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# Brogan-Kutner Data see http://www-stat.stanford.edu/~rag/ed351longit/brogkut.dat

# Cell means
> tapply(urea, list(method, prepost), mean)
         1        2
1 46.37500 47.12500
2 43.53846 31.46154

# Recreate repeated measures anova (nesting)
# within-groups anova to obtain the 2 error terms

#within group 1 subjXtime
> bkrepaovW1 = aov(urea[method == "1"] ~ as.factor(prepost[method == "1"])*as.factor(subj[method == "1"]))
> summary(bkrepaovW1)
                                                          Df Sum Sq Mean Sq
as.factor(prepost[method == "1"])                          1   2.25    2.25
as.factor(subj[method == "1"])                             7 915.00  130.71
                        piece of subjects within groups  Between subjects error term
as.factor(prepost[method == "1"]):as.factor(subj[method == "1"])  7 331.75   47.39
   piece of subjectsxrepeated measure  within group interaction   Within subjects error term

#within group 2 subjXtime
> bkrepaovW2 = aov(urea[method == "2"] ~ as.factor(prepost[method == "2"])*as.factor(subj[method == "2"]))
> summary(bkrepaovW2)
                                                          Df Sum Sq Mean Sq
as.factor(prepost[method == "2"])                          1  948.0   948.0
as.factor(subj[method == "2"])                            12 3525.0   293.7
                       piece of subjects within groups  Between subjects error term
as.factor(prepost[method == "2"]):as.factor(subj[method == "2"]) 12  349.5    29.1
   piece of subjectsxrepeated measure  within group interaction   Within subjects error term

#              915 + 3525 = 4440 (and 7 + 12 = 19df)   Between subjects SS error term
#              331.7 + 349.5 = 681.2 (and 7 + 12 = 19df) Within subjects SS error term

# ignore within-subjects, get
> bkrepaovBase = aov(urea ~ as.factor(prepost)*as.factor(method))
> summary(bkrepaovBase)
                                 Df Sum Sq Mean Sq F value  Pr(>F)
as.factor(prepost)                1  542.9   542.9  4.0282 0.05190 .  #repeated measure (Within subj part)
as.factor(method)                 1  847.5   847.5  6.2884 0.01654 *  #Group  (Between subjects part)
as.factor(prepost):as.factor(method)  1  407.4   407.4  3.0230 0.09019 .  #GroupxRepeated measure Interaction
Residuals                        38 5121.2   134.8                                (Within subjects part)

# Brogan-Kutner Section 5 Equivalences
   # Groups, pooling over occasion
> sumtime = pre + post
> t.test(sumtime ~ as.factor(method), var.equal = TRUE)
    Two Sample t-test data:  sumtime by as.factor(method)
t = 1.9044, df = 19, p-value = 0.07212
95 percent confidence interval: -1.832786 38.832786
mean in group 1 mean in group 2
          93.5           75.0
> 1.904^2  [1] 3.625216  # matches F-stat for Groups (bet subj)

> imp = post - pre
> t.test(imp ~ as.factor(method), var.equal = TRUE)
  Two Sample t-test data:  imp by as.factor(method)
t = 3.3709, df = 19, p-value = 0.003209
95 percent confidence interval:  4.862645 20.791201
mean in group 1 mean in group 2
        0.75000       -12.07692
> 3.3709^2  [1] 11.36297  # matches F-stat for Groups X prepost

> t.test(imp)
 One Sample t-test data:  imp
t = -3.1581, df = 20, p-value = 0.004947
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval: -11.939835  -2.441117
mean of x -7.190476
> 3.1581^2 [1] 9.973596  # equiv to prepost, no differential change
                            BK p.232

> bksubj
   pre post method
1   51   48      1
2   35   55      1
3   66   60      1
4   40   35      1
5   39   36      1
6   46   43      1
7   52   46      1
8   42   54      1
9   34   16      2
10  40   36      2
11  34   16      2
12  36   18      2
13  38   32      2
14  32   14      2
15  44   20      2
16  50   43      2
17  60   45      2
18  63   67      2
19  50   36      2
20  42   34      2
21  43   32      2

> bkrepaov1 = aov(urea ~ as.factor(prepost)*as.factor(method)+ Error(as.factor(subj)))
> summary(bkrepaov1)
Error: as.factor(subj)
                  Df Sum Sq Mean Sq F value  Pr(>F)
as.factor(method)  1  847.5   847.5  3.6266 0.07212 .
Residuals         19 4440.0   233.7
---
Error: Within
                                 Df Sum Sq Mean Sq F value    Pr(>F)
as.factor(prepost)                1 542.88  542.88  15.142 0.0009823 ***Type III SS(prepost) = 317
as.factor(prepost):as.factor(method)  1 407.41  407.41  11.363 0.0032085 **
Residuals                        19 681.21   35.85
```