16 A	2. Mixed Design ANOVA – calculations by hand

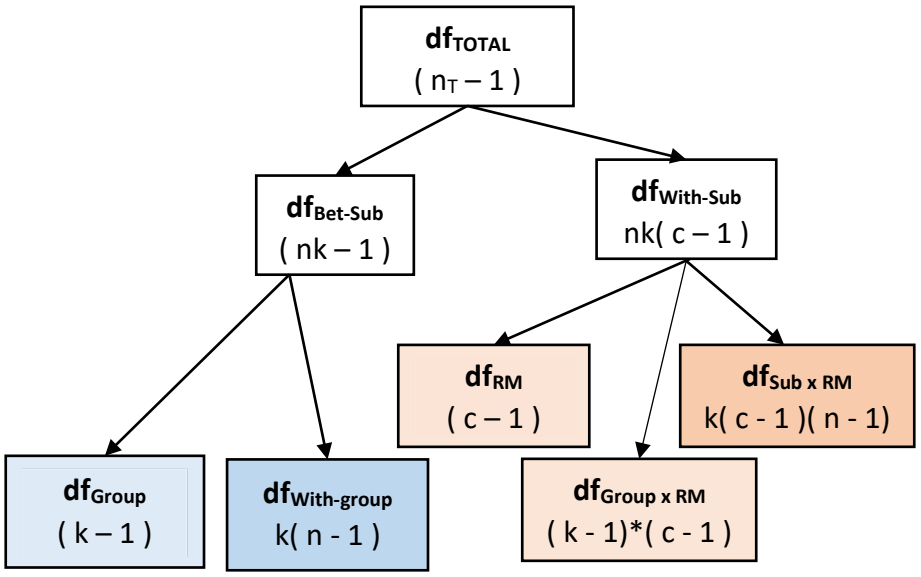
A researcher tested two groups of subjects – six alcohol abusers and six moderate social drinkers – on a reaction time task. Each subject was measured twice: before and after drinking 4 ounces of vodka. A mixed-design ANOVA produced the following SS components:

$SS_{groups} = 88,\ SS_{with-grp} = 1380,$ AND $SS_{RM} = 550,\ SS_{G\ x\ RM} = 2.0,\ SS_{S\ x\ RM} = 134$

Complete the analysis and present the results in a **summary table**.

Source	SS	df	MS	F	p
Between-Subjects					
Groups = _____					
Residual: Within-Groups					
Within-Subjects					
RM = _____					
INTER: Group x RM					
Residual: INTER(Sub x RM)					
Total					

F_{CV} (_____ , _____) = _____

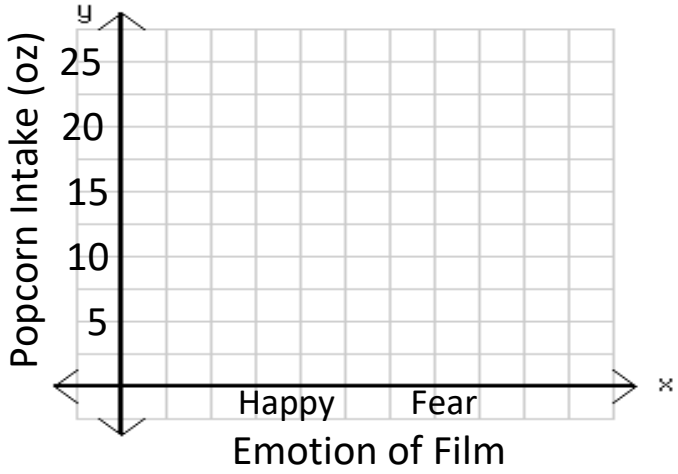


16 A	4.RM plots – viewing interactions

The following table shows the number of ounces of popcorn consumed by each subject while viewing two emotion-evoking films, one evoking happiness and one evoking fear. Half the subjects ate a meal just before the film (preload condition), whereas the others did not (no load condition).

Graph the data for all the subjects on one graph. → **Let the repeated measure by the x-axis**
(Make a key to show the between-subject groups with color, shape, and linetypes)

	Happiness	Fear
Preload	10 13 8 16	12 16 11 17
No Load	26 19 27 20	20 14 20 15



a) Does there appear to be about the same amount of **subject x treatment** interaction in each group?
☐ yes ☐ no

b) Does there appear to be a considerable amount of **group x repeated-measure** interaction?
☐ yes ☐ no

16 A	5.Source of RM variation

If you calculate an RM ANOVA and then assign the subjects to subgroups to create a mixed design, the observed F ratio for the **RM factor may get considerably larger.** Under which of the following conditions is this likely?

☐ a) The degrees of freedom associated with the error term are reduced considerably.

☐ b) There is a good deal of subject x RM treatment interaction

☐ c) There is a good deal of (sub)group x RM treatment interaction

☐ d) There is a good deal of subject-to-subject variabilibty

16 B	4. Mixed Design ANOVA –	Code: R notebook

In exercise 15 B #2 subjects performed a clerical task under three noise conditions. Now suppose a new group of subject is added to study the effects of the same three conditions on the performance of a simpler, more mechanical task. The data is presented in the textbook.

a) Perform a mixed-design ANOVA, and display the results in a **summary table.**

```r
# Mixed ANOVA: no correction for spericity and both effect sizes
fit_tasks <- tasks_long %>%
  afex::aov_4(completed ~ type_task + (noise|id),
              data = .,
              anova_table = list(correction = "none",
                                 es = c("ges", "pes")))

fit_tasks$aov
```

Source	SS	df	MS	F	p
Between-Subjects					
Groups = _____					
Residual: Within-Groups					
Within-Subjects					
RM = _____					
INTER: Group x RM					
Residual: INTER(Sub x RM)					
Total					

b) Calculate the **generalized eta squared** for the main effect of the **type-of-task** factor.
For simplicity: DO NOT correct for violations of spericity.
(record the two values from R by running the model's name "fit_tasks", but also calculate by hand)

☐ ges = general eta-squared = _____

☐ pes = partial eta-squared = _____

Formula 16.8

$$Grp\ assigned: \eta^2_{gen} = \frac{SS_{Grp}}{SS_{Grp} + SS_{WithGrp} + SS_{Sub*RM}}$$

η^2_{Gen} =

Does this look like a **large effect size**?

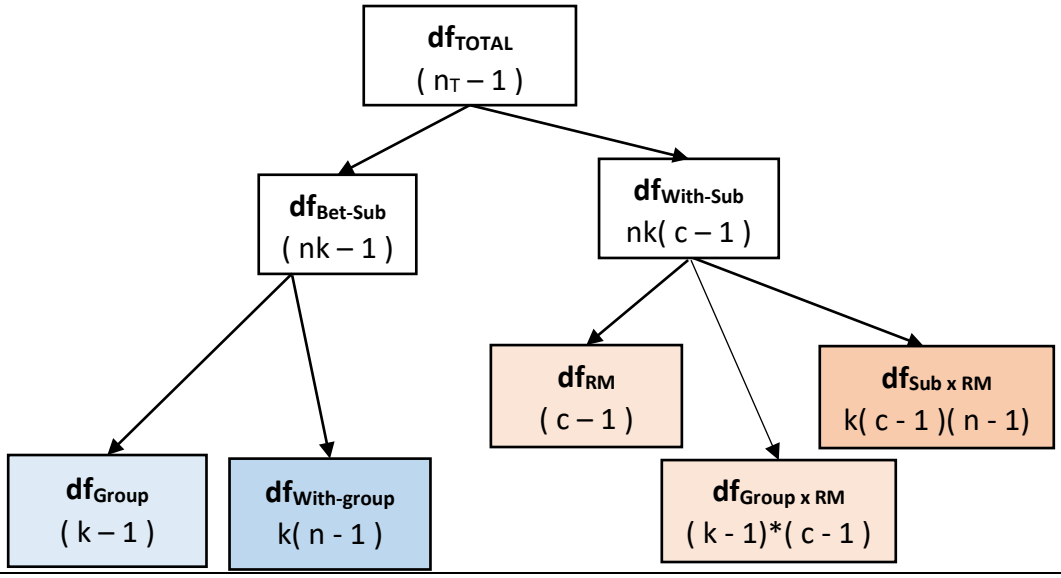
☐ yes ☐ no

Explain.

16 A	5. Mixed Design ANOVA	Code: R notebook

Dr. Jones is investigating various conditions that affect mental effort – which, in this experiment, involves solving anagrams. Subjects were randomly assigned to one of three experimental conditions. Subjects in the first group were told that they would not be getting feedback on their performance. Subjects in the second and third groups were told they would get feedback, but only subjects in the third group were told (erroneously) that anagram solving was highly correlated with intelligence and creativity (Dr. Jones hoped this information would produce ego involvement). The list of anagrams given to each subject containced a random mix of problems at four levels of difficulty determined by the number of letters presented (five, six, seven, or eight). The number of anagrams correctly solved by each subject in each condition and at the each difficulty level is given in the textbook.

a) Draw a **degrees of freedom tree** for this experiment.



b) Perform a mixed analysis of variance, and display the results in a summary table.

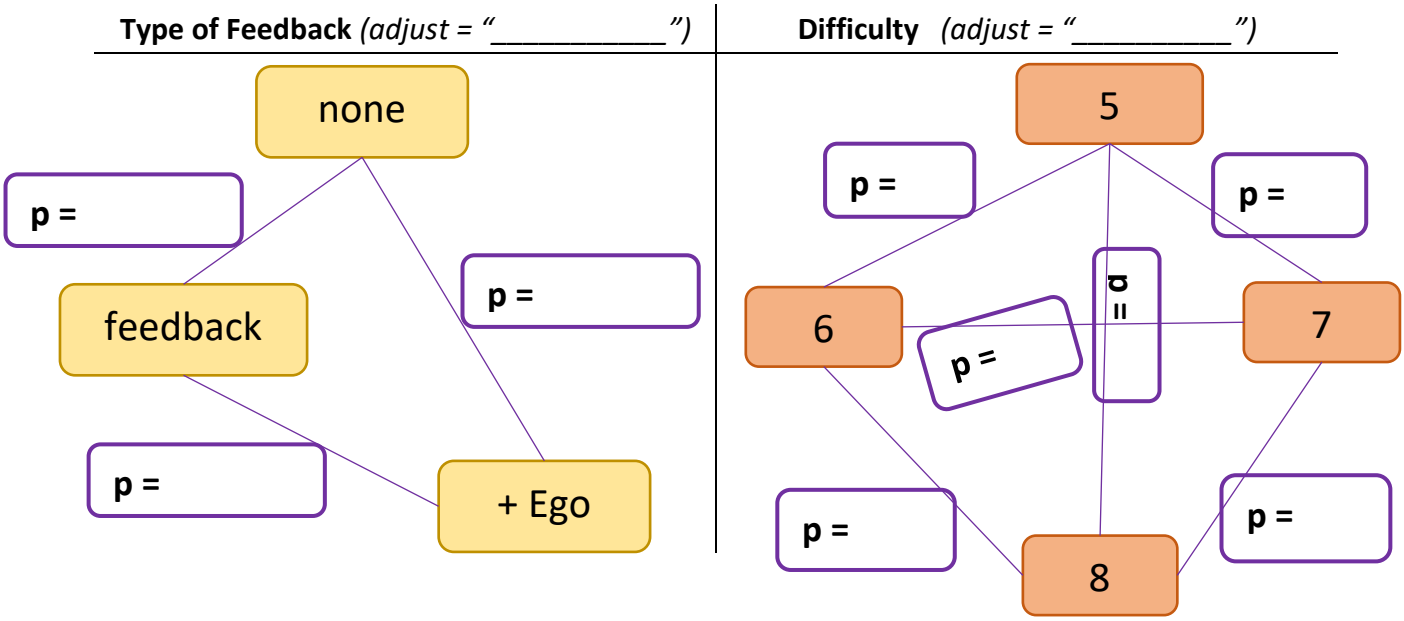
Source	SS	df	MS	F	p
Between-Subjects					
Groups = _____					
Residual: Within-Groups					
Within-Subjects					
RM = _____					
INTER: Group x RM					
Residual: INTER(Sub x RM)					
Total					

Would any of your conclusions change if you do **not assume sphericity**?

☐ yes ☐ no

Explain.

c) Perform post hoc pairwise comparisons for both main effects, using the appropriate error term from part b in each case.



Explain why these follow-up tests are appropriate given your results in part b.

Briefly state the conclusion of this analysis.

16 A	8. Mixed Design ANOVA	Code: R notebook

Exercise 15B #6 described a neuropsychologist studying subjects with brain damage to the left cerebral hemisphere. Such a study would probably include a group of subjects with damage to the right hemisphere and a group of control subjects without brain damage. The data the previous exercise, along with data for the two comparison groups just mentioned are presented below.

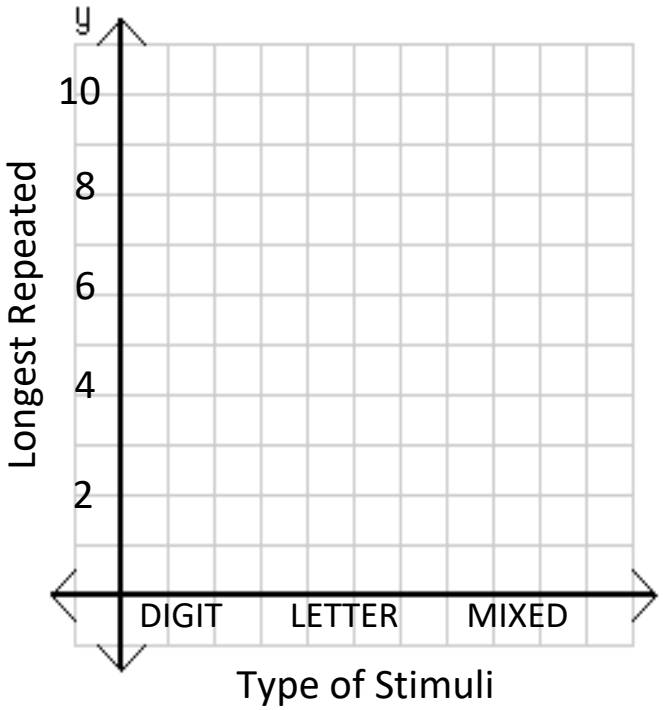
Perform a mixed-design ANOVA and test the **three F ratios at the .05 level**.

Source	SS	df	MS	F	p
Between-Subjects					
Groups = _____					
Residual: Within-Groups					
Within-Subjects					
RM = _____					
INTER: Group x RM					
Residual: INTER(Sub x RM)					
Total					

What can you **conclude** about the effects of brain damage on short-term recall for these types of stimuli?

a) Draw a **graph** of these data, subject by subject.
(Make a key to show the between-subject groups with color, shape, and linetypes)

	Digit	Letter	Mixed
LEFT Brain Damage	6	5	6
	8	7	5
	7	7	4
	8	5	8
	6	4	7
	7	6	5
RIGHT Brain Damage	9	8	6
	8	8	7
	9	7	8
	7	8	8
	7	6	7
	9	8	9
CONTROL no Damage	8	8	7
	10	9	9
	9	10	8
	9	7	9
	8	8	8
	10	10	9



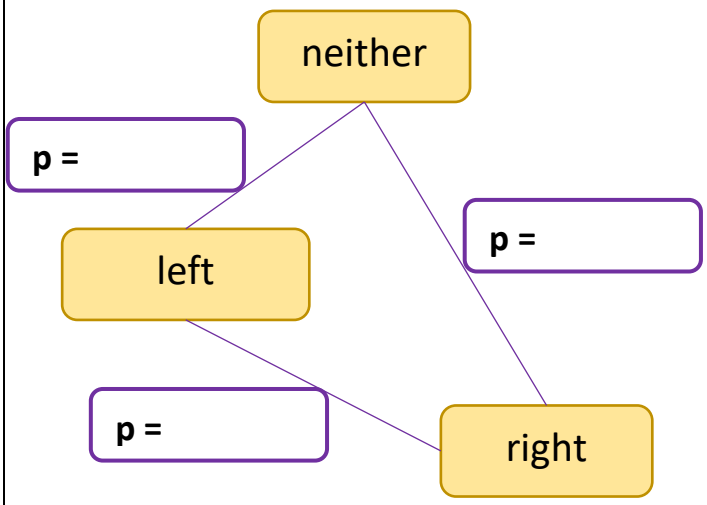
Do the **assumptions** of the mixed-design ANOVA seem **reasonable** in this case?

☐ yes ☐ no

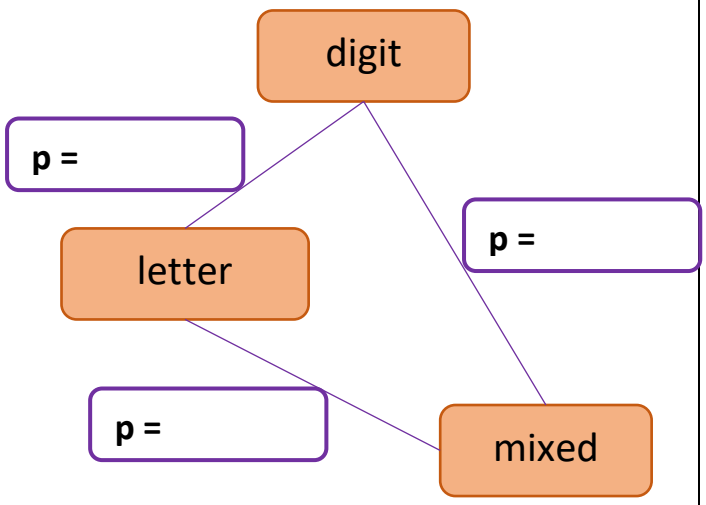
Explain.

b) Perform **post hoc pairwise** comparisons for <u>both</u> main effects.

Brain Damage *(adjust = "_____")*



Stimuli *(adjust = "_____")*



Briefly state the conclusion of this analysis.

16	C	1. Anxiety: Time x Major	Code: R notebook

a) Perform a mixed-design ANOVA with the **three anxiety measures** as the RM levels, and **major** as the between-subjects factor. Request a plot of the cell means, and post hoc test for both the RM factor (LSD) and for major (Tukey). Report the **results** of the ANOVA in **APA style**.

16	C	2. Heart Rate: time x gender	Code: R notebook

a) Perform a mixed-design ANOVA with the **three heart-rate measures** as the RM levels and **gender** as the between-subjects factor. Request a plot of the cell means and post hoc test for the RM factor (LSD). Report the **results** of the ANOVA in **APA style**.

16	C	3. Stat Quizzes: time x Experimental condition	Code: R notebook

a) Perform a mixed-design ANOVA with the **two 10-point quizzes (statquiz & exp_sqz)** as the RM levels and **exp_cond** as the between-subjects factor. Request a plot of the cell means. Report the **results** of the ANOVA in **APA style**. If the interaction is significant, explain the pattern you see in the plot of the cell means.