: carData
```

```
## lattice theme set by effectsTheme()
## See ?effectsTheme for details.
```

```
effect("metaphor_desc.f", ModelA2)
```

```
##
##  metaphor_desc.f effect
## metaphor_desc.f
##        0        1
## 3.002439 3.226154
```

8. Create a figure that illustrates the results of your final model. (3 points)

```
plot(effect("metaphor_desc.f", ModelA2))
```