W241 Final Project | Decoding Game of Thrones

The Effect of Gender Expression on Information Uptake

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0.0 | Abstract

1.0 | Introduction and Literature Review

1.1 | Research Hypothesis

2.0 | Experiment Design

3.0 | Primary Analysis 1: Two-Group

Individual Values Plot

```
ggplot(e1, aes(x = as.factor(Same_Gen), y = Total_Scaled)) +
  geom_boxplot(color="black", fill="gray", position=position_dodge(1)) +
  stat_boxplot(geom ='errorbar') +
  geom_jitter(aes(x = as.factor(Same_Gen), y = Total_Scaled, fill=as.factor(G_s)),
              size=3, color="black", pch=21, position=position_jitter(0.1)) +
  scale_x_discrete(labels= c("Same-Gender Instructor", "Opposite-Gender Instructor")) +
  labs(title = "Experiment Design 1: Two-Group", subtitle = "All Subjects") +
  labs(y = "Total Phase I Score (Scaled)", x = "Treatment Condition") +
  scale_fill_discrete(name = "Student Gender", labels = c("Female", "Male"))
```

Hypothesis Testing

```
#calculate group distributions
same_gender_group <- e1[Same_Gen == 0, Total_Scaled, ]
mixed_gender_group <- e1[Same_Gen == 1, Total_Scaled, ]
```

```
t.test(same_gender_group, mixed_gender_group)
```

```
##
##  Welch Two Sample t-test
##
## data:  same_gender_group and mixed_gender_group
## t = -0.10149, df = 221.53, p-value = 0.9192
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -4.557389  4.110960
## sample estimates:
## mean of x mean of y
##  80.24554  80.46875
```

```
pwr.t2n.test(n1=length(same_gender_group), n2=length(mixed_gender_group), d=effect(same_gender_group,mi
```

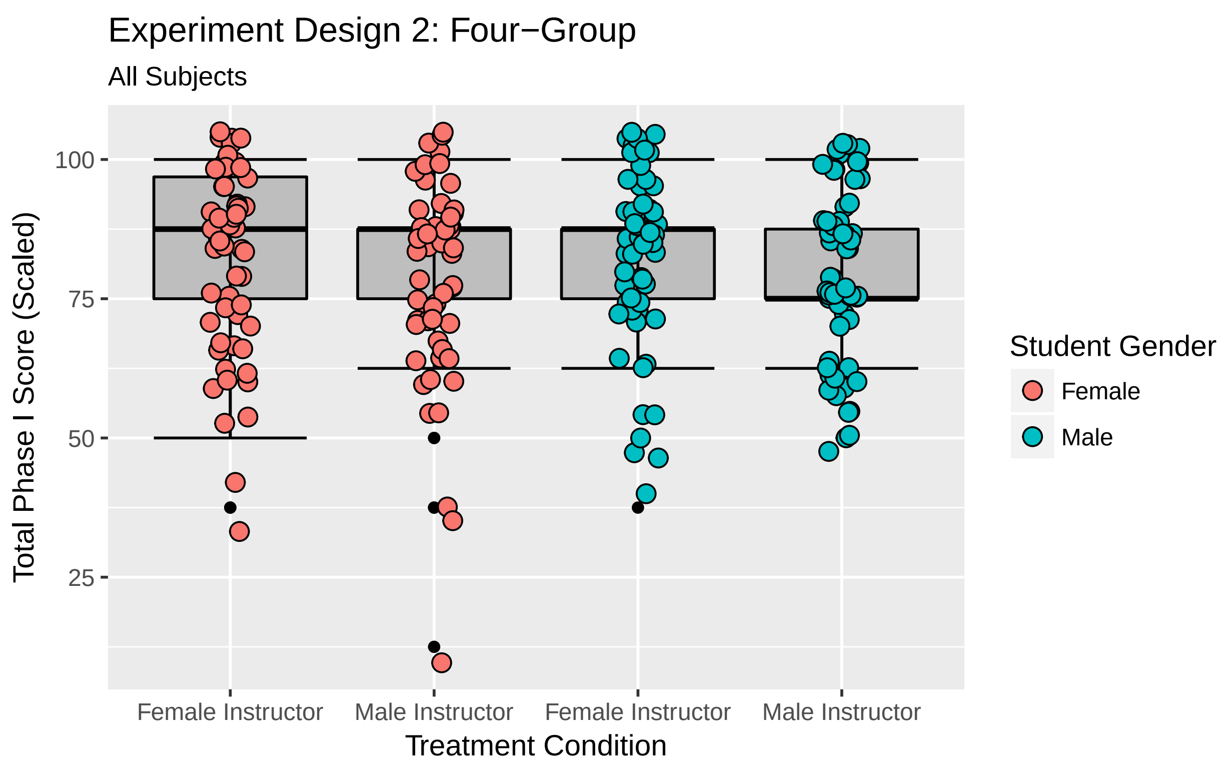
```
##
##      t test power calculation
##
##              n1 = 112
```

```
##              n2 = 112
##               d = 0.01359298
##       sig.level = 0.05
##           power = 0.05117589
##     alternative = two.sided
```

3.1 | Primary Analysis 2: Four-Group

Individual Values Plot

```
ggplot(e1, aes(x = as.factor(PA_2), y = Total_Scaled)) +
  geom_boxplot(color="black", fill="gray", position=position_dodge(1)) +
  stat_boxplot(geom ='errorbar') +
  geom_jitter(aes(x = as.factor(PA_2), y = Total_Scaled, fill=as.factor(G_s)),
              size=3, color="black", pch=21, position=position_jitter(0.1)) +
  scale_x_discrete(labels= c("Female Instructor", "Male Instructor",
                             "Female Instructor", "Male Instructor")) +
  labs(title = "Experiment Design 2: Four-Group", subtitle = "All Subjects") +
  labs (y = "Total Phase I Score (Scaled)",
        x = "Treatment Condition") +
  scale_fill_discrete(name = "Student Gender", labels = c("Female", "Male"))
```



Hypothesis Testing

```r
#calculate group distributions
FF_group <- e1[FF == 1, Total_Scaled, ]
FM_group <- e1[FM == 1, Total_Scaled, ]
MF_group <- e1[MF == 1, Total_Scaled, ]
MM_group <- e1[MM == 1, Total_Scaled, ]
```

```r
t.test(FF_group, FM_group, paired = TRUE, alternative = "two.sided")
```

```
##
##  Paired t-test
##
## data:  FF_group and FM_group
## t = 0.85695, df = 53, p-value = 0.3953
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -4.034115 10.052633
## sample estimates:
## mean of the differences
##                3.009259
```

```r
pwr.t.test(n=length(FF_group), d=effect(FF_group, FM_group), type = "paired")
```

```
##
##      Paired t test power calculation
##
##               n = 54
##               d = 0.1729021
##       sig.level = 0.05
##           power = 0.2387907
##     alternative = two.sided
##
## NOTE: n is number of *pairs*
```

```r
t.test(MF_group, MM_group, paired = TRUE, alternative = "two.sided")
```

```
##
##  Paired t-test
##
## data:  MF_group and MM_group
## t = 0.97569, df = 57, p-value = 0.3333
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -2.494825  7.236205
## sample estimates:
## mean of the differences
##                 2.37069
```

```r
pwr.t.test(n=length(MF_group), d=effect(MF_group, MM_group), type = "paired")
```

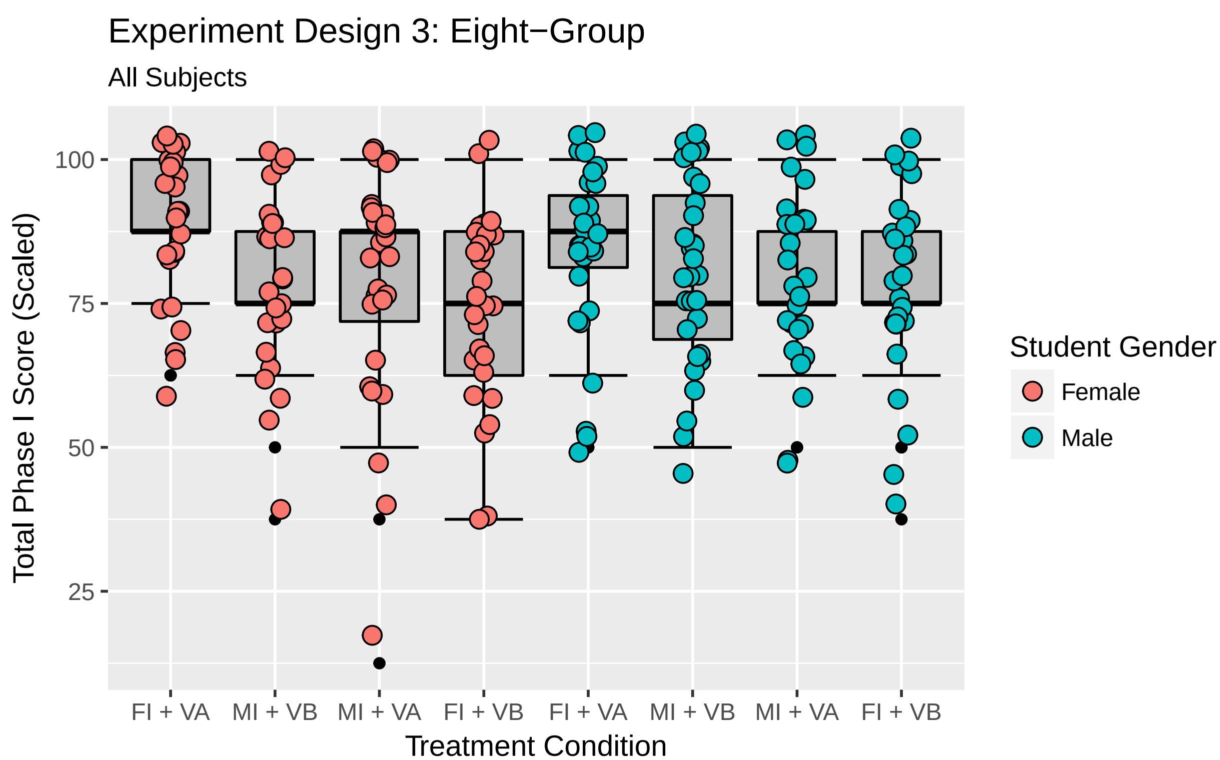
```
##
```

```
##      Paired t test power calculation
##
##               n = 58
##               d = 0.1529052
##       sig.level = 0.05
##           power = 0.2084785
##     alternative = two.sided
##
## NOTE: n is number of *pairs*
```

3.2 | Primary Analysis 3: Eight-Group

Individual Values Plot

```
ggplot(e1, aes(x = as.factor(PA_3), y = Total_Scaled)) +
  geom_boxplot(color="black", fill="gray", position=position_dodge(1)) +
  stat_boxplot(geom ='errorbar') +
  geom_jitter(aes(x = as.factor(PA_3), y = Total_Scaled,
                  fill=as.factor(G_s)), size=3, color="black", pch=21,
              position=position_jitter(0.1)) +
  scale_x_discrete(labels= c("FI + VA", "MI + VB","MI + VA", "FI + VB",
                             "FI + VA", "MI + VB","MI + VA", "FI + VB")) +
  labs(title = "Experiment Design 3: Eight-Group", subtitle = "All Subjects") +
  labs (y = "Total Phase I Score (Scaled)",
        x = "Treatment Condition") +
  scale_fill_discrete(name = "Student Gender", labels = c("Female", "Male"))
```



Hypothesis Testing

```r
#calculate group distributions
FFA_group <- e1[FFA == 1, Total_Scaled, ]
FMB_group <- e1[FMB == 1, Total_Scaled, ]
FMA_group <- e1[FMA == 1, Total_Scaled, ]
FFB_group <- e1[FFB == 1, Total_Scaled, ]
MFA_group <- e1[MFA == 1, Total_Scaled, ]
MMB_group <- e1[MMB == 1, Total_Scaled, ]
MMA_group <- e1[MMA == 1, Total_Scaled, ]
MFB_group <- e1[MFB == 1, Total_Scaled, ]
Not_FFA_group <- e1[FFA != 1, Total_Scaled, ]
```

```r
t.test(FFA_group, FMB_group, paired = TRUE, alternative = "two.sided")
```

```
##
##  Paired t-test
##
## data:  FFA_group and FMB_group
## t = 3.2022, df = 25, p-value = 0.003696
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##   3.774281 17.379565
## sample estimates:
## mean of the differences
##                10.57692
```

```r
pwr.t.test(n=length(FFA_group), d=effect(FFA_group,FMB_group), type = "paired")
```

```
##
##      Paired t test power calculation
##
##               n = 26
##               d = 0.6973988
##       sig.level = 0.05
##           power = 0.9273691
##     alternative = two.sided
##
## NOTE: n is number of *pairs*
```

```r
t.test(FMA_group, FFB_group, paired = TRUE, alternative = "two.sided")
```

```
##
##  Paired t-test
##
## data:  FMA_group and FFB_group
## t = 1.1214, df = 27, p-value = 0.272
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -3.333396 11.369110
```

```
## sample estimates:
## mean of the differences
##                4.017857
```

```r
pwr.t.test(n=length(FMA_group), d=effect(FMA_group,FFB_group), type = "paired")
```

```
##
##      Paired t test power calculation
##
##               n = 28
##               d = 0.2153292
##       sig.level = 0.05
##           power = 0.1957883
##     alternative = two.sided
##
## NOTE: n is number of *pairs*
```

```r
t.test(MFA_group, MMB_group, paired = TRUE, alternative = "two.sided")
```

```
##
##  Paired t-test
##
## data:  MFA_group and MMB_group
## t = 1.3975, df = 30, p-value = 0.1725
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -2.232504 11.909923
## sample estimates:
## mean of the differences
##                 4.83871
```

```r
pwr.t.test(n=length(MFA_group), d=effect(MFA_group,MMB_group), type = "paired")
```

```
##
##      Paired t test power calculation
##
##               n = 31
##               d = 0.3100285
##       sig.level = 0.05
##           power = 0.3864208
##     alternative = two.sided
##
## NOTE: n is number of *pairs*
```

```r
t.test(MMA_group, MFB_group, paired = TRUE, alternative = "two.sided")
```

```
##
##  Paired t-test
##
## data:  MMA_group and MFB_group
## t = 0.13746, df = 26, p-value = 0.8917
```

```
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -6.460008  7.385934
## sample estimates:
## mean of the differences
##                0.462963
```

```r
pwr.t.test(n=length(MMA_group), d=effect(MMA_group,MFB_group), type = "paired")
```

```
##
##      Paired t test power calculation
##
##               n = 27
##               d = 0.03008682
##       sig.level = 0.05
##           power = 0.05260382
##     alternative = two.sided
##
## NOTE: n is number of *pairs*
```

```r
t.test(FFA_group, Not_FFA_group)
```

```
##
##  Welch Two Sample t-test
##
## data:  FFA_group and Not_FFA_group
## t = 3.4807, df = 36.706, p-value = 0.001308
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##   4.057041 15.367978
## sample estimates:
## mean of x mean of y
##  88.94231  79.22980
```

```r
pwr.t2n.test(n1=length(FFA_group), n2=length(Not_FFA_group), d=effect(FFA_group,Not_FFA_group))
```

```
##
##      t test power calculation
##
##              n1 = 26
##              n2 = 198
##               d = 0.5914583
##       sig.level = 0.05
##           power = 0.8059823
##     alternative = two.sided
```

Regression Analysis

```r
# fit regression models
m3c1 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e1)
m3c2 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA + IFE_Scaled, data = e1)
m3c3 <- lm(Total_Perf ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e1)

# output results
reg_rse_3(m3c1, m3c2, m3c3, "Experiment Design 3: Eight-Group")
```

Table 1: Experiment Design 3: Eight-Group

	Dependent variable:		
	Total_Scaled		Total_Perf
	(1)	(2)	(3)
FFA	9.776^{**}	6.035^{**}	5.976
	(4.103)	(2.410)	(4.103)
FMB	−0.801	-4.542^{*}	2.569
	(4.466)	(2.420)	(4.466)
FMA	−1.042	3.093	−4.842
	(5.044)	(2.519)	(5.044)
FFB	−5.060	−0.925	−1.690
	(4.567)	(2.537)	(4.567)
MFA	5.511	3.147	2.711
	(4.167)	(2.572)	(4.167)
MMB	0.672	−1.692	0.672
	(4.369)	(2.506)	(4.369)
MMA	0.463	0.463	−2.337
	(4.308)	(2.530)	(4.308)
IFE_Scaled		0.986^{***}	
		(0.060)	
Constant	79.167^{***}	0.396	−0.363
	(3.189)	(5.283)	(3.189)
Type of Std. Error	Robust	Robust	Robust
Observations	224	224	224
R^2	0.065	0.681	0.038
Adjusted R^2	0.034	0.669	0.006
Residual Std. Error	16.136 (df = 216)	9.444 (df = 215)	16.136 (df = 216)
F Statistic	2.135^{**} (df = 7; 216)	57.411^{***} (df = 8; 215)	1.205 (df = 7; 216)
Note:			*p<0.1; **p<0.05; ***p<0.01

```r
# fit regression models
m3f1 <- lm(Total_Scaled ~ FFA, data = e1)
m3f2 <- lm(Total_Scaled ~ FFA + IFE_Scaled, data = e1)
m3f3 <- lm(Total_Perf ~ FFA, data = e1)

# output results
reg_rse_3(m3f1, m3f2, m3f3, "Experiment Design 3: Female Students/Female Instructor/Video A")
```

Table 2: Experiment Design 3: Female Students/Female Instructor/Video A

	Dependent variable:		
	Total_Scaled		Total_Perf
	(1)	(2)	(3)
FFA	9.713***	6.089***	6.351**
	(2.837)	(1.800)	(2.835)
IFE_Scaled		0.971***	
		(0.059)	
Constant	79.230***	1.590	−0.739
	(1.177)	(5.103)	(1.172)
Type of Std. Error	Robust	Robust	Robust
Observations	224	224	224
R^2	0.036	0.661	0.016
Adjusted R^2	0.032	0.658	0.011
Residual Std. Error	16.159 (df = 222)	9.606 (df = 221)	16.095 (df = 222)
F Statistic	8.303*** (df = 1; 222)	215.308*** (df = 2; 221)	3.578* (df = 1; 222)
Note:			*p<0.1; **p<0.05; ***p<0.01

4.1 | Secondary Analyses

Student Subgroup

```r
# create student subset
e_student <- subset(e1, e == 1)
dim(e_student)
```

```
## [1] 120  59
```

```r
# fit regression models
m4a1 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e_student)
m4a2 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA + IFE_Scaled, data = e_student)
m4a3 <- lm(Total_Perf ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e_student)

# output results
reg_rse_3(m4a1, m4a2, m4a3, "Subgroup Analysis: Students")
```

Table 3: Subgroup Analysis: Students

	Dependent variable:		
	Total_Scaled		Total_Perf
	(1)	(2)	(3)
FFA	8.929*	7.103**	5.129
	(4.649)	(3.033)	(4.649)
FMB	−4.464	−6.290**	−1.094
	(5.154)	(3.040)	(5.154)
FMA	−5.469	1.116	−9.269
	(7.214)	(3.758)	(7.214)
FFB	−7.031	−0.446	−3.661
	(5.586)	(3.740)	(5.586)
MFA	0.000	0.830	−2.800
	(6.121)	(3.484)	(6.121)
MMB	−2.679	−1.849	−2.679
	(5.760)	(3.424)	(5.760)
MMA	0.781	0.781	−2.019
	(5.266)	(3.405)	(5.266)
IFE_Scaled		0.992***	
		(0.096)	
Constant	81.250***	0.295	1.720
	(3.727)	(8.438)	(3.727)
Type of Std. Error	Robust	Robust	Robust
Observations	120	120	120
R^2	0.080	0.693	0.054
Adjusted R^2	0.022	0.671	−0.005
Residual Std. Error	16.205 (df = 112)	9.405 (df = 111)	16.205 (df = 112)
F Statistic	1.390 (df = 7; 112)	31.302*** (df = 8; 111)	0.919 (df = 7; 112)

Note: *p<0.1; **p<0.05; ***p<0.01

Under 30 Subgroup

```
# create under 30 subset
e_young <- subset(e1, b == 1 | b == 2)
dim(e_young)
```

```
## [1] 90 59
```

```
# fit regression models
m4b1 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e_young)
m4b2 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA + IFE_Scaled, data = e_young)
m4b3 <- lm(Total_Perf ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e_young)

# output results
reg_rse_3(m4b1, m4b2, m4b3, "Subgroup Analysis: Under 30 Years Old")
```

Over 30 Subgroup

```
# create over 30 subset
e_old <- subset(e1, b == 3 | b == 4 | b == 5)
dim(e_old)
```

```
## [1] 134  59
```

```
# fit regression models
m4c1 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e_old)
m4c2 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA + IFE_Scaled, data = e_old)
m4c3 <- lm(Total_Perf ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e_old)

# output results
reg_rse_3(m4c1, m4c2, m4c3, "Subgroup Analysis: Over 30 Years Old")
```

Highly Educated Subgroup

```
# create highly educated subset
e_edu <- subset(e1, f == 6 | f == 7)
dim(e_edu)
```

```
## [1] 148  59
```

```
# fit regression models
m4d1 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e_edu)
m4d2 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA + IFE_Scaled, data = e_edu)
m4d3 <- lm(Total_Perf ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e_edu)

# output results
reg_rse_3(m4d1, m4d2, m4d3, "Subgroup Analysis: Highly Educated")
```

Table 4: Subgroup Analysis: Under 30 Years Old

	Dependent variable:		
	Total_Scaled		Total_Perf
	(1)	(2)	(3)
FFA	4.773	3.750	0.973
	(6.426)	(4.145)	(6.426)
FMB	−7.727	−8.750**	−4.357
	(6.895)	(4.145)	(6.895)
FMA	−11.250	−3.750	−15.050
	(10.623)	(5.397)	(10.623)
FFB	−8.750	−1.250	−5.380
	(8.618)	(5.397)	(8.618)
MFA	−2.857	−0.714	−5.657
	(6.364)	(3.958)	(6.364)
MMB	−6.429	−4.286	−6.429
	(7.015)	(3.958)	(7.015)
MMA	−5.000	−5.000	−7.800
	(7.607)	(4.497)	(7.607)
IFE_Scaled		1.000***	
		(0.111)	
Constant	85.000***	2.500	5.470
	(5.122)	(10.031)	(5.122)
Type of Std. Error	Robust	Robust	Robust
Observations	90	90	90
R^2	0.072	0.708	0.064
Adjusted R^2	−0.007	0.679	−0.016
Residual Std. Error	17.643 (df = 82)	9.960 (df = 81)	17.643 (df = 82)
F Statistic	0.914 (df = 7; 82)	24.545*** (df = 8; 81)	0.805 (df = 7; 82)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 5: Subgroup Analysis: Over 30 Years Old

	Dependent variable:		
	Total_Scaled		Total_Perf
	(1)	(2)	(3)
FFA	12.598**	7.310**	8.798
	(5.472)	(3.098)	(5.472)
FMB	3.431	−1.857	6.801
	(6.053)	(3.137)	(6.053)
FMA	4.820	7.024***	1.020
	(5.446)	(2.583)	(5.446)
FFB	−2.819	−0.615	0.551
	(5.449)	(2.703)	(5.449)
MFA	11.029**	5.670	8.229
	(5.627)	(3.731)	(5.627)
MMB	5.147	−0.212	5.147
	(5.697)	(3.553)	(5.697)
MMA	3.676	3.676	0.876
	(5.346)	(3.122)	(5.346)
IFE_Scaled		0.972***	
		(0.068)	
Constant	75.735***	−0.369	−3.795
	(4.055)	(5.926)	(4.055)
Type of Std. Error	Robust	Robust	Robust
Observations	134	134	134
R^2	0.094	0.678	0.051
Adjusted R^2	0.043	0.658	−0.002
Residual Std. Error	15.318 (df = 126)	9.162 (df = 125)	15.318 (df = 126)
F Statistic	1.859* (df = 7; 126)	32.945*** (df = 8; 125)	0.970 (df = 7; 126)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 6: Subgroup Analysis: Highly Educated

	Dependent variable:		
	Total_Scaled		Total_Perf
	(1)	(2)	(3)
FFA	7.341	4.924	3.541
	(5.562)	(3.080)	(5.562)
FMB	1.091	−1.326	4.461
	(5.915)	(3.084)	(5.915)
FMA	−6.548	1.395	−10.348
	(7.006)	(3.212)	(7.006)
FFB	−5.853	2.089	−2.483
	(5.603)	(3.200)	(5.603)
MFA	2.307	1.530	−0.493
	(5.445)	(2.901)	(5.445)
MMB	1.786	1.009	1.786
	(5.500)	(2.898)	(5.500)
MMA	1.786	1.786	−1.014
	(6.135)	(3.328)	(6.135)
IFE_Scaled		0.995***	
		(0.075)	
Constant	79.464***	−1.339	−0.066
	(4.429)	(6.694)	(4.429)
Type of Std. Error	Robust	Robust	Robust
Observations	148	148	148
R^2	0.066	0.688	0.068
Adjusted R^2	0.019	0.671	0.021
Residual Std. Error	16.241 (df = 140)	9.413 (df = 139)	16.241 (df = 140)
F Statistic	1.414 (df = 7; 140)	38.401*** (df = 8; 139)	1.455 (df = 7; 140)

Note: *p<0.1; **p<0.05; ***p<0.01

Native English Speaker Subgroup

```r
# create native English speaker subset
e_eng <- subset(e1, d == 1)
dim(e_eng)
```

```
## [1] 164  59
```

```r
# fit regression models
m4e1 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e_eng)
m4e2 <- lm(Total_Scaled ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA + IFE_Scaled, data = e_eng)
m4e3 <- lm(Total_Perf ~ FFA + FMB + FMA + FFB + MFA + MMB + MMA, data = e_eng)

# output results
reg_rse_3(m4e1, m4e2, m4e3, "Subgroup Analysis: Native English Speakers")
```

Appendix

Exploratory Data Analysis 1

```r
summary(e1$Total_Perf)
```

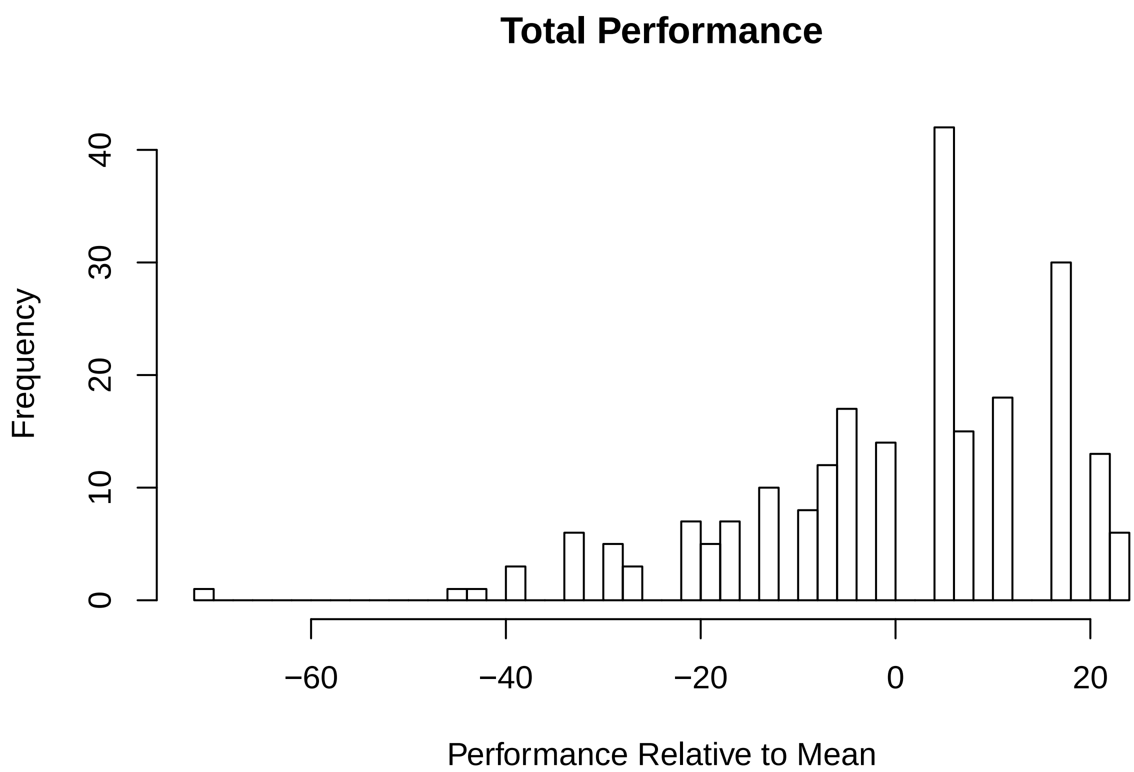
```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -70.83000  -8.33000   4.17000  -0.00152  11.34000  23.84000
```

```r
hist(e1$Total_Perf, breaks = 50,
     main = "Total Performance",
     xlab = "Performance Relative to Mean")
```

Table 7: Subgroup Analysis: Native English Speakers

	Dependent variable:		
	Total_Scaled		Total_Perf
	(1)	(2)	(3)
FFA	8.260	6.703**	4.460
	(5.296)	(3.046)	(5.296)
FMB	−0.950	−2.508	2.420
	(5.503)	(3.050)	(5.503)
FMA	−3.770	4.390	−7.570
	(6.479)	(3.121)	(6.479)
FFB	−7.341	0.818	−3.971
	(5.846)	(3.156)	(5.846)
MFA	3.299	3.901	0.499
	(5.335)	(3.031)	(5.335)
MMB	0.694	1.297	0.694
	(5.472)	(2.956)	(5.472)
MMA	2.778	2.778	−0.022
	(5.524)	(3.347)	(5.524)
IFE_Scaled		0.991***	
		(0.069)	
Constant	80.556***	−1.337	1.026
	(4.188)	(6.376)	(4.188)
Type of Std. Error	Robust	Robust	Robust
Observations	164	164	164
R^2	0.065	0.701	0.042
Adjusted R^2	0.023	0.686	−0.001
Residual Std. Error	17.006 (df = 156)	9.641 (df = 155)	17.006 (df = 156)
F Statistic	1.551 (df = 7; 156)	45.517*** (df = 8; 155)	0.987 (df = 7; 156)

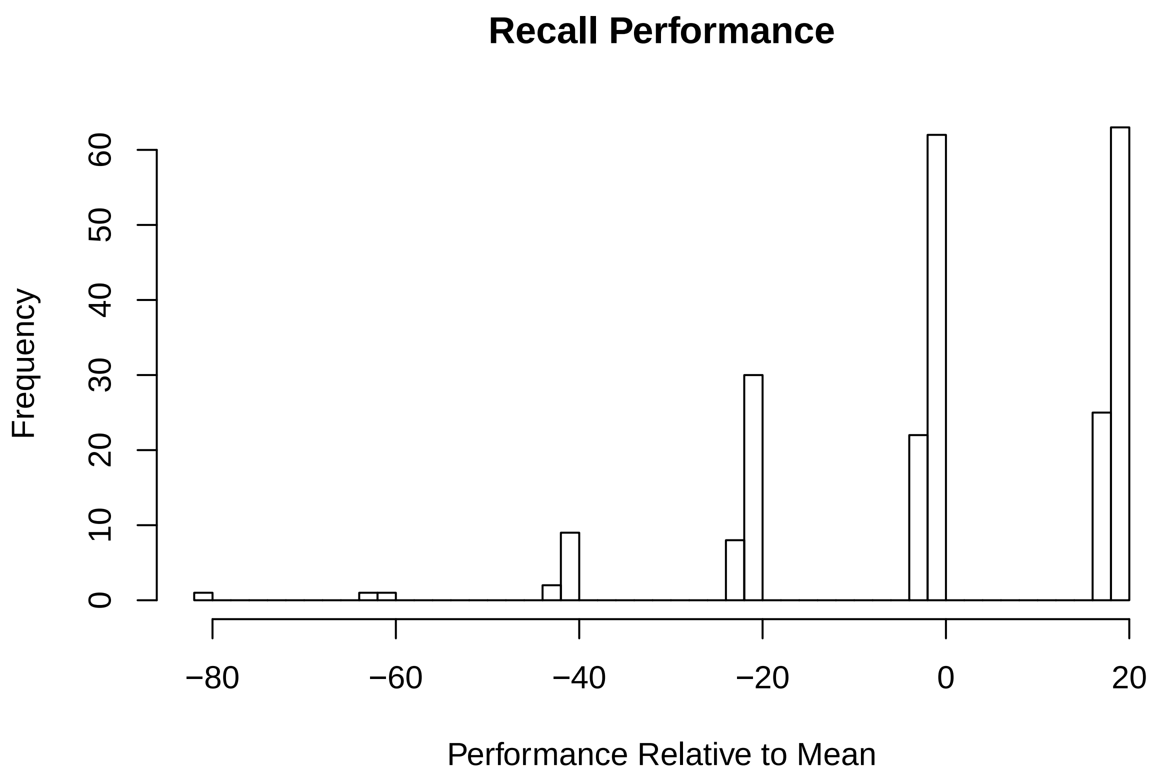
Note: *p<0.1; **p<0.05; ***p<0.01




```
summary(e1$Recall_Perf)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -81.07000  -3.45000  -1.07000  -0.07982  18.62000  19.26000
```

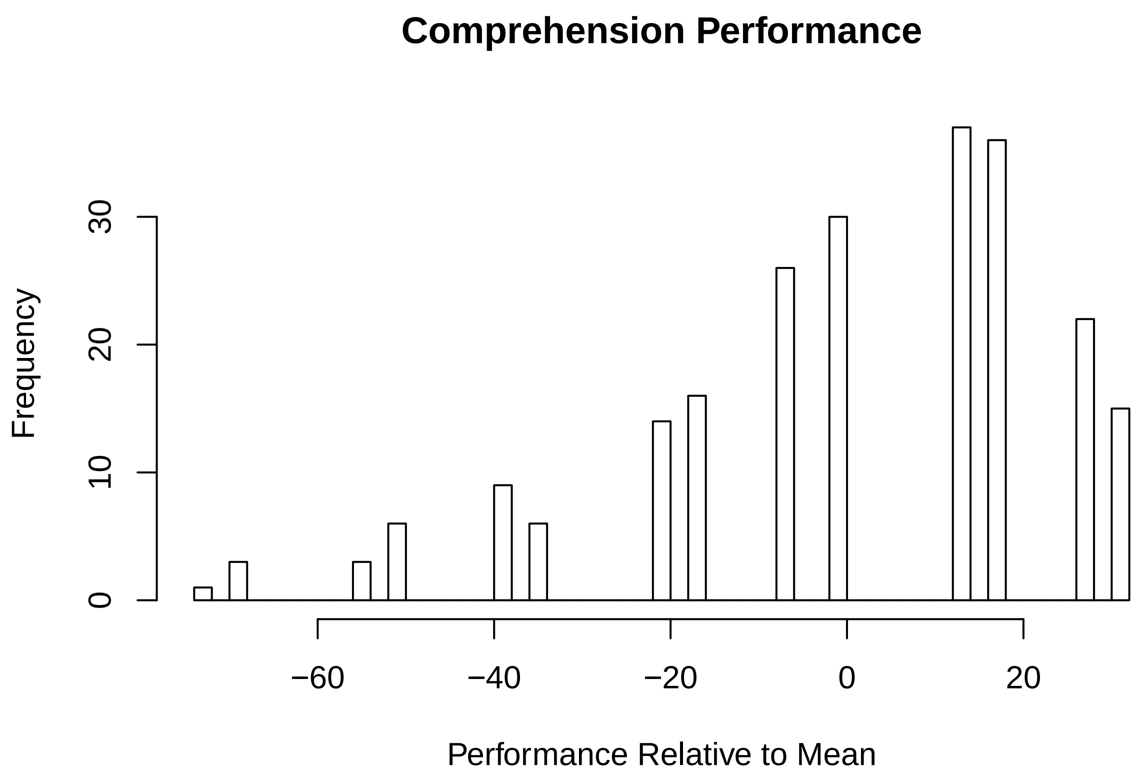
```
hist(e1$Recall_Perf, breaks = 50,
     main = "Recall Performance",
     xlab = "Performance Relative to Mean")
```




```r
summary(e1$Comp_Perf)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -72.99000 -17.24000  -1.85000   0.00071  16.09000  31.48000
```

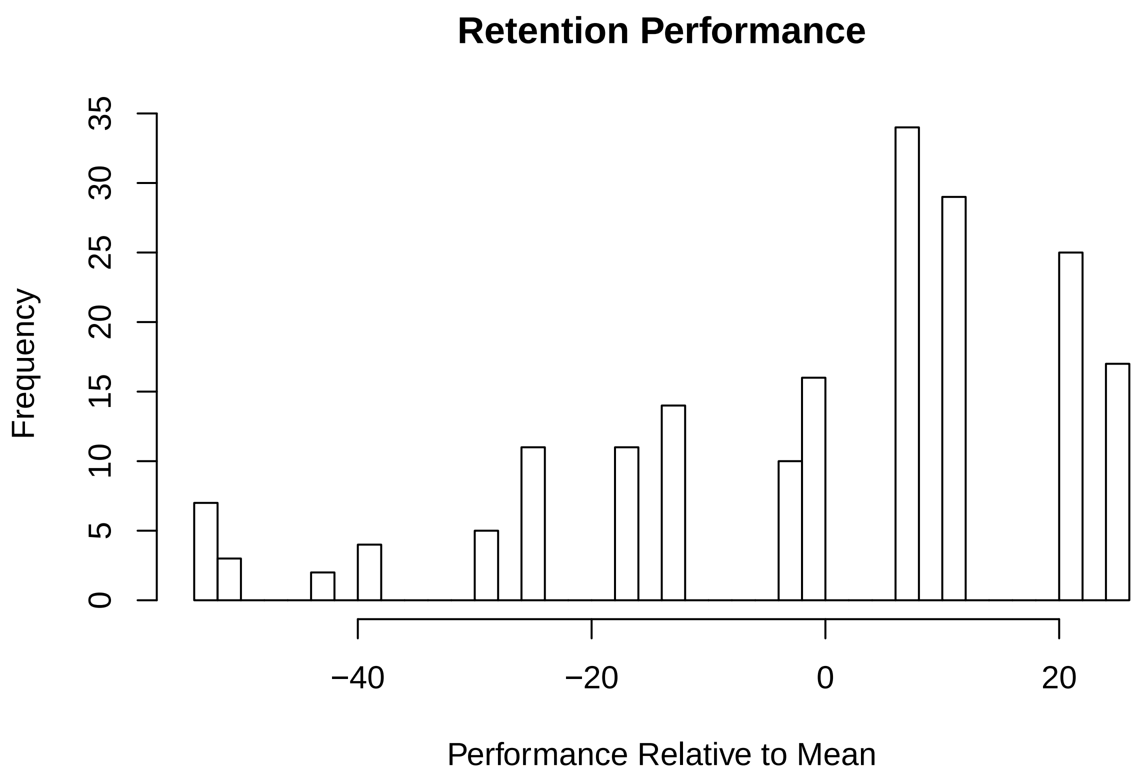
```r
hist(e1$Comp_Perf, breaks = 50,
     main = "Comprehension Performance",
     xlab = "Performance Relative to Mean")
```




```r
summary(e2$Ret_Perf)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max. 
## -53.19150 -13.29790   7.97870  -0.00002  11.70210  25.00000
```

```r
hist(e2$Ret_Perf, breaks = 50,
     main = "Retention Performance",
     xlab = "Performance Relative to Mean")
```




```r
# fit regression models
m0a <- lm(Total_Perf ~ G_s, data = e1)
m0b <- lm(Total_Perf ~ G_i, data = e1)
m0c <- lm(Total_Perf ~ G_s + G_i, data = e1)
m0d <- lm(Total_Perf ~ G_s*G_i, data = e1)

# output results
reg_rse_4(m0a, m0b, m0c, m0d, "Preliminary Models")
```

Primary Analysis 1: Two-Group Regression Anlysis

```r
# fit regression models
m2a1 <- lm(Total_Scaled ~ Same_Gen, data = e1)
m2a2 <- lm(Total_Scaled ~ Same_Gen + IFE_Scaled, data = e1)
m2a3 <- lm(Total_Perf ~ Same_Gen, data = e1)

# output results
reg_rse_3(m2a1, m2a2, m2a3, "Experiment Design 1: Two Groups")
```

```r
# fit regression models
m2b1 <- lm(Recall_Scaled ~ Same_Gen, data = e1)
m2b2 <- lm(Recall_Scaled ~ Same_Gen + IFE_Scaled, data = e1)
m2b3 <- lm(Recall_Perf ~ Same_Gen, data = e1)

# output results
reg_rse_3(m2b1, m2b2, m2b3, "Experiment Design 1: Two Groups (Recall)")
```

Table 8: Preliminary Models

	Dependent variable:			
	Total_Perf			
	(1)	(2)	(3)	(4)
G_s	−0.004		−0.004	−1.649
	(2.187)		(2.189)	(6.736)
G_i		−2.707	−2.707	−4.372
		(2.170)	(2.180)	(7.222)
G_s:G_i				1.097
				(4.397)
Constant	0.004	4.058	4.064	6.562
	(3.593)	(3.330)	(4.586)	(10.910)
Type of Std. Error	Robust	Robust	Robust	Robust
Observations	224	224	224	224
R^2	0.000	0.007	0.007	0.007
Adjusted R^2	−0.005	0.003	−0.002	−0.006
Residual Std. Error	16.224 (df = 222)	16.167 (df = 222)	16.204 (df = 221)	16.238 (df = 220)
F Statistic	0.00000 (df = 1; 222)	1.569 (df = 1; 222)	0.781 (df = 2; 221)	0.540 (df = 3; 220)
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 9: Experiment Design 1: Two Groups

	Dependent variable:		
	Total_Scaled		Total_Perf
	(1)	(2)	(3)
Same_Gen	0.223	0.223	0.451
	(2.209)	(1.322)	(2.178)
IFE_Scaled		0.984***	
		(0.060)	
Constant	80.246***	1.140	−0.227
	(1.598)	(5.236)	(1.603)
Type of Std. Error	Robust	Robust	Robust
Observations	224	224	224
R^2	0.00005	0.647	0.0002
Adjusted R^2	−0.004	0.644	−0.004
Residual Std. Error	16.458 (df = 222)	9.803 (df = 221)	16.223 (df = 222)
F Statistic	0.010 (df = 1; 222)	202.381*** (df = 2; 221)	0.043 (df = 1; 222)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 10: Experiment Design 1: Two Groups (Recall)

	Dependent variable:		
	Recall_Scaled		Recall_Perf
	(1)	(2)	(3)
Same_Gen	2.143	2.143	2.075
	(2.560)	(1.862)	(2.556)
IFE_Scaled		0.980^{***}	
		(0.080)	
Constant	80.536^{***}	1.805	-1.117
	(1.948)	(7.084)	(1.950)
Type of Std. Error	Robust	Robust	Robust
Observations	224	224	224
R^2	0.003	0.479	0.003
Adjusted R^2	-0.001	0.474	-0.002
Residual Std. Error	19.074 (df = 222)	13.825 (df = 221)	19.043 (df = 222)
F Statistic	0.707 (df = 1; 222)	101.458^{***} (df = 2; 221)	0.665 (df = 1; 222)
Note:			*p<0.1; **p<0.05; ***p<0.01

```r
# fit regression models
m2c1 <- lm(Comp_Scaled ~ Same_Gen, data = e1)
m2c2 <- lm(Comp_Scaled ~ Same_Gen + IFE_Scaled, data = e1)
m2c3 <- lm(Comp_Perf ~ Same_Gen, data = e1)

# output results
reg_rse_3(m2c1, m2c2, m2c3, "Experiment Design 1: Two Groups (Retention)")
```

Primary Analysis 2: Four-Group Regression Analysis

```r
# fit regression models
m2c1 <- lm(Total_Scaled ~ FF + FM + MF, data = e1)
m2c2 <- lm(Total_Scaled ~ FF + FM + MF + IFE_Scaled, data = e1)
m2c3 <- lm(Total_Perf ~ FF + FM + MF, data = e1)

# output results
reg_rse_3(m2c1, m2c2, m2c3, "Experiment Design 1: Four Groups")
```

Table 11: Experiment Design 1: Two Groups (Retention)

	Dependent variable:		
	Comp_Scaled		Comp_Perf
	(1)	(2)	(3)
Same_Gen	−2.977	−2.977	−2.245
	(3.322)	(2.812)	(3.158)
IFE_Scaled		0.992^{***}	
		(0.111)	
Constant	79.763^{***}	0.032	1.123
	(2.221)	(9.538)	(2.182)
Type of Std. Error	Robust	Robust	Robust
Observations	224	224	224
R^2	0.004	0.293	0.002
Adjusted R^2	−0.001	0.287	−0.002
Residual Std. Error	24.750 (df = 222)	20.894 (df = 221)	23.525 (df = 222)
F Statistic	0.810 (df = 1; 222)	45.820^{***} (df = 2; 221)	0.510 (df = 1; 222)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 12: Experiment Design 1: Four Groups

	Dependent variable:		
	Total_Scaled		Total_Perf
	(1)	(2)	(3)
FF	1.509	3.113^{*}	2.730
	(3.087)	(1.852)	(2.965)
FM	−1.501	0.104	−0.545
	(3.218)	(1.862)	(3.265)
MF	2.371	2.371	2.178
	(2.908)	(1.819)	(2.898)
IFE_Scaled		0.985^{***}	
		(0.060)	
Constant	79.741^{***}	−0.215	−1.092
	(2.053)	(5.188)	(2.063)
Type of Std. Error	Robust	Robust	Robust
Observations	224	224	224
R^2	0.008	0.654	0.007
Adjusted R^2	−0.005	0.647	−0.006
Residual Std. Error	16.466 (df = 220)	9.751 (df = 219)	16.238 (df = 220)
F Statistic	0.597 (df = 3; 220)	103.362^{***} (df = 4; 219)	0.540 (df = 3; 220)
Note:			*p<0.1; **p<0.05; ***p<0.01