ADHD Study 2 Power Analysis

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library(pacman)  
p\_load(tidyverse, stats, rstatix, MASS,effects,Superpower)  
set.seed(1234)  
filter <- dplyr::filter  
select <- dplyr::select

## Setting Parameters

To estimate the correlation between work-specific and general frame of reference (FOR) Conscientiousness scores within-subjects, I used *r* = .49 as reported by Lievens et al. (2008). I used the same within-subjects correlation for ADHD and non-ADHD participants.

For the general FOR items, I used the results from Study 1 to estimate the mean and standard deviation (SD) for the ADHD (M = 3.27, SD = 0.53) and non-ADHD (M = 3.74, SD = 0.55) groups, Cohen’s *d* = 0.87.

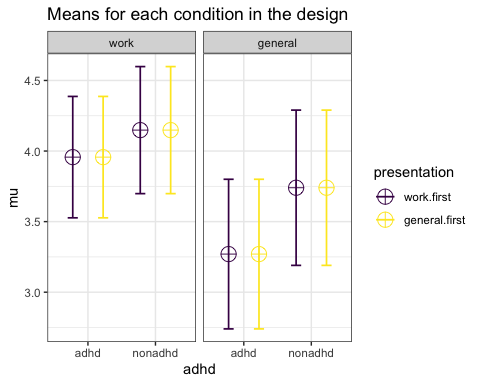
I used Cohen’s *d* = 0.797 for the difference between general and work-specific items among non-ADHD participants (Lievens et al., 2008).

I tested a range of effect sizes for group mean differences by ADHD status in the work-specific FOR. I estimated that the effect of ADHD on group mean differences on the work-specific items would be half the difference that was found on general items in Study 1 (i.e. estimated *d* = 0.87/2 = 0.435). Here, we’re assuming no effect of presentation order.

nadhd.mean.general <- 3.74  
nadhd.sd.general <- .55  
nadhd.sd.work <- .45  
r.val <- .49  
nadhd.mean.work.denom <- sqrt(((nadhd.sd.general^2)+(nadhd.sd.work^2))-(2\*r.val\*(nadhd.sd.general)\*(nadhd.sd.work)))  
cod.nadhd.work.general <- .797  
nadhd.mean.work.ls <- cod.nadhd.work.general\*nadhd.mean.work.denom  
nadhd.mean.work <- nadhd.mean.work.ls + nadhd.mean.general  
  
adhd.sd.work <- .43  
nadhd.n <- 140 #conservative n of 140  
adhd.n <- 140  
comp.denom <- sqrt((((nadhd.n-1)\*nadhd.sd.work^2) + ((adhd.n-1)\*adhd.sd.work^2))/(nadhd.n+adhd.n-2))  
cod.adhd.nadhd.work <- .435  
comp.ls <- cod.adhd.nadhd.work\*comp.denom  
adhd.mean.work <- nadhd.mean.work-comp.ls  
  
adhd.mean.general <- 3.27  
adhd.sd.general <- .53

Below, the power analysis suggests that 280 participants (140 with ADHD and 140 without ADHD) will result in over 80% power for the effects of ADHD, FOR, and their interaction with an alpha level of .05.

m <- c(adhd.mean.work, adhd.mean.general,  
 adhd.mean.work, adhd.mean.general,  
 nadhd.mean.work, nadhd.mean.general,  
 nadhd.mean.work, nadhd.mean.general) # means  
  
sd <- c(adhd.sd.work, adhd.sd.general,  
 adhd.sd.work, adhd.sd.general,  
 nadhd.sd.work, nadhd.sd.general,  
 nadhd.sd.work, nadhd.sd.general)  
  
design\_result <- ANOVA\_design(design = "2b\*2b\*2w",  
 n = 70, #conservative n, 140 in both ADHD and non-ADHD groups for 280 total participants  
 mu = m,  
 sd = sd,  
 r <- r.val,  
 label\_list = list(adhd = c("adhd", "nonadhd"),  
 presentation = c("work.first", "general.first"),  
 frame = c("work", "general")  
 ))



ANOVA\_exact(design\_result,verbose=F,alpha\_level = .05)

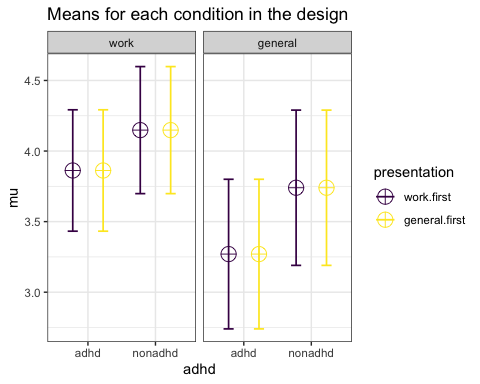
## Power and Effect sizes for ANOVA tests  
## power partial\_eta\_squared cohen\_f non\_centrality  
## adhd 99.9997 0.1338 0.3930 42.6342  
## presentation 5.0000 0.0000 0.0000 0.0000  
## adhd:presentation 5.0000 0.0000 0.0000 0.0000  
## frame 100.0000 0.5465 1.0977 332.5575  
## adhd:frame 99.6118 0.0723 0.2792 21.5141  
## presentation:frame 5.0000 0.0000 0.0000 0.0000  
## adhd:presentation:frame 5.0000 0.0000 0.0000 0.0000  
##   
## Power and Effect sizes for pairwise comparisons (t-tests)  
## power  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_work.first\_frame\_general 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_work 5.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 72.43  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 73.26  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 72.43  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 73.26  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_general 5.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 99.92  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 99.92  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general 100.00  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 72.43  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 73.26  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 72.43  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 73.26  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 99.92  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 99.92  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 100.00  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 5.00  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 99.75  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 99.75  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 5.00  
## p\_adhd\_nonadhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 100.00  
## effect\_size  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_work.first\_frame\_general -1.39  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_work 0.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general -1.42  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 0.44  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general -0.44  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.44  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.44  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_work 1.42  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_general 0.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 0.87  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 0.87  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general -1.39  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 0.44  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general -0.44  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.44  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.44  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 0.87  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 0.87  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general -0.80  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.00  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.81  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.81  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 0.00  
## p\_adhd\_nonadhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.80

If the difference in the effect of ADHD on scores in the work-specific vs. general items is smaller (i.e., a Cohen’s *d* closer to that observed in the general FOR items, or *d* > 0.435 when comparing ADHD vs. non-ADHD in the work-specific items), how many participants are needed?

For this sensitivity analysis, I’ll use Cohen’s *d* = 0.87\*0.75 = 0.65.

As shown below, this still results in over 80% power with 140 subjects and alpha = .05.

nadhd.mean.general <- 3.74  
nadhd.sd.general <- .55  
nadhd.sd.work <- .45  
r.val <- .49  
nadhd.mean.work.denom <- sqrt(((nadhd.sd.general^2)+(nadhd.sd.work^2))-(2\*r.val\*(nadhd.sd.general)\*(nadhd.sd.work)))  
cod.nadhd.work.general <- .797  
nadhd.mean.work.ls <- cod.nadhd.work.general\*nadhd.mean.work.denom  
nadhd.mean.work <- nadhd.mean.work.ls + nadhd.mean.general  
  
adhd.sd.work <- .43  
nadhd.n <- 140 #conservative n of 140 in each group  
adhd.n <- 140  
comp.denom <- sqrt((((nadhd.n-1)\*nadhd.sd.work^2) + ((adhd.n-1)\*adhd.sd.work^2))/(nadhd.n+adhd.n-2))  
cod.adhd.nadhd.work <- 0.65  
comp.ls <- cod.adhd.nadhd.work\*comp.denom  
adhd.mean.work <- nadhd.mean.work-comp.ls  
  
adhd.mean.general <- 3.27  
adhd.sd.general <- .53  
  
m <- c(adhd.mean.work, adhd.mean.general,  
 adhd.mean.work, adhd.mean.general,  
 nadhd.mean.work, nadhd.mean.general,  
 nadhd.mean.work, nadhd.mean.general) # means  
  
sd <- c(adhd.sd.work, adhd.sd.general,  
 adhd.sd.work, adhd.sd.general,  
 nadhd.sd.work, nadhd.sd.general,  
 nadhd.sd.work, nadhd.sd.general)  
  
design\_result <- ANOVA\_design(design = "2b\*2b\*2w",  
 n = 70, #conservative n, 140 in both ADHD and non-ADHD groups for 280 total participants  
 mu = m,  
 sd = sd,  
 r <- r.val,  
 label\_list = list(adhd = c("adhd", "nonadhd"),  
 presentation = c("work.first", "general.first"),  
 frame = c("work", "general")  
 ))

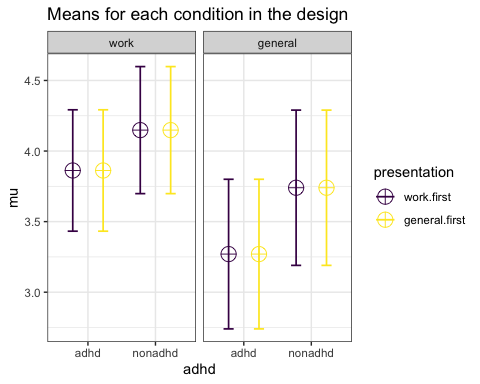


ANOVA\_exact(design\_result,verbose=F,alpha\_level = .05)

## Power and Effect sizes for ANOVA tests  
## power partial\_eta\_squared cohen\_f non\_centrality  
## adhd 100.0000 0.1679 0.4493 55.7048  
## presentation 5.0000 0.0000 0.0000 0.0000  
## adhd:presentation 5.0000 0.0000 0.0000 0.0000  
## frame 100.0000 0.5014 1.0028 277.5724  
## adhd:frame 86.2593 0.0329 0.1844 9.3800  
## presentation:frame 5.0000 0.0000 0.0000 0.0000  
## adhd:presentation:frame 5.0000 0.0000 0.0000 0.0000  
##   
## Power and Effect sizes for pairwise comparisons (t-tests)  
## power  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_work.first\_frame\_general 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_work 5.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 96.85  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 30.70  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 96.85  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 30.70  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_general 5.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 99.92  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 99.92  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general 100.00  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 96.85  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 30.70  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 96.85  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 30.70  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 99.92  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 99.92  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 100.00  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 5.00  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 99.75  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 99.75  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 5.00  
## p\_adhd\_nonadhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 100.00  
## effect\_size  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_work.first\_frame\_general -1.20  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_work 0.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general -1.23  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 0.65  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general -0.25  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.65  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.25  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_work 1.23  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_general 0.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 0.87  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 0.87  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general -1.20  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 0.65  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general -0.25  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.65  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.25  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 0.87  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 0.87  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general -0.80  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.00  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.81  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.81  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 0.00  
## p\_adhd\_nonadhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.80

Assuming a conservative effect size with a smaller sample size (n = 120 ADHD, n = 120 non-ADHD):

nadhd.mean.general <- 3.74  
nadhd.sd.general <- .55  
nadhd.sd.work <- .45  
r.val <- .49  
nadhd.mean.work.denom <- sqrt(((nadhd.sd.general^2)+(nadhd.sd.work^2))-(2\*r.val\*(nadhd.sd.general)\*(nadhd.sd.work)))  
cod.nadhd.work.general <- .797  
nadhd.mean.work.ls <- cod.nadhd.work.general\*nadhd.mean.work.denom  
nadhd.mean.work <- nadhd.mean.work.ls + nadhd.mean.general  
  
adhd.sd.work <- .43  
nadhd.n <- 120 #conservative n of 120 in each group  
adhd.n <- 120  
comp.denom <- sqrt((((nadhd.n-1)\*nadhd.sd.work^2) + ((adhd.n-1)\*adhd.sd.work^2))/(nadhd.n+adhd.n-2))  
cod.adhd.nadhd.work <- 0.65  
comp.ls <- cod.adhd.nadhd.work\*comp.denom  
adhd.mean.work <- nadhd.mean.work-comp.ls  
  
adhd.mean.general <- 3.27  
adhd.sd.general <- .53  
  
m <- c(adhd.mean.work, adhd.mean.general,  
 adhd.mean.work, adhd.mean.general,  
 nadhd.mean.work, nadhd.mean.general,  
 nadhd.mean.work, nadhd.mean.general) # means  
  
sd <- c(adhd.sd.work, adhd.sd.general,  
 adhd.sd.work, adhd.sd.general,  
 nadhd.sd.work, nadhd.sd.general,  
 nadhd.sd.work, nadhd.sd.general)  
  
design\_result <- ANOVA\_design(design = "2b\*2b\*2w",  
 n = 60, #conservative n, 140 in both ADHD and non-ADHD groups for 280 total participants  
 mu = m,  
 sd = sd,  
 r <- r.val,  
 label\_list = list(adhd = c("adhd", "nonadhd"),  
 presentation = c("work.first", "general.first"),  
 frame = c("work", "general")  
 ))



ANOVA\_exact(design\_result,verbose=F,alpha\_level = .05)

## Power and Effect sizes for ANOVA tests  
## power partial\_eta\_squared cohen\_f non\_centrality  
## adhd 100.0000 0.1683 0.4498 47.7470  
## presentation 5.0000 0.0000 0.0000 0.0000  
## adhd:presentation 5.0000 0.0000 0.0000 0.0000  
## frame 100.0000 0.5020 1.0041 237.9192  
## adhd:frame 80.6198 0.0329 0.1846 8.0400  
## presentation:frame 5.0000 0.0000 0.0000 0.0000  
## adhd:presentation:frame 5.0000 0.0000 0.0000 0.0000  
##   
## Power and Effect sizes for pairwise comparisons (t-tests)  
## power  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_work.first\_frame\_general 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_work 5.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 94.19  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 26.98  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 94.19  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 26.98  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_general 5.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 99.72  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 99.72  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general 100.00  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 94.19  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 26.98  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 94.19  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 26.98  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 99.72  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 100.00  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 99.72  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 100.00  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 5.00  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 99.29  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 99.29  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 5.00  
## p\_adhd\_nonadhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 100.00  
## effect\_size  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_work.first\_frame\_general -1.20  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_work 0.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general -1.23  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 0.65  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general -0.25  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.65  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.25  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_work 1.23  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_adhd\_presentation\_general.first\_frame\_general 0.00  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 0.87  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 0.87  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_adhd\_presentation\_general.first\_frame\_general -1.20  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 0.65  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general -0.25  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.65  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.25  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_work.first\_frame\_general 0.87  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 1.79  
## p\_adhd\_adhd\_presentation\_general.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 0.87  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_work.first\_frame\_general -0.80  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.00  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.81  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_work 0.81  
## p\_adhd\_nonadhd\_presentation\_work.first\_frame\_general\_adhd\_nonadhd\_presentation\_general.first\_frame\_general 0.00  
## p\_adhd\_nonadhd\_presentation\_general.first\_frame\_work\_adhd\_nonadhd\_presentation\_general.first\_frame\_general -0.80

# Simulate Data for Test Analysis

n <- rep(70, 8)  
  
m <- c(adhd.mean.work, adhd.mean.general,  
 adhd.mean.work, adhd.mean.general,  
 nadhd.mean.work, nadhd.mean.general,  
 nadhd.mean.work, nadhd.mean.general) # means  
  
sd <- c(adhd.sd.work, adhd.sd.general,  
 adhd.sd.work, adhd.sd.general,  
 nadhd.sd.work, nadhd.sd.general,  
 nadhd.sd.work, nadhd.sd.general)  
  
dp <- cbind(n,m,sd) # create rows of n/m/SD  
df <- apply(dp, 1, function(x) rnorm(x[1],x[2],x[3])) # generate data based on each row of dp  
df <- data.frame(df)  
colnames(df) <- c("adhd.work.wf", "adhd.general.wf",   
 "adhd.work.gf", "adhd.general.gf",  
 "nadhd.work.wf", "nadhd.general.wf",   
 "nadhd.work.gf", "nadhd.general.gf")  
consc.df <- stack(df) %>%  
 mutate(adhd = factor(if\_else(str\_starts(ind, "nadhd"), "NO ADHD", "ADHD"),  
 levels = c("NO ADHD", "ADHD")),  
 presentation = factor(if\_else(str\_detect(ind,"gf"), "general.first", "work.first"),  
 levels = c("general.first", "work.first")),  
 frame = factor(if\_else(str\_detect(ind, "work"), "work.scores", "general.scores"),  
 levels = c("general.scores", "work.scores"))) %>%   
 group\_by(frame) %>%   
 mutate(pnum = 1:(sum(n)/2))%>%   
 arrange(pnum) %>%   
 ungroup()  
  
cod.tmp <- consc.df %>%   
 filter(frame=="general.scores") %>%   
 cohens\_d(values~adhd)  
cat(paste0("Effect of ADHD on general scores: ", scales::number(cod.tmp$effsize[1], accuracy = .01)))

Effect of ADHD on general scores: 0.72

cat(" \n")

cod.tmp<- consc.df %>%   
 filter(frame=="work.scores") %>%   
 cohens\_d(values~adhd)  
cat(paste0("Effect of ADHD on work scores: ", scales::number(cod.tmp$effsize[1], accuracy = .01)))

Effect of ADHD on work scores: 0.60

cat(" \n")

cod.tmp <- consc.df %>%   
 dplyr::filter(adhd=="ADHD") %>%  
 cohens\_d(values ~ frame, paired = T)  
cat(paste0("Effect FOR on ADHD participants' scores: ", scales::number(cod.tmp$effsize[1], accuracy = .01)))

Effect FOR on ADHD participants’ scores: -0.90

cat(" \n")

cod.tmp <- consc.df %>%   
 dplyr::filter(adhd=="NO ADHD") %>%  
 cohens\_d(values ~ frame, paired = T)  
cat(paste0("Effect FOR on non-ADHD participants' scores: ", scales::number(cod.tmp$effsize[1], accuracy = .01)))

Effect FOR on non-ADHD participants’ scores: -0.65

cat(" \n")

Run the ANOVA:

p\_load(afex,lsmeans)  
  
  
model <- aov\_ez(consc.df,   
 id="pnum",   
 dv="values",   
 within="frame",  
 between = c("adhd","presentation"))

## Contrasts set to contr.sum for the following variables: adhd, presentation

summary(model)

##   
## Univariate Type III Repeated-Measures ANOVA Assuming Sphericity  
##   
## Sum Sq num Df Error SS den Df F value Pr(>F)   
## (Intercept) 7843.7 1 64.724 276 33447.4186 < 2.2e-16 \*\*\*  
## adhd 14.7 1 64.724 276 62.8520 5.551e-14 \*\*\*  
## presentation 0.0 1 64.724 276 0.1750 0.6760   
## adhd:presentation 0.3 1 64.724 276 1.4545 0.2288   
## frame 40.9 1 68.264 276 165.2800 < 2.2e-16 \*\*\*  
## adhd:frame 0.6 1 68.264 276 2.5076 0.1144   
## presentation:frame 0.4 1 68.264 276 1.7216 0.1906   
## adhd:presentation:frame 0.0 1 68.264 276 0.1668 0.6833   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

#no effect of presentation order--drop the factor  
model <- aov\_ez(consc.df,   
 id="pnum",   
 dv="values",   
 within="frame",  
 between = c("adhd"))

## Contrasts set to contr.sum for the following variables: adhd

summary(model)

##   
## Univariate Type III Repeated-Measures ANOVA Assuming Sphericity  
##   
## Sum Sq num Df Error SS den Df F value Pr(>F)   
## (Intercept) 7843.7 1 65.106 278 33492.0512 < 2.2e-16 \*\*\*  
## adhd 14.7 1 65.106 278 62.9359 5.255e-14 \*\*\*  
## frame 40.9 1 68.731 278 165.3463 < 2.2e-16 \*\*\*  
## adhd:frame 0.6 1 68.731 278 2.5087 0.1144   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1