PSYC 7720 Lab

Lab 9 Activity

Andrew Graves, Department of Psychology, University of Virginia

Directions:

A. Download the mccarthyData.csv. This is hypothetical data from 12 children who took the McCarthy Scales of Children's Abilites (MSCA) test at 30, 36, 42, and 48 months. The DV is the age-normed general cognitive score from the MSCA.
B. Answer the following questions and save the code you used in an R script.
C. You have until the end of lab to complete.

```
library(tidyverse)
library(ez)
library(emmeans)
options(contrasts = c("contr.sum","contr.poly"))
theme_set(theme_classic())
```

Questions:

1. Convert the mccarthyData from wide format to long format. Name the first column *id*, the second column *month*, the third column *mcsa*, and the dataframe *long_data*. Print the head and the dimensions of the long data.

```
long_data <- read_csv("mccarthyData.csv") %>%
  rownames_to_column(var = "id") %>%
  pivot_longer(-id, names_to = "month", values_to = "mcsa") %>%
  mutate(id = factor(id),
         month = factor(month, ordered = TRUE))
head(long_data)
```

```
## # A tibble: 6 x 3
##   id    month     mcsa
##   <fct> <ord>    <dbl>
## 1 1     MONTHS30   108
## 2 1     MONTHS36    96
## 3 1     MONTHS42   110
## 4 1     MONTHS48   122
## 5 2     MONTHS30   103
## 6 2     MONTHS36   117
```

```
dim(long_data)
```

```
## [1] 48  3
```

2. Run and interpret the results of an RM ANOVA using aov.

```r
aov_mod <- aov(mcsa ~ month + Error(id/month), data = long_data)
summary(aov_mod)
```

```
##
## Error: id
##           Df Sum Sq Mean Sq F value Pr(>F)
## Residuals 11   6624   602.2
##
## Error: id:month
##           Df Sum Sq Mean Sq F value Pr(>F)
## month      3    552  184.00   3.027 0.0432 *
## Residuals 33   2006   60.79
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

- *Month* is a significant predictor of *mcsa*.

3. Run and interpret the results of an RM ANOVA using ezANOVA.

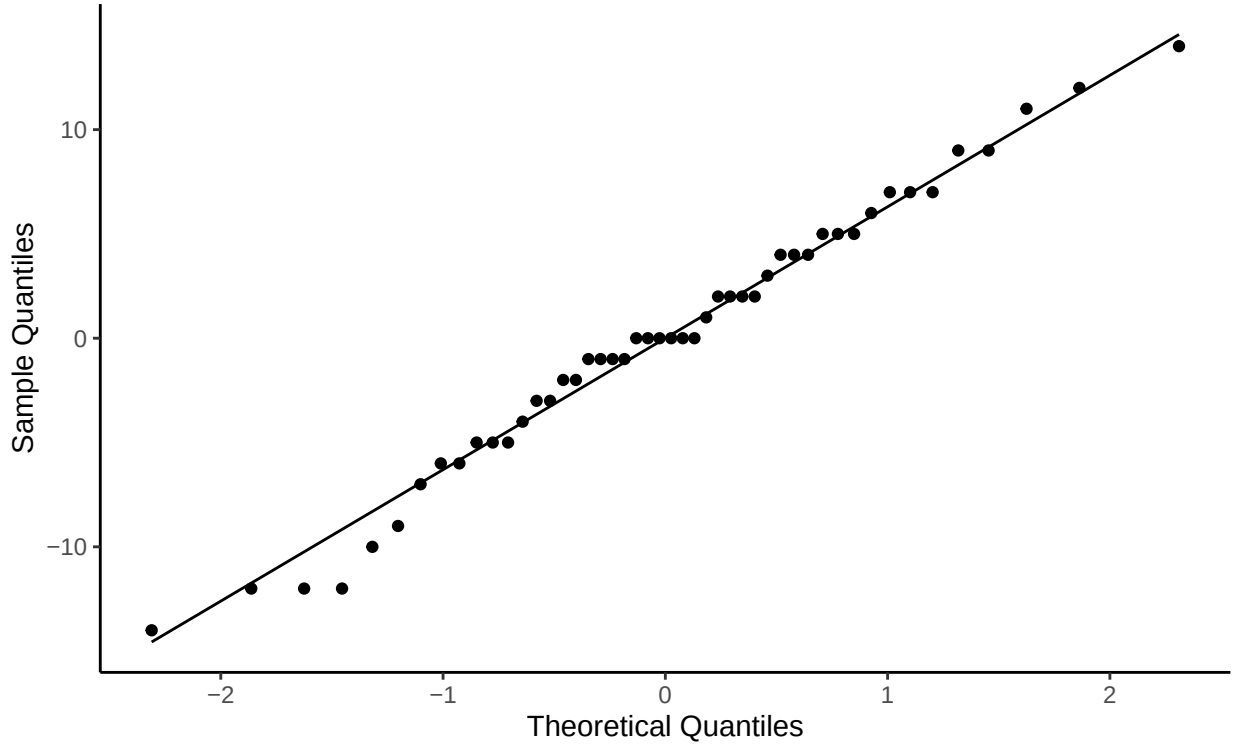
```r
ez_mod <- ezANOVA(data = long_data,
                  dv = mcsa,
                  within = month,
                  wid = id,
                  type = 3,
                  return_aov = TRUE,
                  detailed = TRUE
        )
ez_mod
```

```
## $ANOVA
##        Effect DFn DFd    SSn  SSd          F            p p<.05        ges
## 1 (Intercept)   1  11 559872 6624 929.739130 5.586316e-12     * 0.98481975
## 2       month   3  33    552 2006   3.026919 4.321863e-02     * 0.06011762
##
## $`Mauchly's Test for Sphericity`
##   Effect         W          p p<.05
## 2  month 0.2426472 0.01771762     *
##
## $`Sphericity Corrections`
##   Effect       GGe     p[GG] p[GG]<.05       HFe      p[HF] p[HF]<.05
## 2  month 0.6095445 0.0747874           0.7248502 0.06353773
##
## $aov
##
## Call:
## aov(formula = formula(aov_formula), data = data)
##
## Grand Mean: 108
##
## Stratum 1: id
##
## Terms:
##                 Residuals
## Sum of Squares       6624
## Deg. of Freedom        11
```

```
##
## Residual standard error: 24.53939
##
## Stratum 2: id:month
##
## Terms:
##                  month Residuals
## Sum of Squares     552      2006
## Deg. of Freedom      3        33
##
## Residual standard error: 7.796658
## Estimated effects are balanced
```

```r
# Check the residuals for normality
resid <- proj(ez_mod$aov)[[3]][, "Residuals"]

resid %>%
  tibble() %>%
  ggplot(aes(sample = `.`)) +
  geom_qq() +
  stat_qq_line() +
  labs(x = "Theoretical Quantiles",
       y = "Sample Quantiles")
```

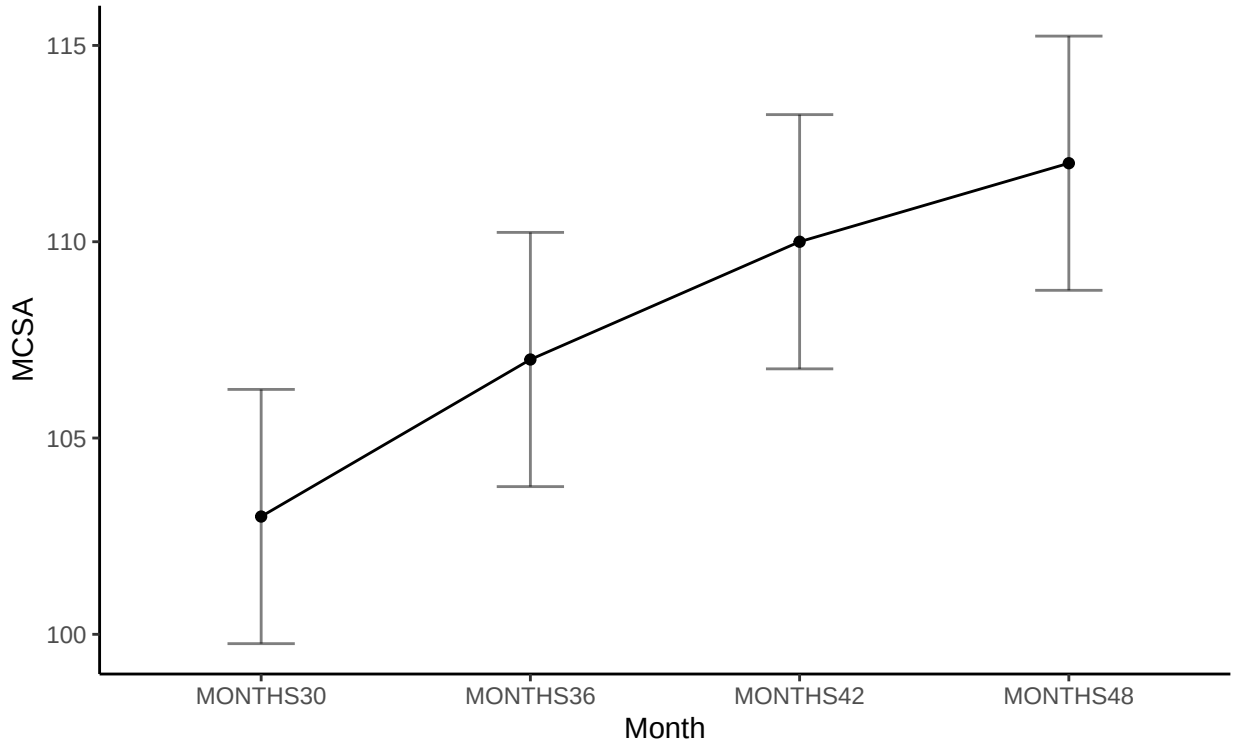



```r
# If we were to follow-up... although in this
# case after correction technically the effect
# is not significant.
follow_up <- contrast(
  emmeans(ez_mod$aov, ~ month),
          method = "poly",
```

```
          adjust = "bonferroni"
  )
follow_up
```

```
##  contrast  estimate   SE df t.ratio p.value
##  linear          30 10.1 33  2.980  0.0161
##  quadratic       -2  4.5 33 -0.444  1.0000
##  cubic            0 10.1 33  0.000  1.0000
##
## P value adjustment: bonferroni method for 3 tests
```

```
ez_plot <- ezPlot(
  data = long_data,
  dv = mcsa,
  wid = id,
  within = month,
  x = month,
  x_lab = "Month",
  y_lab = "MCSA"
  )
ez_plot
```



- After Greenhouse-Geisser correction due to violations of sphericity, *month* is not a significant predictor of *mcsa*. However, if we had planned a linear contrast across months, we could haved specifically tested the polynomial contrasts (or just the linear contrast if we had strong theory). In this case, after Bonferonni correction, there was a positive significant linear trend on *mcsa* across *months*.