

1. (From G&W7) People with agoraphobia are so filled with anxiety about being in public places that they seldom leave their homes. Knowing this is a difficult disorder to treat, a researcher tries a long-term treatment. A sample of individuals report how often they have ventured out of the house in the past month. Then they receive relaxation training and are introduced to trips away from the house at gradually increasing durations. After two months of treatment, participants report the number of trips out of the house they made in the last 30 days. Analyze the data below as completely as possible [15 pts]

Participant	Before Treatment	After Treatment	P
1	0	4	4
2	0	0	0
3	3	14	17
4	3	23	26
5	2	9	11
6	0	8	8
7	0	6	6
Sum (T)	8	64	72
ΣX^2	22	922	944
SS	12.86	336.86	349.7

$H_0: \mu_{\text{Before}} = \mu_{\text{After}}$ $H_1: \text{Not } H_0$

Source	SS	df	MS	F
Treatment	224	1	224	11.3
Within	349.7	12		
Subject	230.7	6		
Error	119	6	19.8	
Total	573.7	13		

Decision: With $F_{\text{Crit}}(1,6) = 5.99$, we would reject H_0 ($F_{\text{Obt}} \geq F_{\text{Crit}}$).

Conclusion: The number of trips out of the house was significantly greater after treatment ($M = 9.1$) than before treatment ($M = 1.1$). [Keep in mind that there is no counterbalancing here, so the improvement may be due to the simple passage of time, and not due to the treatment per se.]

Effect size: $\eta^2 = .65$

2. (From G&W1) A scientist tests two drugs for their effects on insomnia. A sample of $n = 10$ insomniacs is pre-tested with a placebo before bedtime, and the latency to sleep is measured to serve as a baseline. A week later, the subjects receive Drug 1 before bedtime, and the time that lapses between drug administration and sleep onset is measured again. Finally, a week later Drug 2 is tested in the same fashion. The latency to sleep (in minutes) is the DV in the analysis seen below. Complete the source table and interpret the results of this study as completely as you can. [15 pts]

Descriptive Statistics

	Mean	Std. Deviation	N
Pretest	109.7000	34.42238	10
Drug1	72.7000	38.93599	10
Drug2	58.6000	42.32205	10

$$H_0: \mu_{Pre} = \mu_{D1} = \mu_{D2}$$

$$H_1: \text{Not } H_0$$

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power ^a
Drug	Sphericity Assumed	13930.067	2	6965.033	6.042	.010	12.084	.823
	Greenhouse-Geisser	13930.067	1.652	8430.959	6.042	.015	9.983	.761
	Huynh-Feldt	13930.067	1.976	7047.995	6.042	.010	11.941	.819
	Lower-bound	13930.067	1.000	13930.067	6.042	.036	6.042	.592
Error(Drug)	Sphericity Assumed	20750.600	18	1152.811				
	Greenhouse-Geisser	20750.600	14.870	1395.443				
	Huynh-Feldt	20750.600	17.788	1166.542				
	Lower-bound	20750.600	9.000	2305.622				

a. Computed using alpha = .05

First, note that there is a design problem, because in this repeated measures design, the conditions are not appropriately counterbalanced. Thus, position and treatment are confounded.

Decision: Reject H_0 , because $p < .05$.

$$HSD = 3.61 \sqrt{\frac{1152.8}{10}} = 38.76$$

	Pre	Drug 1	Drug 2
Pre	---		
Drug 1	3.7	---	
Drug 2	51.1	14.1	---

Conclusion: Latency to sleep is significantly less at Time 3 (or maybe Drug 2) compared to Time 1 (or maybe No Drug).

3a. (From G&W1) Does coffee help people to become sober more quickly after drinking too much? The (made-up) data below represent the results from an experiment intended to address this question. A sample of 40 volunteers is randomly divided into four groups. One group serves as a control and receives no alcohol. Subjects in each of the remaining three groups drink a fixed amount of alcohol in a one-hour period. During the next half hour, subjects in the second group drink two cups of decaffeinated coffee, subjects in the third group drink two cups of regular coffee, and subjects in the final group drink two cups of water. Finally, all subjects are given a reaction time test to determine mental alertness (i.e., faster reaction times indicate greater alertness). Complete the source table below and interpret the results of this study as completely as you can. [15 pts]

Descriptives

Reaction Time Test

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	10	194.9000	10.80586	3.41711	187.1700	202.6300	179.00	215.00
Decaf Coffee	10	212.3000	12.89315	4.07717	203.0768	221.5232	191.00	230.00
Regular Coffee	10	211.1000	14.13781	4.47077	200.9864	221.2136	189.00	231.00
Water	10	211.5000	14.56976	4.60736	201.0774	221.9226	192.00	231.00
Total	40	207.4500	14.64442	2.31549	202.7665	212.1335	179.00	231.00

$H_0: \mu_{\text{Control}} = \mu_{\text{Decaf}} = \mu_{\text{Coffee}} = \mu_{\text{Water}}$

$H_1: \text{Not } H_0$

ANOVA

Reaction Time Test

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2107.500	3	702.500	4.042	.014
Within Groups	6256.400	36	173.789		
Total	8363.900	39			

Test for homogeneity of variance: $F_{\text{Max}} = 212.3/116.8 = 1.82$ and $F_{\text{Max Crit}} = 6.31$

Thus, we wouldn't be concerned about heterogeneity. Use $\alpha =$

.05

Decision: Reject H_0 , because $p < .05$.

$$HSD = 3.8 \sqrt{\frac{175.6}{10}} = 15.92$$

	Control	Decaf	Regular	Water
Control	---			
Decaf	17.4	---		
Regular	16.2	1.2	---	
Water	16.6	.8	.4	---

Conclusion: Control condition is significantly faster than Decaf, Regular and Water, which don't differ.

Effect size: $\eta^2 = 2107.5/8429.1 = .25$

3b. Suppose that you had only the Descriptive Statistics for the analysis above. How could you use that information to determine the $MS_{\text{Within Groups}}$? [2 pts]

Square each standard deviation (to turn it into a variance) and then take the mean of those four variances.

3c. What parameter is estimated by $MS_{\text{Within Groups}}$? [2 pts]

population variance (σ^2)

3d. Again, look at the Descriptive Statistics for the analysis above. What information found in that table is driving the $MS_{\text{Between Groups}}$? [2 pts]

The four group means ($MS_{\text{Between}} = n$ (variance of means))

3e. Let's presume that regular coffee would actually speed up reaction times, but that its effect was quite small. How could you detect the effect of regular coffee in an experiment? [2 pts]

Increase the power (e.g., increase n).

3f. Suppose that this experiment were to be conducted as a repeated measures design. In other words, the 40 scores came from $n = 10$ people who were each tested under each of the four conditions. What would happen to your df_{Error} ? What would likely happen to your F -ratio? [2 pts]

The df_{Error} ($df_{\text{Error}} = 27$) would be smaller than df_{Within} ($df_{\text{Within}} = 36$) for independent groups. Even with the loss of df , the F -ratio would likely increase (due to the removal of individual differences).