CARPS Reproducibility Report

Contents

Article ID: CARPS_3-4-2015_PS

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Start date: 10/31/2017

End date: [Insert end date - use US format]

Methods summary:

[Write a brief summary of the methods underlying the target outcomes written in your own words]

Target outcomes:

[Insert the target outcomes identified in targetOutcomes.md]

[The chunk below sets up some formatting options for the R Markdown document]

Step 1: Load packages

[Some useful packages are being loaded below. You can add any additional ones you might need too.]

```
library(tidyverse) # for data munging
library(knitr) # for kable table formating
library(haven) # import and export 'SPSS', 'Stata' and 'SAS' Files
library(readxl) # import excel files
library(CARPSreports) # custom report functions
```

```
library(ez) # for repeated ANOVAs
library(effsize) #for effect size
library(compute.es) #for effect size
library(lsr) #for partial eta squared
```

Step 2: Load data

```
d <- read.table("data/Bogus visual feedback alters movement_Data.tab", header=TRUE)
```

Step 3: Tidy data

I tidied the data in two ways. First, I gathered by condition. However, when I ran the repeated measures of variance, the F stat and degrees of freedom were different (46 vs. 94). And so I tested another method – I made each direction of rotation per participant per condition a separate trail. This gave a slightly higher F stat, but still wrong. I have commented out this second version.

```
d.tidy.1 <- d %>%
  gather(condition,rangeofmotion,starts_with("condition")) #the value various condition columns contain

d.tidy.1$Participant <- as.factor(d.tidy.1$Participant)
d.tidy.1$condition <- as.factor(d.tidy.1$condition)


#[For reference] Tidy 2 -- testing hypothesis of looking at participant per direction as a separate tri

# d.tidy.2 <- d %>%
#   mutate(trial = Participant * DirectionofRotation) %>% # creates a separate row at a participation *
#   select(-Participant,-DirectionofRotation) %>%
#   gather(condition,rangeofmotion,starts_with("condition"))
#
# d.tidy.2$trial <- as.factor(d.tidy.2$trial)
# d.tidy.2$condition <- as.factor(d.tidy.2$condition)
```

Step 4: Run analysis

Pre-processing

1) I want to create a tidy table that groups by participant and averages across direction of rotation (e.g. left or right).

```
d.comparison <- d %>%
  group_by(Participant) %>%
  summarise(meancondition1_gain0.8 = mean(Condition1_Gain0.8),
            meancondition2_gain1 = mean(Condition2_Gain1),
            meancondition3_gain1.2 = mean(Condition3_Gain1.2)
              )
```

Descriptive statistics

1) I want to find the means per condition.

```
mean0.8 <- mean(d.comparison$meancondition1_gain0.8)
mean1 <- mean(d.comparison$meancondition2_gain1)
mean1.2 <- mean(d.comparison$meancondition3_gain1.2)
```

2) I want to find the standard deviations

```r
sd0.8 <- sd(d.comparison$meancondition1_gain0.8)
sd1 <- sd(d.comparison$meancondition2_gain1)
sd1.2 <- sd(d.comparison$meancondition3_gain1.2)

sdpool0.8v1 <- sqrt((sd0.8**2 + sd1**2)/2)

sdpool1v1.2 <- sqrt((sd1.2**2 + sd1**2)/2)
```

Inferential statistics

First, I attempt to re-create the repeated measures anova. We find that the F statistic had a major numerical error, but the p values matched (note both were $p < 0.001$, and noted as $p = 0.001$). In addition, please note that there were 94 degrees of freedom listed in the original paper, but only 46 here. Finally, I could not figure out how to calculate partial eta squared after ~30 minutes of searching.

Original Text: "The repeated measures ANOVA revealed a large overall effect of visual-proprioceptive feedback (condition) on pain-free range of motion $F(2, 94) = 18.9$, $p < .001$, p 2 = 0.29."

```r
modANOVA.1 <- ezANOVA(data = d.tidy.1,
                  dv = rangeofmotion,
                  wid = Participant,
                  within = .(condition),
                  within_full = DirectionofRotation,
                  detailed = TRUE,
                  return_aov = TRUE) #returns aov object, which is useful for calculating partial eta s

print(modANOVA.1)
```

```
## $ANOVA
##        Effect DFn DFd        SSn       SSd           F            p p<.05
## 1 (Intercept)   1  23 71.8400889 0.1033778 15983.33878 3.366327e-34     *
## 2   condition   2  46  0.2160528 0.3567806    13.92793 1.864561e-05     *
##         ges
## 1 0.9936355
## 2 0.3195049
##
## $`Mauchly's Test for Sphericity`
##      Effect         W            p p<.05
## 2 condition 0.4933248 0.0004211748     *
##
## $`Sphericity Corrections`
##      Effect       GGe        p[GG] p[GG]<.05       HFe        p[HF]
## 2 condition 0.6637131 0.0002853589         * 0.6888482 0.0002324356
##   p[HF]<.05
## 2         *
##
## $aov
##
## Call:
## aov(formula = formula(aov_formula), data = data)
##
## Grand Mean: 0.9988889
##
## Stratum 1: Participant
```

```
##
## Terms:
##                 Residuals
## Sum of Squares  0.1033778
## Deg. of Freedom        23
##
## Residual standard error: 0.06704242
##
## Stratum 2: Participant:condition
##
## Terms:
##                 condition Residuals
## Sum of Squares  0.2160528 0.3567806
## Deg. of Freedom         2        46
##
## Residual standard error: 0.08806872
## Estimated effects may be unbalanced
```

```
#Note on within_full: this so the condition data is collapsed to mean of DirectionofRotation; becuase o


# #Version 2
#
# modANOVA.2 <- ezANOVA(data = d.tidy.2,
#                    dv = rangeofmotion,
#                    wid = trial,
#                    within = .(condition),
#                    detailed = TRUE)
#
# print(modANOVA.2)


#demoAnova <- ezANOVA(myData, # specify data frame
#                      dv = RT, # specify dependent variable
#                      wid = subject, # specify the subject variable
#                      within = .(block, check), # specify within-subject variables
#                      detailed = TRUE # get a detailed table that includes SS
#                      )

#Repeated ANOVA in R: http://sherifsoliman.com/2014/12/10/ANOVA_in_R/ ; https://www.r-statistics.com/20
```

```
repanova.fstat.comp <- compareValues(reportedValue = 18.9, obtainedValue = 13.92793)

repanova.pval.comp <- compareValues(reportedValue = .001, obtainedValue = .001, isP=T)


repanova.fstat.comp
```

```
## [1] "MAJOR NUMERICAL ERROR. The reported value (18.9) and the obtained value (13.9) differed by 26.4
```

```
repanova.pval.comp
```

```
## [1] "MATCH. The reported value (0.001) and the obtained value (0.001) differed by 0%. NB obtained val
```

2) Second, I look at all pairwise compairsons. Since the methodology was not mentioned (e.g. either F-statistic comparisons or t tests), I used t-tests. All were the same, e.g. ; < 0.01.

Original text: "All pairwise comparisons were significant (ps < .01)."

```r
#T-test by condition

ttest_0.8v1 <- t.test(d.comparison$meancondition1_gain0.8, d.comparison$meancondition2_gain1, paired = T

ttest_0.8v1.2 <- t.test(d.comparison$meancondition1_gain0.8, d.comparison$meancondition3_gain1.2, paire

ttest_1.2v1 <- t.test(d.comparison$meancondition2_gain1, d.comparison$meancondition3_gain1.2, paired = T

ttest_0.8v1
```

```
##
##  Paired t-test
##
## data:  d.comparison$meancondition1_gain0.8 and d.comparison$meancondition2_gain1
## t = 3.1073, df = 23, p-value = 0.004961
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  0.02186668 0.10896665
## sample estimates:
## mean of the differences
##              0.06541667
```

```r
ttest_0.8v1.2
```

```
##
##  Paired t-test
##
## data:  d.comparison$meancondition1_gain0.8 and d.comparison$meancondition3_gain1.2
## t = 4.0354, df = 23, p-value = 0.0005152
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  0.06538871 0.20294462
## sample estimates:
## mean of the differences
##               0.1341667
```

```r
ttest_1.2v1
```

```
##
##  Paired t-test
##
## data:  d.comparison$meancondition2_gain1 and d.comparison$meancondition3_gain1.2
## t = 3.4794, df = 23, p-value = 0.002027
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  0.02787523 0.10962477
## sample estimates:
## mean of the differences
##                 0.06875
```

```r
pairwise.1 <- compareValues(reportedValue = .01, obtainedValue = .01, isP=T)

pairwise.2 <- compareValues(reportedValue = .01, obtainedValue = .01, isP=T)

pairwise.3 <- compareValues(reportedValue = .01, obtainedValue = .01, isP=T)
```

```r
pairwise.1
```

```
## [1] "MATCH. The reported value (0.01) and the obtained value (0.01) differed by 0%. NB obtained valu
```

```r
pairwise.2
```

```
## [1] "MATCH. The reported value (0.01) and the obtained value (0.01) differed by 0%. NB obtained valu
```

```r
pairwise.3
```

```
## [1] "MATCH. The reported value (0.01) and the obtained value (0.01) differed by 0%. NB obtained valu
```

3) Third, I compare effect sizes and related p values. The effect sizes and associated p values were all wrong.

Original Effect: "As shown in Figure 3, when vision understated true rotation, pain-free range of motion was increased, and this was a medium-sized effect, p = .006, d = 0.67; when vision overstated true rotation, pain-free range of motion was decreased, and this was a large effect, p = .001, d = 0.80."

```r
d0.8v1 <- (mean0.8 - mean1) / sdpool0.8v1


d1v1.2 <- (mean1.2 - mean1) / sdpool1v1.2

print(d0.8v1) #when vision understated motion, hence range of motion increased
```

```
## [1] 0.8970123
```

```r
ttest_0.8v1
```

```
##
##  Paired t-test
##
## data:  d.comparison$meancondition1_gain0.8 and d.comparison$meancondition2_gain1
## t = 3.1073, df = 23, p-value = 0.004961
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  0.02186668 0.10896665
## sample estimates:
## mean of the differences
##             0.06541667
```

```r
print(d1v1.2) #when vision overstated motion, hence range of motion decreased
```

```
## [1] -1.00442
```

```r
ttest_1.2v1
```

```
##
##  Paired t-test
##
## data:  d.comparison$meancondition2_gain1 and d.comparison$meancondition3_gain1.2
## t = 3.4794, df = 23, p-value = 0.002027
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  0.02787523 0.10962477
## sample estimates:
## mean of the differences
```

```
##                 0.06875
```

```
understatement.effectsize <- compareValues(reportedValue = .67, obtainedValue = .89)

understatement.pvalue <- compareValues(reportedValue = .006, obtainedValue = .0049, isP=T)

overstatement.effectsize <- compareValues(reportedValue = .8, obtainedValue = 1.0042, isP=T)

overstatement.pvalue <- compareValues(reportedValue = .001, obtainedValue = .002, isP=T)



understatement.effectsize
```

```
## [1] "MAJOR NUMERICAL ERROR. The reported value (0.67) and the obtained value (0.89) differed by 32.84
```

```
understatement.pvalue
```

```
## [1] "MAJOR NUMERICAL ERROR. The reported value (0.006) and the obtained value (0.005) differed by 16
```

```
overstatement.effectsize
```

```
## [1] "MAJOR NUMERICAL ERROR. The reported value (0.8) and the obtained value (1) differed by 25%. NB
```

```
overstatement.pvalue
```

```
## [1] "MAJOR NUMERICAL ERROR. The reported value (0.001) and the obtained value (0.002) differed by 10
```

4) Fourth, I compare the percentage change and confidence intervals. The percentage change for the understatement was off, but the percentage change for the overstatement was right.

Original quote: "Specifically, during visual feedback that understated true rotation, pain-free range of motion was increased by 6% (95% confidence interval, or CI = [2%, 11%]); during visual feedback that overstated true rotation, pain-free range of motion decreased by 7% (95% CI = [3%, 11%]). Therefore, our results show an overall effect of the manipulation of 13%.""

```
pctchng0.8v1 <- 100*((mean0.8-mean1)/mean1)
pctchng1.2v1 <- 100*((mean1.2-mean1)/mean1)
pctchngtotal <- abs(pctchng0.8v1) + abs(pctchng1.2v1)

t.test0.8v1 <- t.test(d.comparison$meancondition1_gain0.8,d.comparison$meancondition2_gain1)$conf.int
t.test1.2v1 <- t.test(d.comparison$meancondition2_gain1,d.comparison$meancondition3_gain1.2)$conf.int

#Vision understated true rotation
pctchng0.8v1
```

```
## [1] 6.541667
```

```
t.test0.8v1
```

```
## [1] 0.02186668 0.10896665
## attr(,"conf.level")
## [1] 0.95
```

```
#Vision overstated true rotation
pctchng1.2v1
```

```
## [1] -6.875
```

```
t.test1.2v1
```

```
## [1] 0.02787523 0.10962477
```

```
## attr(,"conf.level")
## [1] 0.95
```

```
pctchngtotal
```

```
## [1] 13.41667
```

```
understatement.pctchng <- compareValues(reportedValue = 6, obtainedValue = 6.54)
understatement.confidence.lower <- compareValues(reportedValue = 2, obtainedValue = 2.18)
understatement.confidence.upper <- compareValues(reportedValue = 11, obtainedValue = 10.89)

overstatement.pctchng <- compareValues(reportedValue = 7, obtainedValue = 6.875)
overstatement.confidence.lower <- compareValues(reportedValue = 3, obtainedValue = 2.79)
overstatement.confidence.upper <- compareValues(reportedValue = 11, obtainedValue = 10.96)

pctchngtotal <- compareValues(reportedValue = 13, obtainedValue = 13.42)

understatement.pctchng
```

```
## [1] "MAJOR NUMERICAL ERROR. The reported value (6) and the obtained value (7) differed by 16.67%. NB
```

```
understatement.confidence.lower
```

```
## [1] "MATCH. The reported value (2) and the obtained value (2) differed by 0%. NB obtained value was r
```

```
understatement.confidence.upper
```

```
## [1] "MATCH. The reported value (11) and the obtained value (11) differed by 0%. NB obtained value was
```

```
overstatement.pctchng
```

```
## [1] "MATCH. The reported value (7) and the obtained value (7) differed by 0%. NB obtained value was r
```

```
overstatement.confidence.lower
```

```
## [1] "MATCH. The reported value (3) and the obtained value (3) differed by 0%. NB obtained value was r
```

```
overstatement.confidence.upper
```

```
## [1] "MATCH. The reported value (11) and the obtained value (11) differed by 0%. NB obtained value was
```

```
pctchngtotal
```

```
## [1] "MATCH. The reported value (13) and the obtained value (13) differed by 0%. NB obtained value was
```

Step 5: Conclusion

[Include the carpsReport function below]

```
# You can delete this commented text for your report, it is here to serve as a guide.
# Use the carpsReport() function in this code chunk.
# Here is a guide to the arguments you should include in the function:
# Report_Type: Enter 'pilot' or 'final'
# Article_ID: Enter the article's unique ID code
# Insufficient_Information_Errors: Enter the number of Insufficient Information Errors
# Decision_Errors Enter: the number of decision errors
# Major_Numerical_Errors: Enter the number of major numerical errors
# Time_to_Complete: Enter the estimated time to complete the report in minutes
# Author_Assistance: Enter whether author assistance was required (TRUE/FALSE)
# FOR EXAMPLE:
```

```
# carpsReport(Report_Type = "pilot",
#             Article_ID = "ABhgyo",
#             Insufficient_Information_Errors = 0,
#             Decision_Errors = 1,
#             Major_Numerical_Errors = 4,
#             Time_to_Complete = 120,
#             Author_Assistance = TRUE)
```

[Please also include a brief text summary describing your findings. If this reproducibility check was a failure, you should note any suggestions as to what you think the likely cause(s) might be.]

[This function will output information about the package versions used in this report:]

```
devtools::session_info()
```

```
##  setting  value
##  version  R version 3.4.1 (2017-06-30)
##  system   x86_64, darwin15.6.0
##  ui       X11
##  language (EN)
##  collate  en_US.UTF-8
##  tz       America/Los_Angeles
##  date     2017-11-02
##
##  package      * version date
##  assertthat     0.2.0   2017-04-11
##  backports      1.1.1   2017-09-25
##  base         * 3.4.1   2017-07-07
##  bindr          0.1     2016-11-13
##  bindrcpp       0.2     2017-06-17
##  broom          0.4.2   2017-02-13
##  car            2.1-5   2017-07-04
##  CARPSreports * 0.1     2017-10-30
##  cellranger     1.1.0   2016-07-27
##  colorspace     1.3-2   2016-12-14
##  compiler       3.4.1   2017-07-07
##  compute.es   * 0.2-4   2014-09-16
##  datasets     * 3.4.1   2017-07-07
##  devtools       1.13.3  2017-08-02
##  digest         0.6.12  2017-01-27
##  dplyr        * 0.7.3   2017-09-09
##  effsize      * 0.7.1   2017-03-21
##  evaluate       0.10.1  2017-06-24
##  ez           * 4.4-0   2016-11-02
##  forcats        0.2.0   2017-01-23
##  foreign        0.8-69  2017-06-22
##  ggplot2      * 2.2.1   2016-12-30
##  glue           1.1.1   2017-06-21
##  graphics     * 3.4.1   2017-07-07
##  grDevices    * 3.4.1   2017-07-07
##  grid           3.4.1   2017-07-07
##  gtable         0.2.0   2016-02-26
##  haven        * 1.1.0   2017-07-09
##  hms            0.3     2016-11-22
##  htmltools      0.3.6   2017-04-28
```

```
##  httr           1.3.1   2017-08-20
##  jsonlite       1.5     2017-06-01
##  knitr        * 1.17    2017-08-10
##  lattice        0.20-35 2017-03-25
##  lazyeval       0.2.0   2016-06-12
##  lme4           1.1-14  2017-09-27
##  lsr          * 0.5     2015-03-02
##  lubridate      1.6.0   2016-09-13
##  magrittr       1.5     2014-11-22
##  MASS           7.3-47  2017-02-26
##  Matrix         1.2-10  2017-05-03
##  MatrixModels   0.4-1   2015-08-22
##  memoise        1.1.0   2017-04-21
##  methods      * 3.4.1   2017-07-07
##  mgcv           1.8-17  2017-02-08
##  minqa          1.2.4   2014-10-09
##  mnormt         1.5-5   2016-10-15
##  modelr         0.1.1   2017-07-24
##  munsell        0.4.3   2016-02-13
##  nlme           3.1-131 2017-02-06
##  nloptr         1.0.4   2014-08-04
##  nnet           7.3-12  2016-02-02
##  parallel       3.4.1   2017-07-07
##  pbkrtest       0.4-7   2017-03-15
##  pkgconfig      2.0.1   2017-03-21
##  plyr           1.8.4   2016-06-08
##  psych          1.7.8   2017-09-09
##  purrr        * 0.2.3   2017-08-02
##  quantreg       5.34    2017-10-25
##  R6             2.2.2   2017-06-17
##  Rcpp           0.12.12 2017-07-15
##  readr        * 1.1.1   2017-05-16
##  readxl       * 1.0.0   2017-04-18
##  reshape2       1.4.2   2016-10-22
##  rlang          0.1.2   2017-08-09
##  rmarkdown      1.6     2017-06-15
##  rprojroot      1.2     2017-01-16
##  rvest          0.3.2   2016-06-17
##  scales         0.5.0   2017-08-24
##  SparseM        1.77    2017-04-23
##  splines        3.4.1   2017-07-07
##  stats        * 3.4.1   2017-07-07
##  stringi        1.1.5   2017-04-07
##  stringr        1.2.0   2017-02-18
##  tibble       * 1.3.4   2017-08-22
##  tidyr        * 0.7.1   2017-09-01
##  tidyselect     0.2.0   2017-08-30
##  tidyverse    * 1.1.1   2017-01-27
##  tools          3.4.1   2017-07-07
##  utils        * 3.4.1   2017-07-07
##  withr          2.0.0   2017-07-28
##  xml2           1.1.1   2017-01-24
##  yaml           2.1.14  2016-11-12
##  source
```

```
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.2)
##  local
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  Github (METRICS-CARPS/CARPSreports@d8ebcab)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.0)
##  local
##  CRAN (R 3.4.0)
##  local
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  local
##  local
##  local
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.2)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.0)
##  local
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  CRAN (R 3.4.0)
##  CRAN (R 3.4.1)
##  local
##  CRAN (R 3.4.0)
```

```
##   CRAN (R 3.4.0)
##   CRAN (R 3.4.0)
##   CRAN (R 3.4.1)
##   CRAN (R 3.4.1)
##   CRAN (R 3.4.2)
##   CRAN (R 3.4.0)
##   CRAN (R 3.4.1)
##   CRAN (R 3.4.0)
##   CRAN (R 3.4.0)
##   CRAN (R 3.4.0)
##   CRAN (R 3.4.1)
##   CRAN (R 3.4.1)
##   CRAN (R 3.4.0)
##   CRAN (R 3.4.0)
##   CRAN (R 3.4.1)
##   CRAN (R 3.4.0)
##   local
##   local
##   CRAN (R 3.4.0)
##   CRAN (R 3.4.0)
##   CRAN (R 3.4.1)
##   CRAN (R 3.4.1)
##   CRAN (R 3.4.1)
##   CRAN (R 3.4.0)
##   local
##   local
##   CRAN (R 3.4.1)
##   CRAN (R 3.4.0)
##   CRAN (R 3.4.0)
```