JEP LMC 2018: Reviews Analysis

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1 Word Type Analysis

```
> library(dplyr)
> main = read.csv("Julie_Main5Studies.csv", header = TRUE, sep = ",")
> main$StudyNo = as.factor(main$StudyNo)
> main$PrimeCondition = as.factor(main$PrimeCondition)
> word_type = read.csv("ItemWordTypes.csv", header = TRUE, sep = ",")
> main_word = merge(main, word_type, by = c("Target"))
> main_word = main_word %>% arrange(Subject, TargetNo)
> library(dplyr)
```

1.1 Topic Wise Accuracy: Age Split

```
> pn_topic_age = group_by(main_word, ExperimentName, Subject, AgeGroup,
+                         Proper, Category ) %>%
+   summarise_at(vars(Accuracy), mean)
> pn_topic_age$Subject = as.factor(pn_topic_age$Subject)
> pn_topic_age_e1 = pn_topic_age %>%
+   filter(ExperimentName == "tot extended prime" & Proper == "ProperName")
> pn_topic_age_e2 = pn_topic_age %>%
+   filter(ExperimentName == "tot not the prime" & Proper == "ProperName")
> pn_topic_age_e3 = pn_topic_age %>%
+   filter(ExperimentName == "tot 48 ms" & Proper == "ProperName")
> pn_topic_e1_aov = aov(data = pn_topic_age_e1, Accuracy ~ AgeGroup*Category +
+                         Error(Subject/Category))
> summary(pn_topic_e1_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup   1  0.202  0.2024   1.253  0.267
Residuals 71 11.470  0.1615

Error: Subject:Category
                  Df Sum Sq Mean Sq F value Pr(>F)
Category           3  0.265 0.08849   3.304 0.0212 *
```

```
AgeGroup:Category   3  0.089 0.02975   1.111 0.3455
Residuals         213  5.704 0.02678
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> pn_topic_e2_aov = aov(data = pn_topic_age_e2, Accuracy ~ AgeGroup*Category +
+                          Error(Subject/Category))
> summary(pn_topic_e2_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup   1  0.027 0.02676   0.162  0.688
Residuals 63 10.392 0.16495

Error: Subject:Category
                   Df Sum Sq Mean Sq F value  Pr(>F)
Category            3  0.260 0.08656   4.598 0.00394 **
AgeGroup:Category   3  0.062 0.02055   1.092 0.35380
Residuals         189  3.558 0.01883
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

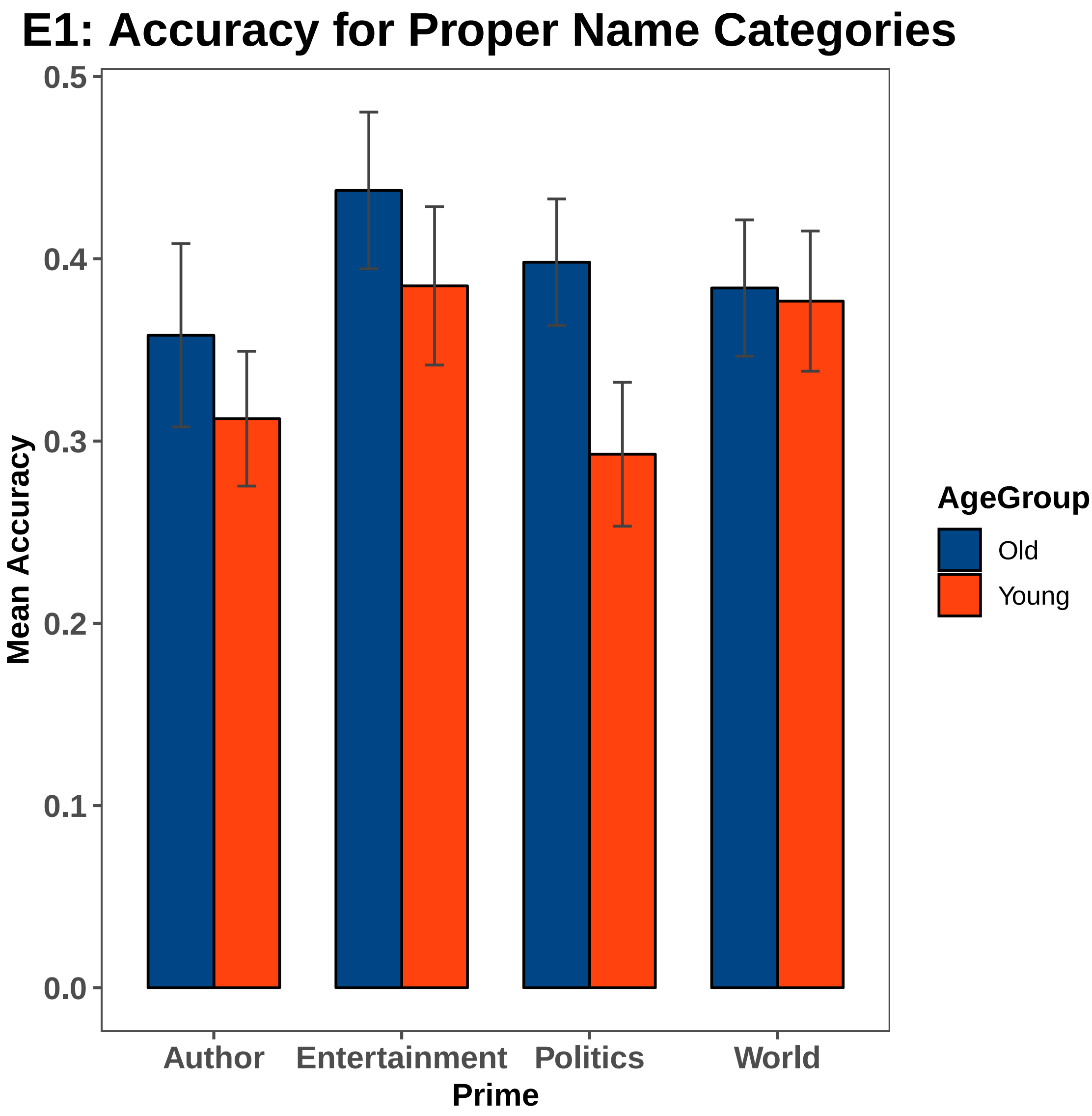
```
> pn_topic_e3_aov = aov(data = pn_topic_age_e3, Accuracy ~ Category +
+                          Error(Subject/Category))
> summary(pn_topic_e3_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
Residuals 35  4.063  0.1161

Error: Subject:Category
           Df Sum Sq Mean Sq F value Pr(>F)
Category    3 0.2283 0.07610   3.891 0.0111 *
Residuals 105 2.0538 0.01956
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

1.1.1 E1

```
> pn_topic_e1_rmisc = Rmisc::summarySE(pn_topic_age_e1,
+                                     measurevar = "Accuracy",
+                               groupvars = c("AgeGroup", "Proper", "Category"))
> library(ggplot2)
> library(ggthemes)
> pn_topic_e1_rmisc %>%
+ ggplot(aes(x = Category, y = Accuracy,
+            group = AgeGroup, fill = AgeGroup))+
```

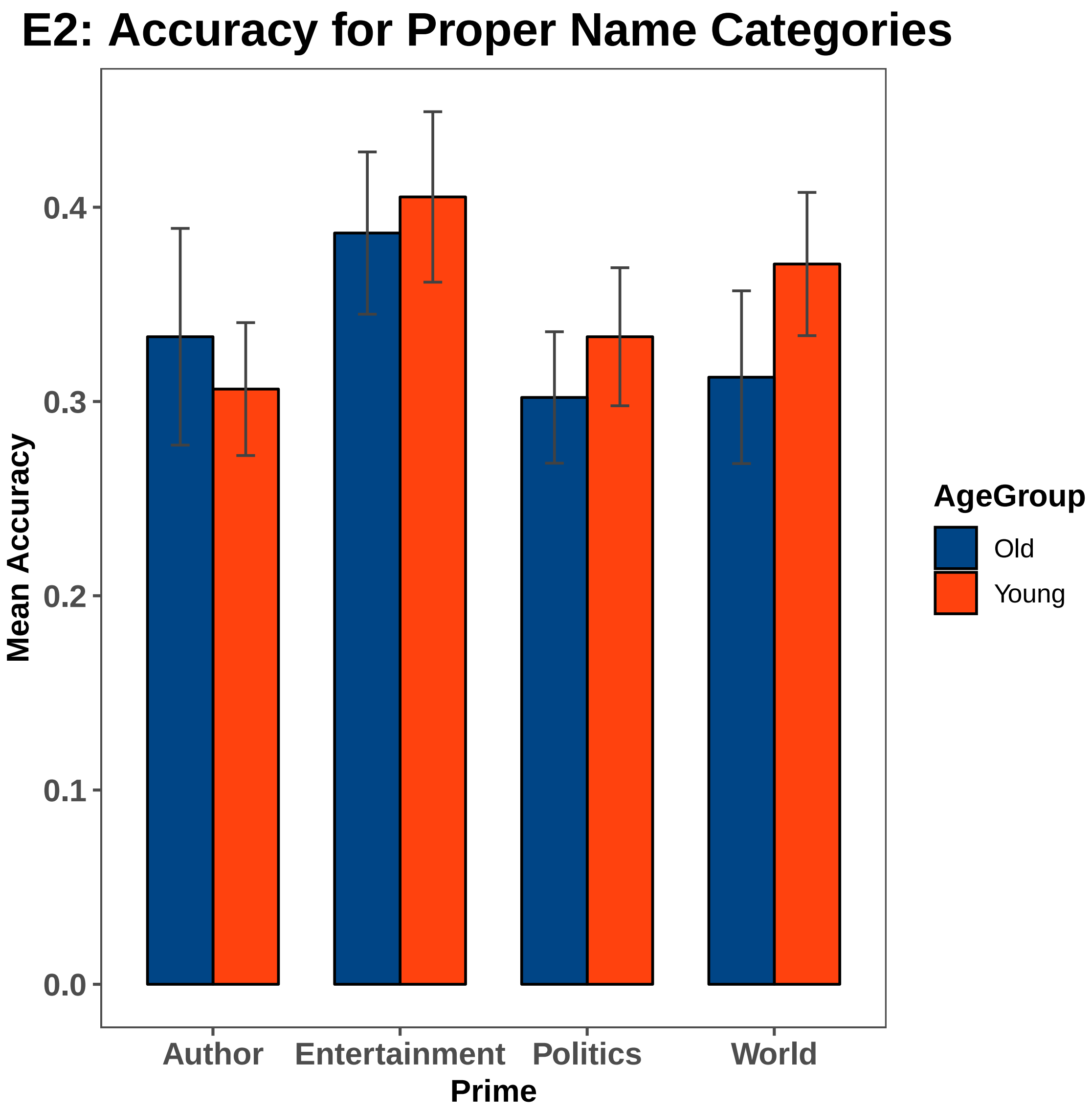
```
+   geom_bar(stat = "identity", position = "dodge",
+            width = 0.7, color = "black")+
+    geom_errorbar(aes(ymin=Accuracy - se, ymax=Accuracy + se),
+               width=.2, color = "gray26",
+               position = position_dodge(0.7))+
+   theme_few()+
+    scale_fill_calc()+
+    xlab("Prime") + ylab("Mean Accuracy") +
+    ggtitle("E1: Accuracy for Proper Name Categories ")  +
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+            axis.title = element_text(face = "bold", size = rel(1)),
+            legend.title = element_text(face = "bold", size = rel(1)),
+       plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+           strip.text.x = element_text(face = "bold", size = rel(1.4)))
```



1.1.2 E2

```
> pn_topic_e2_rmisc = Rmisc::summarySE(pn_topic_age_e2,
+                                      measurevar = "Accuracy",
+                               groupvars = c("AgeGroup", "Proper", "Category"))
> library(ggplot2)
> library(ggthemes)
> pn_topic_e2_rmisc %>%
+ ggplot(aes(x = Category, y = Accuracy,
+            group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge",
```

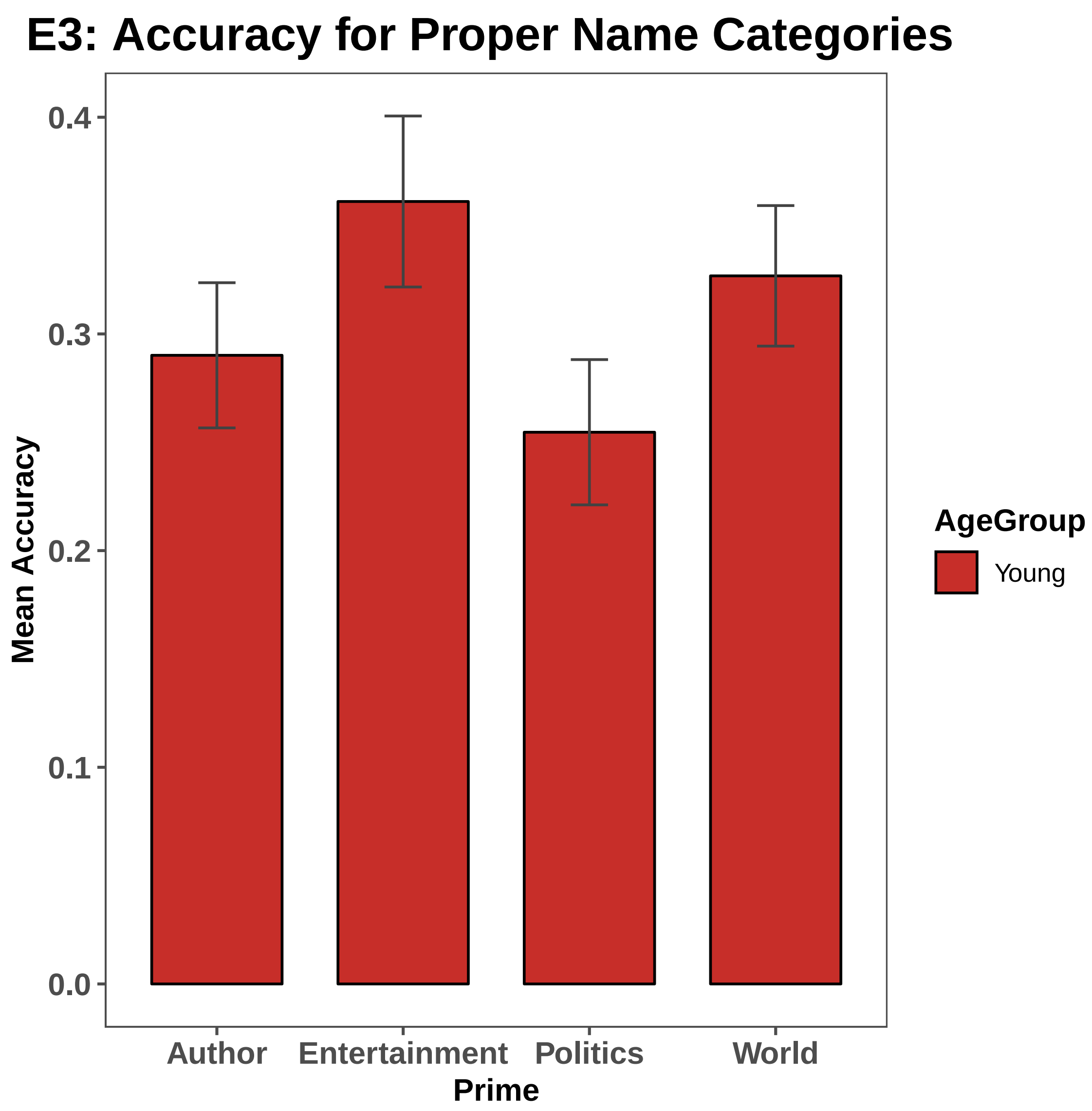
```
+           width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Accuracy - se, ymax=Accuracy + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+  theme_few()+
+   scale_fill_calc()+
+   xlab("Prime") + ylab("Mean Accuracy") +
+   ggtitle("E2: Accuracy for Proper Name Categories ")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+      plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
```



1.1.3 E3

```
> pn_topic_e3_rmisc = Rmisc::summarySE(pn_topic_age_e3,
+                                      measurevar = "Accuracy",
+                               groupvars = c("AgeGroup", "Proper", "Category"))
> library(ggplot2)
> library(ggthemes)
> pn_topic_e3_rmisc %>%
+ ggplot(aes(x = Category, y = Accuracy,
+            group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge",
```

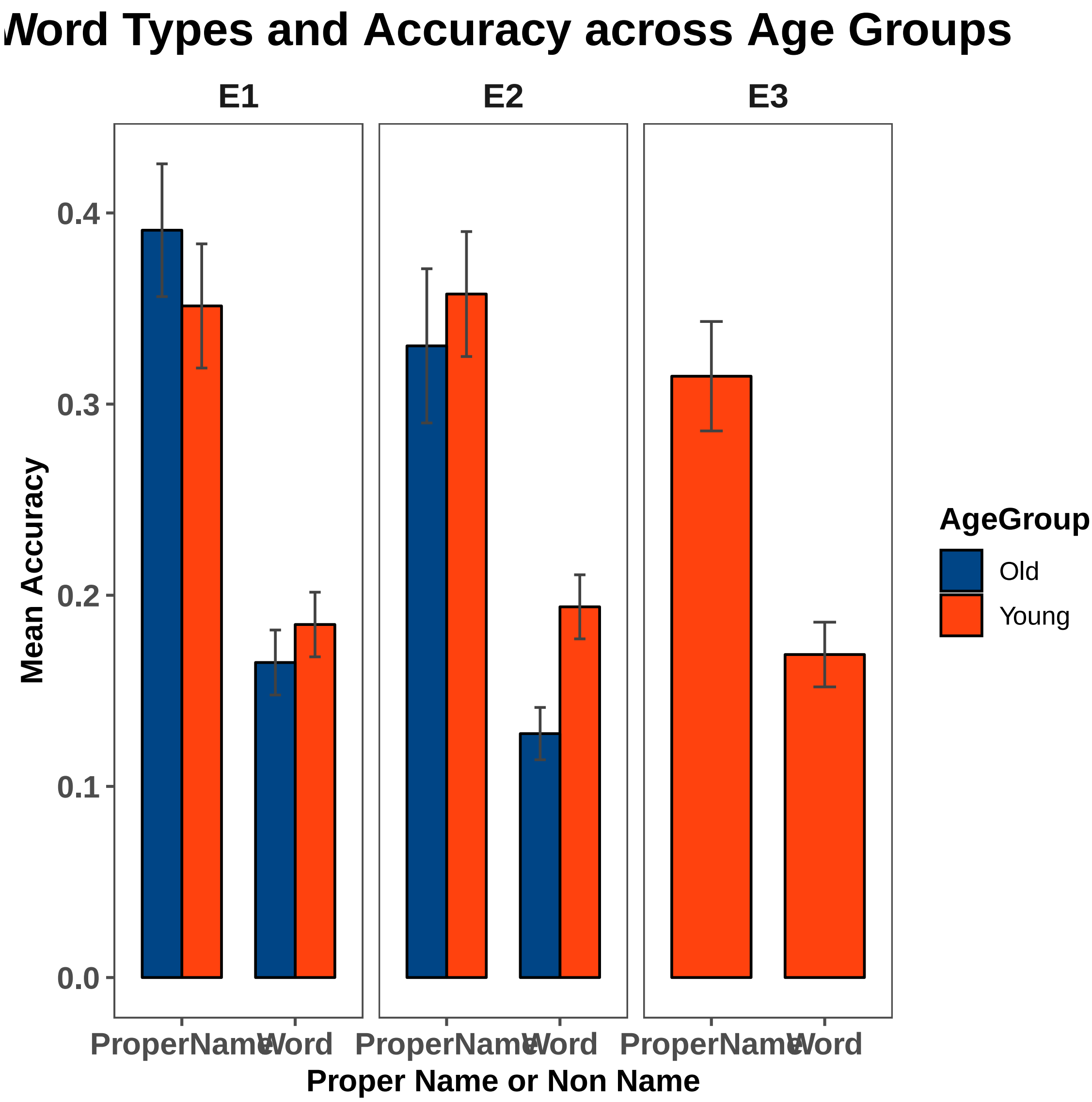
```
+           width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Accuracy - se, ymax=Accuracy + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+  theme_few()+
+   scale_fill_wsj()+
+   xlab("Prime") + ylab("Mean Accuracy") +
+   ggtitle("E3: Accuracy for Proper Name Categories ")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+      plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
```



1.2 Age Differences: PN vs Non Names

```
> word_type_age = group_by(main_word, ExperimentName, Subject,
+                           AgeGroup, Proper) %>%
+   summarise_at(vars(Accuracy), mean)
> word_type_age_rmisc = Rmisc::summarySE(word_type_age,
+                                        measurevar = "Accuracy",
+                                groupvars = c("ExperimentName", "AgeGroup", "Proper"))
> word_type_age_rmisc$ExperimentName = ifelse(word_type_age_rmisc$ExperimentName ==
+                                                  "tot 48 ms", "E3",
```

```
+                                ifelse(word_type_age_rmisc$ExperimentName ==
+                                         "tot extended prime", "E1", "E2"))
> library(ggplot2)
> library(ggthemes)
> word_type_age_rmisc %>%
+ ggplot(aes(x = Proper, y = Accuracy,
+            group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge",
+           width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Accuracy - se, ymax=Accuracy + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+  theme_few()+
+   facet_wrap(~ExperimentName)+
+   scale_fill_calc()+
+   xlab("Proper Name or Non Name") + ylab("Mean Accuracy") +
+   ggtitle("Word Types and Accuracy across Age Groups")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+      plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
```



1.2.1 E1

```
> word_type_age_E1 = main_word %>% filter(ExperimentName == "tot extended prime") %>%
+   group_by(AgeGroup, Subject, Proper) %>%
+   summarise_at(vars(Accuracy), mean)
> word_type_age_E1$Subject = as.factor(word_type_age_E1$Subject)
> e1_age_aov = aov(data = word_type_age_E1, Accuracy ~ AgeGroup*Proper +
+                    Error(Subject/Proper))
> summary(e1_age_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup   1 0.0036 0.00356   0.089  0.767
Residuals 71 2.8552 0.04021

Error: Subject:Proper
                Df Sum Sq Mean Sq F value Pr(>F)
Proper           1 1.4022  1.4022 122.429 <2e-16 ***
AgeGroup:Proper  1 0.0323  0.0323   2.819 0.0975 .
Residuals       71 0.8132  0.0115
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> ## only marginal
```

1.2.2 E2

```
> word_type_age_E2 = main_word %>% filter(ExperimentName == "tot not the prime") %>%
+   group_by(AgeGroup, Subject, Proper) %>%
+   summarise_at(vars(Accuracy), mean)
> word_type_age_E2$Subject = as.factor(word_type_age_E2$Subject)
> e2_age_aov = aov(data = word_type_age_E2, Accuracy ~ AgeGroup*Proper +
+                    Error(Subject/Proper))
> summary(e2_age_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup   1 0.0709 0.07093   1.872  0.176
Residuals 63 2.3868 0.03789

Error: Subject:Proper
                Df Sum Sq Mean Sq F value  Pr(>F)
Proper           1 1.0878  1.0878  81.736 5.5e-13 ***
AgeGroup:Proper  1 0.0125  0.0125   0.939   0.336
Residuals       63 0.8384  0.0133
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> ## no interaction
```

1.3 TOTs and PNs

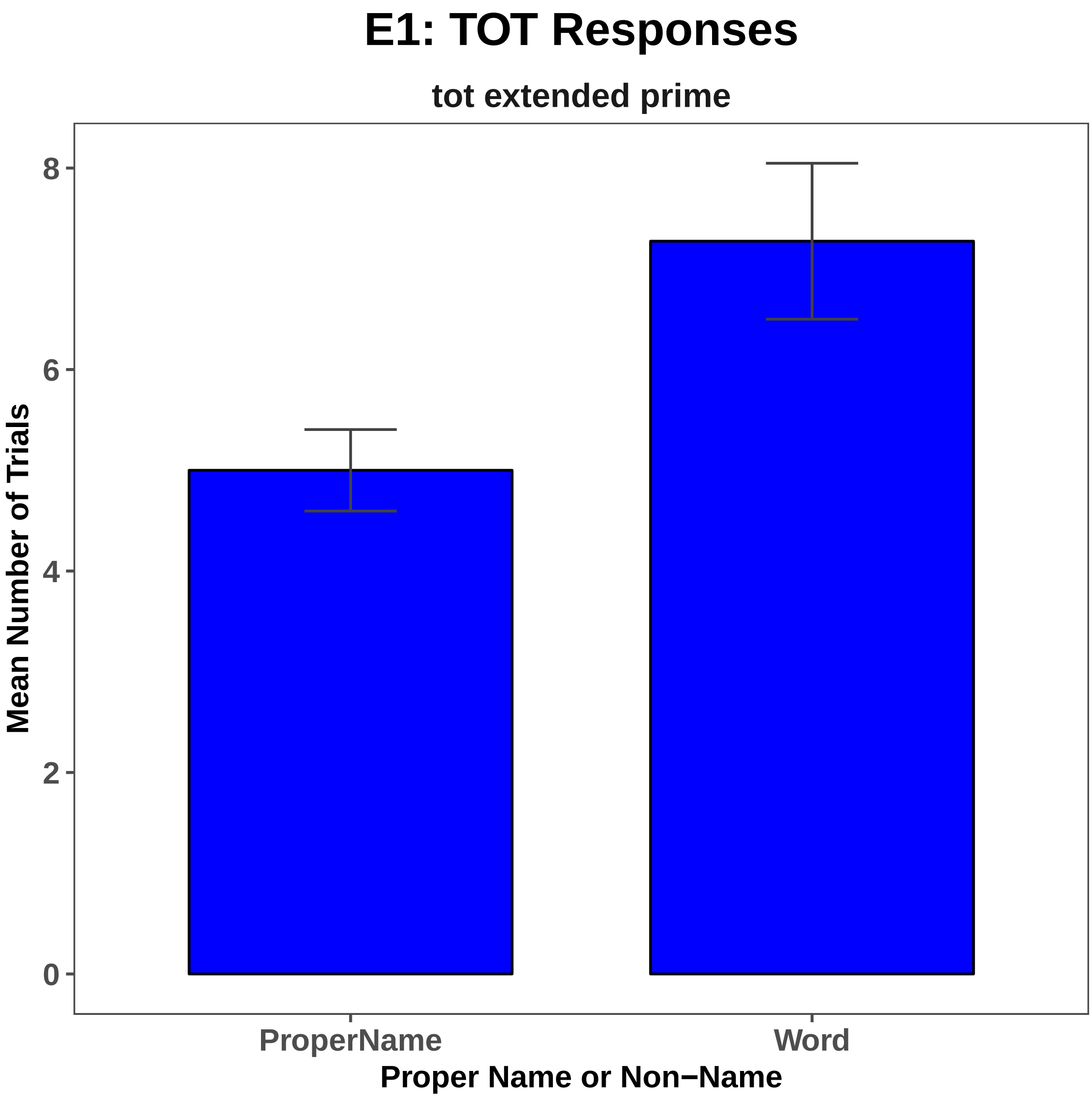
```
> word_type_state_experiment = group_by(main_word, ExperimentName, AgeGroup, Subject,
+                              Proper, Question.RESP) %>%
+   summarise(Trials = n())
```

```
> word_type_state_experiment_rmisc = Rmisc::summarySE(word_type_state_experiment,
+                                                      measurevar = "Trials",
+                                            groupvars = c("ExperimentName",
+                                                          "AgeGroup", "Proper",
+                                                                   "Question.RESP"))
> state_pn_e1 = word_type_state_experiment_rmisc %>%
+   filter(ExperimentName == "tot extended prime")
> state_pn_e2 = word_type_state_experiment_rmisc %>%
+   filter(ExperimentName == "tot not the prime")
> word_collapsedage_rmisc = Rmisc::summarySE(word_type_state_experiment,
+                                                      measurevar = "Trials",
+                                                      groupvars = c("ExperimentName",
+                                                                   "Proper",
+                                                                   "Question.RESP"))
> state_pn_e1_collapsedage = word_collapsedage_rmisc %>%
+   filter(ExperimentName == "tot extended prime")
> state_pn_e2_collapsedage = word_collapsedage_rmisc %>%
+   filter(ExperimentName == "tot not the prime")
> state_pn_e3_collapsedage = word_collapsedage_rmisc %>%
+   filter(ExperimentName == "tot 48 ms")
>
```

1.3.1 E1

TOT

```
> state_pn_e1_TOT = state_pn_e1_collapsedage %>% filter(Question.RESP == "4")
> state_pn_e1_TOT %>%
+ ggplot(aes(x = Proper, y = Trials))+
+  geom_bar(stat = "identity", position = "dodge",
+           width = 0.7, color = "black", fill = "blue")+
+   geom_errorbar(aes(ymin=Trials - se, ymax=Trials + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+  theme_few()+
+   scale_fill_calc()+
+     facet_wrap(~ExperimentName)+
+   xlab("Proper Name or Non-Name") + ylab("Mean Number of Trials") +
+   ggtitle("E1: TOT Responses")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+      plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
```

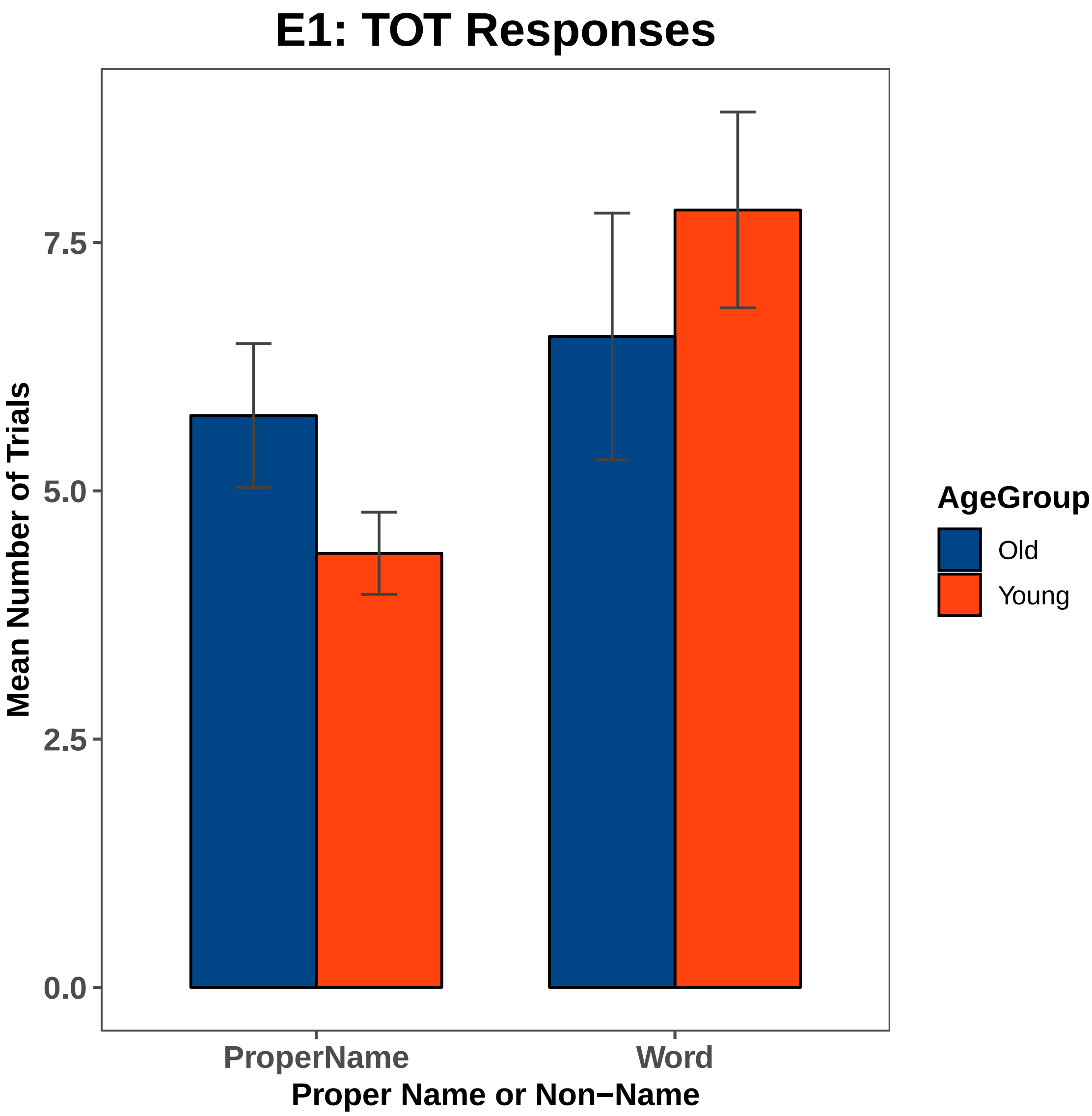


Split by Age

```
> state_pn_e1_TOT = state_pn_e1 %>% filter(Question.RESP == "4")
> state_pn_e1_TOT %>%
+ ggplot(aes(x = Proper, y = Trials,
+            group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge",
+          width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Trials - se, ymax=Trials + se),
+             width=.2, color = "gray26",
+             position = position_dodge(0.7))+
+  theme_few()+
+   scale_fill_calc()+
```

```
+   xlab("Proper Name or Non-Name") + ylab("Mean Number of Trials") +
+   ggtitle("E1: TOT Responses")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+      plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> ## ANOVA
> library(lme4)
> e1_pn_TOT_aovdata = word_type_state_experiment %>%
+   filter(ExperimentName == "tot extended prime" & Question.RESP == "4")
> e1_pn_TOT_aov = lmer(data = e1_pn_TOT_aovdata, Trials ~ AgeGroup*Proper +
+                        (1|Subject))
> car::Anova(e1_pn_TOT_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Trials
                 Chisq Df Pr(>Chisq)
AgeGroup        0.0010  1   0.975148
Proper          9.4964  1   0.002059 **
AgeGroup:Proper 3.4381  1   0.063709 .
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

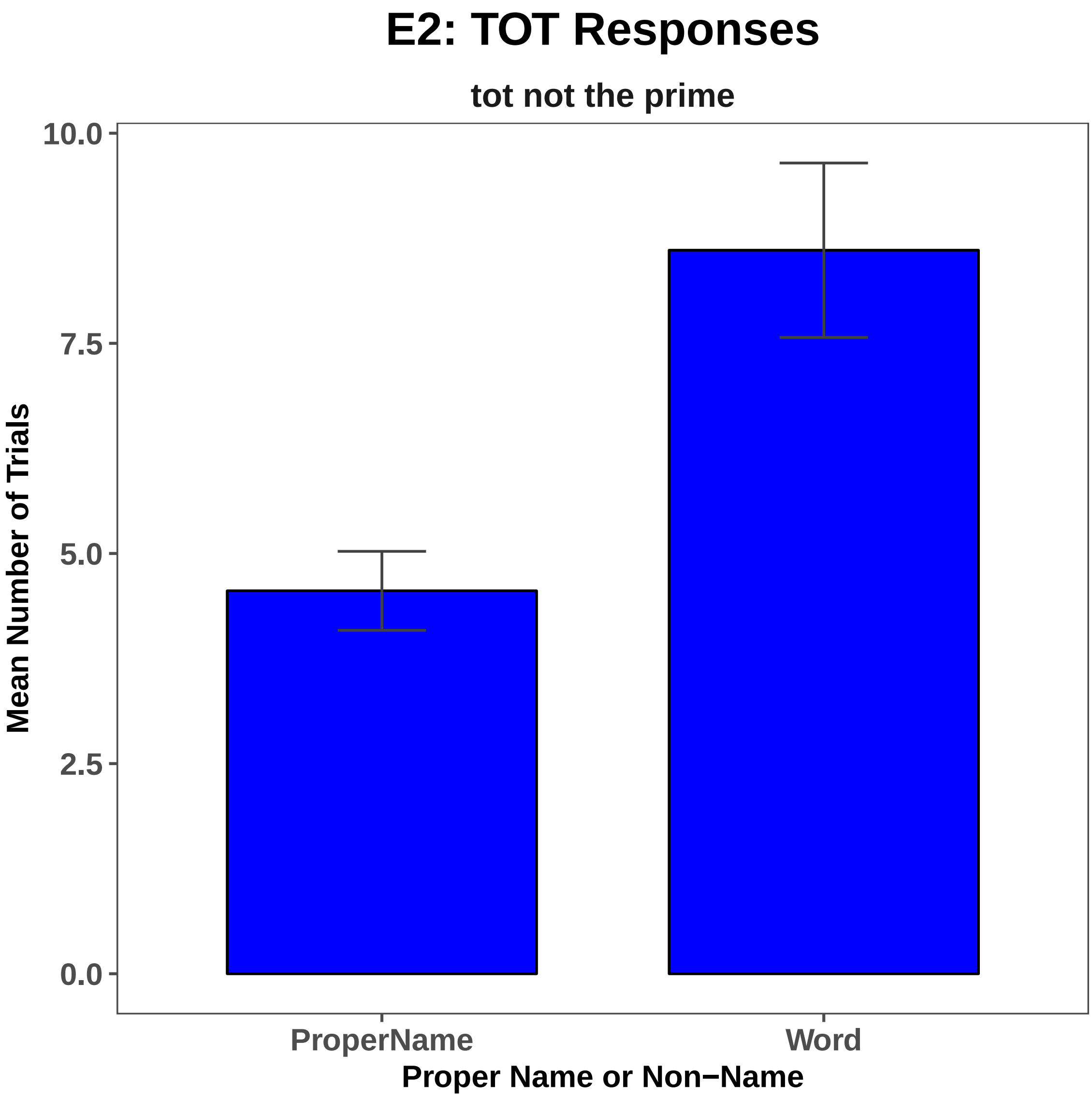


1.3.2 E2

TOT

```
> state_pn_e2_TOT = state_pn_e2_collapsedage %>% filter(Question.RESP == "4")
> state_pn_e2_TOT %>%
+ ggplot(aes(x = Proper, y = Trials))+
+  geom_bar(stat = "identity", position = "dodge",
+           width = 0.7, color = "black", fill = "blue")+
+   geom_errorbar(aes(ymin=Trials - se, ymax=Trials + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
```

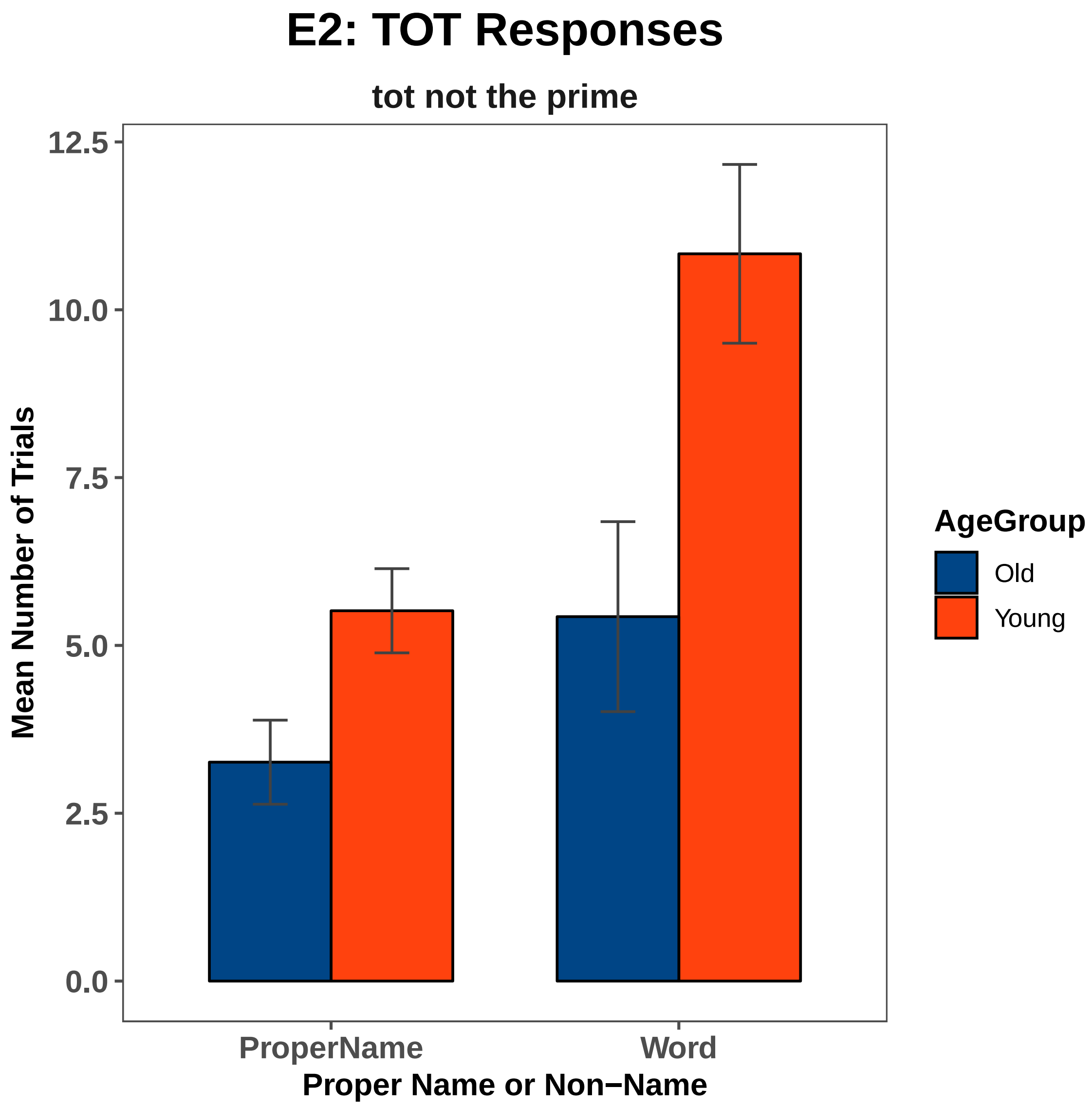
```
+   theme_few()+
+    facet_wrap(~ExperimentName)+
+    scale_fill_calc()+
+    xlab("Proper Name or Non-Name") + ylab("Mean Number of Trials") +
+    ggtitle("E2: TOT Responses")  +
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+            axis.title = element_text(face = "bold", size = rel(1)),
+            legend.title = element_text(face = "bold", size = rel(1)),
+       plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+           strip.text.x = element_text(face = "bold", size = rel(1.4)))
```



Split by Age

```
> state_pn_e2_TOT = state_pn_e2 %>% filter(Question.RESP == "4")
> state_pn_e2_TOT %>%
+ ggplot(aes(x = Proper, y = Trials,
+            group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge",
+           width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Trials - se, ymax=Trials + se),
+                 width=.2, color = "gray26",
+                 position = position_dodge(0.7))+
+  theme_few()+
+   facet_wrap(~ExperimentName)+
+   scale_fill_calc()+
+   xlab("Proper Name or Non-Name") + ylab("Mean Number of Trials") +
+   ggtitle("E2: TOT Responses")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+      plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> e2_pn_TOT_aovdata = word_type_state_experiment %>%
+   filter(ExperimentName == "tot not the prime" & Question.RESP == "4" )
> e2_pn_TOT_aov = lmer(data = e2_pn_TOT_aovdata, Trials ~ AgeGroup*Proper +
+                        (1|Subject))
> car::Anova(e2_pn_TOT_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Trials
                  Chisq Df Pr(>Chisq)
AgeGroup        11.4167  1  0.0007279 ***
Proper          17.1792  1  3.401e-05 ***
AgeGroup:Proper  2.4293  1  0.1190876
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

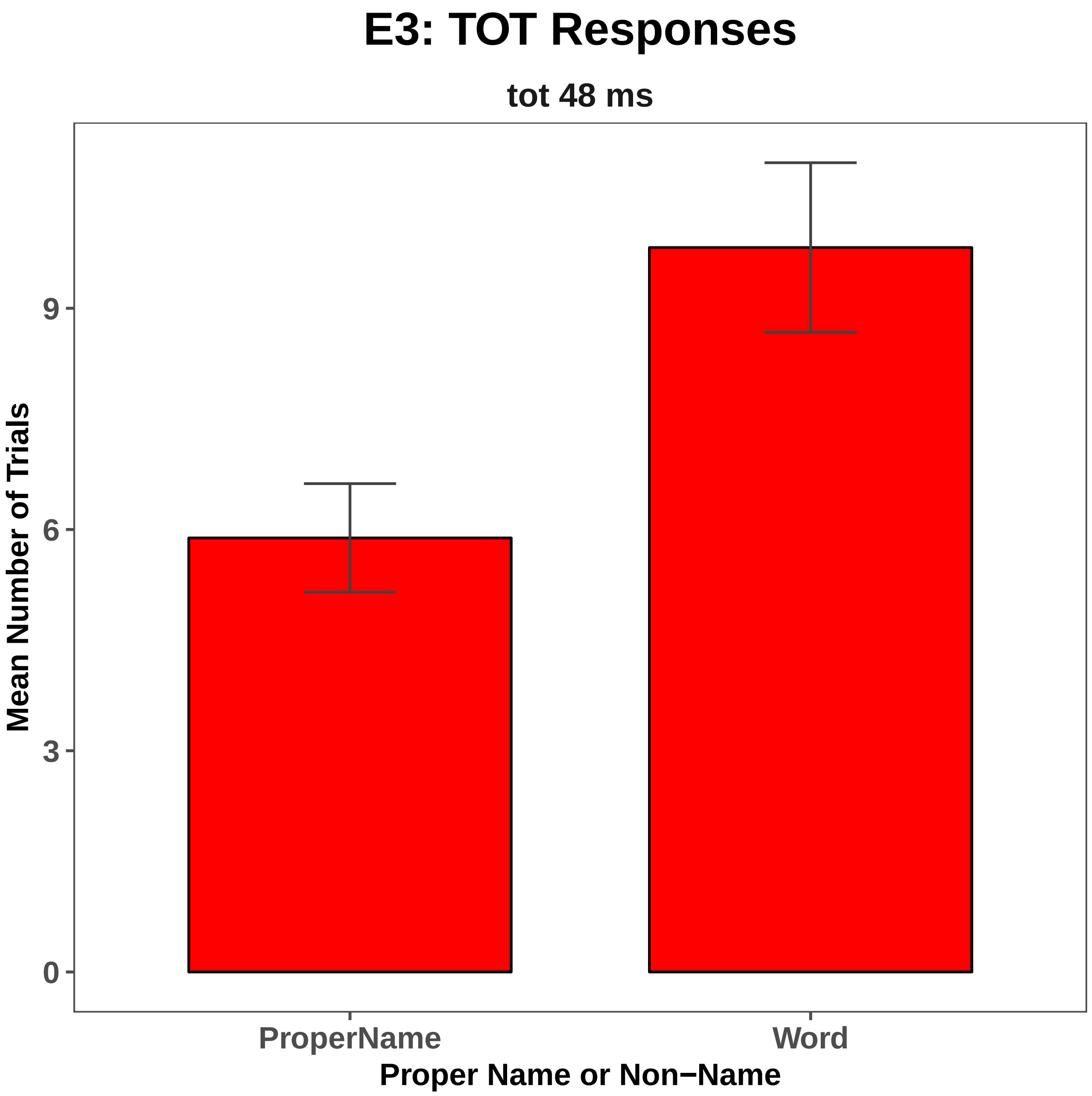


1.3.3 E3

TOT

```
> state_pn_e3_TOT = state_pn_e3_collapsedage %>% filter(Question.RESP == "4")
> state_pn_e3_TOT %>%
+ ggplot(aes(x = Proper, y = Trials))+
+  geom_bar(stat = "identity", position = "dodge",
+            width = 0.7, color = "black", fill = "red")+
+   geom_errorbar(aes(ymin=Trials - se, ymax=Trials + se),
+                 width=.2, color = "gray26",
+                 position = position_dodge(0.7))+
```

```
+   theme_few()+
+    facet_wrap(~ExperimentName)+
+    scale_fill_calc()+
+    xlab("Proper Name or Non-Name") + ylab("Mean Number of Trials") +
+    ggtitle("E3: TOT Responses")  +
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+            axis.title = element_text(face = "bold", size = rel(1)),
+            legend.title = element_text(face = "bold", size = rel(1)),
+       plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+           strip.text.x = element_text(face = "bold", size = rel(1.4)))
```



1.4 TOT, PN and Correct Retrievals

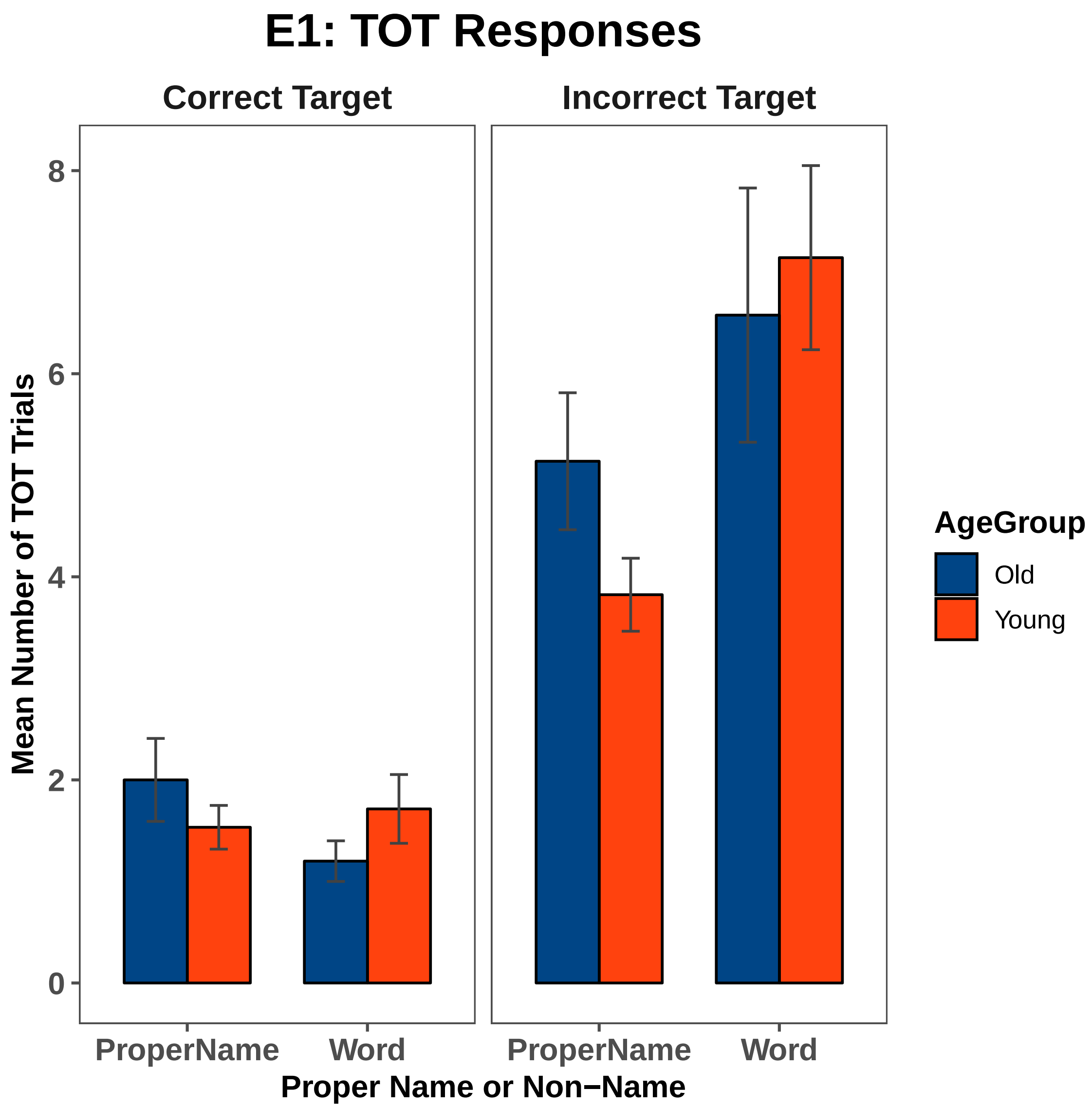
```
> tot_pn_acc = group_by(main_word, ExperimentName, AgeGroup, Subject,
+                           Proper, Accuracy, Question.RESP) %>%
+   summarise(Trials = n())
> tot_pn_acc$Subject = as.factor(tot_pn_acc$Subject)
> ## ONLY TOT trials
> tot_pn_acc = tot_pn_acc %>% filter(Question.RESP == "4")
> tot_pn_acc_e1 = tot_pn_acc %>% filter(ExperimentName == "tot extended prime")
> tot_pn_acc_e2 = tot_pn_acc %>% filter(ExperimentName == "tot not the prime")
> tot_pn_acc_e3 = tot_pn_acc %>% filter(ExperimentName == "tot 48 ms")
```

1.4.1 E1

```
> tot_pn_acc_e1_rmisc = Rmisc::summarySE(tot_pn_acc_e1,
+                                        measurevar = "Trials",
+                                        groupvars = c("AgeGroup", "Proper",
+                                                      "Accuracy"))
> tot_pn_acc_e1_rmisc$Accuracy = ifelse(tot_pn_acc_e1_rmisc$Accuracy == "0",
+                                        "Incorrect Target", "Correct Target")
> tot_pn_acc_e1_rmisc %>%
+ ggplot(aes(x = Proper, y = Trials,
+            group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge",
+           width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Trials - se, ymax=Trials + se),
+                 width=.2, color = "gray26",
+                 position = position_dodge(0.7))+
+  theme_few()+
+   facet_wrap(~Accuracy)+
+   scale_fill_calc()+
+   xlab("Proper Name or Non-Name") + ylab("Mean Number of TOT Trials") +
+   ggtitle("E1: TOT Responses")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+      plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> tot_pn_acc_e1_aov = lmer(data = tot_pn_acc_e1,
+                          Trials ~ AgeGroup*Proper*Accuracy +
+                            (1|Subject))
> car::Anova(tot_pn_acc_e1_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Trials
                           Chisq Df Pr(>Chisq)
```

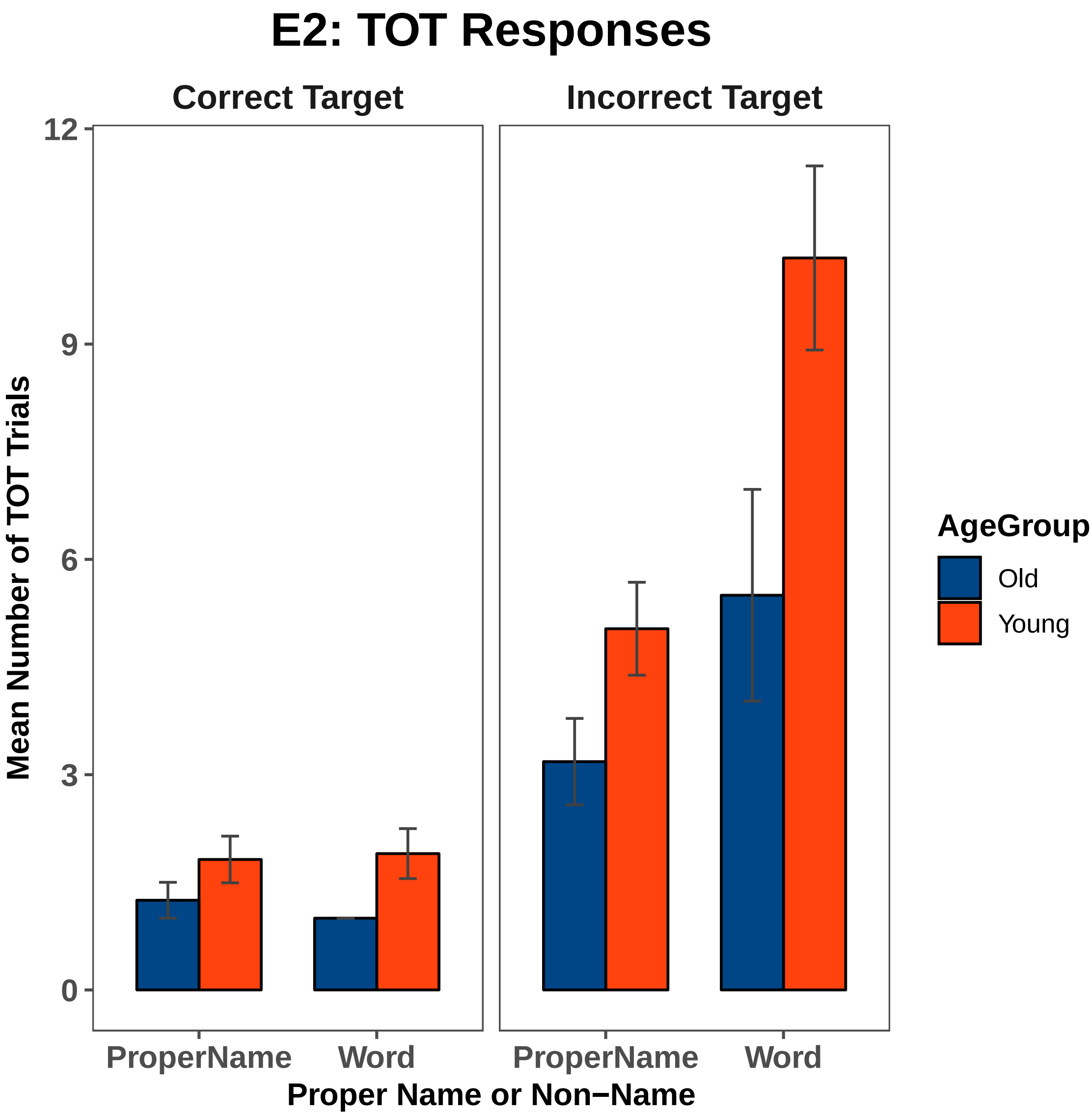
```
AgeGroup                    0.1144  1  0.7352269
Proper                     11.5222  1  0.0006877 ***
Accuracy                   38.3896  1  5.794e-10 ***
AgeGroup:Proper             2.4175  1  0.1199879
AgeGroup:Accuracy           0.1524  1  0.6962497
Proper:Accuracy             4.0232  1  0.0448788 *
AgeGroup:Proper:Accuracy    0.0857  1  0.7697162
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```



1.4.2 E2

```
> tot_pn_acc_e2_rmisc = Rmisc::summarySE(tot_pn_acc_e2,
+                                        measurevar = "Trials",
+                                        groupvars = c("AgeGroup", "Proper",
+                                                      "Accuracy"))
> tot_pn_acc_e2_rmisc$Accuracy = ifelse(tot_pn_acc_e2_rmisc$Accuracy == "0",
+                                       "Incorrect Target", "Correct Target")
> tot_pn_acc_e2_rmisc %>%
+ ggplot(aes(x = Proper, y = Trials,
+            group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge",
+           width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Trials - se, ymax=Trials + se),
+                 width=.2, color = "gray26",
+                 position = position_dodge(0.7))+
+  theme_few()+
+   facet_wrap(~Accuracy)+
+   scale_fill_calc()+
+   xlab("Proper Name or Non-Name") + ylab("Mean Number of TOT Trials") +
+   ggtitle("E2: TOT Responses")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+      plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> tot_pn_acc_e2_aov = lmer(data = tot_pn_acc_e2,
+                          Trials ~ AgeGroup*Proper*Accuracy +
+                            (1|Subject))
> car::Anova(tot_pn_acc_e2_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Trials
                           Chisq Df Pr(>Chisq)
AgeGroup                  9.1190  1    0.00253 **
Proper                   15.8520  1  6.849e-05 ***
Accuracy                 24.9370  1  5.923e-07 ***
AgeGroup:Proper           1.8583  1    0.17283
AgeGroup:Accuracy         1.4640  1    0.22629
Proper:Accuracy           5.3710  1    0.02047 *
AgeGroup:Proper:Accuracy  0.5840  1    0.44473
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

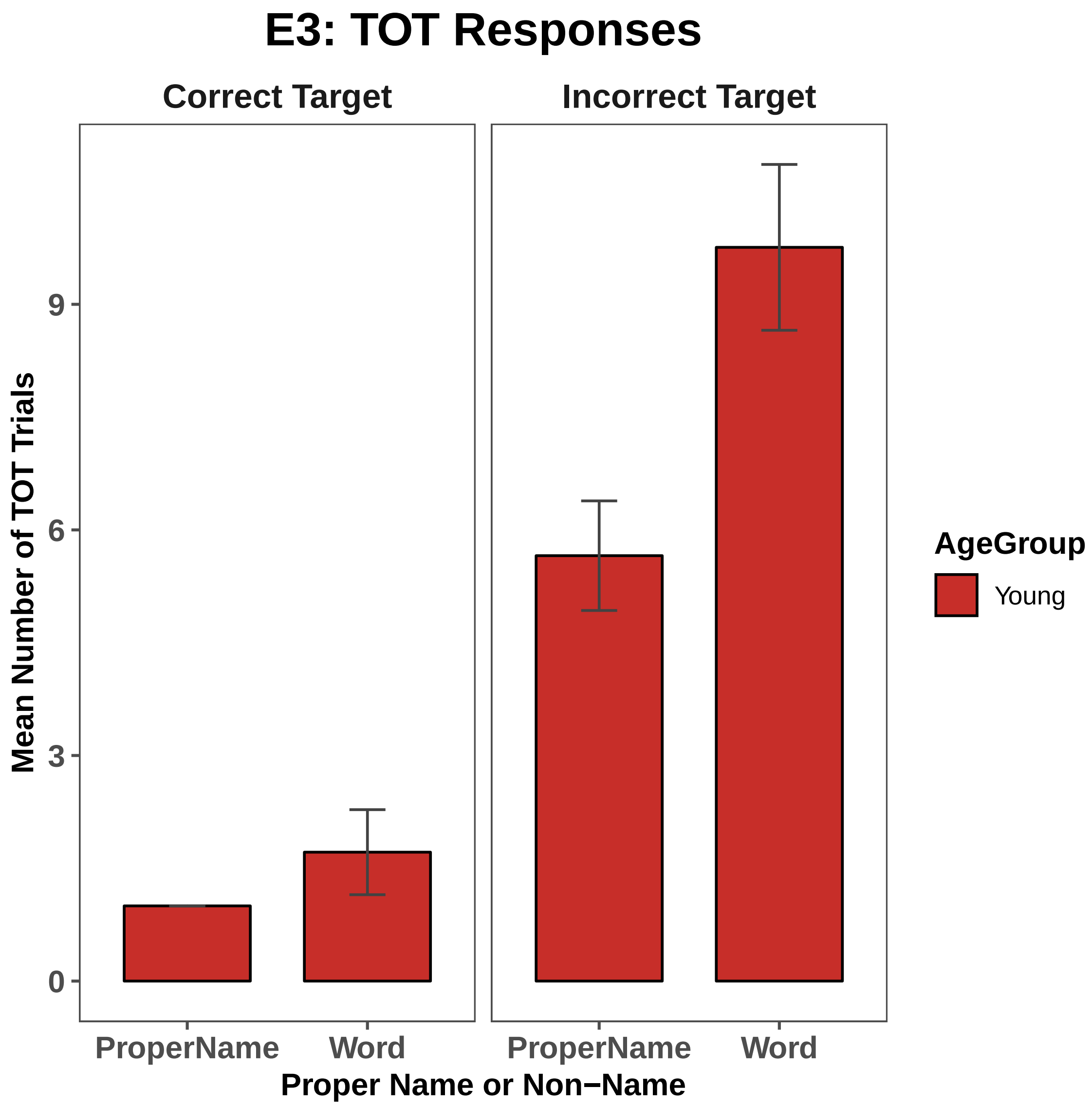


1.4.3 E3

```
> tot_pn_acc_e3_rmisc = Rmisc::summarySE(tot_pn_acc_e3,
+                                         measurevar = "Trials",
+                                         groupvars = c("AgeGroup", "Proper",
+                                                       "Accuracy"))
> tot_pn_acc_e3_rmisc$Accuracy = ifelse(tot_pn_acc_e3_rmisc$Accuracy == "0",
+                                        "Incorrect Target", "Correct Target")
> tot_pn_acc_e3_rmisc %>%
+ ggplot(aes(x = Proper, y = Trials,
+            group = AgeGroup, fill = AgeGroup))+
```

```
+   geom_bar(stat = "identity", position = "dodge",
+            width = 0.7, color = "black")+
+    geom_errorbar(aes(ymin=Trials - se, ymax=Trials + se),
+               width=.2, color = "gray26",
+               position = position_dodge(0.7))+
+   theme_few()+
+    facet_wrap(~Accuracy)+
+    scale_fill_wsj()+
+    xlab("Proper Name or Non-Name") + ylab("Mean Number of TOT Trials") +
+    ggtitle("E3: TOT Responses")  +
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+            axis.title = element_text(face = "bold", size = rel(1)),
+            legend.title = element_text(face = "bold", size = rel(1)),
+       plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+           strip.text.x = element_text(face = "bold", size = rel(1.4)))
> tot_pn_acc_e3_aov = lmer(data = tot_pn_acc_e3,
+                          Trials ~ Proper*Accuracy +
+                            (1|Subject))
> car::Anova(tot_pn_acc_e3_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Trials
                  Chisq Df Pr(>Chisq)
Proper          15.5574  1  8.004e-05 ***
Accuracy        33.2140  1  8.256e-09 ***
Proper:Accuracy  1.6716  1      0.196
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```



2 TOT: Split by Target Accuracy

```
> statedata ← read.csv("Julie_Main5Studies.csv", header = TRUE, sep = ",")
> statedata ← subset(statedata, statedata$Subject!= 198 & statedata$Subject!= 95)
> statedata = statedata %>% filter(Question.RESP == "4")
> ## want TOT as a function of correct retrievals
> age_statedata = group_by(statedata, ExperimentName, AgeGroup,
+                          Subject, Accuracy) %>%
+   summarise(Trials = n())
> exp1_age_TOT = age_statedata %>% filter(ExperimentName == "tot extended prime")
```

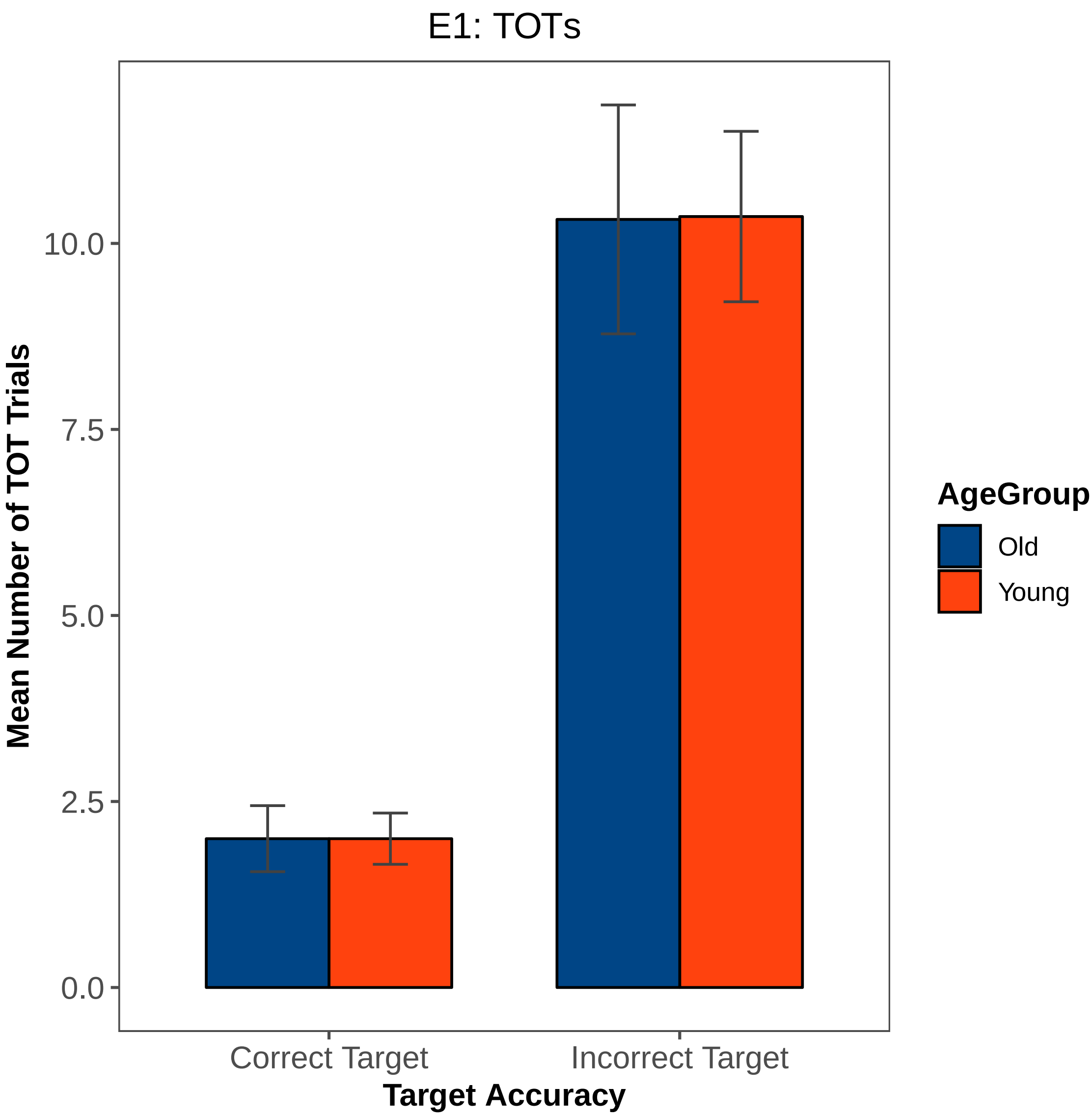
```
> exp2_age_TOT = age_statedata %>% filter(ExperimentName == "tot not the prime")
```

2.1 E1

```
> exp1_age_TOT_rmisc = Rmisc::summarySE(exp1_age_TOT,
+                                       measurevar = "Trials",
+                                       groupvars = c("AgeGroup", "Accuracy"))
> exp1_age_TOT_rmisc$Accuracy = ifelse(exp1_age_TOT_rmisc$Accuracy == "0",
+                                      "Incorrect Target", "Correct Target")
> ## plotting number of TOT trials
>
> exp1_age_TOT_rmisc %>%
+ ggplot(aes(x = factor(Accuracy), y = Trials,
+            group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7,
+           color= "black")+
+  theme_few()+
+    geom_errorbar(aes(ymin=Trials - se, ymax=Trials + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+   scale_fill_calc()+
+     xlab("Target Accuracy") + ylab("Mean Number of TOT Trials") +
+   ggtitle("E1: TOTs")  +
+    theme(axis.text = element_text(size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+          plot.title = element_text(hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> exp1_age_TOT_aov = lmer(data = exp1_age_TOT, Trials ~ AgeGroup*Accuracy +
+                          (1|Subject))
> car::Anova(exp1_age_TOT_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Trials
                    Chisq Df  Pr(>Chisq)
AgeGroup           0.0090  1      0.9246
Accuracy          52.1733  1   5.081e-13 ***
AgeGroup:Accuracy  0.0157  1      0.9004
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
>
```



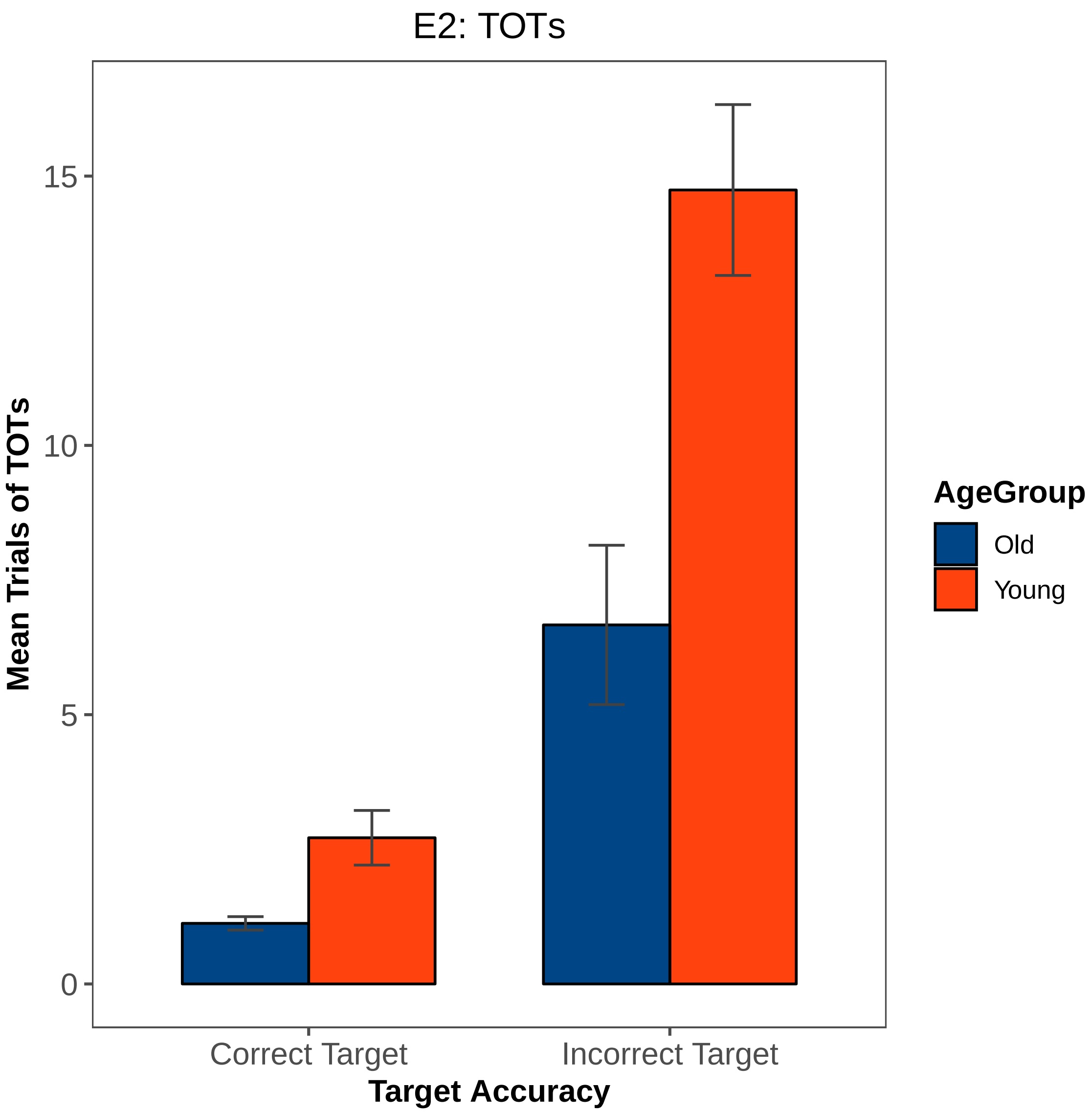
2.2 E2

```
> exp2_age_TOT_rmisc = Rmisc::summarySE(exp2_age_TOT,
+                                       measurevar = "Trials",
+                                       groupvars = c("AgeGroup", "Accuracy"))
> exp2_age_TOT_rmisc$Accuracy = ifelse(exp2_age_TOT_rmisc$Accuracy == "0",
+                                      "Incorrect Target", "Correct Target")
> ## plotting number of TOT trials
>
> exp2_age_TOT_rmisc %>%
```

```
+ ggplot(aes(x = factor(Accuracy), y = Trials,
+             group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7,
+           color= "black")+
+  theme_few()+
+    geom_errorbar(aes(ymin=Trials - se, ymax=Trials + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+   scale_fill_calc()+
+     xlab("Target Accuracy") + ylab("Mean Trials of TOTs") +
+   ggtitle("E2: TOTs")  +
+    theme(axis.text = element_text(size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+          plot.title = element_text(hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> exp2_age_TOT_aov = lmer(data = exp2_age_TOT, Trials ~ AgeGroup*Accuracy +
+                          (1|Subject))
> car::Anova(exp2_age_TOT_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Trials
                    Chisq Df Pr(>Chisq)
AgeGroup          15.0102  1  0.0001069 ***
Accuracy          29.9957  1   4.33e-08 ***
AgeGroup:Accuracy  3.2354  1  0.0720647 .
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
>
```



3 Cond TOT: Split by Target Accuracy

```
> ## remove all incorrect TOT: when McAcc was 0
> statedata <- read.csv("Julie_Main5Studies.csv", header = TRUE, sep = ",")
> statedata <- subset(statedata, statedata$Subject!= 198 & statedata$Subject!= 95)
> statedata$TOTmeasure = ifelse(statedata$Question.RESP == "4" &
+                                 statedata$McAcc == "1", "correctTOT",
+                   ifelse(statedata$Question.RESP == "4" &
+                            statedata$McAcc == "0","incorrectTOT",
+                   ifelse(statedata$Question.RESP == "1" &
```

```
+                            statedata$Accuracy == "0","incorrectKnow",
+                  ifelse(statedata$Question.RESP == "2","dontknow",
+                ifelse(statedata$Question.RESP == "3"&
+                            statedata$Accuracy == "0","incorrectOther","NA")))))
> age_statedata = group_by(statedata, AgeGroup,
+                            ExperimentName,Subject, TOTmeasure) %>%
+   summarise(Trials = n())
> library(tidyr)
> age_statedata_wide = spread(age_statedata, TOTmeasure, Trials)
> age_statedata_wide$correctTOT = ifelse(is.na(age_statedata_wide$correctTOT),0,
+                                        age_statedata_wide$correctTOT)
> age_statedata_wide$incorrectTOT = ifelse(is.na(age_statedata_wide$incorrectTOT),0, age
> age_statedata_wide$incorrectKnow = ifelse(is.na(age_statedata_wide$incorrectKnow),0,
age_statedata_wide$incorrectKnow)
> age_statedata_wide$dontknow = ifelse(is.na(age_statedata_wide$dontknow),0,
+                                        age_statedata_wide$dontknow)
> age_statedata_wide$incorrectOther = ifelse(is.na(age_statedata_wide$incorrectOther),0,
age_statedata_wide$incorrectOther)
> age_statedata_wide = mutate(age_statedata_wide,
+                              propTOT = correctTOT/(correctTOT + dontknow +
+                                           incorrectKnow + incorrectTOT +
+                                             incorrectOther))
> exp1_age_TOT = age_statedata_wide %>% filter(ExperimentName == "tot extended prime")
> exp2_age_TOT = age_statedata_wide %>% filter(ExperimentName == "tot not the prime")
> e1_TOT_aov = aov(data = exp1_age_TOT, propTOT ~ AgeGroup)
> summary(e1_TOT_aov)
```

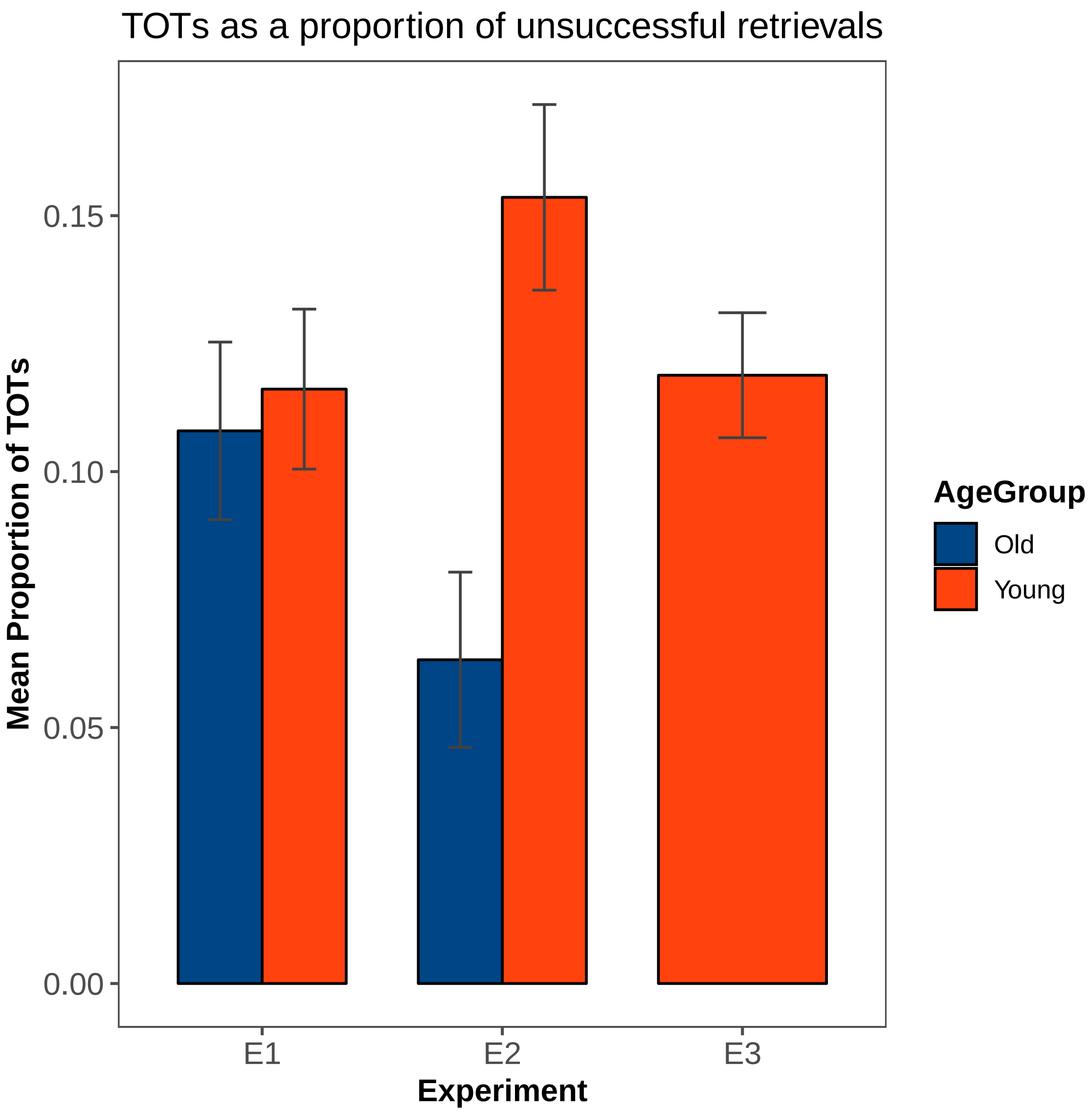
```
            Df Sum Sq  Mean Sq F value Pr(>F)
AgeGroup     1 0.0012 0.001197   0.122  0.728
Residuals   70 0.6868 0.009812
```

```
> e2_TOT_aov = aov(data = exp2_age_TOT, propTOT ~ AgeGroup)
> summary(e2_TOT_aov)
```

```
            Df Sum Sq Mean Sq F value   Pr(>F)
AgeGroup     1 0.1306 0.13056   13.12 0.000589 ***
Residuals   62 0.6168 0.00995
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> ## plotting this proportion ## remove subject from dply code
> successTOT_plot_rmisc = Rmisc::summarySE(age_statedata_wide,
+                                          measurevar = "propTOT",
+                                       groupvars = c("ExperimentName", "AgeGroup"))
> successTOT_plot_rmisc$ExperimentName = ifelse(successTOT_plot_rmisc$ExperimentName ==
+                                          "tot extended prime", "E1", "E2"))
> successTOT_plot = successTOT_plot_rmisc %>%
+ ggplot(aes(x = ExperimentName, y = propTOT,
```

```
+             group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7,
+            color= "black")+
+   geom_errorbar(aes(ymin=propTOT - se, ymax=propTOT + se),
+               width=.2, color = "gray26",
+               position = position_dodge(0.7))+
+  theme_few()+
+ scale_fill_calc()+
+   xlab("Experiment") + ylab("Mean Proportion of TOTs") +
+   ggtitle("TOTs as a proportion of unsuccessful retrievals")  +
+    theme(axis.text = element_text(size = rel(1)),
+            axis.title = element_text(face = "bold", size = rel(1)),
+            legend.title = element_text(face = "bold", size = rel(1)),
+           plot.title = element_text(hjust = .5),
+           strip.text.x = element_text(face = "bold", size = rel(1.4)))
> successTOT_plot
>
> ## again, OA lower than YA
```



3.1 Conditionalized on PN

```
> statedata ← read.csv("Julie_Main5Studies.csv", header = TRUE, sep = ",")
> word_type = read.csv("ItemWordTypes.csv", header = TRUE, sep = ",")
> statedata = merge(statedata, word_type, by = c("Target"))
> statedata ← subset(statedata, statedata$Subject!= 198 & statedata$Subject!= 95)
> statedata$TOTmeasure = ifelse(statedata$Question.RESP == "4" &
+                            statedata$McAcc == "1", "correctTOT",
+               ifelse(statedata$Question.RESP == "4" &
+                         statedata$McAcc == "0","incorrectTOT",
```

```
+                  ifelse(statedata$Question.RESP == "1" &
+                           statedata$Accuracy == "0","incorrectKnow",
+                 ifelse(statedata$Question.RESP == "2","dontknow",
+               ifelse(statedata$Question.RESP == "3"&
+                           statedata$Accuracy == "0","incorrectOther","NA")))))
> age_statedata = group_by(statedata, AgeGroup,
+                           ExperimentName,Subject, Proper, TOTmeasure) %>%
+   summarise(Trials = n())
> library(tidyr)
> age_statedata_wide = spread(age_statedata, TOTmeasure, Trials)
> age_statedata_wide$correctTOT = ifelse(is.na(age_statedata_wide$correctTOT),0,
+                                          age_statedata_wide$correctTOT)
> age_statedata_wide$incorrectTOT = ifelse(is.na(age_statedata_wide$incorrectTOT),0, age
> age_statedata_wide$incorrectKnow = ifelse(is.na(age_statedata_wide$incorrectKnow),0,
age_statedata_wide$incorrectKnow)
> age_statedata_wide$dontknow = ifelse(is.na(age_statedata_wide$dontknow),0,
+                                          age_statedata_wide$dontknow)
> age_statedata_wide$incorrectOther = ifelse(is.na(age_statedata_wide$incorrectOther),0,
age_statedata_wide$incorrectOther)
> age_statedata_wide = mutate(age_statedata_wide,
+                              propTOT = correctTOT/(correctTOT + dontknow +
+                                             incorrectKnow + incorrectTOT +
+                                               incorrectOther))
> age_statedata_wide$Subject = as.factor(age_statedata_wide$Subject)
> exp1_age_TOT = age_statedata_wide %>% filter(ExperimentName == "tot extended prime")
> exp2_age_TOT = age_statedata_wide %>% filter(ExperimentName == "tot not the prime")
> exp3_age_TOT = age_statedata_wide %>% filter(ExperimentName == "tot 48 ms")
> e1_TOT_aov = aov(data = exp1_age_TOT, propTOT ~ AgeGroup*Proper +
+                    Error(Subject/Proper))
> summary(e1_TOT_aov)
```

```
Error: Subject
          Df Sum Sq  Mean Sq F value Pr(>F)
AgeGroup   1 0.0019 0.001918   0.092  0.763
Residuals 70 1.4663 0.020948

Error: Subject:Proper
                Df Sum Sq Mean Sq F value   Pr(>F)
Proper           1 0.1769 0.17694  20.322 2.56e-05 ***
AgeGroup:Proper  1 0.0695 0.06947   7.978  0.00616 **
Residuals       70 0.6095 0.00871
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> e2_TOT_aov = aov(data = exp2_age_TOT, propTOT ~ AgeGroup*Proper+
+                                     Error(Subject/Proper))
> summary(e2_TOT_aov)
```

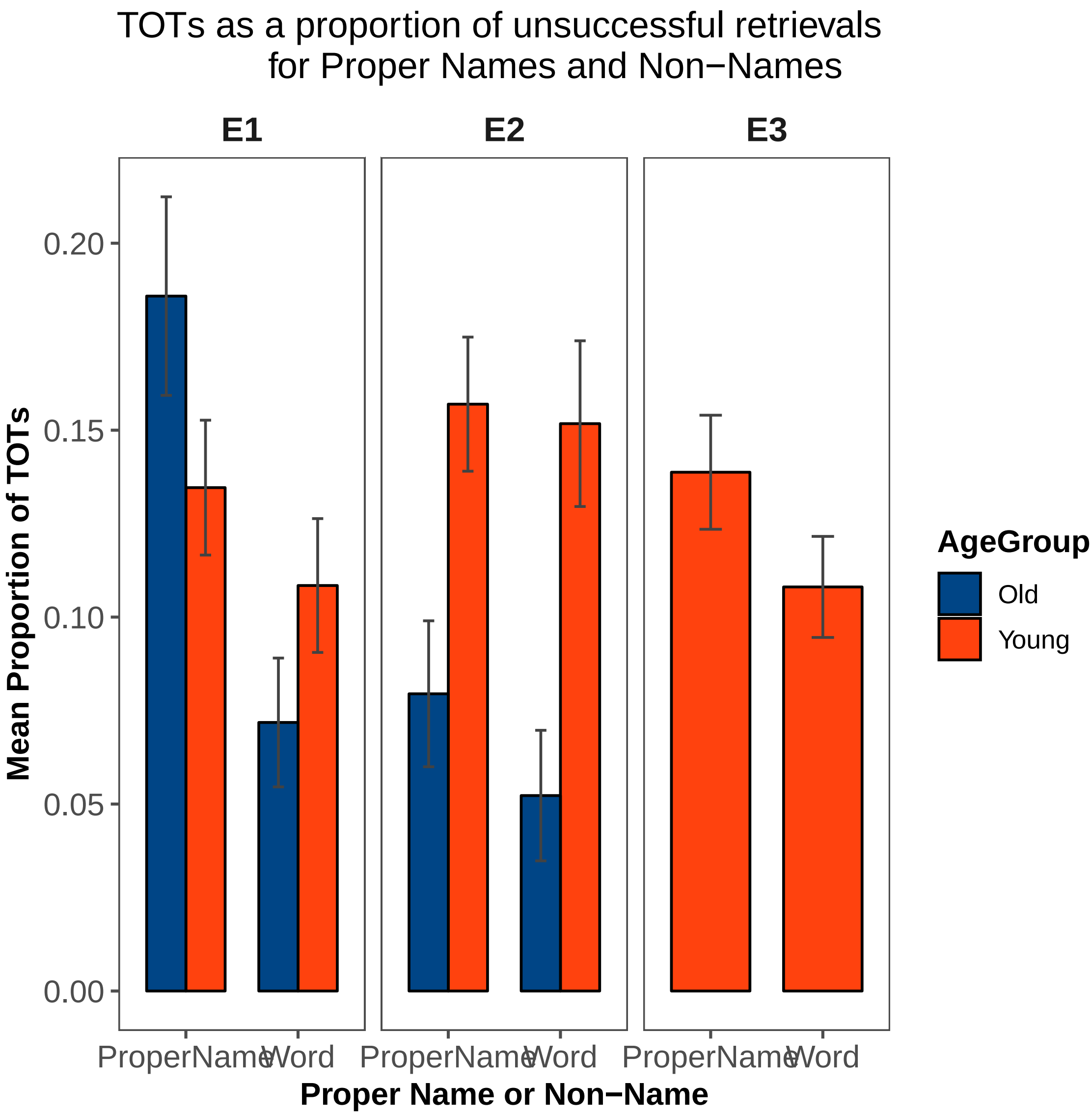
```
Error: Subject
          Df Sum Sq Mean Sq F value   Pr(>F)
AgeGroup   1 0.2505 0.25046   13.64 0.00047 ***
Residuals 62 1.1386 0.01836
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:Proper
                Df Sum Sq  Mean Sq F value Pr(>F)
Proper           1 0.0084 0.008414   1.500  0.225
AgeGroup:Proper  1 0.0039 0.003874   0.691  0.409
Residuals       62 0.3478 0.005610
```

```
> e3_TOT_aov = aov(data = exp3_age_TOT, propTOT ~ Proper+
+                                        Error(Subject/Proper))
> summary(e3_TOT_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
Residuals 35 0.3776 0.01079

Error: Subject:Proper
          Df  Sum Sq Mean Sq F value Pr(>F)
Proper     1 0.01694 0.01694   4.072 0.0513 .
Residuals 35 0.14561 0.00416
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> ## plotting this proportion ## remove subject from dply code
> successTOT_plot_rmisc = Rmisc::summarySE(age_statedata_wide,
+                                           measurevar = "propTOT",
+                                        groupvars = c("ExperimentName", "AgeGroup",
+                                                      "Proper"))
> successTOT_plot_rmisc$ExperimentName = ifelse(successTOT_plot_rmisc$ExperimentName ==
+                                           "tot extended prime", "E1", "E2"))
> successTOT_plot = successTOT_plot_rmisc %>%
+ ggplot(aes(x = Proper, y = propTOT,
+            group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7,
+           color= "black")+
+   geom_errorbar(aes(ymin=propTOT - se, ymax=propTOT + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+  theme_few()+
+   facet_wrap(~ExperimentName)+
+ scale_fill_calc()+
+   xlab("Proper Name or Non-Name") + ylab("Mean Proportion of TOTs") +
```

```
+   ggtitle("TOTs as a proportion of unsuccessful retrievals
+           for Proper Names and Non-Names")  +
+    theme(axis.text = element_text(size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+          plot.title = element_text(hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> successTOT_plot
```



3.2 Subject: Conditionalized on Prime and Age

```
> statedata ← read.csv("Julie_Main5Studies.csv", header = TRUE, sep = ",")
> statedata ← subset(statedata, statedata$Subject!= 198 & statedata$Subject!= 95)
> statedata$TOTmeasure = ifelse(statedata$Question.RESP == "4" &
+                                 statedata$McAcc == "1", "correctTOT",
+                     ifelse(statedata$Question.RESP == "4" &
+                             statedata$McAcc == "0","incorrectTOT",
+                     ifelse(statedata$Question.RESP == "1" &
+                             statedata$Accuracy == "0","incorrectKnow",
+                    ifelse(statedata$Question.RESP == "2","dontknow",
+                  ifelse(statedata$Question.RESP == "3"&
+                             statedata$Accuracy == "0","incorrectOther","NA")))))
> age_statedata = group_by(statedata, AgeGroup,
+                             ExperimentName,Subject, PrimeCondition, TOTmeasure) %>%
+   summarise(Trials = n())
> library(tidyr)
> age_statedata_wide = spread(age_statedata, TOTmeasure, Trials)
> age_statedata_wide$correctTOT = ifelse(is.na(age_statedata_wide$correctTOT),0,
+                                       age_statedata_wide$correctTOT)
> age_statedata_wide$incorrectTOT = ifelse(is.na(age_statedata_wide$incorrectTOT),0, age
> age_statedata_wide$incorrectKnow = ifelse(is.na(age_statedata_wide$incorrectKnow),0,
age_statedata_wide$incorrectKnow)
> age_statedata_wide$dontknow = ifelse(is.na(age_statedata_wide$dontknow),0,
+                                       age_statedata_wide$dontknow)
> age_statedata_wide$incorrectOther = ifelse(is.na(age_statedata_wide$incorrectOther),0,
age_statedata_wide$incorrectOther)
> age_statedata_wide = mutate(age_statedata_wide,
+                                propTOT = correctTOT/(correctTOT + dontknow +
+                                               incorrectKnow + incorrectTOT +
+                                                 incorrectOther))
> age_statedata_wide$Subject = as.factor(age_statedata_wide$Subject)
> exp1_age_TOT = age_statedata_wide %>% filter(ExperimentName == "tot extended prime")
> exp2_age_TOT = age_statedata_wide %>% filter(ExperimentName == "tot not the prime")
> exp3_age_TOT = age_statedata_wide %>% filter(ExperimentName == "tot 48 ms")
> e1_TOT_aov = aov(data = exp1_age_TOT, propTOT ~ AgeGroup*PrimeCondition +
+                       Error(Subject/PrimeCondition))
> summary(e1_TOT_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup   1 0.0093 0.00933   0.248   0.62
Residuals 70 2.6337 0.03762

Error: Subject:PrimeCondition
                         Df Sum Sq Mean Sq F value Pr(>F)
PrimeCondition            3 0.0212 0.00707   0.987  0.400
AgeGroup:PrimeCondition   3 0.0369 0.01230   1.717  0.165
Residuals               210 1.5036 0.00716
```

```
> e2_TOT_aov = aov(data = exp2_age_TOT, propTOT ~ AgeGroup*PrimeCondition+
+                                        Error(Subject/PrimeCondition))
> summary(e2_TOT_aov)
```

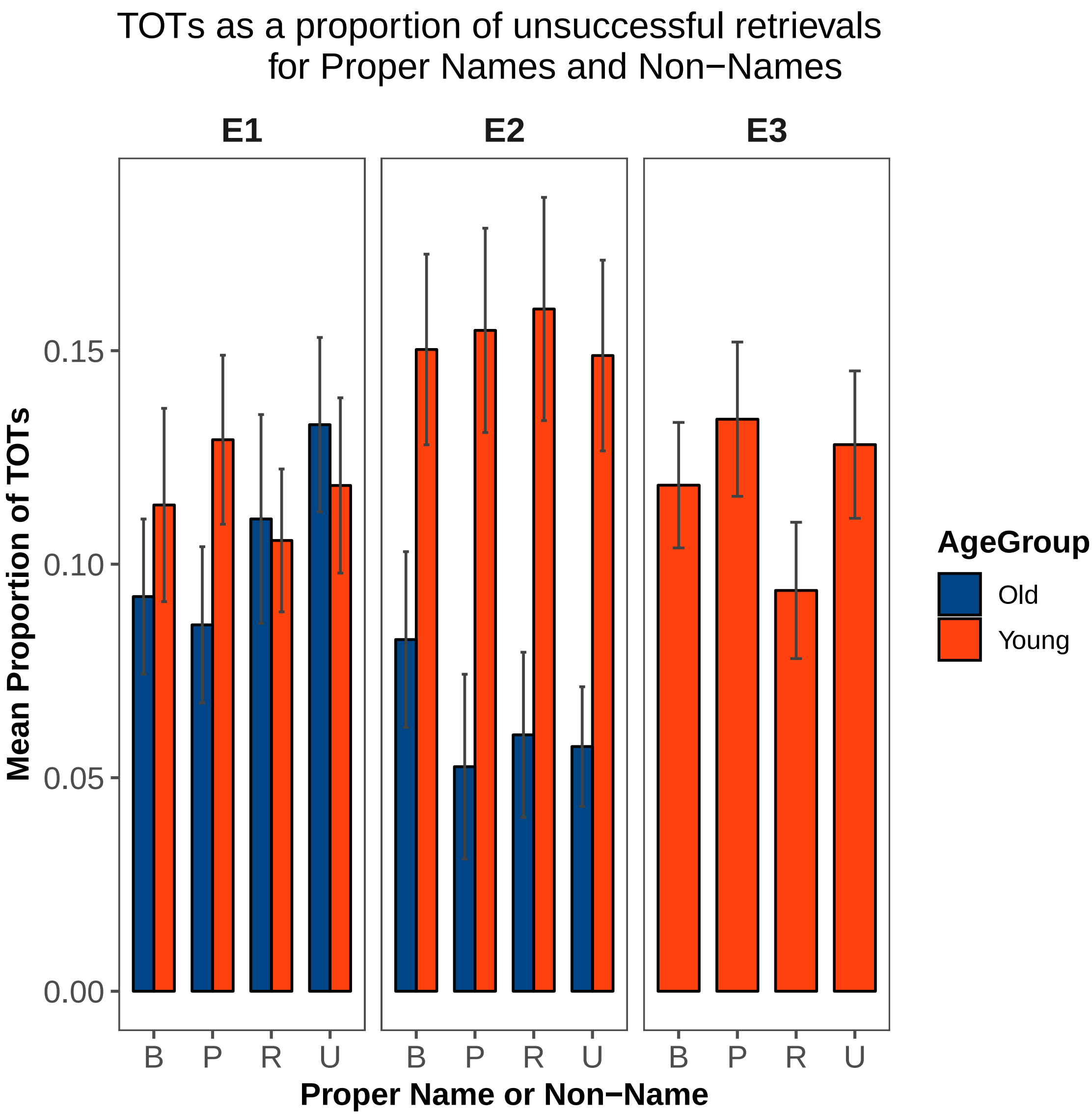
```
Error: Subject
          Df Sum Sq Mean Sq F value   Pr(>F)
AgeGroup   1 0.5223  0.5223    12.7 0.000711 ***
Residuals 62 2.5507  0.0411
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeCondition
                         Df Sum Sq  Mean Sq F value Pr(>F)
PrimeCondition            3 0.0074 0.002464   0.405   0.75
AgeGroup:PrimeCondition   3 0.0117 0.003904   0.641   0.59
Residuals               186 1.1329 0.006091
```

```
> e3_TOT_aov = aov(data = exp3_age_TOT, propTOT ~ PrimeCondition+
+                                        Error(Subject/PrimeCondition))
> summary(e3_TOT_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
Residuals 35 0.7721 0.02206

Error: Subject:PrimeCondition
                Df Sum Sq  Mean Sq F value Pr(>F)
PrimeCondition   3 0.0337 0.011241   1.943  0.127
Residuals      105 0.6074 0.005785
```

```
> ## plotting this proportion ## remove subject from dply code
> successTOT_plot_rmisc = Rmisc::summarySE(age_statedata_wide,
+                                           measurevar = "propTOT",
+                                        groupvars = c("ExperimentName", "AgeGroup",
+                                                      "PrimeCondition"))
> successTOT_plot_rmisc$ExperimentName = ifelse(successTOT_plot_rmisc$ExperimentName ==
+                                           "tot extended prime", "E1", "E2"))
> successTOT_plot = successTOT_plot_rmisc %>%
+ ggplot(aes(x = PrimeCondition, y = propTOT,
+            group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7,
+           color= "black")+
+   geom_errorbar(aes(ymin=propTOT - se, ymax=propTOT + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+  theme_few()+
+   facet_wrap(~ExperimentName)+
```

```
+ scale_fill_calc()+
+   xlab("Proper Name or Non-Name") + ylab("Mean Proportion of TOTs") +
+   ggtitle("TOTs as a proportion of unsuccessful retrievals
+           for Proper Names and Non-Names")  +
+    theme(axis.text = element_text(size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+          plot.title = element_text(hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> successTOT_plot
```



3.3 Item: Conditionalized on Prime and Age

```
> statedata <- read.csv("Julie_Main5Studies.csv", header = TRUE, sep = ",")
> statedata <- subset(statedata, statedata$Subject!= 198 & statedata$Subject!= 95)
> statedata$TOTmeasure = ifelse(statedata$Question.RESP == "4" &
+                                statedata$McAcc == "1", "correctTOT",
+                    ifelse(statedata$Question.RESP == "4" &
+                              statedata$McAcc == "0","incorrectTOT",
+                    ifelse(statedata$Question.RESP == "1" &
+                              statedata$Accuracy == "0","incorrectKnow",
+                   ifelse(statedata$Question.RESP == "2","dontknow",
+                 ifelse(statedata$Question.RESP == "3"&
+                              statedata$Accuracy == "0","incorrectOther","NA")))))
> age_statedata = group_by(statedata,Target,ExperimentName,
+                          AgeGroup,PrimeCondition, TOTmeasure) %>%
+   summarise(Trials = n())
> library(tidyr)
> age_statedata_wide = spread(age_statedata, TOTmeasure, Trials)
> age_statedata_wide$correctTOT = ifelse(is.na(age_statedata_wide$correctTOT),0,
+                                        age_statedata_wide$correctTOT)
> age_statedata_wide$incorrectTOT = ifelse(is.na(age_statedata_wide$incorrectTOT),0, age
> age_statedata_wide$incorrectKnow = ifelse(is.na(age_statedata_wide$incorrectKnow),0,
age_statedata_wide$incorrectKnow)
> age_statedata_wide$dontknow = ifelse(is.na(age_statedata_wide$dontknow),0,
+                                        age_statedata_wide$dontknow)
> age_statedata_wide$incorrectOther = ifelse(is.na(age_statedata_wide$incorrectOther),0,
age_statedata_wide$incorrectOther)
> age_statedata_wide = mutate(age_statedata_wide,
+                             propTOT = correctTOT/(correctTOT + dontknow +
+                                           incorrectKnow + incorrectTOT +
+                                             incorrectOther))
> age_statedata_wide$Target = as.factor(age_statedata_wide$Target)
> age_statedata_wide$propTOT = ifelse(is.na(age_statedata_wide$propTOT), 0,
+                                    age_statedata_wide$propTOT )
> exp1_age_TOT = age_statedata_wide %>% filter(ExperimentName == "tot extended prime")
> exp2_age_TOT = age_statedata_wide %>% filter(ExperimentName == "tot not the prime")
> exp3_age_TOT = age_statedata_wide %>% filter(ExperimentName == "tot 48 ms")
> e1_TOT_aov = aov(data = exp1_age_TOT, propTOT ~ AgeGroup*PrimeCondition +
+                    Error(Target/(AgeGroup*PrimeCondition)))
> summary(e1_TOT_aov)
```

```
Error: Target
          Df Sum Sq Mean Sq F value Pr(>F)
Residuals 99  4.959 0.05009

Error: Target:AgeGroup
          Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup   1  0.020 0.02000   0.464  0.498
```

```
Residuals 99   4.272 0.04315

Error: Target:PrimeCondition
                Df Sum Sq Mean Sq F value Pr(>F)
PrimeCondition   3  0.044 0.01458   0.686  0.561
Residuals      297  6.313 0.02125

Error: Target:AgeGroup:PrimeCondition
                         Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup:PrimeCondition   3  0.057 0.01902   0.914  0.434
Residuals               297  6.176 0.02079
```

```
> e2_TOT_aov = aov(data = exp2_age_TOT, propTOT ~ AgeGroup*PrimeCondition+
+                      Error(Target/(AgeGroup*PrimeCondition)))
> summary(e2_TOT_aov)
```

```
Error: Target
          Df Sum Sq Mean Sq F value Pr(>F)
Residuals 99  3.065 0.03096

Error: Target:AgeGroup
          Df Sum Sq Mean Sq F value   Pr(>F)
AgeGroup   1  1.755  1.7551    63.9 2.48e-12 ***
Residuals 99  2.719  0.0275
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Target:PrimeCondition
                Df Sum Sq  Mean Sq F value Pr(>F)
PrimeCondition   3  0.023 0.007788   0.383  0.766
Residuals      297  6.044 0.020352

Error: Target:AgeGroup:PrimeCondition
                         Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup:PrimeCondition   3  0.059 0.01970    0.92  0.432
Residuals               297  6.362 0.02142
```

```
> e3_TOT_aov = aov(data = exp3_age_TOT, propTOT ~ PrimeCondition+
+                                        Error(Target/PrimeCondition))
> summary(e3_TOT_aov)
```

```
Error: Target
          Df Sum Sq Mean Sq F value Pr(>F)
Residuals 99  5.086 0.05137

Error: Target:PrimeCondition
                Df Sum Sq Mean Sq F value Pr(>F)
PrimeCondition   3  0.171 0.05683   2.245 0.0831 .
```

```
Residuals       297   7.518 0.02531
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> options(contrasts = c('contr.sum', 'contr.poly'))
> library(lsmeans)
> library(multcomp)
> target_lsm = lsmeans::lsmeans(e3_TOT_aov,
+                                  c("PrimeCondition"))
> prime_effect = cld(target_lsm, alpha = 0.05,
+                    adjust = "tukey", details = TRUE)
> library(knitr)
> kable(subset(prime_effect$comparisons,prime_effect$comparisons$p.value < 0.1 ))
```

```
|   |contrast | estimate|         SE|  df|  t.ratio|    p.value|
|:--|:--------|--------:|----------:|---:|--------:|----------:|
|4  |P - R    | 0.052377| 0.0224999| 297| 2.327876| 0.0940545|
```

```
> target_p = exp3_age_TOT %>% filter(PrimeCondition == "P")
> target_r = exp3_age_TOT %>% filter(PrimeCondition == "R")
> target_b = exp3_age_TOT %>% filter(PrimeCondition == "B")
> target_u = exp3_age_TOT %>% filter(PrimeCondition == "U")
> t.test(target_u$propTOT, target_r$propTOT, paired = TRUE)
```

```
        Paired t-test

data:  target_u$propTOT and target_r$propTOT
t = 2.2405, df = 99, p-value = 0.0273
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.00547796 0.09031569
sample estimates:
mean of the differences
             0.04789683
```

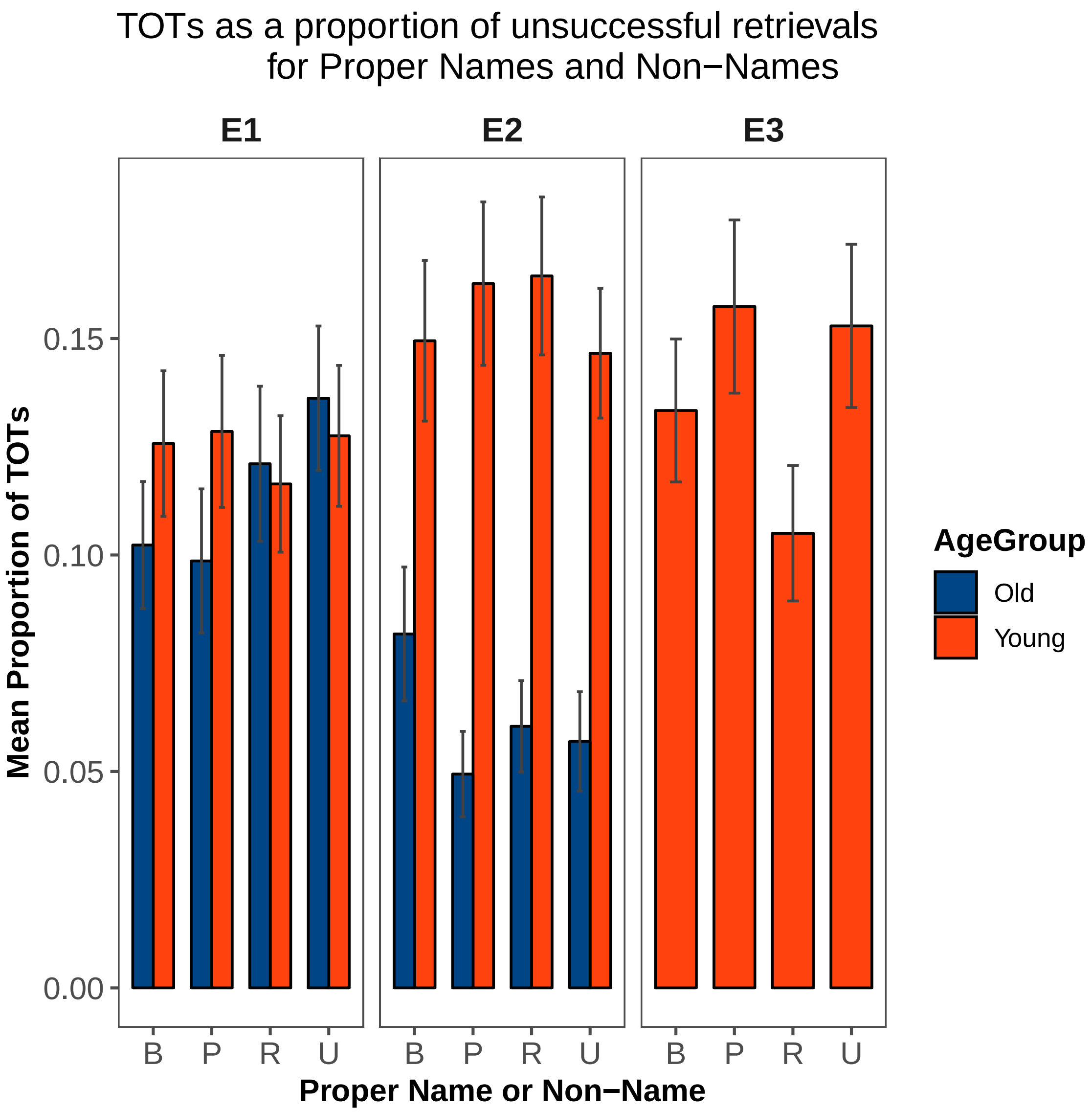
```
> t.test(target_r$propTOT, target_b$propTOT, paired = TRUE)
```

```
        Paired t-test

data:  target_r$propTOT and target_b$propTOT
t = -1.405, df = 99, p-value = 0.1631
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.06842306  0.01169290
sample estimates:
mean of the differences
            -0.02836508
```

```
> t.test(target_r$propTOT, target_p$propTOT, paired = TRUE)
```

```
        Paired t-test

data:  target_r$propTOT and target_p$propTOT
t = -2.1253, df = 99, p-value = 0.03605
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.101276862 -0.003477106
sample estimates:
mean of the differences
            -0.05237698
```

```
> ## plotting this proportion ## remove subject from dply code
> successTOT_plot_rmisc = Rmisc::summarySE(age_statedata_wide,
+                                          measurevar = "propTOT",
+                                       groupvars = c("ExperimentName", "AgeGroup",
+                                                     "PrimeCondition"))
> successTOT_plot_rmisc$ExperimentName = ifelse(successTOT_plot_rmisc$ExperimentName ==
+                                          "tot extended prime", "E1", "E2"))
> successTOT_plot = successTOT_plot_rmisc %>%
+ ggplot(aes(x = PrimeCondition, y = propTOT,
+            group = AgeGroup, fill = AgeGroup))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7,
+           color= "black")+
+   geom_errorbar(aes(ymin=propTOT - se, ymax=propTOT + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+  theme_few()+
+   facet_wrap(~ExperimentName)+
+ scale_fill_calc()+
+   xlab("Proper Name or Non-Name") + ylab("Mean Proportion of TOTs") +
+   ggtitle("TOTs as a proportion of unsuccessful retrievals
+           for Proper Names and Non-Names")  +
+    theme(axis.text = element_text(size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+          plot.title = element_text(hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> successTOT_plot
```



4 Without PN Analyses

```
> itemratings= read.csv("item_ratings_wide.csv",
+                                  header = TRUE, sep = ",")
> library(dplyr)
> main_word1 = main_word %>% filter(! PrimeCondition %in% c( "R", "U"))
> main_item1 = merge(main_word1, itemratings,
+                    by = c("Target", "PrimeCondition", "TargetNo"))
> main_item1 = dplyr::arrange(main_item1, StudyNo, Subject, TargetNo, PrimeType)
> main_item2 = main_item1 %>% filter(Proper == "ProperName")
```

```
> main_item1 = main_item1 %>% filter(Proper == "Word")
> numitems = group_by(main_item1, Subject, PrimeCondition) %>%
+   summarise(n = n())
```

4.0.1 E1

```
> e1 = main_item1 %>% filter(ExperimentName == "tot extended prime")
> e1 = e1 %>% filter(!Subject %in% c(198, 95))
> ## ANOVA at the item level
> e1_item_agg = e1 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, SoundRating), mean)
> e1_item_aov = lmer(data = e1_item_agg, Accuracy ~ PrimeCondition +
+                      SoundRating +
+                      (1|Target))
> summary(e1_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + SoundRating + (1 | Target)
   Data: e1_item_agg

REML criterion at convergence: -77.6

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.68999 -0.46872 -0.05815  0.46362  2.19877

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.039924 0.19981
 Residual             0.008088 0.08993
Number of obs: 120, groups:  Target, 60

Fixed effects:
                 Estimate Std. Error t value
(Intercept)     -0.005244   0.070900  -0.074
PrimeCondition1 -0.043885   0.008482  -5.174
SoundRating      0.047496   0.014385   3.302

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 -0.232
SoundRating -0.924  0.251
```

```
> car::Anova(e1_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)
```

```
Response: Accuracy
                Chisq Df Pr(>Chisq)
PrimeCondition 26.767  1  2.295e-07 ***
SoundRating    10.901  1   0.000961 ***
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(e1_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.311214 0.311214  38.477
SoundRating     1 0.088172 0.088172  10.901
```

```
> ## E1 PROPER NAME
> e1 = main_item2 %>% filter(ExperimentName == "tot extended prime")
> e1 = e1 %>% filter(!Subject %in% c(198, 95))
> ## ANOVA at the item level
> e1_item_agg = e1 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, SoundRating), mean)
> e1_item_aov = lmer(data = e1_item_agg, Accuracy ~ PrimeCondition +
+                      SoundRating +
+                      (1|Target))
> summary(e1_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + SoundRating + (1 | Target)
   Data: e1_item_agg

REML criterion at convergence: -57.5

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.82724 -0.46882  0.00423  0.45363  1.90130

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.026886 0.16397
 Residual             0.008834 0.09399
Number of obs: 80, groups:  Target, 40

Fixed effects:
                Estimate Std. Error t value
(Intercept)      0.21662    0.09312   2.326
PrimeCondition1 -0.02176    0.01126  -1.932
SoundRating      0.04822    0.02062   2.338

Correlation of Fixed Effects:
```

```
             (Intr) PrmCn1
PrimeCndtn1 -0.343
SoundRating -0.954  0.360
```

```
> car::Anova(e1_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                Chisq Df Pr(>Chisq)
PrimeCondition 3.7337  1    0.05332 .
SoundRating    5.4675  1    0.01937 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(e1_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.078125 0.078125  8.8441
SoundRating     1 0.048297 0.048297  5.4675
```

```
>
```

4.0.2 E1 z-scored

```
> e1$zSoundRating = scale(e1$SoundRating, center = TRUE, scale = TRUE)
> e1$zSoundRating = as.numeric(e1$zSoundRating)
> e1$Target = tolower(e1$Target)
> e1$Prime = tolower(e1$Prime)
> e1$LD = RecordLinkage::levenshteinDist(e1$Target, e1$Prime)
> ## reverse scoring LD since higher LD means less overlap
>
> e1$reverseLD = 10 - e1$LD ## 11 for proper name subset
> e1$zLD = scale(e1$reverseLD, center = TRUE, scale = TRUE)
> e1$zLD = as.numeric(e1$zLD)
> e1$meanLDRating = (e1$zLD + e1$zSoundRating)/2
> e1_item_agg = e1 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, meanLDRating), mean)
> options(contrasts = c("contr.sum","contr.poly"))
> e1_item_aov = lmer(data = e1_item_agg, Accuracy ~ PrimeCondition + meanLDRating +
+                      (1|Target))
> car::Anova(e1_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

```

```
Response: Accuracy
                Chisq Df Pr(>Chisq)
PrimeCondition 4.0253  1    0.04482 *
meanLDRating   4.3297  1    0.03745 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> summary(e1_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + meanLDRating + (1 | Target)
   Data: e1_item_agg

REML criterion at convergence: -56.1

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.78491 -0.44854  0.01874  0.44005  1.87872

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.027400 0.16553
 Residual             0.008924 0.09447
Number of obs: 80, groups:  Target, 40

Fixed effects:
                Estimate Std. Error t value
(Intercept)      0.42431    0.02822  15.034
PrimeCondition1 -0.02273    0.01133  -2.006
meanLDRating     0.03819    0.01835   2.081

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 0.000
meanLDRatng 0.000  0.362
```

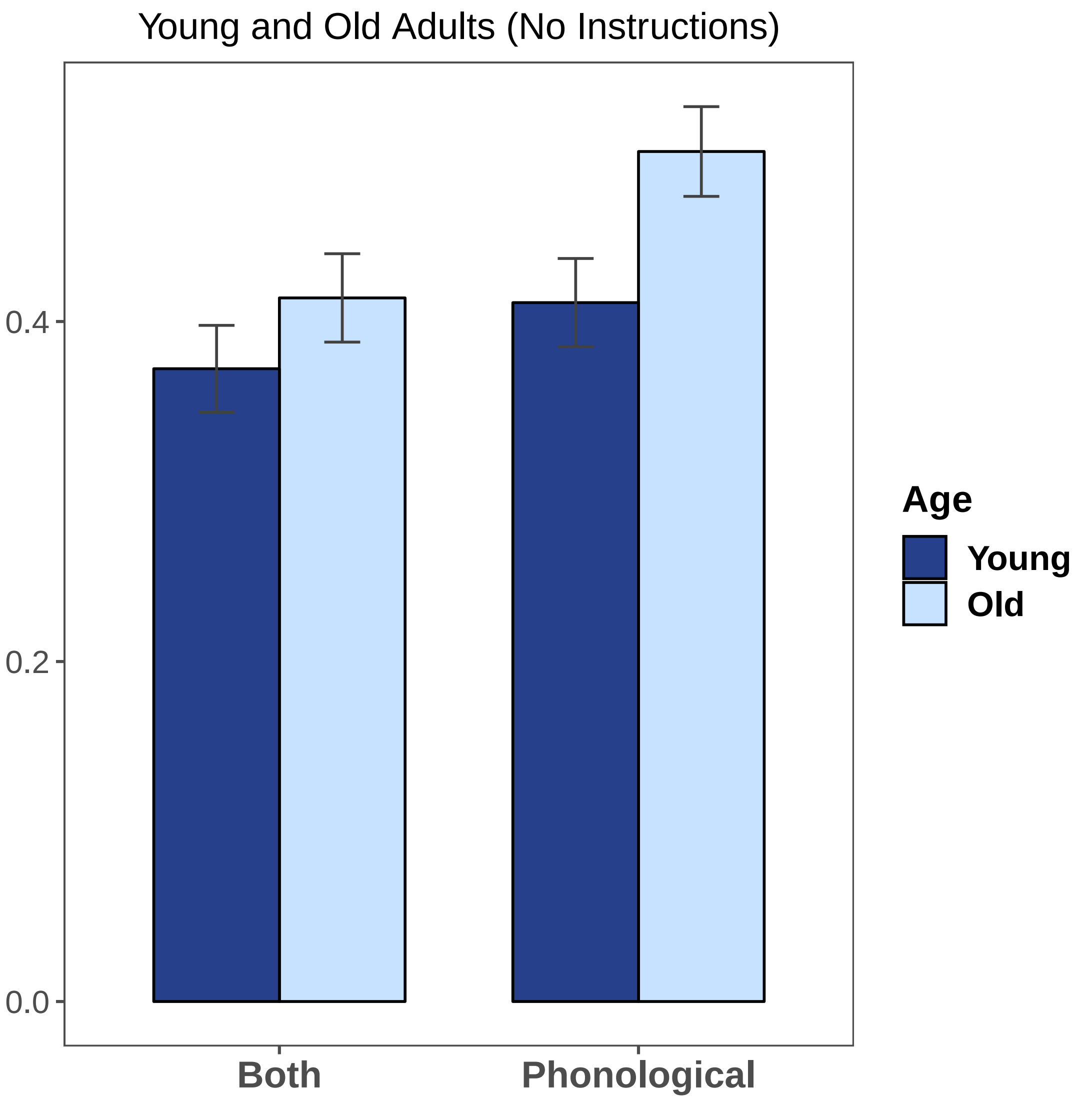
```
> anova(e1_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.078125 0.078125  8.7541
meanLDRating    1 0.038640 0.038640  4.3297
```

```
>
```

4.0.3 E1 plot

```
> exp1_fig_target = Rmisc::summarySE(e1,
+                         measurevar = "Accuracy",
+                         groupvars = c("AgeGroup", "PrimeCondition"))
> exp1_fig_target =  arrange(exp1_fig_target, desc(AgeGroup))
> library(ggplot2)
> library(ggthemes)
> exp1_fig_target %>% mutate(PrimeType = factor(PrimeCondition,
+                                                  levels = unique(PrimeCondition),
+                     labels = c("Both", "Phonological")),
+                     Age = factor(AgeGroup, levels = unique(AgeGroup),
+                     labels = c("Young", "Old")))%>%
+ ggplot(aes(x = PrimeType, y = Accuracy,
+                               fill = Age, group = Age))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Accuracy - se, ymax=Accuracy + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+  theme_few()+
+   scale_fill_manual(values = c("royalblue4", "slategray1"))+
+     xlab("") + ylab("") +
+   ggtitle("Young and Old Adults (No Instructions)")  +
+   theme(axis.text = element_text(size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1.2)),
+          plot.title = element_text(hjust = .5),
+           legend.text = element_text(face = "bold", size = rel(1.1)),
+          axis.text.x = element_text(face = "bold", size = rel(1.2)),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
```



4.0.4 E2

```
> e2 = main_item1 %>% filter(ExperimentName == "tot not the prime")
> e2 = e2 %>% filter(!Subject %in% c(198, 95))
> #contrasts(e2$PrimeType) = contr.treatment(2, base = 1)
>
> ## ANOVA at the item level
>
> e2_item_agg = e2 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, SoundRating), mean)
> e2_item_aov = lmer(data = e2_item_agg, Accuracy ~ PrimeCondition + SoundRating +
```

```
+                       (1|Target))
> summary(e2_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + SoundRating + (1 | Target)
   Data: e2_item_agg

REML criterion at convergence: -104.1

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.68656 -0.56377  0.05585  0.42846  2.22065

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.031833 0.17842
 Residual             0.006441 0.08025
Number of obs: 120, groups:  Target, 60

Fixed effects:
                 Estimate Std. Error t value
(Intercept)       0.091600   0.063277   1.448
PrimeCondition1 -0.025038   0.007569  -3.308
SoundRating       0.020824   0.012838   1.622

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 -0.232
SoundRating -0.924  0.251
```

```
> car::Anova(e2_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                 Chisq Df Pr(>Chisq)
PrimeCondition 10.9416  1  0.0009403 ***
SoundRating     2.6313  1  0.1047777
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(e2_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.094922 0.094922 14.7377
SoundRating     1 0.016947 0.016947  2.6313
```

```
> ### PROPER NAME E2
>
> e2 = main_item2 %>% filter(ExperimentName == "tot not the prime")
> e2 = e2 %>% filter(!Subject %in% c(198, 95))
> #contrasts(e2$PrimeType) = contr.treatment(2, base = 1)
>
> ## ANOVA at the item level
>
> e2_item_agg = e2 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, SoundRating), mean)
> e2_item_aov = lmer(data = e2_item_agg, Accuracy ~ PrimeCondition + SoundRating +
+                      (1|Target))
> summary(e2_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + SoundRating + (1 | Target)
   Data: e2_item_agg

REML criterion at convergence: -46.9

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.58198 -0.56456 -0.01391  0.58645  1.37086

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.03036  0.1742
 Residual             0.01026  0.1013
Number of obs: 80, groups:  Target, 40

Fixed effects:
                Estimate Std. Error t value
(Intercept)      0.14100    0.10008   1.409
PrimeCondition1 -0.02309    0.01214  -1.902
SoundRating      0.05342    0.02218   2.408

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 -0.343
SoundRating -0.955  0.359
```

```
> car::Anova(e2_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                Chisq Df Pr(>Chisq)
```

```
PrimeCondition 3.6169  1     0.05720 .
SoundRating    5.7998  1     0.01603 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(e2_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.090283 0.090283  8.7956
SoundRating     1 0.059533 0.059533  5.7998
```

4.0.5 E2 z-scored

```
> e2$zSoundRating = scale(e2$SoundRating, center = TRUE, scale = TRUE)
> e2$zSoundRating = as.numeric(e2$zSoundRating)
> e2$Target = tolower(e2$Target)
> e2$Prime = tolower(e2$Prime)
> e2$LD = RecordLinkage::levenshteinDist(e2$Target, e2$Prime)
> ## reverse scoring LD since higher LD means less overlap
>
> e2$reverseLD = 10 - e2$LD # 11 for proper name
> e2$zLD = scale(e2$reverseLD, center = TRUE, scale = TRUE)
> e2$zLD = as.numeric(e2$zLD)
> e2$meanLDRating = (e2$zLD + e2$zSoundRating)/2
> e2_item_agg = e2 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, meanLDRating), mean)
> options(contrasts = c("contr.sum","contr.poly"))
> e2_item_aov = lmer(data = e2_item_agg, Accuracy ~ PrimeCondition + meanLDRating +
+                      (1|Target))
> summary(e2_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + meanLDRating + (1 | Target)
   Data: e2_item_agg

REML criterion at convergence: -44.7

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.60140 -0.50352 -0.02849  0.60137  1.30685

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.03120  0.1766
 Residual             0.01051  0.1025
Number of obs: 80, groups:  Target, 40
```

```
Fixed effects:
                 Estimate Std. Error t value
(Intercept)       0.37109    0.03019  12.292
PrimeCondition1 -0.02501    0.01229  -2.036
meanLDRating      0.03846    0.01986   1.936

Correlation of Fixed Effects:
             (Intr) PrmCn1
PrimeCndtn1 0.000
meanLDRatng 0.000  0.361
```

```
> car::Anova(e2_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                 Chisq Df Pr(>Chisq)
PrimeCondition 4.1435  1    0.04179 *
meanLDRating   3.7496  1    0.05282 .
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

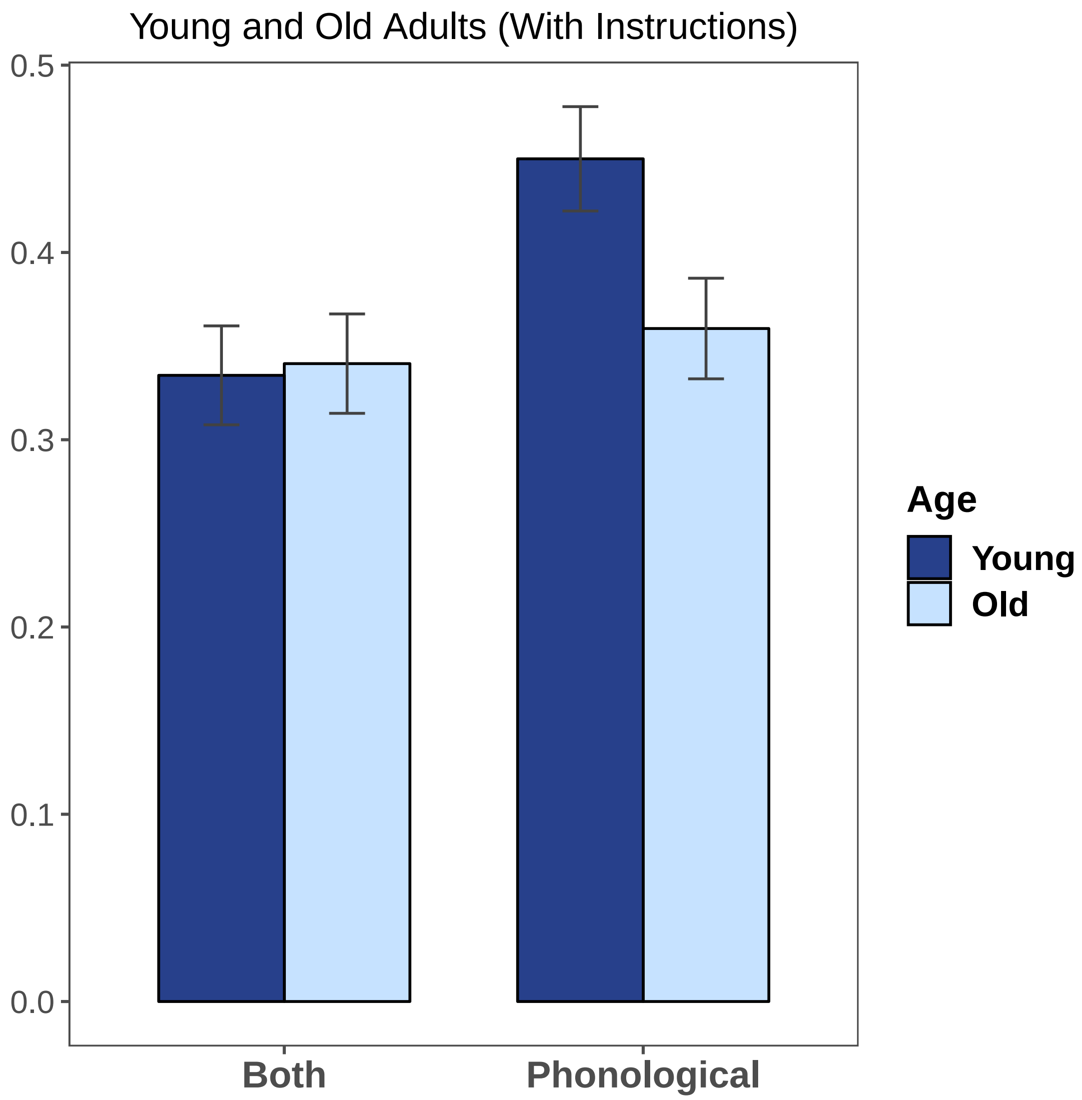
```
> anova(e2_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.090283 0.090283  8.5921
meanLDRating    1 0.039400 0.039400  3.7496
```

4.0.6 E2 plot

```
> exp2_fig_target = Rmisc::summarySE(e2,
+                         measurevar = "Accuracy",
+                         groupvars = c("AgeGroup", "PrimeCondition"))
> exp2_fig_target =  arrange(exp2_fig_target, desc(AgeGroup))
> library(ggplot2)
> library(ggthemes)
> exp2_fig_target %>% mutate(PrimeType = factor(PrimeCondition,
+                                               levels = unique(PrimeCondition),
+                    labels = c("Both", "Phonological")),
+                    Age = factor(AgeGroup, levels = unique(AgeGroup),
+                    labels = c("Young", "Old")))%>%
+ ggplot(aes(x = PrimeType, y = Accuracy,
+                            fill = Age, group = Age))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Accuracy - se, ymax=Accuracy + se),
```

```
+               width=.2, color = "gray26",
+               position = position_dodge(0.7))+
+  theme_few()+
+   scale_fill_manual(values = c("royalblue4", "slategray1"))+
+     xlab("") + ylab("") +
+   ggtitle("Young and Old Adults (With Instructions)")  +
+   theme(axis.text = element_text(size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1.2)),
+          plot.title = element_text(hjust = .5),
+           legend.text = element_text(face = "bold", size = rel(1.1)),
+          axis.text.x = element_text(face = "bold", size = rel(1.2)),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
```



4.0.7 E3

```
> e3 = main_item1 %>% filter(ExperimentName == "tot 48 ms")
> e3_item_agg = e3 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, SoundRating), mean)
> e3_item_aov = lmer(data = e3_item_agg, Accuracy ~ PrimeCondition + SoundRating +
+                        (1|Target))
> summary(e3_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + SoundRating + (1 | Target)
```

```
   Data: e3_item_agg

REML criterion at convergence: -44.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.1123 -0.3832 -0.1513  0.2619  2.6017

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.04819  0.2195
 Residual             0.01155  0.1075
Number of obs: 120, groups:  Target, 60

Fixed effects:
                 Estimate Std. Error t value
(Intercept)      0.035920   0.083281   0.431
PrimeCondition1 -0.009776   0.010130  -0.965
SoundRating      0.033987   0.017056   1.993

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 -0.233
SoundRating -0.933  0.250
```

```
> car::Anova(e3_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                Chisq Df Pr(>Chisq)
PrimeCondition 0.9314  1    0.33451
SoundRating    3.9709  1    0.04629 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(e3_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.026337 0.026337  2.2808
SoundRating     1 0.045854 0.045854  3.9709
```

```
> ## E# PROPER NAME
>
> e3 = main_item2 %>% filter(ExperimentName == "tot 48 ms")
> e3_item_agg = e3 %>% group_by(Target, PrimeCondition ) %>%
```

```
+   summarize_at(vars(Accuracy, SoundRating), mean)
> e3_item_aov = lmer(data = e3_item_agg, Accuracy ~ PrimeCondition + SoundRating +
+                       (1|Target))
> summary(e3_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + SoundRating + (1 | Target)
   Data: e3_item_agg

REML criterion at convergence: -11.1

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.65363 -0.48653 -0.08549  0.44503  2.25746

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.04187  0.2046
 Residual             0.01812  0.1346
Number of obs: 80, groups:  Target, 40

Fixed effects:
                 Estimate Std. Error t value
(Intercept)       0.319310   0.129496   2.466
PrimeCondition1  -0.022780   0.016089  -1.416
SoundRating       0.004223   0.028901   0.146

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 -0.340
SoundRating -0.961  0.353
```

```
> car::Anova(e3_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                Chisq Df Pr(>Chisq)
PrimeCondition 2.0048  1     0.1568
SoundRating    0.0214  1     0.8838
```

```
> anova(e3_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.044599 0.044599  2.4609
SoundRating     1 0.000387 0.000387  0.0214
```

4.0.8 E3 z-scored

```
> e3$zSoundRating = scale(e3$SoundRating, center = TRUE, scale = TRUE)
> e3$zSoundRating = as.numeric(e3$zSoundRating)
> e3$Target = tolower(e3$Target)
> e3$Prime = tolower(e3$Prime)
> e3$LD = RecordLinkage::levenshteinDist(e3$Target, e3$Prime)
> ## reverse scoring LD since higher LD means less overlap
>
> e3$reverseLD = 10 - e3$LD ## 11 for PN
> e3$zLD = scale(e3$reverseLD, center = TRUE, scale = TRUE)
> e3$zLD = as.numeric(e3$zLD)
> e3$meanLDRating = (e3$zLD + e3$zSoundRating)/2
> ## ANOVA at the item level
>
>
> options(contrasts = c("contr.sum","contr.poly"))
> e3_item_agg = e3 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, meanLDRating), mean)
> e3_item_aov = lmer(data = e3_item_agg, Accuracy ~ PrimeCondition + meanLDRating +
+                       (1|Target))
> summary(e3_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + meanLDRating + (1 | Target)
   Data: e3_item_agg

REML criterion at convergence: -11.7

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.55076 -0.51482 -0.01936  0.36290  2.17535

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.04383  0.2094
 Residual             0.01723  0.1313
Number of obs: 80, groups:  Target, 40

Fixed effects:
                Estimate Std. Error t value
(Intercept)      0.33750    0.03621   9.320
PrimeCondition1 -0.02879    0.01571  -1.833
meanLDRating    -0.02322    0.02510  -0.925

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 0.000
```

```
meanLDRatng 0.000   0.356
```

```
> car::Anova(e3_item_aov, type = 3, contrasts=list(topic=contr.sum, sys=contr.sum))
```

```
Analysis of Deviance Table (Type III Wald chisquare tests)

Response: Accuracy
                  Chisq Df Pr(>Chisq)
(Intercept)     86.8645  1     < 2e-16 ***
PrimeCondition   3.3589  1     0.06684 .
meanLDRating     0.8559  1     0.35489
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> car::Anova(e3_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                Chisq Df Pr(>Chisq)
PrimeCondition 3.3589  1    0.06684 .
meanLDRating   0.8559  1    0.35489
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(e3_item_aov)
```

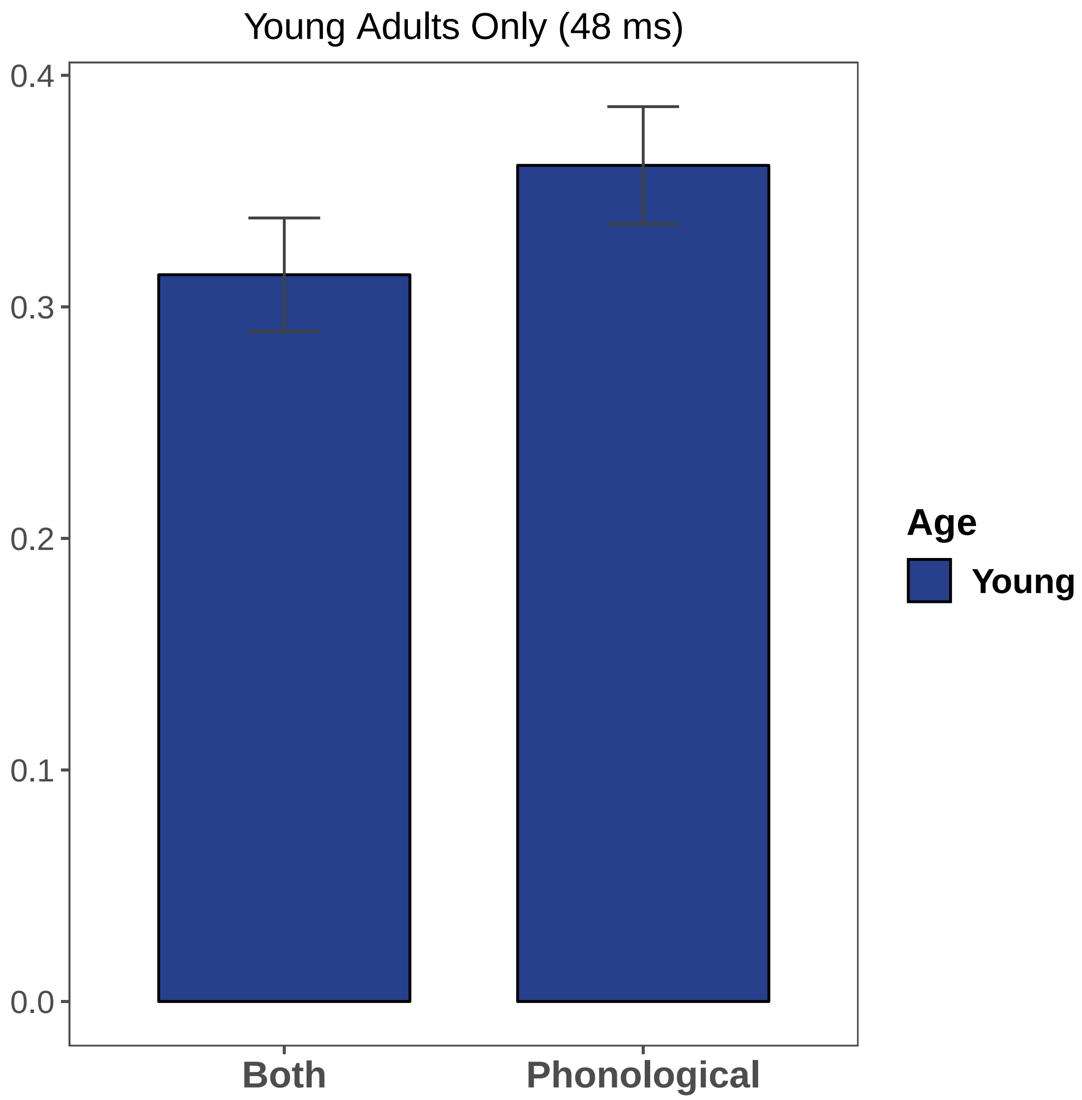
```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.044599 0.044599  2.5877
meanLDRating    1 0.014751 0.014751  0.8559
```

```
>
```

4.0.9 E3 plot

```
> exp3_fig_target = Rmisc::summarySE(e3,
+                         measurevar = "Accuracy",
+                         groupvars = c("AgeGroup", "PrimeCondition"))
> exp3_fig_target =  arrange(exp3_fig_target, desc(AgeGroup))
> library(ggplot2)
> library(ggthemes)
> exp3_fig_target %>% mutate(PrimeType = factor(PrimeCondition,
+                                      levels = unique(PrimeCondition),
+                     labels = c("Both", "Phonological")),
+                     Age = factor(AgeGroup, levels = unique(AgeGroup),
```

```
+                     labels = c("Young")))%>%
+ ggplot(aes(x = PrimeType, y = Accuracy,
+                              fill = Age, group = Age))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Accuracy - se, ymax=Accuracy + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+  theme_few()+
+   scale_fill_manual(values = c("royalblue4", "slategray1"))+
+     xlab("") + ylab("") +
+   ggtitle("Young Adults Only (48 ms)")  +
+   theme(axis.text = element_text(size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1.2)),
+          plot.title = element_text(hjust = .5),
+           legend.text = element_text(face = "bold", size = rel(1.1)),
+          axis.text.x = element_text(face = "bold", size = rel(1.2)),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
```



5 M Turk Rating Data

Calculating item level accuracies

```
> itemratings= read.csv("item_ratings_wide.csv",
+                          header = TRUE, sep = ",")
> main = read.csv("Julie_Main5Studies.csv", header = TRUE, sep = ",")
> library(dplyr)
> main = main %>% filter(! PrimeCondition %in% c( "R", "U"))
> main_item = merge(main, itemratings, by = c("Target", "PrimeCondition"))
```

```
> main_item = dplyr::arrange(main_item, StudyNo, Subject, TargetNo, PrimeType)
> numitems = group_by(main_item, Subject, PrimeCondition) %>%
+   summarise(n = n())
```

Predicting Accuracy Using PrimeCondition and Rating

5.0.1 Sound Analysis

```
> library(lme4)
> #main_item_sub = main_item %>% filter(ExperimentName != "tot 48 ms")
> main_item$PrimeType = ifelse(main_item$PrimeCondition == "P", "P","B")
> main_item$PrimeType = as.factor(as.character(main_item$PrimeType))
> contrasts(main_item$PrimeType) = contr.treatment(2, base = 1)
> library(lme4)
> acc_sound1 = glmer(data = main_item, Accuracy ~ PrimeType+SoundRating+
+                    (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
+             optCtrl=list(maxfun=100000)))
> summary(acc_sound1)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeType + SoundRating + (1 | Subject) + (1 | Target)
   Data: main_item
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  7812.4   7847.7  -3901.2   7802.4     8695

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.9706 -0.4865 -0.2561  0.3859 10.6573

Random effects:
 Groups  Name        Variance Std.Dev.
 Subject (Intercept) 0.9915   0.9957
 Target  (Intercept) 2.2972   1.5156
Number of obs: 8700, groups:  Subject, 174; Target, 100

Fixed effects:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -2.89385    0.30698  -9.427  < 2e-16 ***
PrimeType2   0.39975    0.06250   6.396 1.59e-10 ***
SoundRating  0.26518    0.05809   4.565 4.99e-06 ***
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
Correlation of Fixed Effects:
            (Intr) PrmTy2
PrimeType2   0.157
SoundRating -0.818 -0.318
```

```
> car::Anova(acc_sound1)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
             Chisq Df Pr(>Chisq)
PrimeType   40.914  1  1.591e-10 ***
SoundRating 20.841  1  4.990e-06 ***
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
>
```

5.1 Overall

```
> main_item = main_item %>% filter(!Subject %in% c(198, 95))
> contrasts(main_item$PrimeType) = contr.treatment(2, base = 1)
> ## ANOVA at the item level
> main_item_agg = main_item %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, SoundRating), mean)
> main_item_item_aov = lmer(data = main_item_agg,
+                         Accuracy ~ PrimeCondition + SoundRating +
+                           (1|Target))
> summary(main_item_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + SoundRating + (1 | Target)
   Data: main_item_agg

REML criterion at convergence: -228.6

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.72836 -0.48527 -0.02476  0.45582  1.81099

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.043726 0.20911
 Residual             0.003148 0.05611
Number of obs: 200, groups:  Target, 100
```

```
Fixed effects:
                 Estimate Std. Error t value
(Intercept)      0.115543   0.039849   2.900
PrimeCondition1 -0.027211   0.004165  -6.533
SoundRating      0.035367   0.007560   4.678

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 -0.257
SoundRating -0.845  0.304
```

```
> car::Anova(main_item_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
               Chisq Df Pr(>Chisq)
PrimeCondition 42.684  1  6.434e-11 ***
SoundRating    21.884  1  2.896e-06 ***
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(main_item_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.219646 0.219646  69.769
SoundRating     1 0.068895 0.068895  21.884
```

```
> ### Z-scored
>
> main_item$zSoundRating = scale(main_item$SoundRating, center = TRUE, scale = TRUE)
> main_item$zSoundRating = as.numeric(main_item$zSoundRating)
> main_item$Target = tolower(main_item$Target)
> main_item$Prime = tolower(main_item$Prime)
> main_item$LD = RecordLinkage::levenshteinDist(main_item$Target, main_item$Prime)
> ## reverse scoring LD since higher LD means less overlap
>
> main_item$reverseLD = 11 - main_item$LD
> main_item$zLD = scale(main_item$reverseLD, center = TRUE, scale = TRUE)
> main_item$zLD = as.numeric(main_item$zLD)
> main_item$meanLDRating = (main_item$zLD + main_item$zSoundRating)/2
> main_item_agg2 = main_item %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, meanLDRating), mean)
> main_item_agg2$Target = as.factor(main_item_agg2$Target)
> main_item_aov = lmer(data = main_item_agg2,
```

```
+                           Accuracy ~ PrimeCondition + meanLDRating +
+                        (1|Target))
> car::Anova(main_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                Chisq Df Pr(>Chisq)
PrimeCondition 38.140  1  6.584e-10 ***
meanLDRating   15.354  1  8.914e-05 ***
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> summary(main_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + meanLDRating + (1 | Target)
   Data: main_item_agg2

REML criterion at convergence: -223.6

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.69510 -0.46266 -0.03697  0.45120  1.77238

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.042191 0.20540
 Residual             0.003419 0.05847
Number of obs: 200, groups:  Target, 100

Fixed effects:
                 Estimate Std. Error t value
(Intercept)      0.273140   0.020952  13.036
PrimeCondition1 -0.027197   0.004404  -6.176
meanLDRating     0.029903   0.007631   3.918

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 0.000
meanLDRatng 0.000  0.344
```

```
> anova(main_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.219646 0.219646  64.248
meanLDRating    1 0.052491 0.052491  15.354
```

```
> ## main_b
>
> main_b = main_item %>% filter(PrimeCondition == "B")
> main_b_aov = lm(data = main_b,
+                 Accuracy ~ meanLDRating)
> car::Anova(main_b_aov)
```

```
Anova Table (Type II tests)

Response: Accuracy
             Sum Sq   Df F value   Pr(>F)
meanLDRating   0.75    1  4.1199 0.04244 *
Residuals    783.57 4298
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> summary(main_b_aov)
```

```
Call:
lm(formula = Accuracy ~ meanLDRating, data = main_b)

Residuals:
    Min      1Q  Median      3Q     Max
-0.2760 -0.2452 -0.2332 -0.2152  0.7849

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.242965   0.006673   36.41   <2e-16 ***
meanLDRating 0.014920   0.007351    2.03   0.0424 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Residual standard error: 0.427 on 4298 degrees of freedom
Multiple R^2:  0.0009577,       Adjusted R^2:  0.0007252
F-statistic:  4.12 on 1 and 4298 DF,  p-value: 0.04244
```

5.2 Experiment Wise

5.2.1 E1

```
> e1 = main_item %>% filter(ExperimentName == "tot extended prime")
> e1 = e1 %>% filter(!Subject %in% c(198, 95))
> contrasts(e1$PrimeType) = contr.treatment(2, base = 1)
> ## ANOVA at the item level
> e1_item_agg = e1 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, SoundRating), mean)
```

```
> e1_item_aov = lmer(data = e1_item_agg, Accuracy ~ PrimeCondition + SoundRating +
+                      (1|Target))
> summary(e1_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + SoundRating + (1 | Target)
   Data: e1_item_agg

REML criterion at convergence: -120.5

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.87081 -0.46661 -0.02674  0.43863  2.16329

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.046278 0.21512
 Residual             0.008491 0.09215
Number of obs: 200, groups:  Target, 100

Fixed effects:
                 Estimate Std. Error t value
(Intercept)      0.104800   0.058216   1.800
PrimeCondition1 -0.035848   0.006822  -5.255
SoundRating      0.042995   0.012051   3.568

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 -0.273
SoundRating -0.922  0.296
```

```
> car::Anova(e1_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                Chisq Df Pr(>Chisq)
PrimeCondition 27.615  1   1.48e-07 ***
SoundRating    12.728  1  0.0003602 ***
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(e1_item_aov)
```

```
Analysis of Variance Table
               Df  Sum Sq Mean Sq F value
PrimeCondition  1 0.37076 0.37076  43.664
SoundRating     1 0.10808 0.10808  12.728
```

```
>
```

5.2.2 E1 z-scored

```
> e1$zSoundRating = scale(e1$SoundRating, center = TRUE, scale = TRUE)
> e1$zSoundRating = as.numeric(e1$zSoundRating)
> e1$Target = tolower(e1$Target)
> e1$Prime = tolower(e1$Prime)
> e1$LD = RecordLinkage::levenshteinDist(e1$Target, e1$Prime)
> ## reverse scoring LD since higher LD means less overlap
>
> e1$reverseLD = 11 - e1$LD
> e1$zLD = scale(e1$reverseLD, center = TRUE, scale = TRUE)
> e1$zLD = as.numeric(e1$zLD)
> e1$meanLDRating = (e1$zLD + e1$zSoundRating)/2
> e1_item_agg = e1 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, meanLDRating), mean)
> options(contrasts = c("contr.sum","contr.poly"))
> e1_item_aov = lmer(data = e1_item_agg, Accuracy ~ PrimeCondition + meanLDRating +
+                    (1|Target))
> car::Anova(e1_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                Chisq Df Pr(>Chisq)
PrimeCondition 23.959  1  9.842e-07 ***
meanLDRating   14.896  1  0.0001136 ***
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> summary(e1_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + meanLDRating + (1 | Target)
   Data: e1_item_agg

REML criterion at convergence: -122.9

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.7719 -0.4691 -0.0402  0.4527  2.0827

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.044260 0.21038
```

```
 Residual              0.008619 0.09284
Number of obs: 200, groups:  Target, 100

Fixed effects:
                 Estimate Std. Error t value
(Intercept)       0.296389   0.022038  13.449
PrimeCondition1 -0.034086   0.006964  -4.895
meanLDRating      0.045137   0.011695   3.860

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 0.000
meanLDRatng 0.000  0.334
```

```
> anova(e1_item_aov)
```

```
Analysis of Variance Table
               Df  Sum Sq Mean Sq F value
PrimeCondition  1 0.37076 0.37076  43.017
meanLDRating    1 0.12839 0.12839  14.896
```

```
>
```

5.2.3 E1 zItem

```
> meanRating = group_by(e1, Target) %>%
+   summarise_at(vars(SoundRating), mean)
> colnames(meanRating) = c("Target",
+                          "meanSoundRating")
> sdRating = group_by(e1, Target) %>%
+   summarise_at(vars(SoundRating), sd)
> colnames(sdRating) = c("Target",
+                          "sdSoundRating")
> Rating_agg = merge(meanRating, sdRating, by = "Target")
> ## merge aggregate info with long data
> e1_z_final = merge(e1, Rating_agg, by = "Target", all.x = T)
> ## person and grand-mean centered scores using original and aggregate
> library(dplyr)
> e1_z_final = e1_z_final %>% mutate( zItemRating =
+                                          (SoundRating -
+                                    meanSoundRating)/sdSoundRating)
> ## checking: subject level means should be zero
>
> sub_pic = group_by(e1_z_final, Target) %>%
+   summarise_at(vars(zItemRating), mean)
> acc_z_sound_e1_2 = glmer(data = e1_z_final, Accuracy ~ PrimeType + zItemRating +
+                       (1|Subject) + (1|Target), family = "binomial",
```

```
+      control=glmerControl(optimizer="bobyqa",
+              optCtrl=list(maxfun=100000)))
> summary(acc_z_sound_e1_2)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeType + zItemRating + (1 | Subject) + (1 | Target)
   Data: e1_z_final
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  3388.1   3419.0  -1689.1   3378.1     3523

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.6723 -0.5086 -0.2601  0.4813 12.1942

Random effects:
 Groups  Name        Variance Std.Dev.
 Target  (Intercept) 2.205    1.485
 Subject (Intercept) 1.037    1.018
Number of obs: 3528, groups:  Target, 98; Subject, 72

Fixed effects:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -1.63188    0.20678  -7.892 2.97e-15 ***
PrimeType2   0.56382    0.09349   6.031 1.63e-09 ***
zItemRating  0.17642    0.04929   3.579 0.000345 ***
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmTy2
PrimeType2  -0.257
zItemRating  0.024 -0.201
```

```
> car::Anova(acc_z_sound_e1_2)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
             Chisq Df Pr(>Chisq)
PrimeType   36.372  1   1.63e-09 ***
zItemRating 12.809  1  0.0003449 ***
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

5.2.4 E2

```
> e2 = main_item %>% filter(ExperimentName == "tot not the prime")
> e2 = e2 %>% filter(!Subject %in% c(198, 95))
> contrasts(e2$PrimeType) = contr.treatment(2, base = 1)
> ## ANOVA at the item level
>
> e2_item_agg = e2 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, SoundRating), mean)
> e2_item_aov = lmer(data = e2_item_agg, Accuracy ~ PrimeCondition + SoundRating +
+                        (1|Target))
> summary(e2_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + SoundRating + (1 | Target)
   Data: e2_item_agg

REML criterion at convergence: -141.4

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.70865 -0.54257 -0.00197  0.45817  1.88994

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.04017  0.20043
 Residual             0.00787  0.08871
Number of obs: 200, groups:  Target, 100

Fixed effects:
                 Estimate Std. Error t value
(Intercept)      0.137449   0.055657   2.470
PrimeCondition1 -0.025690   0.006566  -3.913
SoundRating      0.027572   0.011567   2.384

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 -0.273
SoundRating -0.926  0.295
```

```
> car::Anova(e2_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                 Chisq Df Pr(>Chisq)
PrimeCondition 15.3099  1  9.124e-05 ***
SoundRating     5.6821  1    0.01714 *
```

```
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(e2_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.183770 0.183770 23.3507
SoundRating     1 0.044718 0.044718  5.6821
```

5.2.5 E2 z-scored

```
> e2$zSoundRating = scale(e2$SoundRating, center = TRUE, scale = TRUE)
> e2$zSoundRating = as.numeric(e2$zSoundRating)
> e2$Target = tolower(e2$Target)
> e2$Prime = tolower(e2$Prime)
> e2$LD = RecordLinkage::levenshteinDist(e2$Target, e2$Prime)
> ## reverse scoring LD since higher LD means less overlap
>
> e2$reverseLD = 11 - e2$LD
> e2$zLD = scale(e2$reverseLD, center = TRUE, scale = TRUE)
> e2$zLD = as.numeric(e2$zLD)
> e2$meanLDRating = (e2$zLD + e2$zSoundRating)/2
> e2_item_agg = e2 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, meanLDRating), mean)
> options(contrasts = c("contr.sum","contr.poly"))
> e2_item_aov = lmer(data = e2_item_agg, Accuracy ~ PrimeCondition + meanLDRating +
+                    (1|Target))
> summary(e2_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + meanLDRating + (1 | Target)
   Data: e2_item_agg

REML criterion at convergence: -141.5

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.70599 -0.55206  0.01534  0.45378  1.92581

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.038989 0.19746
 Residual             0.008061 0.08978
Number of obs: 200, groups:  Target, 100

Fixed effects:
```

```
                  Estimate Std. Error t value
(Intercept)       0.260313   0.020741  12.551
PrimeCondition1 -0.024970   0.006732  -3.709
meanLDRating      0.026886   0.011272   2.385

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 0.000
meanLDRatng 0.000  0.333
```

```
> car::Anova(e2_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                  Chisq Df Pr(>Chisq)
PrimeCondition 13.7576  1   0.000208 ***
meanLDRating    5.6895  1   0.017067 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(e2_item_aov)
```

```
Analysis of Variance Table
                Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.183770 0.183770 22.7980
meanLDRating    1 0.045862 0.045862  5.6895
```

5.2.6 E2 zItem

```
> meanRating = group_by(e2, Target) %>%
+   summarise_at(vars(SoundRating), mean)
> colnames(meanRating) = c("Target",
+                          "meanSoundRating")
> sdRating = group_by(e2, Target) %>%
+   summarise_at(vars(SoundRating), sd)
> colnames(sdRating) = c("Target",
+                          "sdSoundRating")
> Rating_agg = merge(meanRating, sdRating, by = "Target")
> ## merge aggregate info with long data
> e2_z_final = merge(e2, Rating_agg, by = "Target", all.x = T)
> ## person and grand-mean centered scores using original and aggregate
> library(dplyr)
> e2_z_final = e2_z_final %>% mutate( zItemRating =
+                                        (SoundRating -
+                                      meanSoundRating)/sdSoundRating)
> ## checking: subject level means should be zero
```

```
>
> sub_pic = group_by(e2_z_final, Target) %>%
+   summarise_at(vars(zItemRating), mean)
> acc_z_sound_e2_2 = glmer(data = e2_z_final, Accuracy ~ PrimeType + zItemRating +
+                      (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
+             optCtrl=list(maxfun=100000)))
> summary(acc_z_sound_e2_2)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeType + zItemRating + (1 | Subject) + (1 | Target)
   Data: e2_z_final
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  2875.1   2905.4  -1432.6   2865.1     3131

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.2630 -0.4763 -0.2655  0.3226  8.1185

Random effects:
 Groups  Name        Variance Std.Dev.
 Target  (Intercept) 2.167    1.472
 Subject (Intercept) 1.073    1.036
Number of obs: 3136, groups:  Target, 98; Subject, 64

Fixed effects:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -1.79673    0.21425  -8.386  < 2e-16 ***
PrimeType2   0.38343    0.10202   3.758 0.000171 ***
zItemRating  0.12584    0.05346   2.354 0.018571 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmTy2
PrimeType2  -0.260
zItemRating  0.039 -0.235
```

```
> car::Anova(acc_z_sound_e2_2)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
              Chisq Df Pr(>Chisq)
```

```
PrimeType    14.1243  1  0.0001711 ***
zItemRating  5.5414   1  0.0185715 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

5.2.7 E3

```
> e3 = main_item %>% filter(ExperimentName == "tot 48 ms")
> e3_item_agg = e3 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, SoundRating), mean)
> e3_item_aov = lmer(data = e3_item_agg, Accuracy ~ PrimeCondition + SoundRating +
+                    (1|Target))
> summary(e3_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + SoundRating + (1 | Target)
   Data: e3_item_agg

REML criterion at convergence: -57.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.9694 -0.4260 -0.1424  0.3480  2.5918

Random effects:
 Groups   Name        Variance Std.Dev.
 Target   (Intercept) 0.05008  0.2238
 Residual             0.01421  0.1192
Number of obs: 200, groups:  Target, 100

Fixed effects:
                 Estimate Std. Error t value
(Intercept)      0.167269   0.071973   2.324
PrimeCondition1 -0.015242   0.008807  -1.731
SoundRating      0.018441   0.015234   1.211

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 -0.273
SoundRating -0.943  0.290
```

```
> car::Anova(e3_item_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                Chisq Df Pr(>Chisq)
```

```
PrimeCondition 2.9950  1     0.08352 .
SoundRating    1.4654  1     0.22608
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(e3_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.067222 0.067222  4.7309
SoundRating     1 0.020822 0.020822  1.4654
```

5.2.8 E3 z-scored

```
> e3$zSoundRating = scale(e3$SoundRating, center = TRUE, scale = TRUE)
> e3$zSoundRating = as.numeric(e3$zSoundRating)
> e3$Target = tolower(e3$Target)
> e3$Prime = tolower(e3$Prime)
> e3$LD = RecordLinkage::levenshteinDist(e3$Target, e3$Prime)
> ## reverse scoring LD since higher LD means less overlap
>
> e3$reverseLD = 11 - e3$LD
> e3$zLD = scale(e3$reverseLD, center = TRUE, scale = TRUE)
> e3$zLD = as.numeric(e3$zLD)
> e3$meanLDRating = (e3$zLD + e3$zSoundRating)/2
> ## ANOVA at the item level
>
>
> options(contrasts = c("contr.sum","contr.poly"))
> e3_item_agg = e3 %>% group_by(Target, PrimeCondition ) %>%
+   summarize_at(vars(Accuracy, meanLDRating), mean)
> e3_item_aov = lmer(data = e3_item_agg, Accuracy ~ PrimeCondition + meanLDRating +
+                       (1|Target))
> summary(e3_item_aov)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: Accuracy ~ PrimeCondition + meanLDRating + (1 | Target)
   Data: e3_item_agg

REML criterion at convergence: -56.6

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.9734 -0.4330 -0.1205  0.3715  2.5776

Random effects:
 Groups   Name        Variance Std.Dev.
```

```
 Target   (Intercept) 0.04955  0.2226
 Residual             0.01447  0.1203
Number of obs: 200, groups:  Target, 100

Fixed effects:
                  Estimate Std. Error t value
(Intercept)       0.249444   0.023829  10.468
PrimeCondition1 -0.016578   0.008998  -1.842
meanLDRating      0.008837   0.014767   0.598

Correlation of Fixed Effects:
            (Intr) PrmCn1
PrimeCndtn1 0.000
meanLDRatng 0.000  0.326
```

```
> car::Anova(e3_item_aov, type = 3, contrasts=list(topic=contr.sum, sys=contr.sum))
```

```
Analysis of Deviance Table (Type III Wald chisquare tests)

Response: Accuracy
                   Chisq Df Pr(>Chisq)
(Intercept)     109.5828  1    < 2e-16 ***
PrimeCondition    3.3943  1    0.06542 .
meanLDRating      0.3581  1    0.54956
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> anova(e3_item_aov)
```

```
Analysis of Variance Table
               Df   Sum Sq  Mean Sq F value
PrimeCondition  1 0.067222 0.067222  4.6454
meanLDRating    1 0.005182 0.005182  0.3581
```

```
>
```

5.2.9 E3 zItem

```
> meanRating = group_by(e3, Target) %>%
+   summarise_at(vars(SoundRating), mean)
> colnames(meanRating) = c("Target",
+                          "meanSoundRating")
> sdRating = group_by(e3, Target) %>%
+   summarise_at(vars(SoundRating), sd)
> colnames(sdRating) = c("Target",
+                          "sdSoundRating")
```

```
> Rating_agg = merge(meanRating, sdRating, by = "Target")
> ## merge aggregate info with long data
> e3_z_final = merge(e3, Rating_agg, by = "Target", all.x = T)
> ## person and grand-mean centered scores using original and aggregate
> library(dplyr)
> e3_z_final = e3_z_final %>% mutate( zItemRating =
+                                        (SoundRating -
+                                 meanSoundRating)/sdSoundRating)
> ## checking: subject level means should be zero
>
> sub_pic = group_by(e3_z_final, Target) %>%
+   summarise_at(vars(zItemRating), mean)
> #contrasts(e3_z_final$PrimeType) = contr.treatment(3, base = 2)
> acc_z_sound_e3_2 = glmer(data = e3_z_final, Accuracy ~ PrimeType + zItemRating +
+                     (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
+             optCtrl=list(maxfun=100000)))
> summary(acc_z_sound_e3_2)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeType + zItemRating + (1 | Subject) + (1 | Target)
   Data: e3_z_final
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  1602.0   1629.4   -796.0   1592.0     1759

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.9632 -0.4468 -0.2344  0.2532  5.8926

Random effects:
 Groups  Name        Variance Std.Dev.
 Target  (Intercept) 3.0195   1.7377
 Subject (Intercept) 0.7234   0.8505
Number of obs: 1764, groups:  Target, 98; Subject, 36

Fixed effects:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -1.924835   0.254755  -7.556 4.17e-14 ***
PrimeType2   0.310538   0.136942   2.268   0.0233 *
zItemRating  0.003291   0.072171   0.046   0.9636
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
```

```
             (Intr) PrmTy2
PrimeType2   -0.293
zItemRating   0.061 -0.227
```

```
> car::Anova(acc_z_sound_e3_2)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
             Chisq Df Pr(>Chisq)
PrimeType    5.1423  1    0.02335 *
zItemRating 0.0021  1    0.96363
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

5.3 Plotting Model

5.3.1 Sound

```
> # library(ggplot2)
> # library(ggthemes)
> # fixed.frame ←
> #   data.frame(
> #     expand.grid(
> #       # here, you add values for your time variable and predictors
> #       SoundRating = seq(1,7,1),
> #        PrimeType = c("B" ,"P","R") ))
> #
> # fixed.frame$pred = predict(acc_z_sound_e1_2, newdata = fixed.frame, re.form = NA)
> # fixed.frame$odds = exp(fixed.frame$pred)
> # fixed.frame$prob = fixed.frame$odds/(1+fixed.frame$odds)
> #
> # e1_plot = fixed.frame %>% mutate(PrimeType = factor(PrimeType,
> #                                  levels = unique(PrimeType),
> #                         labels = c("Both", "Phonological",
> #                                  "Semantic")))%>%
> #   ggplot(aes(x = SoundRating, y = prob, group = PrimeType,
> #              color = PrimeType)) +
> #   geom_line(size = 1) +
> #         labs(x = "",
> #              y = "",
> #          title = "E1: Young and Old Adults (No Instructions)") +
> #   theme_few()+
> #     theme(axis.text = element_text(face = "bold", size = rel(1)),
> #           axis.title = element_text(face = "bold", size = rel(1)),
> #           legend.title = element_text(face = "bold", size = rel(1)),
> #           plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
```

```
> #
> # fixed.frame <-
> #   data.frame(
> #     expand.grid(
> #       # here, you add values for your time variable and predictors
> #       SoundRating = seq(1,7,1),
> #        PrimeType = c("B" ,"P","R") ))
> #
> # fixed.frame$pred = predict(acc_z_sound_e2_2, newdata = fixed.frame, re.form = NA)
> # fixed.frame$odds = exp(fixed.frame$pred)
> # fixed.frame$prob = fixed.frame$odds/(1+fixed.frame$odds)
> #
> # e2_plot = fixed.frame %>% mutate(PrimeType = factor(PrimeType,
> #                                        levels = unique(PrimeType),
> #                          labels = c("Both", "Phonological",
> #                                     "Semantic")))%>%
> #   ggplot(aes(x = SoundRating, y = prob, group = PrimeType,
> #                color = PrimeType)) +
> #   geom_line(size = 1) +
> #         labs(x = "",
> #              y = "Target Accuracy",
> #          title = "E2: Young and Old Adults (With Instructions)") +
> #   theme_few()+
> #     theme(axis.text = element_text(face = "bold", size = rel(1)),
> #           axis.title = element_text(face = "bold", size = rel(1)),
> #           legend.title = element_text(face = "bold", size = rel(1)),
> #           plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
> #
> # fixed.frame <-
> #   data.frame(
> #     expand.grid(
> #       # here, you add values for your time variable and predictors
> #       SoundRating = seq(1,7,1),
> #        PrimeType = c("B" ,"P","R") ))
> #
> # fixed.frame$pred = predict(acc_z_sound_e3_2, newdata = fixed.frame, re.form = NA)
> # fixed.frame$odds = exp(fixed.frame$pred)
> # fixed.frame$prob = fixed.frame$odds/(1+fixed.frame$odds)
> #
> # e3_plot = fixed.frame %>% mutate(PrimeType = factor(PrimeType,
> #                                        levels = unique(PrimeType),
> #                          labels = c("Both", "Phonological",
> #                                     "Semantic")))%>%
> #   ggplot(aes(x = SoundRating, y = prob, group = PrimeType,
> #                color = PrimeType)) +
> #   geom_line(size = 1) +
> #         labs(x = "Rating on Phonological (Sound) Dimension",
> #              y = "",
```

```
> #            title = "E3: Young Adults Only (48 ms)") +
> #    theme_few()+
> #      theme(axis.text = element_text(face = "bold", size = rel(1)),
> #            axis.title = element_text(face = "bold", size = rel(1)),
> #            legend.title = element_text(face = "bold", size = rel(1)),
> #            plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
> #
> # library(grid)
> # gridExtra::grid.arrange(e1_plot, e2_plot, e3_plot, nrow = 3, ncol = 1,
> #           top=textGrob("Target Accuracy as a Function of Prime and
> #            Rating on Phonological Dimension Across Experiments 1, 2, 3",
> #                                      gp=gpar(fontsize=16)))
```

5.3.2 Meaning

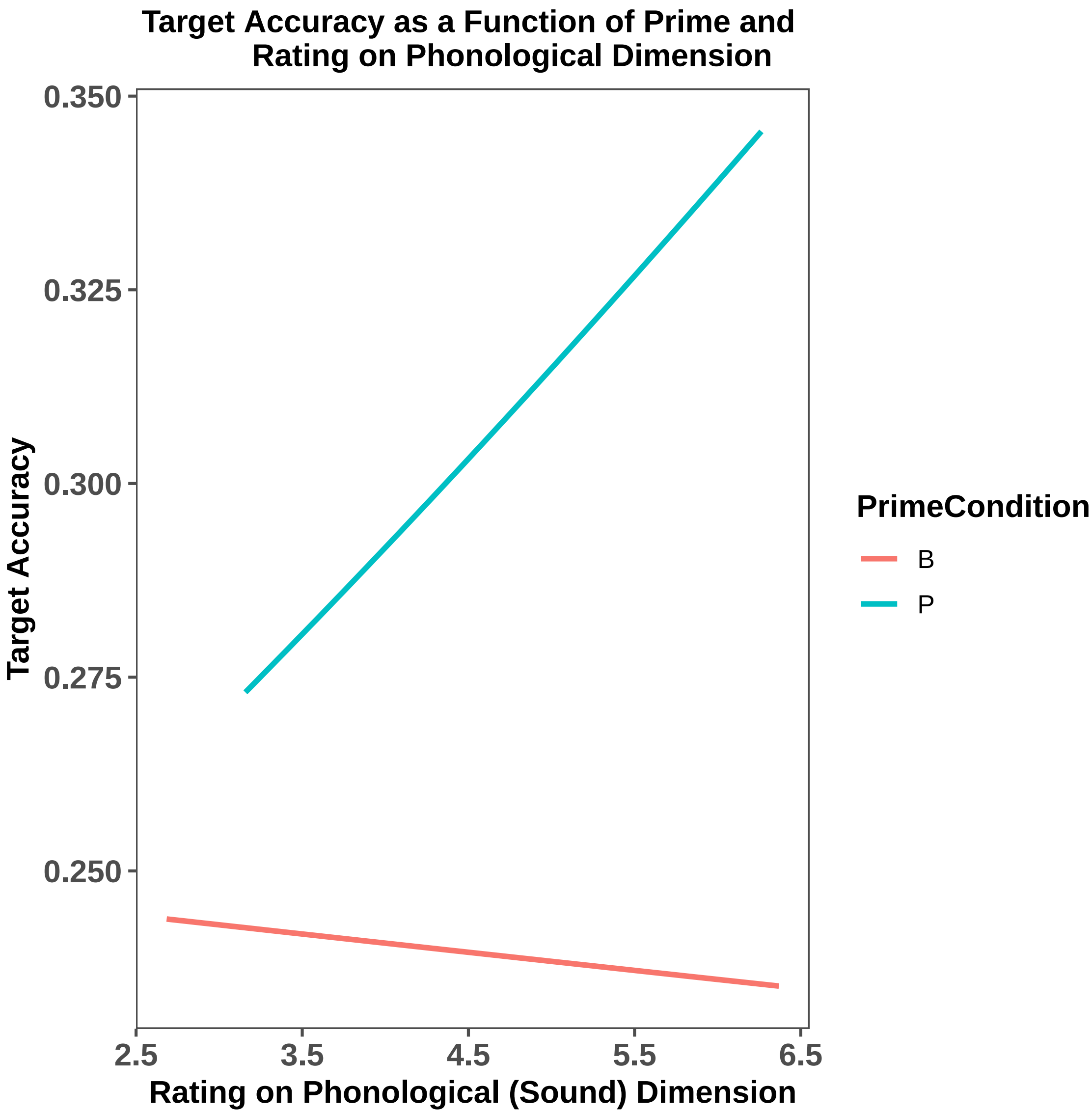
```
> # fixed.frame <-
> #    data.frame(
> #      expand.grid(
> #        # here, you add values for your time variable and predictors
> #        MeaningRating = seq(1,7,0.5),
> #         PrimeCondition = c("B" ,"P","R") ))
> #
> # fixed.frame$pred = predict(acc_meaning, newdata = fixed.frame, re.form = NA)
> # fixed.frame$odds = exp(fixed.frame$pred)
> # fixed.frame$prob = fixed.frame$odds/(1+fixed.frame$odds)
> #
> # fixed.frame %>%
> #    ggplot(aes(x = MeaningRating, y = prob, group = PrimeCondition,
> #                color = PrimeCondition)) +
> #    geom_line(size = 1) +
> #           labs(x = "Rating on Semantic (Meaning) Dimension",
> #                y = "Target Accuracy",
> #            title = "Target Accuracy as a Function of Prime and
> #            Rating on Semantic Dimension")+
> #    ylim(0,0.5)+
> #    theme_few()+
> #      theme(axis.text = element_text(face = "bold", size = rel(1)),
> #            axis.title = element_text(face = "bold", size = rel(1)),
> #            legend.title = element_text(face = "bold", size = rel(1)),
> #            plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
```

5.4 Plotting Raw Data

5.4.1 Sound

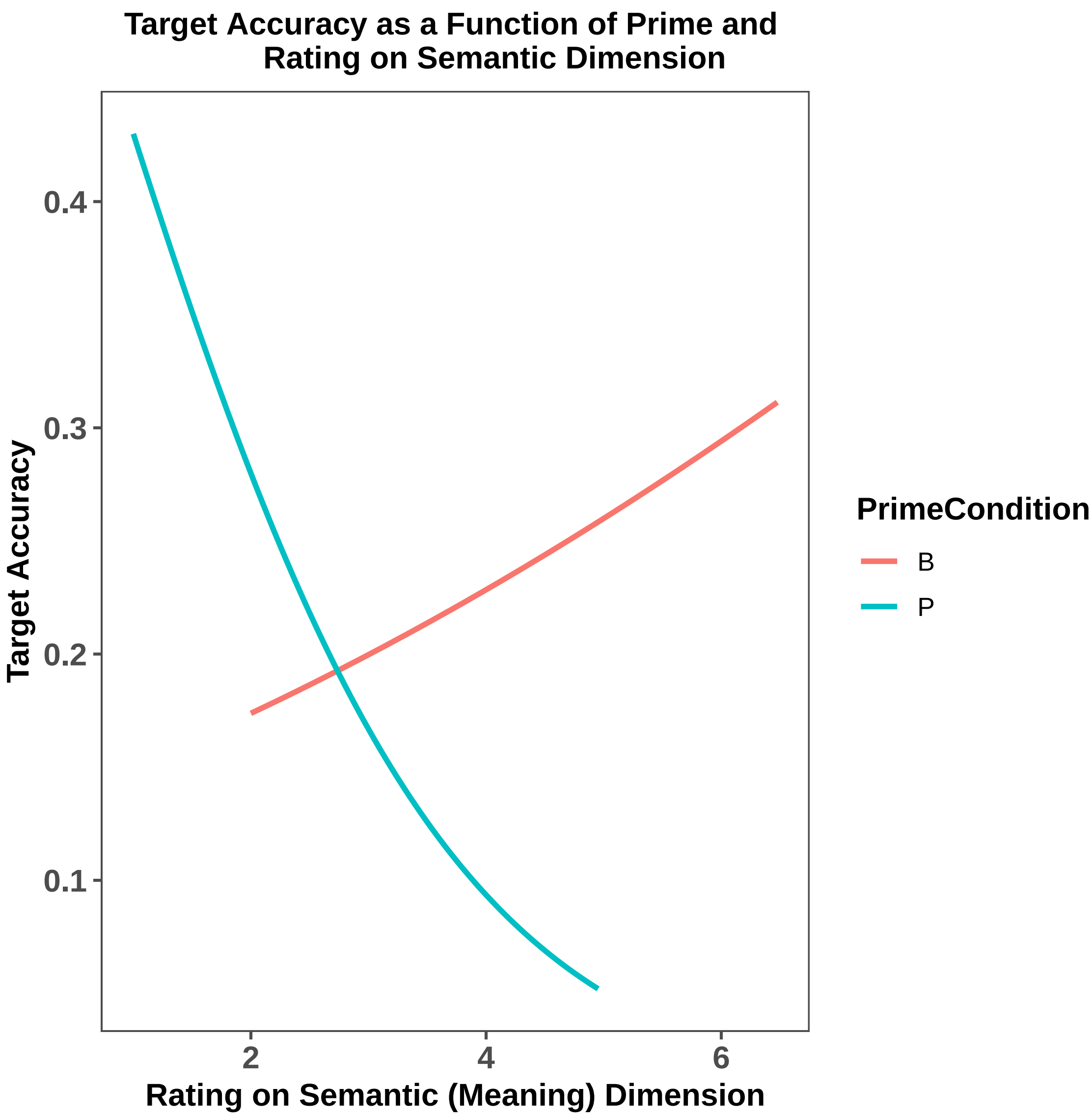
```
> main_item %>%
+   ggplot(aes(x = SoundRating, y = Accuracy, group = PrimeCondition,
```

```
+              color = PrimeCondition)) +
+   geom_smooth(method = "glm", se = FALSE, method.args = list(family = "binomial"))+
+         labs(x = "Rating on Phonological (Sound) Dimension",
+              y = "Target Accuracy",
+          title = "Target Accuracy as a Function of Prime and
+          Rating on Phonological Dimension") +
+   theme_few()+
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+           plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
```



5.4.2 Meaning

```
> main_item %>%
+   ggplot(aes(x = MeaningRating, y = Accuracy, group = PrimeCondition,
+               color = PrimeCondition)) +
+   geom_smooth(method = "glm", se = FALSE, method.args = list(family = "binomial"))+
+         labs(x = "Rating on Semantic (Meaning) Dimension",
+              y = "Target Accuracy",
+          title = "Target Accuracy as a Function of Prime and
+          Rating on Semantic Dimension")+
+   theme_few()+
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+           plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
```



5.5 Levenshtein Distance

```
> main = read.csv("Julie_Main5Studies.csv", header = TRUE, sep = ",")
> library(dplyr)
> main$Target = tolower(main$Target)
> main$Prime = tolower(main$Prime)
> main$LD = RecordLinkage::levenshteinDist(main$Target,
+                                           main$Prime)
> ld_avg = group_by(main, Target, Prime, PrimeCondition) %>%
+   summarise_at(vars(LD), mean)
```

```
> ld_avg1 = ld_avg[,-2]
> ld_avg_wide = tidyr::spread(ld_avg1, PrimeCondition, LD)
> t.test(ld_avg_wide$B, ld_avg_wide$P, paired = TRUE)
```

```
        Paired t-test

data:  ld_avg_wide$B and ld_avg_wide$P
t = 3.5625, df = 99, p-value = 0.0005669
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.3056856 1.0743144
sample estimates:
mean of the differences
                   0.69
```

```
> t.test(ld_avg_wide$R, ld_avg_wide$P, paired = TRUE)
```

```
        Paired t-test

data:  ld_avg_wide$R and ld_avg_wide$P
t = 14.02, df = 99, p-value < 2.2e-16
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 2.300701 3.059299
sample estimates:
mean of the differences
                   2.68
```

```
> t.test(ld_avg_wide$R, ld_avg_wide$B, paired = TRUE)
```

```
        Paired t-test

data:  ld_avg_wide$R and ld_avg_wide$B
t = 10.039, df = 99, p-value < 2.2e-16
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 1.596685 2.383315
sample estimates:
mean of the differences
                   1.99
```

```
> t.test(ld_avg_wide$R, ld_avg_wide$U, paired = TRUE)
```

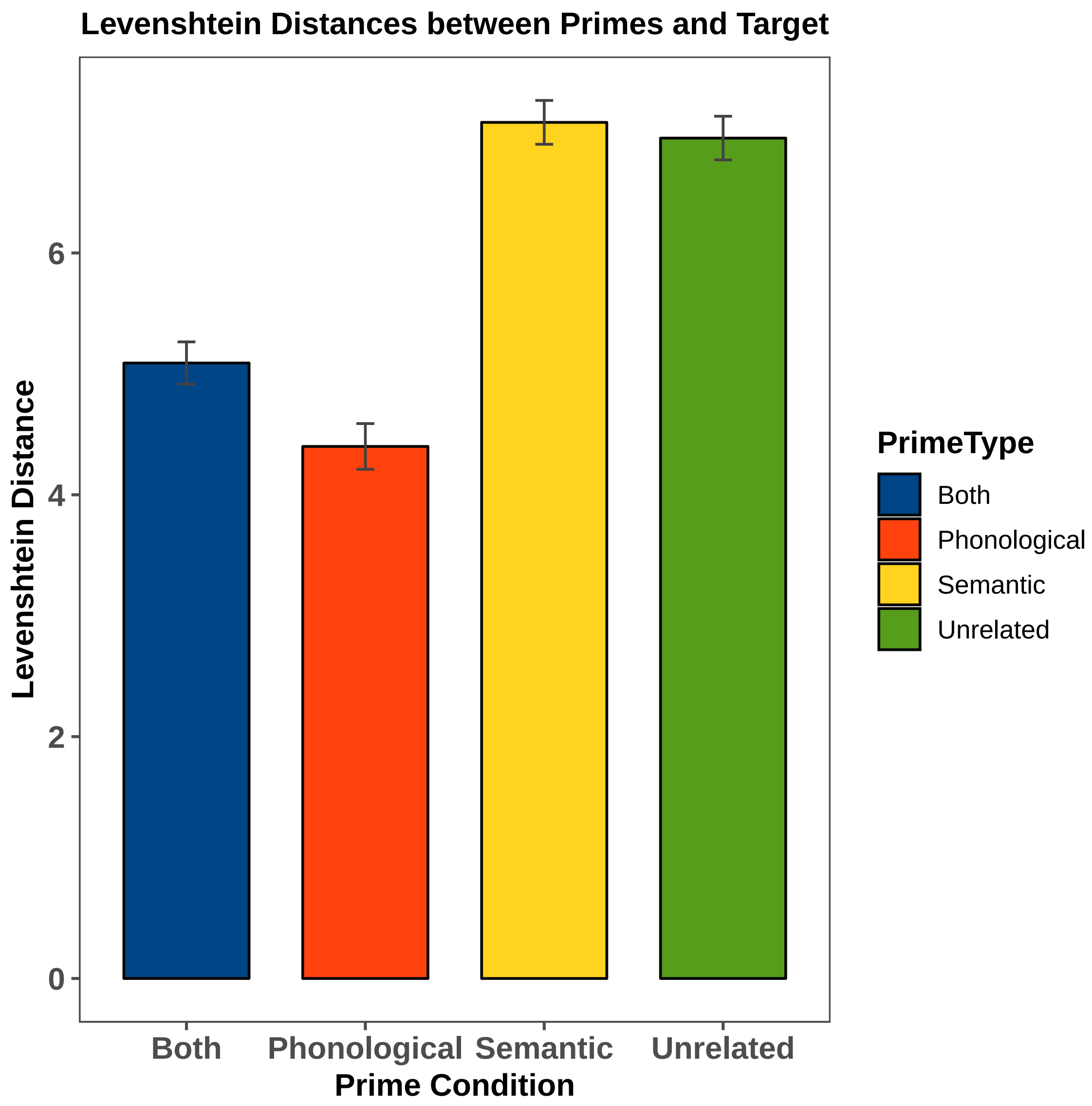
```
        Paired t-test

data:  ld_avg_wide$R and ld_avg_wide$U
t = 0.81594, df = 99, p-value = 0.4165
```

```
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.1861378  0.4461378
sample estimates:
mean of the differences
                   0.13
```

```
> t.test(ld_avg_wide$B, ld_avg_wide$U, paired = TRUE)
```

```
        Paired t-test

data:  ld_avg_wide$B and ld_avg_wide$U
t = -9.3949, df = 99, p-value = 2.286e-15
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -2.252835 -1.467165
sample estimates:
mean of the differences
                  -1.86
```

```
> ld_avg_rmisc = Rmisc::summarySE(ld_avg,
+                                 measurevar = "LD",
+                                 groupvars = c("PrimeCondition"))
> ld_avg_rmisc %>% mutate(PrimeType = factor(PrimeCondition,
+                                 levels = unique(PrimeCondition),
+                     labels = c("Both", "Phonological",
+                                "Semantic", "Unrelated")))%>%
+   ggplot(aes(x = PrimeType, y = LD,
+                          fill = PrimeType, group = PrimeType)) +
+ geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "gray2")+
+   geom_errorbar(aes(ymin=LD - se, ymax=LD + se),
+              width=.1, color = "gray26",
+              position = position_dodge(0.7))+
+   labs(x = "Prime Condition",
+              y = "Levenshtein Distance",
+          title = "Levenshtein Distances between Primes and Target") +
+   theme_few()+
+   scale_fill_calc()+
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+           plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
```



5.5.1 Predicting Accuracy from LD

```
> library(lme4)
> contrasts(main$PrimeCondition)= contr.treatment(4, base = 1)
> #main1 = main %>% filter(ExperimentName == "tot extended prime")
> acc_ld = glmer(data = main, Accuracy ~ PrimeCondition + LD +
+                      (1|Subject) + (1|Target), family = "binomial",
+      control=glmerControl(optimizer="bobyqa",
+              optCtrl=list(maxfun=100000)))
> summary(acc_ld)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeCondition + LD + (1 | Subject) + (1 | Target)
   Data: main
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
 14131.9  14186.3  -7059.0  14117.9    17393

Scaled residuals:
    Min      1Q  Median      3Q     Max
-5.8533 -0.4575 -0.2308 -0.0574 12.9771

Random effects:
 Groups  Name        Variance Std.Dev.
 Subject (Intercept) 0.9656   0.9827
 Target  (Intercept) 2.3257   1.5250
Number of obs: 17400, groups:  Subject, 174; Target, 100

Fixed effects:
                Estimate Std. Error z value Pr(>|z|)
(Intercept)     -1.52936    0.20350  -7.515 5.67e-14 ***
PrimeCondition2  0.46193    0.06148   7.514 5.75e-14 ***
PrimeCondition3 -0.15480    0.07074  -2.188 0.028648 *
PrimeCondition4 -0.23488    0.06990  -3.360 0.000778 ***
LD              -0.04942    0.01953  -2.531 0.011384 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmCn2 PrmCn3 PrmCn4
PrimeCndtn2 -0.284
PrimeCndtn3  0.116  0.297
PrimeCndtn4  0.097  0.312  0.589
LD          -0.499  0.259 -0.484 -0.448
```

```
> car::Anova(acc_ld)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                 Chisq Df Pr(>Chisq)
PrimeCondition 95.0621  3    < 2e-16 ***
LD              6.4044  1    0.01138 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> acc_ld2 = glmer(data = main, Accuracy ~ PrimeCondition*LD +
+                     (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
+             optCtrl=list(maxfun=100000)))
> summary(acc_ld2)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeCondition * LD + (1 | Subject) + (1 | Target)
   Data: main
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
 14137.5  14215.1  -7058.7  14117.5    17390

Scaled residuals:
    Min      1Q  Median      3Q     Max
-5.8197 -0.4580 -0.2308 -0.0571 12.9639

Random effects:
 Groups  Name        Variance Std.Dev.
 Subject (Intercept) 0.9659   0.9828
 Target  (Intercept) 2.3316   1.5269
Number of obs: 17400, groups:  Subject, 174; Target, 100

Fixed effects:
                   Estimate Std. Error z value Pr(>|z|)
(Intercept)        -1.47100    0.22798  -6.452  1.1e-10 ***
PrimeCondition2     0.35715    0.17428   2.049   0.0404 *
PrimeCondition3    -0.20224    0.24492  -0.826   0.4089
PrimeCondition4    -0.33195    0.26291  -1.263   0.2067
LD                 -0.06143    0.02874  -2.138   0.0325 *
PrimeCondition2:LD  0.02299    0.03570   0.644   0.5195
PrimeCondition3:LD  0.01021    0.03921   0.260   0.7945
PrimeCondition4:LD  0.01774    0.04235   0.419   0.6752
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmCn2 PrmCn3 PrmCn4 LD     PC2:LD PC3:LD
PrimeCndtn2 -0.469
PrimeCndtn3 -0.285  0.434
PrimeCndtn4 -0.262  0.443  0.345
LD          -0.632  0.681  0.419  0.390
PrmCndt2:LD  0.397 -0.935 -0.396 -0.418 -0.646
PrmCndt3:LD  0.357 -0.494 -0.953 -0.370 -0.582  0.493
```

```
PrmCndt4:LD  0.325 -0.494 -0.368 -0.960 -0.536  0.503  0.446
```

```
> car::Anova(acc_ld2)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                    Chisq Df Pr(>Chisq)
PrimeCondition    95.2387  3    < 2e-16 ***
LD                 6.3994  1    0.01142 *
PrimeCondition:LD  0.4365  3    0.93260
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

5.6 Exp Wise zLD and zSoundRating

5.6.1 E1

```
> library(dplyr)
> e1_z_final$Target = tolower(e1_z_final$Target)
> e1_z_final$Prime = tolower(e1_z_final$Prime)
> e1_z_final$LD = RecordLinkage::levenshteinDist(e1_z_final$Target, e1_z_final$Prime)
> ## reverse scoring LD since higher LD means less overlap
>
> e1_z_final$reverseLD = 13 - e1_z_final$LD
> e1_z_final$zLD = scale(e1_z_final$reverseLD, center = TRUE, scale = TRUE)
> e1_z_final$zLD = as.numeric(e1_z_final$zLD)
> e1_z_final$meanLDRating = (e1_z_final$zLD + e1_z_final$zItemRating)/2
> #contrasts(e1_z_final$PrimeType) = contr.treatment(3, base = 1)
> e1_combined_cov = glmer(data = e1_z_final, Accuracy ~ PrimeType + meanLDRating +
+                      (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
+             optCtrl=list(maxfun=100000)))
> summary(e1_combined_cov)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeType + meanLDRating + (1 | Subject) + (1 | Target)
   Data: e1_z_final
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  3385.1   3415.9  -1687.5   3375.1     3523

Scaled residuals:
    Min      1Q  Median      3Q     Max
```

```
-3.8170 -0.5092 -0.2589  0.4847 12.9189

Random effects:
 Groups  Name        Variance Std.Dev.
 Target  (Intercept) 2.123    1.457
 Subject (Intercept) 1.037    1.018
Number of obs: 3528, groups:  Target, 98; Subject, 72

Fixed effects:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  -1.60850    0.20483  -7.853 4.07e-15 ***
PrimeType2    0.51824    0.09570   5.416 6.11e-08 ***
meanLDRating  0.28127    0.07058   3.985 6.75e-05 ***
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmTy2
PrimeType2  -0.261
meanLDRatng  0.048 -0.291
```

```
> car::Anova(e1_combined_cov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
              Chisq Df Pr(>Chisq)
PrimeType    29.328  1  6.112e-08 ***
meanLDRating 15.880  1  6.749e-05 ***
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> library(ggplot2)
> library(ggthemes)
> fixed.frame <-
+   data.frame(
+     expand.grid(
+       # here, you add values for your time variable and predictors
+       meanLDRating = seq(-2.5,2.5,.1),
+        PrimeType = c("B" ,"P") ))
> fixed.frame$pred = predict(e1_combined_cov, newdata = fixed.frame, re.form = NA)
> fixed.frame$odds = exp(fixed.frame$pred)
> fixed.frame$prob = fixed.frame$odds/(1+fixed.frame$odds)
> e1_z_lD =fixed.frame %>% mutate(PrimeType = factor(PrimeType,
+                                 levels = unique(PrimeType),
+                       labels = c("Both", "Phonological")))%>%
+   ggplot(aes(x = meanLDRating, y = prob, group = PrimeType,
+              color = PrimeType)) +
```

```
+   geom_line(size = 1) +
+         labs(x = "",
+              y = "",
+        title = "E1: Young and Old Adults (No Instructions)") +
+   theme_few()+
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+           plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
>
```

5.6.2 E2

```
> library(dplyr)
> e2_z_final$Target = tolower(e2_z_final$Target)
> e2_z_final$Prime = tolower(e2_z_final$Prime)
> e2_z_final$LD = RecordLinkage::levenshteinDist(e2_z_final$Target, e2_z_final$Prime)
> ## reverse scoring LD since higher LD means less overlap
>
> e2_z_final$reverseLD = 13 - e2_z_final$LD
> e2_z_final$zLD = scale(e2_z_final$reverseLD, center = TRUE, scale = TRUE)
> e2_z_final$zLD = as.numeric(e2_z_final$zLD)
> e2_z_final$meanLDRating = (e2_z_final$zLD + e2_z_final$zItemRating)/2
> #contrasts(e2_z_final$PrimeType) = contr.treatment(3, base = 1)
>
> e2_combined_cov = glmer(data = e2_z_final, Accuracy ~ PrimeType + meanLDRating +
+                     (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
+             optCtrl=list(maxfun=100000)))
> summary(e2_combined_cov)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeType + meanLDRating + (1 | Subject) + (1 | Target)
   Data: e2_z_final
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  2875.0   2905.2  -1432.5   2865.0     3131

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.1894 -0.4791 -0.2653  0.3262  7.6590

Random effects:
 Groups  Name        Variance Std.Dev.
```

```
 Target  (Intercept) 2.104    1.451
 Subject (Intercept) 1.070    1.034
Number of obs: 3136, groups:  Target, 98; Subject, 64

Fixed effects:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  -1.78350    0.21284  -8.379  < 2e-16 ***
PrimeType2    0.36028    0.10453   3.447 0.000567 ***
meanLDRating  0.18089    0.07598   2.381 0.017272 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmTy2
PrimeType2  -0.266
meanLDRatng  0.064 -0.318
```

```
> car::Anova(e2_combined_cov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
               Chisq Df Pr(>Chisq)
PrimeType    11.8799  1  0.0005674 ***
meanLDRating  5.6685  1  0.0172723 *
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> library(ggplot2)
> library(ggthemes)
> fixed.frame <-
+   data.frame(
+     expand.grid(
+       # here, you add values for your time variable and predictors
+       meanLDRating = seq(-2.5,2.5,.1),
+        PrimeType = c("B" ,"P") ))
> fixed.frame$pred = predict(e2_combined_cov, newdata = fixed.frame, re.form = NA)
> fixed.frame$odds = exp(fixed.frame$pred)
> fixed.frame$prob = fixed.frame$odds/(1+fixed.frame$odds)
> e2_z_lD =fixed.frame %>% mutate(PrimeType = factor(PrimeType,
+                                 levels = unique(PrimeType),
+                     labels = c("Both", "Phonological")))%>%
+   ggplot(aes(x = meanLDRating, y = prob, group = PrimeType,
+              color = PrimeType)) +
+   geom_line(size = 1) +
+         labs(x = "",
+              y = "Target Accuracy",
+          title = "E2: Young and Old Adults (With Instructions)") +
```

```
+   theme_few()+
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+           plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
>
```

5.6.3 E3

```
> library(dplyr)
> e3_z_final$Target = tolower(e3_z_final$Target)
> e3_z_final$Prime = tolower(e3_z_final$Prime)
> e3_z_final$LD = RecordLinkage::levenshteinDist(e3_z_final$Target, e3$Prime)
> ## reverse scoring LD since higher LD means less overlap
>
> e3_z_final$reverseLD = 13 - e3_z_final$LD
> e3_z_final$zLD = scale(e3_z_final$reverseLD, center = TRUE, scale = TRUE)
> e3_z_final$zLD = as.numeric(e3_z_final$zLD)
> e3_z_final$meanLDRating = (e3_z_final$zLD + e3_z_final$zItemRating)/2
> e3_combined_cov = glmer(data = e3_z_final, Accuracy ~ PrimeType + meanLDRating +
+                     (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
+             optCtrl=list(maxfun=100000)))
> summary(e3_combined_cov)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeType + meanLDRating + (1 | Subject) + (1 | Target)
   Data: e3_z_final
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  1601.8   1629.2   -795.9   1591.8     1759

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.9621 -0.4421 -0.2347  0.2550  6.0452

Random effects:
 Groups  Name        Variance Std.Dev.
 Target  (Intercept) 3.0410   1.7439
 Subject (Intercept) 0.7268   0.8525
Number of obs: 1764, groups:  Target, 98; Subject, 36

Fixed effects:
             Estimate Std. Error z value Pr(>|z|)
```

```
(Intercept)  -1.93302    0.25558  -7.563 3.93e-14 ***
PrimeType2    0.32301    0.13614   2.373   0.0177 *
meanLDRating -0.04297    0.10506  -0.409   0.6826
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
             (Intr) PrmTy2
PrimeType2   -0.294
meanLDRatng   0.071 -0.200
```

```
> car::Anova(e3_combined_cov)
```

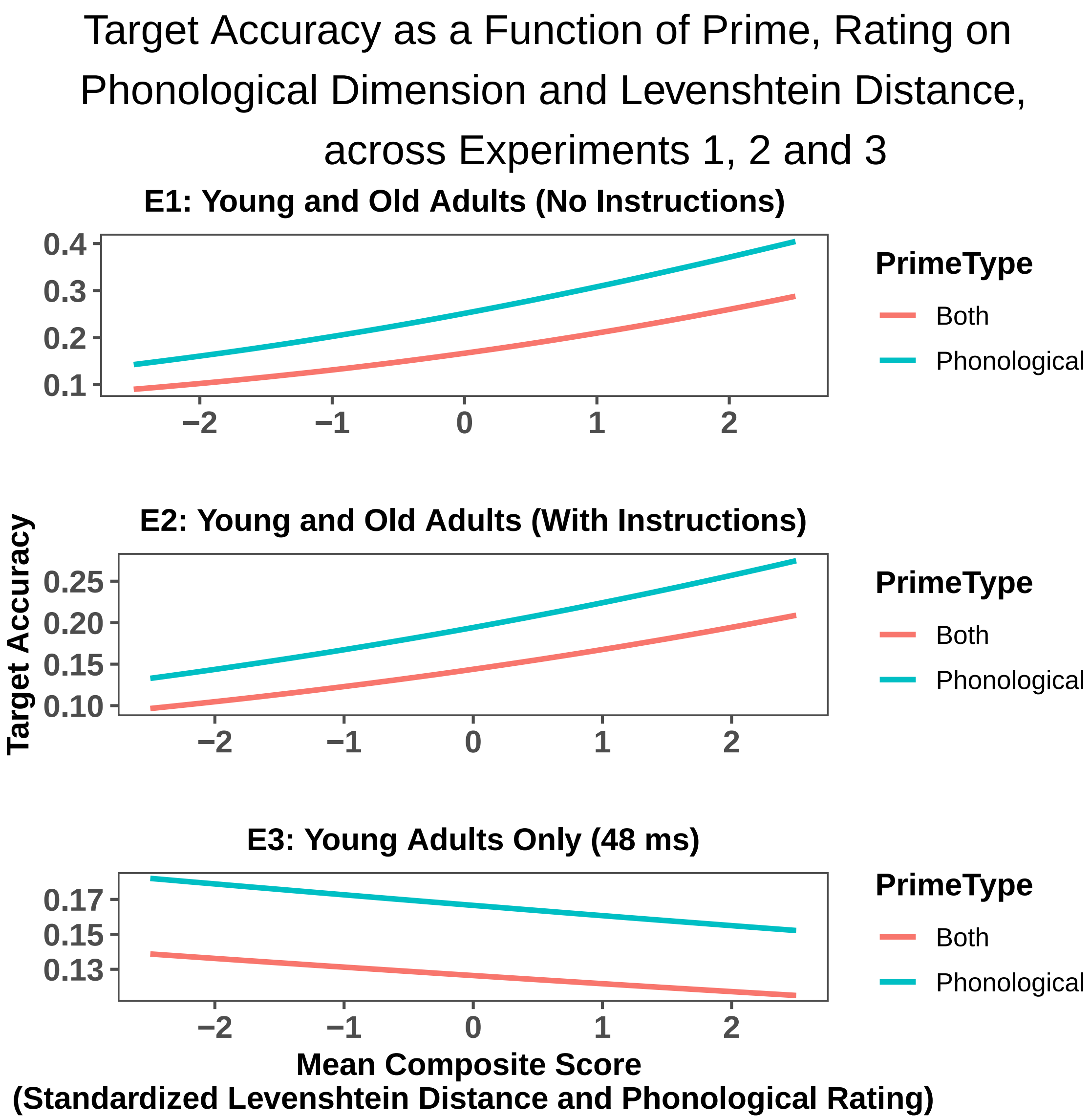
```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
              Chisq Df Pr(>Chisq)
PrimeType    5.6292  1    0.01766 *
meanLDRating 0.1673  1    0.68255
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> library(ggplot2)
> library(ggthemes)
> fixed.frame ←
+   data.frame(
+     expand.grid(
+       # here, you add values for your time variable and predictors
+       meanLDRating = seq(-2.5,2.5,.1),
+        PrimeType = c("B" ,"P") ))
> fixed.frame$pred = predict(e3_combined_cov, newdata = fixed.frame, re.form = NA)
> fixed.frame$odds = exp(fixed.frame$pred)
> fixed.frame$prob = fixed.frame$odds/(1+fixed.frame$odds)
> e3_z_lD = fixed.frame %>% mutate(PrimeType = factor(PrimeType,
+                                 levels = unique(PrimeType),
+                       labels = c("Both", "Phonological")))%>%
+   ggplot(aes(x = meanLDRating, y = prob, group = PrimeType,
+              color = PrimeType)) +
+   geom_line(size = 1) +
+         labs(x = "Mean Composite Score
+ (Standardized Levenshtein Distance and Phonological Rating)",
+              y = "",
+          title = "E3: Young Adults Only (48 ms)") +
+   theme_few()+
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+           plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
```

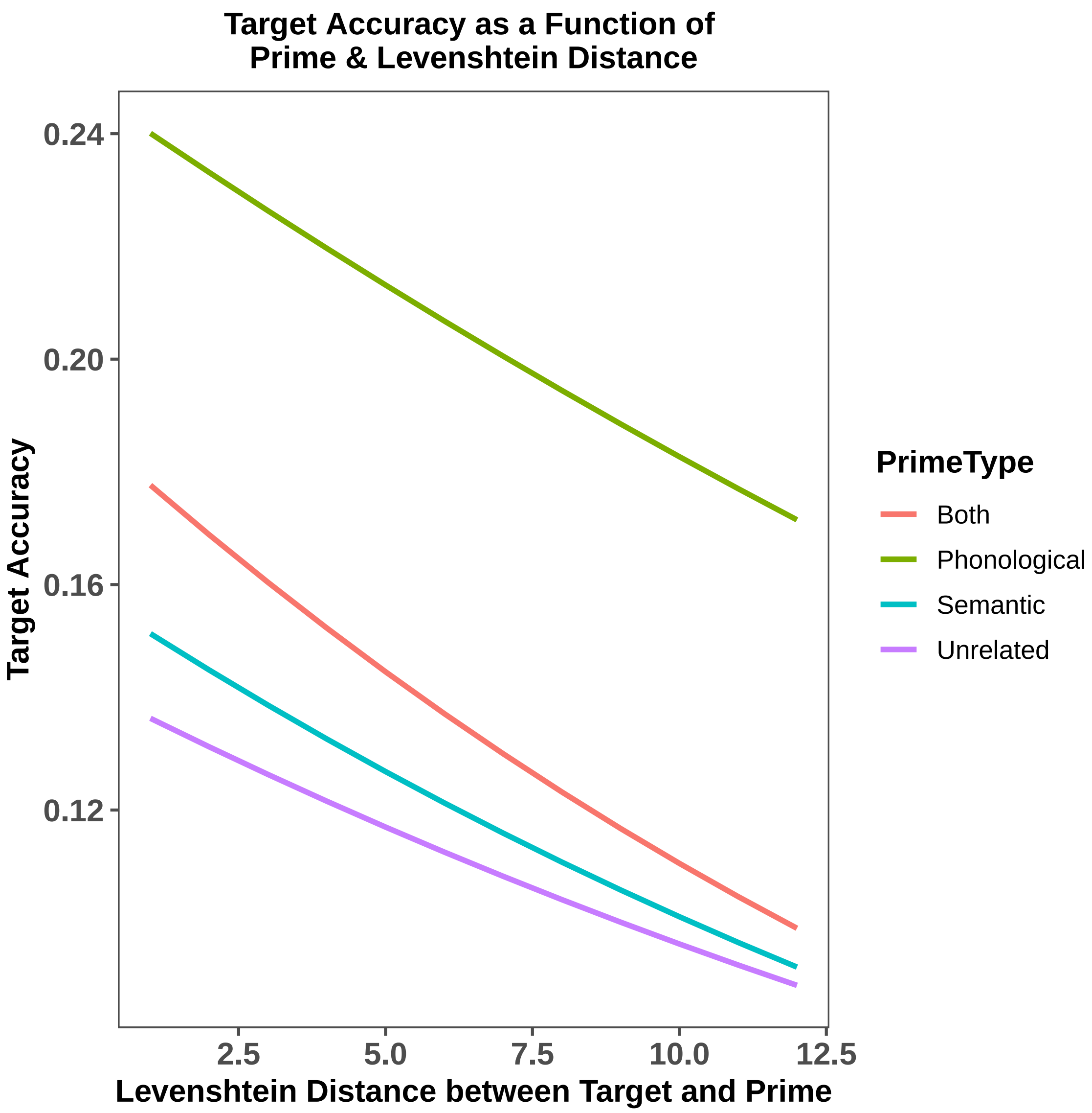
```
>
```

5.7 Plotting Model

```
> library(grid)
> gridExtra::grid.arrange(e1_z_lD, e2_z_lD, e3_z_lD, nrow = 3, ncol = 1,
+          top=textGrob("Target Accuracy as a Function of Prime, Rating on
+ Phonological Dimension and Levenshtein Distance,
+           across Experiments 1, 2 and 3",
+                                    gp=gpar(fontsize=16)))
```



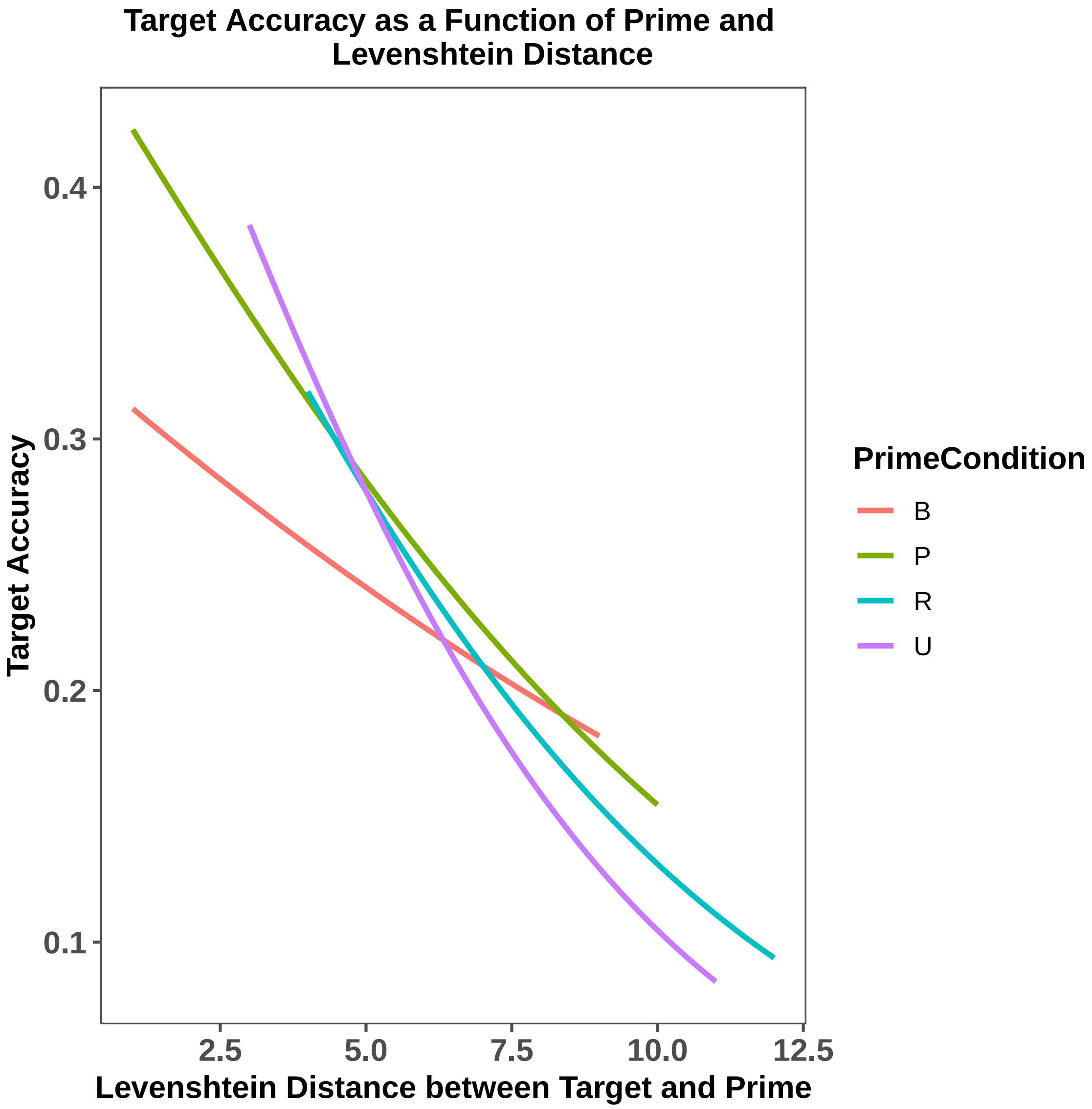
```
> fixed.frame ←
+   data.frame(
+     expand.grid(
+       # here, you add values for your time variable and predictors
+       LD = seq(1,12,1),
+        PrimeCondition = c("B" ,"P","R", "U") ))
> fixed.frame$pred = predict(acc_ld2, newdata = fixed.frame, re.form = NA)
> fixed.frame$odds = exp(fixed.frame$pred)
> fixed.frame$prob = fixed.frame$odds/(1+fixed.frame$odds)
> fixed.frame %>% mutate(PrimeType = factor(PrimeCondition,
+                                 levels = unique(PrimeCondition),
+                     labels = c("Both", "Phonological",
+                                "Semantic", "Unrelated")))%>%
+   ggplot(aes(x = LD, y = prob, group = PrimeType,
+              color = PrimeType)) +
+   geom_line(size = 1) +
+         labs(x = "Levenshtein Distance between Target and Prime",
+              y = "Target Accuracy",
+          title = "Target Accuracy as a Function of
+ Prime & Levenshtein Distance") +
+   theme_few()+
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+           plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
```



5.8 Raw Data

```
> main %>%
+   ggplot(aes(x = LD, y = Accuracy, group = PrimeCondition,
+               color = PrimeCondition)) +
+   geom_smooth(method = "glm", se = FALSE, method.args = list(family = "binomial"))+
+        labs(x = "Levenshtein Distance between Target and Prime",
+             y = "Target Accuracy",
+         title = "Target Accuracy as a Function of Prime and
+         Levenshtein Distance") +
```

```
+   theme_few()+
+     theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+           plot.title = element_text(face = "bold", size = rel(1), hjust = .5))
```



6 Non PN MCQ Agg

Exp 1: Multiple Choice

```
> ## MULTIPLE CHOICE ACCURACY
> library(dplyr)
> exp1_mcq_acc = group_by(exp1_mcq, Subject, PrimeType, AgeGroup) %>%
+     summarise_at(vars(MCQAcc), mean)
> exp1_mcq_acc_aov = aov(data = exp1_mcq_acc, MCQAcc ~ AgeGroup*PrimeType +
+                          Error(Subject/PrimeType))
> summary(exp1_mcq_acc_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup   1  0.144  0.1442   1.054  0.308
Residuals 70  9.582  0.1369

Error: Subject:PrimeType
                    Df Sum Sq Mean Sq F value  Pr(>F)
PrimeType            3  1.527  0.5090  22.716 8.9e-13 ***
AgeGroup:PrimeType   3  0.016  0.0052   0.233   0.874
Residuals          210  4.706  0.0224
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> # ez::ezANOVA(data = exp1_mcq_acc, wid = .(Subject),
> #          dv = .(MCQAcc), within =.(PrimeType),
> #          between = .(AgeGroup))
>
>
> exp1_mcqacc_lsm = lsmeans::lsmeans(exp1_mcq_acc_aov, c("AgeGroup", "PrimeType"))
> prime_effect = cld(exp1_mcqacc_lsm, alpha = 0.05,
+                    adjust = "tukey", details = TRUE, by = c("AgeGroup"))
> kable(subset(prime_effect$comparisons, prime_effect$comparisons$p.value < 0.05))
```

```
|   |contrast |AgeGroup |  estimate|        SE|  df|  t.ratio|   p.value|
|:--|:--------|:--------|---------:|---------:|---:|--------:|---------:|
|1  |b - r    |Old      | 0.1044157| 0.0352837| 210| 2.959319| 0.0179361|
|2  |p - r    |Old      | 0.1714962| 0.0352837| 210| 4.860496| 0.0000136|
|4  |u - r    |Old      | 0.1775007| 0.0352837| 210| 5.030673| 0.0000062|
|7  |b - r    |Young    | 0.1121107| 0.0352837| 210| 3.177409| 0.0092035|
|8  |p - r    |Young    | 0.1632891| 0.0352837| 210| 4.627893| 0.0000381|
|10 |u - r    |Young    | 0.1981271| 0.0352837| 210| 5.615261| 0.0000004|
```

```
> ## SPECIFIC T TESTS
>
> e1_mcq_p = exp1_mcq_acc %>% filter(PrimeType == "p")
> e1_mcq_r = exp1_mcq_acc %>% filter(PrimeType == "r")
> e1_mcq_b = exp1_mcq_acc %>% filter(PrimeType == "b")
> e1_mcq_u = exp1_mcq_acc %>% filter(PrimeType == "u")
> t.test(e1_mcq_p$MCQAcc, e1_mcq_r$MCQAcc, paired = TRUE)
```

```
        Paired t-test

data:  e1_mcq_p$MCQAcc and e1_mcq_r$MCQAcc
t = 8.2699, df = 71, p-value = 5.282e-12
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.1402517 0.2293716
sample estimates:
mean of the differences
              0.1848117
```

```
> t.test(e1_mcq_p$MCQAcc, e1_mcq_b$MCQAcc, paired = TRUE)
```

```
        Paired t-test

data:  e1_mcq_p$MCQAcc and e1_mcq_b$MCQAcc
t = 2.768, df = 71, p-value = 0.007188
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.02140626 0.13169068
sample estimates:
mean of the differences
             0.07654847
```

```
> t.test(e1_mcq_p$MCQAcc, e1_mcq_u$MCQAcc)
```

```
        Welch Two Sample t-test

data:  e1_mcq_p$MCQAcc and e1_mcq_u$MCQAcc
t = 0.38861, df = 141.92, p-value = 0.6981
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.05891953  0.08775300
sample estimates:
mean of x mean of y
0.7733972 0.7589804
```

```
> t.test(e1_mcq_r$MCQAcc, e1_mcq_u$MCQAcc, paired = TRUE)
```

```
        Paired t-test

data:  e1_mcq_r$MCQAcc and e1_mcq_u$MCQAcc
t = -7.4143, df = 71, p-value = 2.03e-10
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.2162197 -0.1245702
```

```
sample estimates:
mean of the differences
             -0.1703949
```

```
> ## MULTIPLE CHOICE ERRORS
>
> ## before we do ANOVA, we need to replace NAs with 0.
>
> for (i in 1: nrow(exp1_mcq)){
+    if(is.na(exp1_mcq[i,7])){
+      exp1_mcq[i,7] = 0
+    }
+
+ }
> exp1_mcq_aov = aov(data = exp1_mcq, Proportion ~ AgeGroup*PrimeType*ChosenPrime +
+                                  Error(Subject/(PrimeType*ChosenPrime)))
> summary(exp1_mcq_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value   Pr(>F)
AgeGroup   1 0.1260 0.12603   12.05 0.000892 ***
Residuals 70 0.7321 0.01046
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeType
                    Df Sum Sq  Mean Sq F value Pr(>F)
PrimeType            3 0.0116 0.003867   0.615  0.606
AgeGroup:PrimeType   3 0.0212 0.007051   1.121  0.341
Residuals          210 1.3205 0.006288

Error: Subject:ChosenPrime
                      Df Sum Sq Mean Sq F value Pr(>F)
ChosenPrime            3  48.29  16.096 335.117 <2e-16 ***
AgeGroup:ChosenPrime   3   0.10   0.033   0.689   0.56
Residuals            210  10.09   0.048
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeType:ChosenPrime
                                Df Sum Sq Mean Sq F value   Pr(>F)
PrimeType:ChosenPrime            9   3.41  0.3786   7.107 7.66e-10 ***
AgeGroup:PrimeType:ChosenPrime   9   0.60  0.0671   1.260    0.256
Residuals                      630  33.56  0.0533
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> # library(ez)
```

```
> # ezANOVA(data = exp1_mcq, wid = .(Subject),
> #         dv = .(Proportion), within =.(PrimeType, ChosenPrime),
> #         between = .(AgeGroup))
>
> options(contrasts = c('contr.sum', 'contr.poly'))
> exp1_errors_lsm = lsmeans::lsmeans(exp1_mcq_aov, c("AgeGroup", "PrimeType", "ChosenPri
> prime_effect = cld(exp1_errors_lsm, alpha = 0.05,
+                    adjust = "tukey", details = TRUE, by = c("AgeGroup", "PrimeType"))
> kable(subset(prime_effect$comparisons, prime_effect$comparisons$p.value < 0.05))
```

```
|   |contrast |AgeGroup |PrimeType |  estimate|        SE|       df|   t.ratio|
p.value|
|:--|:--------|:--------|:---------|---------:|---------:|--------:|---------:|---------
|2  |r - u    |Old      |b         | 0.3737975| 0.0537252| 838.4063|  6.957580| 0.000000
|3  |r - p    |Old      |b         | 0.3513648| 0.0537252| 838.4063|  6.540035| 0.000000
|4  |b - u    |Old      |b         | 0.4691238| 0.0537252| 838.4063|  8.731910| 0.000000
|5  |b - p    |Old      |b         | 0.4466911| 0.0537252| 838.4063|  8.314366| 0.000000
|8  |r - u    |Old      |p         | 0.3506724| 0.0537252| 838.4063|  6.527147| 0.000000
|9  |r - p    |Old      |p         | 0.2521825| 0.0537252| 838.4063|  4.693932| 0.000018
|10 |b - u    |Old      |p         | 0.4515212| 0.0537252| 838.4063|  8.404268| 0.000000
|11 |b - p    |Old      |p         | 0.3530313| 0.0537252| 838.4063|  6.571054| 0.000000
|14 |r - u    |Old      |r         | 0.2250812| 0.0537252| 838.4063|  4.189488| 0.000181
|15 |r - p    |Old      |r         | 0.2190837| 0.0537252| 838.4063|  4.077856| 0.000290
|16 |b - u    |Old      |r         | 0.6564103| 0.0537252| 838.4063| 12.217918| 0.000000
|17 |b - p    |Old      |r         | 0.6504129| 0.0537252| 838.4063| 12.106286| 0.000000
|18 |b - r    |Old      |r         | 0.4313292| 0.0537252| 838.4063|  8.028430| 0.000000
|20 |r - u    |Old      |u         | 0.3294605| 0.0537252| 838.4063|  6.132325| 0.000000
|21 |r - p    |Old      |u         | 0.2707741| 0.0537252| 838.4063|  5.039982| 0.000003
|22 |b - u    |Old      |u         | 0.4040998| 0.0537252| 838.4063|  7.521603| 0.000000
|23 |b - p    |Old      |u         | 0.3454134| 0.0537252| 838.4063|  6.429260| 0.000000
|26 |r - u    |Young    |b         | 0.4268989| 0.0537252| 838.4063|  7.945969| 0.000000
|27 |r - p    |Young    |b         | 0.3648499| 0.0537252| 838.4063|  6.791036| 0.000000
|28 |b - u    |Young    |b         | 0.4867464| 0.0537252| 838.4063|  9.059924| 0.000000
|29 |b - p    |Young    |b         | 0.4246974| 0.0537252| 838.4063|  7.904991| 0.000000
|32 |r - u    |Young    |p         | 0.3246583| 0.0537252| 838.4063|  6.042940| 0.000000
|33 |r - p    |Young    |p         | 0.2594577| 0.0537252| 838.4063|  4.829346| 0.000009
|34 |b - u    |Young    |p         | 0.4979718| 0.0537252| 838.4063|  9.268864| 0.000000
|35 |b - p    |Young    |p         | 0.4327712| 0.0537252| 838.4063|  8.055270| 0.000000
|36 |b - r    |Young    |p         | 0.1733135| 0.0537252| 838.4063|  3.225924| 0.007127
|38 |r - u    |Young    |r         | 0.3558592| 0.0537252| 838.4063|  6.623690| 0.000000
|39 |r - p    |Young    |r         | 0.3425315| 0.0537252| 838.4063|  6.375618| 0.000000
|40 |b - u    |Young    |r         | 0.5647707| 0.0537252| 838.4063| 10.512209| 0.000000
|41 |b - p    |Young    |r         | 0.5514430| 0.0537252| 838.4063| 10.264137| 0.000000
|42 |b - r    |Young    |r         | 0.2089115| 0.0537252| 838.4063|  3.888519| 0.000628
|44 |r - u    |Young    |u         | 0.3518078| 0.0537252| 838.4063|  6.548280| 0.000000
|45 |r - p    |Young    |u         | 0.3375441| 0.0537252| 838.4063|  6.282787| 0.000000
|46 |b - u    |Young    |u         | 0.4742725| 0.0537252| 838.4063|  8.827744| 0.000000
|47 |b - p    |Young    |u         | 0.4600088| 0.0537252| 838.4063|  8.562251| 0.000000
```

```
> ## SPECIFIC OLD COMPARISION T TEST
>
> e1mcq_old_r = exp1_mcq %>% filter(AgeGroup == "Old" & PrimeType == "r")
> e1mcq_old_r_r = e1mcq_old_r %>% filter(ChosenPrime == "r")
> e1mcq_old_r_p = e1mcq_old_r %>% filter(ChosenPrime == "p")
> e1mcq_old_r_b = e1mcq_old_r %>% filter(ChosenPrime == "b")
> e1mcq_old_r_u = e1mcq_old_r %>% filter(ChosenPrime == "u")
> t.test(e1mcq_old_r_r$Proportion, e1mcq_old_r_p$Proportion, paired = TRUE)
```

```
        Paired t-test

data:  e1mcq_old_r_r$Proportion and e1mcq_old_r_p$Proportion
t = 16.296, df = 35, p-value < 2.2e-16
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.5693841 0.7314417
sample estimates:
mean of the differences
              0.6504129
```

```
> t.test(e1mcq_old_r_r$Proportion, e1mcq_old_r_b$Proportion, paired = TRUE)
```

```
        Paired t-test

data:  e1mcq_old_r_r$Proportion and e1mcq_old_r_b$Proportion
t = 7.1597, df = 35, p-value = 2.379e-08
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.3090280 0.5536303
sample estimates:
mean of the differences
              0.4313292
```

```
> t.test(e1mcq_old_r_r$Proportion, e1mcq_old_r_u$Proportion, paired = TRUE)
```

```
        Paired t-test

data:  e1mcq_old_r_r$Proportion and e1mcq_old_r_u$Proportion
t = 16.727, df = 35, p-value < 2.2e-16
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.5767442 0.7360765
sample estimates:
mean of the differences
              0.6564103
```

```
> e1mcq_young_r = exp1_mcq %>% filter(AgeGroup == "Young" & PrimeType == "r")
> e1mcq_young_r_r = e1mcq_young_r %>% filter(ChosenPrime == "r")
> ## comparing young and old
> t.test(e1mcq_young_r_r$Proportion, e1mcq_old_r_r$Proportion)
```

```
        Welch Two Sample t-test

data:  e1mcq_young_r_r$Proportion and e1mcq_old_r_r$Proportion
t = -1.2443, df = 65.983, p-value = 0.2178
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.20799111  0.04828091
sample estimates:
mean of x mean of y
0.5796417 0.6594968
```

```
>
```

Exp 2: Multiple Choice

```
> ## MULTIPLE CHOICE ACCURACY
> library(dplyr)
> exp2_mcq_acc = group_by(exp2_mcq, Subject, PrimeType, AgeGroup) %>%
+     summarise_at(vars(MCQAcc), mean)
> exp2_mcq_acc_aov = aov(data = exp2_mcq_acc, MCQAcc ~ AgeGroup*PrimeType +
+                          Error(Subject/PrimeType))
> summary(exp2_mcq_acc_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup   1  1.018  1.0180   6.594 0.0127 *
Residuals 62  9.571  0.1544
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeType
                    Df Sum Sq Mean Sq F value   Pr(>F)
PrimeType            3  0.849 0.28306  10.680 1.64e-06 ***
AgeGroup:PrimeType   3  0.200 0.06667   2.515   0.0597 .
Residuals          186  4.930 0.02650
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> ## SPECIFIC T TESTS
>
> e2_mcq_p = exp2_mcq_acc %>% filter(PrimeType == "p")
```

```
> e2_mcq_r = exp2_mcq_acc %>% filter(PrimeType == "r")
> e2_mcq_b = exp2_mcq_acc %>% filter(PrimeType == "b")
> e2_mcq_u = exp2_mcq_acc %>% filter(PrimeType == "u")
> e2mcq_y_p = e2_mcq_p %>% filter(AgeGroup == "Young")
> e2mcq_o_p = e2_mcq_p %>% filter(AgeGroup == "Old")
> t.test(e2mcq_y_p$MCQAcc, e2mcq_o_p$MCQAcc)
```

```
        Welch Two Sample t-test

data:  e2mcq_y_p$MCQAcc and e2mcq_o_p$MCQAcc
t = 2.9686, df = 61.28, p-value = 0.004265
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.05730431 0.29375314
sample estimates:
mean of x mean of y
0.8588344 0.6833057
```

```
> e2mcq_y_b = e2_mcq_b %>% filter(AgeGroup == "Young")
> e2mcq_o_b = e2_mcq_b %>% filter(AgeGroup == "Old")
> t.test(e2mcq_y_b$MCQAcc, e2mcq_o_b$MCQAcc)
```

```
        Welch Two Sample t-test

data:  e2mcq_y_b$MCQAcc and e2mcq_o_b$MCQAcc
t = 2.275, df = 60.699, p-value = 0.02645
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.0196739 0.3055865
sample estimates:
mean of x mean of y
0.8794508 0.7168205
```

```
> e2mcq_y_r = e2_mcq_r %>% filter(AgeGroup == "Young")
> e2mcq_o_r = e2_mcq_r %>% filter(AgeGroup == "Old")
> t.test(e2mcq_y_r$MCQAcc, e2mcq_o_r$MCQAcc)
```

```
        Welch Two Sample t-test

data:  e2mcq_y_r$MCQAcc and e2mcq_o_r$MCQAcc
t = 2.9968, df = 61.851, p-value = 0.003924
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.04439358 0.22229677
sample estimates:
mean of x mean of y
0.7122238 0.5788786
```

```
> # ezANOVA(data = exp2_mcq_acc, wid = .(Subject),
> #         dv = .(MCQAcc), within =.(PrimeType),
> #         between = .(AgeGroup))
>
>
> exp2_mcqacc_lsm = lsmeans::lsmeans(exp2_mcq_acc_aov, c("AgeGroup", "PrimeType"))
> prime_effect = cld(exp2_mcqacc_lsm, alpha = 0.05,
+                    adjust = "tukey", details = TRUE, by = c("PrimeType"))
> kable(subset(prime_effect$comparisons, prime_effect$comparisons$p.value < 0.1))
```

```
|contrast     |PrimeType |  estimate|        SE|       df|  t.ratio|   p.value|
|:------------|:---------|---------:|---------:|--------:|--------:|---------:|
|Young - Old  |b         | 0.1626302| 0.0604529| 130.7524| 2.690199| 0.0080730|
|Young - Old  |p         | 0.1755287| 0.0604529| 130.7524| 2.903564| 0.0043323|
|Young - Old  |r         | 0.1333452| 0.0604529| 130.7524| 2.205771| 0.0291470|
```

```
> ## MULTIPLE CHOICE ERRORS
>
> ## before we do ANOVA, we need to replace NAs with 0.
>
> for (i in 1: nrow(exp2_mcq)){
+   if(is.na(exp2_mcq[i,7])){
+     exp2_mcq[i,7] = 0
+   }
+
+ }
> exp2_mcq_aov = aov(data = exp2_mcq, Proportion ~ AgeGroup*PrimeType*ChosenPrime +
+                                      Error(Subject/(PrimeType*ChosenPrime)))
> summary(exp2_mcq_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup   1 0.0398 0.03978   3.979 0.0505 .
Residuals 62 0.6200 0.01000
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeType
                    Df Sum Sq  Mean Sq F value Pr(>F)
PrimeType            3 0.0099 0.003292   0.503 0.6809
AgeGroup:PrimeType   3 0.0616 0.020518   3.133 0.0268 *
Residuals          186 1.2181 0.006549
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:ChosenPrime
                      Df Sum Sq Mean Sq F value Pr(>F)
```

```
ChosenPrime              3  45.60  15.199 334.893 <2e-16 ***
AgeGroup:ChosenPrime     3   0.15   0.051   1.114  0.345
Residuals              186   8.44   0.045
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeType:ChosenPrime
                                Df Sum Sq Mean Sq F value Pr(>F)
PrimeType:ChosenPrime            9   0.78 0.08615   1.358 0.2039
AgeGroup:PrimeType:ChosenPrime   9   1.73 0.19230   3.032 0.0015 **
Residuals                      558  35.39 0.06342
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> library(ez)
> # ezANOVA(data = exp2_mcq, wid = .(Subject),
> #         dv = .(Proportion), within =.(PrimeType, ChosenPrime),
> #         between = .(AgeGroup))
>
> options(contrasts = c('contr.sum', 'contr.poly'))
> exp2_errors_lsm = lsmeans::lsmeans(exp2_mcq_aov, c("AgeGroup", "PrimeType", "ChosenPri
> prime_effect = cld(exp2_errors_lsm, alpha = 0.05,
+                 adjust = "tukey", details = TRUE, by = c("PrimeType", "ChosenPrime"))
> kable(subset(prime_effect$comparisons, prime_effect$comparisons$p.value < 0.05))
```

```
|   |contrast     |PrimeType |ChosenPrime |  estimate|         SE|        df|  t.ratio|
p.value|
|:--|:------------|:---------|:-----------|---------:|----------:|---------:|--------:|----
|1  |Old - Young |b         |b           | 0.1525388| 0.0536398| 789.5017| 2.843759| 0.0
|3  |Old - Young |b         |r           | 0.1319670| 0.0536398| 789.5017| 2.460242| 0.0
|9  |Old - Young |r         |b           | 0.2370229| 0.0536398| 789.5017| 4.418785| 0.0
|11 |Old - Young |r         |r           | 0.1210676| 0.0536398| 789.5017| 2.257047| 0.0
```

```
> ## SPECIFIC OLD COMPARISION T TEST
>
> e2mcq_old_r = exp2_mcq %>% filter(AgeGroup == "Old" & PrimeType == "r")
> e2mcq_young_r = exp2_mcq %>% filter(AgeGroup == "Young" & PrimeType == "r")
> e2mcq_old_r_r = e2mcq_old_r %>% filter(ChosenPrime == "r")
> e2mcq_young_r_r = e2mcq_young_r %>% filter(ChosenPrime == "r")
> ## comparing young and old
> t.test(e2mcq_young_r_r$Proportion, e2mcq_old_r_r$Proportion)
```

```
        Welch Two Sample t-test

data:  e2mcq_young_r_r$Proportion and e2mcq_old_r_r$Proportion
t = -1.5726, df = 51.081, p-value = 0.122
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
```

```
 -0.27561311  0.03347782
sample estimates:
mean of x mean of y
0.4657580 0.5868257
```

```
> e2mcq_old_b = exp2_mcq %>% filter(AgeGroup == "Old" & PrimeType == "b")
> e2mcq_young_b = exp2_mcq %>% filter(AgeGroup == "Young" & PrimeType == "b")
> e2mcq_old_b_b = e2mcq_old_b %>% filter(ChosenPrime == "b")
> e2mcq_young_b_b = e2mcq_young_b %>% filter(ChosenPrime == "b")
> ## comparing young and old
> t.test(e2mcq_young_b_b$Proportion, e2mcq_old_b_b$Proportion)
```

```
        Welch Two Sample t-test

data:  e2mcq_young_b_b$Proportion and e2mcq_old_b_b$Proportion
t = -2.2427, df = 61.929, p-value = 0.0285
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.28850138 -0.01657618
sample estimates:
mean of x mean of y
0.2849702 0.4375090
```

Exp 3: Multiple Choice

```
> ## MULTIPLE CHOICE ACCURACY
> library(dplyr)
> exp3_mcq_acc = group_by(exp3_mcq, Subject, PrimeType) %>%
+     summarise_at(vars(MCQAcc), mean)
> exp3_mcq_acc_aov = aov(data = exp3_mcq_acc, MCQAcc ~ PrimeType +
+                              Error(Subject/PrimeType))
> summary(exp3_mcq_acc_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
Residuals 35  2.245 0.06416

Error: Subject:PrimeType
           Df Sum Sq Mean Sq F value   Pr(>F)
PrimeType   3 0.3827 0.12756    7.58 0.000123 ***
Residuals 105 1.7670 0.01683
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> ## SPECIFIC T TESTS
>
```

```
> e3_mcq_p = exp3_mcq_acc %>% filter(PrimeType == "p")
> e3_mcq_r = exp3_mcq_acc %>% filter(PrimeType == "r")
> e3_mcq_b = exp3_mcq_acc %>% filter(PrimeType == "b")
> e3_mcq_u = exp3_mcq_acc %>% filter(PrimeType == "u")
> t.test(e3_mcq_r$MCQAcc, e3_mcq_u$MCQAcc, paired = TRUE) ##sig
```

```
        Paired t-test

data:  e3_mcq_r$MCQAcc and e3_mcq_u$MCQAcc
t = -4.1112, df = 35, p-value = 0.000226
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.19400176 -0.06574151
sample estimates:
mean of the differences
             -0.1298716
```

```
> t.test(e3_mcq_r$MCQAcc, e3_mcq_p$MCQAcc, paired = TRUE) ##not sig
```

```
        Paired t-test

data:  e3_mcq_r$MCQAcc and e3_mcq_p$MCQAcc
t = -3.8103, df = 35, p-value = 0.0005384
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.1851100 -0.0564234
sample estimates:
mean of the differences
             -0.1207667
```

```
> # ezANOVA(data = exp3_mcq_acc, wid = .(Subject),
> #         dv = .(MCQAcc), within =.(PrimeType))
>
>
> exp3_mcqacc_lsm = lsmeans::lsmeans(exp3_mcq_acc_aov, c("PrimeType"))
> prime_effect = cld(exp3_mcqacc_lsm, alpha = 0.05,
+                 adjust = "tukey", details = TRUE)
> kable(subset(prime_effect$comparisons, prime_effect$comparisons$p.value < 0.1))
```

```
|   |contrast |  estimate|        SE|  df|  t.ratio|   p.value|
|:--|:--------|---------:|---------:|---:|--------:|---------:|
|1  |b - r    | 0.0709526| 0.0305762| 105| 2.320515| 0.0998904|
|2  |p - r    | 0.1207667| 0.0305762| 105| 3.949694| 0.0008080|
|4  |u - r    | 0.1298716| 0.0305762| 105| 4.247472| 0.0002708|
```

```
> ## MULTIPLE CHOICE ERRORS
>
```

```
> ## before we do ANOVA, we need to replace NAs with 0.
>
> for (i in 1: nrow(exp3_mcq)){
+    if(is.na(exp3_mcq[i,7])){
+      exp3_mcq[i,7] = 0
+    }
+
+ }
> exp3_mcq_aov = aov(data = exp3_mcq, Proportion ~ PrimeType*ChosenPrime +
+                               Error(Subject/(PrimeType*ChosenPrime)))
> summary(exp3_mcq_aov)
```

```
Error: Subject
          Df  Sum Sq  Mean Sq F value Pr(>F)
Residuals 35 0.06187 0.001768

Error: Subject:PrimeType
           Df  Sum Sq  Mean Sq F value Pr(>F)
PrimeType   3 0.00477 0.001591   0.889  0.449
Residuals 105 0.18793 0.001790

Error: Subject:ChosenPrime
             Df Sum Sq Mean Sq F value Pr(>F)
ChosenPrime   3 27.720   9.240   276.9 <2e-16 ***
Residuals   105  3.504   0.033
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeType:ChosenPrime
                       Df Sum Sq Mean Sq F value   Pr(>F)
PrimeType:ChosenPrime   9  2.617 0.29079   5.933 1.14e-07 ***
Residuals             315 15.438 0.04901
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> # library(ez)
> # ezANOVA(data = exp3_mcq, wid = .(Subject),
> #         dv = .(Proportion), within =.(PrimeType, ChosenPrime))
>
> options(contrasts = c('contr.sum', 'contr.poly'))
> exp3_errors_lsm = lsmeans::lsmeans(exp3_mcq_aov, c("PrimeType", "ChosenPrime"))
> prime_effect = cld(exp3_errors_lsm, alpha = 0.05,
+                  adjust = "tukey", details = TRUE, by = c("PrimeType"))
> kable(subset(prime_effect$comparisons, prime_effect$comparisons$p.value < 0.8))
```

```
|   |contrast |PrimeType |  estimate|        SE|       df|   t.ratio|   p.value|
|:--|:--------|:---------|---------:|---------:|--------:|---------:|---------:|
|2  |r - u    |b         | 0.4393519| 0.0500554| 410.7392|  8.777309| 0.0000000|
```

```
|3  |r - p   |b          | 0.4258598| 0.0500554| 410.7392|  8.507767| 0.0000000|
|4  |b - u   |b          | 0.5332672| 0.0500554| 410.7392| 10.653536| 0.0000000|
|5  |b - p   |b          | 0.5197751| 0.0500554| 410.7392| 10.383994| 0.0000000|
|6  |b - r   |b          | 0.0939153| 0.0500554| 410.7392|  1.876227| 0.2398901|
|7  |p - u   |p          | 0.0632606| 0.0500554| 410.7392|  1.263811| 0.5865449|
|8  |r - u   |p          | 0.3739638| 0.0500554| 410.7392|  7.470997| 0.0000000|
|9  |r - p   |p          | 0.3107033| 0.0500554| 410.7392|  6.207186| 0.0000000|
|10 |b - u   |p          | 0.4387015| 0.0500554| 410.7392|  8.764316| 0.0000000|
|11 |b - p   |p          | 0.3754409| 0.0500554| 410.7392|  7.500506| 0.0000000|
|12 |b - r   |p          | 0.0647377| 0.0500554| 410.7392|  1.293320| 0.5677010|
|14 |r - u   |r          | 0.2746713| 0.0500554| 410.7392|  5.487345| 0.0000004|
|15 |r - p   |r          | 0.2482704| 0.0500554| 410.7392|  4.959911| 0.0000062|
|16 |b - u   |r          | 0.6767055| 0.0500554| 410.7392| 13.519128| 0.0000000|
|17 |b - p   |r          | 0.6503046| 0.0500554| 410.7392| 12.991694| 0.0000000|
|18 |b - r   |r          | 0.4020342| 0.0500554| 410.7392|  8.031783| 0.0000000|
|19 |p - u   |u          | 0.0509590| 0.0500554| 410.7392|  1.018052| 0.7389675|
|20 |r - u   |u          | 0.3872685| 0.0500554| 410.7392|  7.736796| 0.0000000|
|21 |r - p   |u          | 0.3363095| 0.0500554| 410.7392|  6.718744| 0.0000000|
|22 |b - u   |u          | 0.4728836| 0.0500554| 410.7392|  9.447202| 0.0000000|
|23 |b - p   |u          | 0.4219246| 0.0500554| 410.7392|  8.429150| 0.0000000|
|24 |b - r   |u          | 0.0856151| 0.0500554| 410.7392|  1.710406| 0.3195248|
```

```
> e3_mcq_r = exp3_mcq %>% filter(PrimeType == "r")
> e3_mcq_b = exp3_mcq %>% filter(PrimeType == "b")
> e3_r_r = e3_mcq_r %>% filter(ChosenPrime == "r")
> e3_r_b = e3_mcq_r %>% filter(ChosenPrime == "b")
> t.test(e3_r_r$Proportion, e3_r_b$Proportion, paired = TRUE)
```

```
        Paired t-test

data:  e3_r_r$Proportion and e3_r_b$Proportion
t = 5.3521, df = 35, p-value = 5.522e-06
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.2495385 0.5545300
sample estimates:
mean of the differences
              0.4020342
```

```
> e3_b_r = e3_mcq_b %>% filter(ChosenPrime == "r")
> e3_b_b = e3_mcq_b %>% filter(ChosenPrime == "b")
> t.test(e3_b_r$Proportion, e3_b_b$Proportion, paired = TRUE)
```

```
        Paired t-test

data:  e3_b_r$Proportion and e3_b_b$Proportion
t = -1.0752, df = 35, p-value = 0.2897
alternative hypothesis: true difference in means is not equal to 0
```

```
95 percent confidence interval:
 -0.27124376  0.08341307
sample estimates:
mean of the differences
            -0.09391534
```

7 Comparing YA 48 ms with OA NotthePrime

```
> for (i in 1: nrow(final_mcq)){
+    if(is.na(final_mcq[i,7])){
+      final_mcq[i,7] = 0
+    }
+ }
> exp3_compare_1 = subset(final_mcq, final_mcq$StudyNo == '6' |
+                           final_mcq$StudyNo == '1')
> compare_aov_1 = aov(data = exp3_compare_1, Proportion ~ StudyNo*PrimeType*ChosenPrime
> summary(compare_aov_1)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value   Pr(>F)
StudyNo    1 0.1107 0.11067   24.91 4.63e-06 ***
Residuals 66 0.2932 0.00444
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeType
                   Df Sum Sq  Mean Sq F value Pr(>F)
PrimeType           3 0.0102 0.003414   1.046  0.373
StudyNo:PrimeType   3 0.0132 0.004409   1.351  0.259
Residuals         198 0.6462 0.003264

Error: Subject:ChosenPrime
                     Df Sum Sq Mean Sq F value Pr(>F)
ChosenPrime           3  48.60  16.199 434.732 <2e-16 ***
StudyNo:ChosenPrime   3   0.09   0.031   0.832  0.478
Residuals           198   7.38   0.037
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeType:ChosenPrime
                               Df Sum Sq Mean Sq F value   Pr(>F)
PrimeType:ChosenPrime           9  3.509  0.3899   7.898 4.64e-11 ***
StudyNo:PrimeType:ChosenPrime   9  0.247  0.0274   0.556    0.833
Residuals                     594 29.322  0.0494
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> ## specific t
>
> e3_old_b = exp3_compare_1 %>% filter(AgeGroup == "Old" & ChosenPrime == "b")
> mean_old = group_by(e3_old_b, Subject) %>%
+              summarise_at(vars(Proportion), mean)
> e3_young_b = exp3_compare_1 %>% filter(AgeGroup == "Young" & ChosenPrime == "b")
> mean_young = group_by(e3_young_b, Subject) %>%
+              summarise_at(vars(Proportion), mean)
> t.test(mean_young$Proportion, mean_old$Proportion)
```

```
        Welch Two Sample t-test

data:  mean_young$Proportion and mean_old$Proportion
t = 1.745, df = 65.43, p-value = 0.08568
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.00629643  0.09354327
sample estimates:
mean of x mean of y
0.4058344 0.3622110
```

```
> ### e2 young and e3 young
> exp3_compare_2 = subset(final_mcq, final_mcq$StudyNo == '1' |
+                         final_mcq$StudyNo == '5')
> compare_aov_2 = aov(data = exp3_compare_2, Proportion ~ StudyNo*PrimeType*ChosenPrime
> summary(compare_aov_2)
```

```
Error: Subject
          Df Sum Sq  Mean Sq F value Pr(>F)
StudyNo    1 0.0162 0.016239   2.379  0.128
Residuals 66 0.4505 0.006826

Error: Subject:PrimeType
                   Df Sum Sq  Mean Sq F value Pr(>F)
PrimeType           3 0.0313 0.010442   2.182 0.0914 .
StudyNo:PrimeType   3 0.0262 0.008727   1.823 0.1442
Residuals         198 0.9477 0.004786
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:ChosenPrime
                     Df Sum Sq Mean Sq F value Pr(>F)
ChosenPrime           3  52.47  17.490 429.036 <2e-16 ***
StudyNo:ChosenPrime   3   0.03   0.010   0.248  0.863
Residuals           198   8.07   0.041
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
Error: Subject:PrimeType:ChosenPrime
                              Df Sum Sq Mean Sq F value   Pr(>F)
PrimeType:ChosenPrime          9   0.84  0.0935   1.503    0.143
StudyNo:PrimeType:ChosenPrime  9   3.14  0.3492   5.615 1.82e-07 ***
Residuals                    594  36.94  0.0622
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> options(contrasts = c('contr.sum', 'contr.poly'))
> compare_lsm = lsmeans::lsmeans(compare_aov_1, c("StudyNo", "ChosenPrime"))
> prime_effect = multcomp::cld(compare_lsm, alpha = 0.05,
+                  adjust = "tukey", details = TRUE, by = c("ChosenPrime"))
> knitr::kable(subset(prime_effect$comparisons, prime_effect$comparisons$p.value < 0.05)
```

```
|contrast |ChosenPrime |  estimate|        SE|       df| t.ratio|   p.value|
|:--------|:-----------|---------:|---------:|--------:|-------:|---------:|
|1 - 6    |b           | 0.0436234| 0.0207071| 213.0394| 2.10669| 0.0363147|
```

```
>
```

8 Collapsing the 4 experiments

```
> final_mcq_main4 = subset(final_mcq, final_mcq$StudyNo != '1')
> for (i in 1: nrow(final_mcq_main4)){
+    if(is.na(final_mcq_main4[i,7])){
+      final_mcq_main4[i,7] = 0
+    }
+ }
> fourway_aov = aov(data = final_mcq_main4, Proportion ~ AgeGroup*PrimeInstruction*Prime
> summary(fourway_aov)
```

```
Error: Subject
                           Df Sum Sq Mean Sq F value  Pr(>F)
AgeGroup                    1 0.1561 0.15613  15.242 0.00015 ***
PrimeInstruction            1 0.0020 0.00196   0.192 0.66211
AgeGroup:PrimeInstruction   1 0.0097 0.00968   0.945 0.33270
Residuals                 132 1.3521 0.01024
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeType
                                     Df Sum Sq  Mean Sq F value Pr(>F)
PrimeType                             3 0.0167 0.005579   0.870 0.4565
AgeGroup:PrimeType                    3 0.0441 0.014700   2.293 0.0776 .
PrimeInstruction:PrimeType            3 0.0047 0.001581   0.247 0.8638
```

```
AgeGroup:PrimeInstruction:PrimeType    3 0.0386 0.012869    2.007 0.1124
Residuals                            396 2.5386 0.006411
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:ChosenPrime
                                       Df Sum Sq Mean Sq F value Pr(>F)
ChosenPrime                             3  93.85  31.283 668.613 <2e-16 ***
AgeGroup:ChosenPrime                    3   0.22   0.072   1.545  0.202
PrimeInstruction:ChosenPrime            3   0.04   0.012   0.254  0.858
AgeGroup:PrimeInstruction:ChosenPrime   3   0.03   0.011   0.242  0.867
Residuals                             396  18.53   0.047
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeType:ChosenPrime
                                                  Df Sum Sq Mean Sq F value
PrimeType:ChosenPrime                              9   2.20 0.24456   4.214
AgeGroup:PrimeType:ChosenPrime                     9   1.89 0.20970   3.613
PrimeInstruction:PrimeType:ChosenPrime             9   1.98 0.22015   3.794
AgeGroup:PrimeInstruction:PrimeType:ChosenPrime    9   0.45 0.04971   0.857
Residuals                                       1188  68.94 0.05803
                                                  Pr(>F)
PrimeType:ChosenPrime                           2.19e-05 ***
AgeGroup:PrimeType:ChosenPrime                  0.000186 ***
PrimeInstruction:PrimeType:ChosenPrime          9.84e-05 ***
AgeGroup:PrimeInstruction:PrimeType:ChosenPrime 0.563903
Residuals
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> # library(ez)
> # ezANOVA(data = final_mcq_main4, wid = .(Subject),
> #        dv = .(Proportion), within =.(PrimeType, ChosenPrime),
> #        between = .(AgeGroup, PrimeInstruction)) ## IMPORTANT SPHERICITY
>
> options(contrasts = c('contr.sum', 'contr.poly'))
> fourway_lsm = lsmeans::lsmeans(fourway_aov,
+                               c("AgeGroup", "PrimeInstruction", "PrimeType", "Chos
> prime_effect = cld(fourway_lsm, alpha = 0.05,
+                 adjust = "tukey", details = TRUE, by = c("AgeGroup", "PrimeType", "Cho
> kable(subset(prime_effect$comparisons, prime_effect$comparisons$p.value < 0.05))
```

```
|   |contrast                   |AgeGroup |PrimeType |ChosenPrime |  estimate|
SE|       df|  t.ratio|   p.value|
|:--|:--------------------------|:--------|:---------|:-----------|---------:|---------
|17 |NoInstruction - NotThePrime |Young    |b         |b           | 0.2017762| 0.050531
|19 |NoInstruction - NotThePrime |Young    |b         |r           | 0.1651397| 0.050531
```

```
|21 |NoInstruction - NotThePrime |Young    |p        |b           | 0.1286651| 0.050531
|25 |NoInstruction - NotThePrime |Young    |r        |b           | 0.1220549| 0.050531
|27 |NoInstruction - NotThePrime |Young    |r        |r           | 0.1138836| 0.050531
```

```
> ## SPECIFIC T-TEST
>
> ## Effect of Instruction on Young
>
> ## Semantic
>
> y_r = final_mcq_main4 %>% filter(AgeGroup == "Young" & PrimeType == "r")
> y_r_r_no = y_r %>% filter(PrimeInstruction == "NoInstruction" & ChosenPrime == "r")
> y_r_r_yes = y_r %>% filter(PrimeInstruction != "NoInstruction" & ChosenPrime == "r")
> t.test(y_r_r_no$Proportion, y_r_r_yes$Proportion)
```

```
        Welch Two Sample t-test

data:  y_r_r_no$Proportion and y_r_r_yes$Proportion
t = 1.3709, df = 59.971, p-value = 0.1755
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.05228469  0.28005194
sample estimates:
mean of x mean of y
0.5796417 0.4657580
```

```
> ## Both
>
> y_b = final_mcq_main4 %>% filter(AgeGroup == "Young" & PrimeType == "b")
> y_b_b_no = y_b %>% filter(PrimeInstruction == "NoInstruction" & ChosenPrime == "b")
> y_b_b_yes = y_b %>% filter(PrimeInstruction != "NoInstruction" & ChosenPrime == "b")
> t.test(y_b_b_no$Proportion, y_b_b_yes$Proportion)
```

```
        Welch Two Sample t-test

data:  y_b_b_no$Proportion and y_b_b_yes$Proportion
t = 3.0132, df = 64.947, p-value = 0.003683
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.06803599 0.33551640
sample estimates:
mean of x mean of y
0.4867464 0.2849702
```

```
> ## Effect of Instruction on Old
>
> ## Semantic
```

```
> o_r = final_mcq_main4 %>% filter(AgeGroup == "Old" & PrimeType == "r")
> o_r_r_no = o_r %>% filter(PrimeInstruction == "NoInstruction" & ChosenPrime == "r")
> o_r_r_yes = o_r %>% filter(PrimeInstruction != "NoInstruction" & ChosenPrime == "r")
> t.test(o_r_r_no$Proportion, o_r_r_yes$Proportion)
```

```
        Welch Two Sample t-test

data:  o_r_r_no$Proportion and o_r_r_yes$Proportion
t = 1.2959, df = 65.64, p-value = 0.1995
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.03929995  0.18464211
sample estimates:
mean of x mean of y
0.6594968 0.5868257
```

```
> ## Both
>
> o_b = final_mcq_main4 %>% filter(AgeGroup == "Old" & PrimeType == "b")
> o_b_b_no = o_b %>% filter(PrimeInstruction == "NoInstruction" & ChosenPrime == "b")
> o_b_b_yes = o_b %>% filter(PrimeInstruction != "NoInstruction" & ChosenPrime == "b")
> t.test(o_b_b_no$Proportion, o_b_b_yes$Proportion)
```

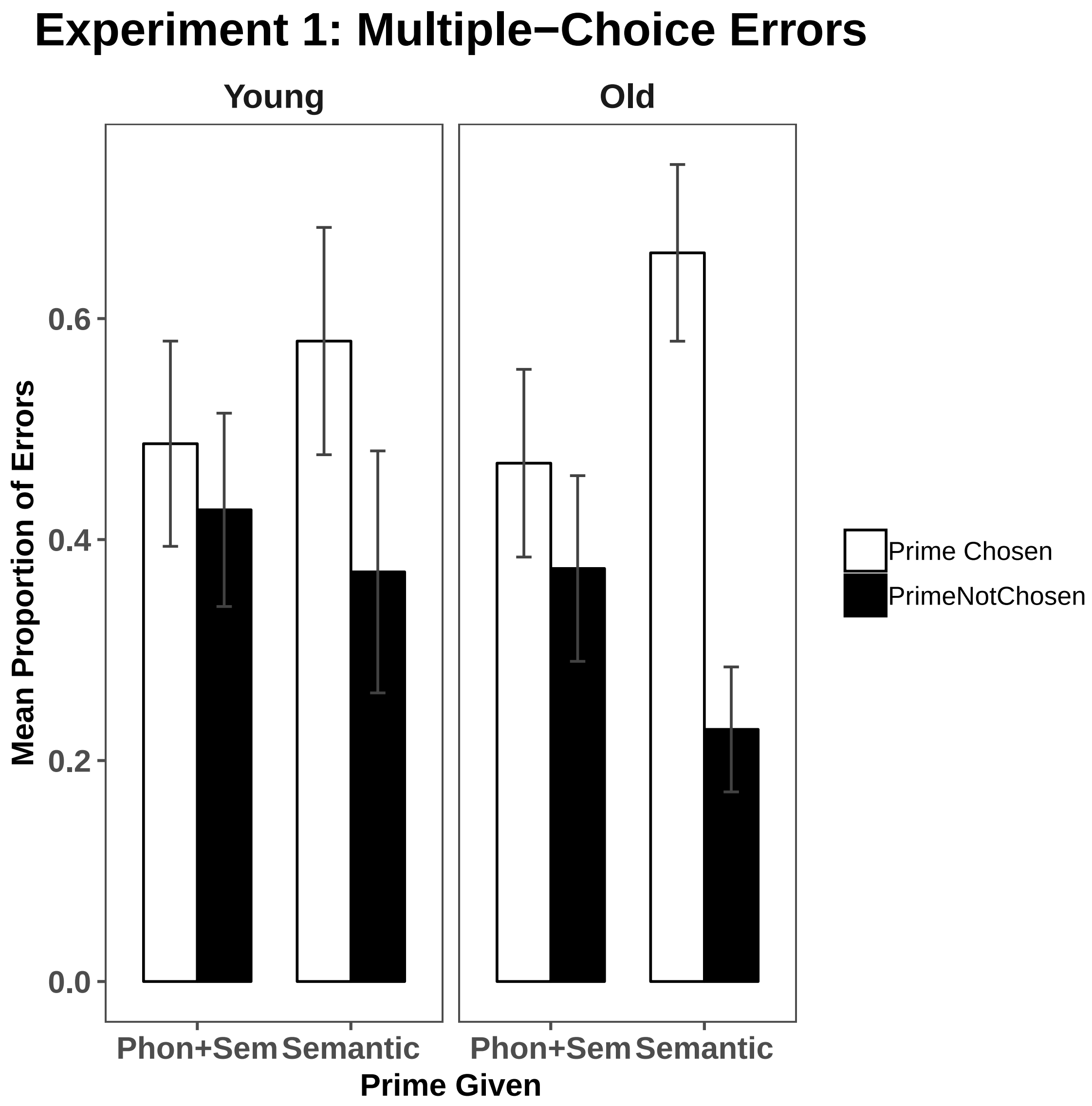
```
        Welch Two Sample t-test

data:  o_b_b_no$Proportion and o_b_b_yes$Proportion
t = 0.5008, df = 63.872, p-value = 0.6182
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.09450378  0.15773330
sample estimates:
mean of x mean of y
0.4691238 0.4375090
```

```
>
>
>
```

E1 MCQ Table

```
> ## CODE BELOW ONLY FOR R AND B CHOICES in MCQ
>
> e1_mcq_agg = Rmisc::summarySE(exp1_mcq,
+                         measurevar = "Proportion",
+                         groupvars = c("AgeGroup", "PrimeType", "ChosenPrime"))
> e1_mcq_main = e1_mcq_agg %>% filter(PrimeType %in% c("b", "r") &
+                                          ChosenPrime %in% c("b", "r"))
```

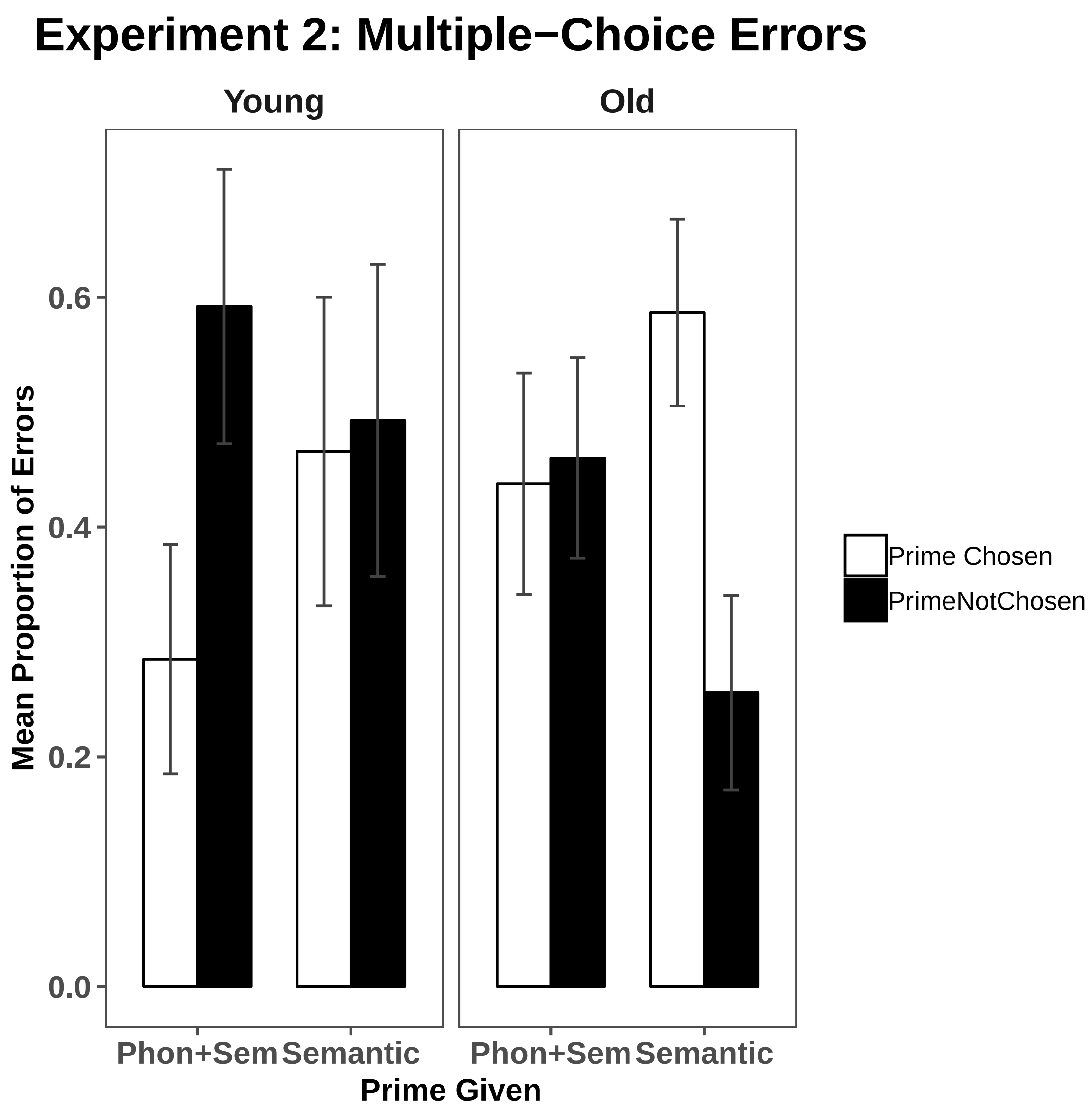
```
> e1_mcq_main$ChoseThePrime = c("1_Yes", "2_No", "2_No", "1_Yes",
+                               "1_Yes", "2_No", "2_No", "1_Yes")
> e1_mcq_main = dplyr::arrange(e1_mcq_main, desc(AgeGroup))
> library(ggplot2)
> library(ggthemes)
> e1_mcq_main %>% mutate(PrimeCondition = factor(PrimeType,
+                                                 levels = unique(PrimeType),
+                     labels = c("Phon+Sem","Semantic")),
+                     Choice = factor(ChoseThePrime,
+                                                 levels = unique(ChoseThePrime),
+                     labels = c("Prime Chosen","PrimeNotChosen")),
+                     Age = factor(AgeGroup, levels = unique(AgeGroup),
+                     labels = c("Young", "Old")))%>%
+ ggplot(aes(x = PrimeCondition, y = Proportion,
+                               fill = Choice, group = Choice))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Proportion - ci, ymax=Proportion + ci),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+   facet_wrap(~Age)+
+  theme_few()+
+   scale_fill_manual(values = c("white", "black"))+
+     xlab("Prime Given") + ylab("Mean Proportion of Errors") +
+   ggtitle("Experiment 1: Multiple-Choice Errors")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_blank(),
+           plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
>
> ## Stored and formatted in excel file: JuliePaperTables.xlsx
```



E2 MCQ Table

```
> e2_mcq_agg = Rmisc::summarySE(exp2_mcq,
+                         measurevar = "Proportion",
+                         groupvars = c("AgeGroup", "PrimeType", "ChosenPrime"))
> e2_mcq_main = e2_mcq_agg %>% filter(PrimeType %in% c("b", "r") &
+                                          ChosenPrime %in% c("b", "r"))
> e2_mcq_main$ChoseThePrime = c("1_Yes", "2_No", "2_No", "1_Yes",
+                               "1_Yes", "2_No", "2_No", "1_Yes")
> e2_mcq_main = arrange(e2_mcq_main, desc(AgeGroup))
> library(ggplot2)
```

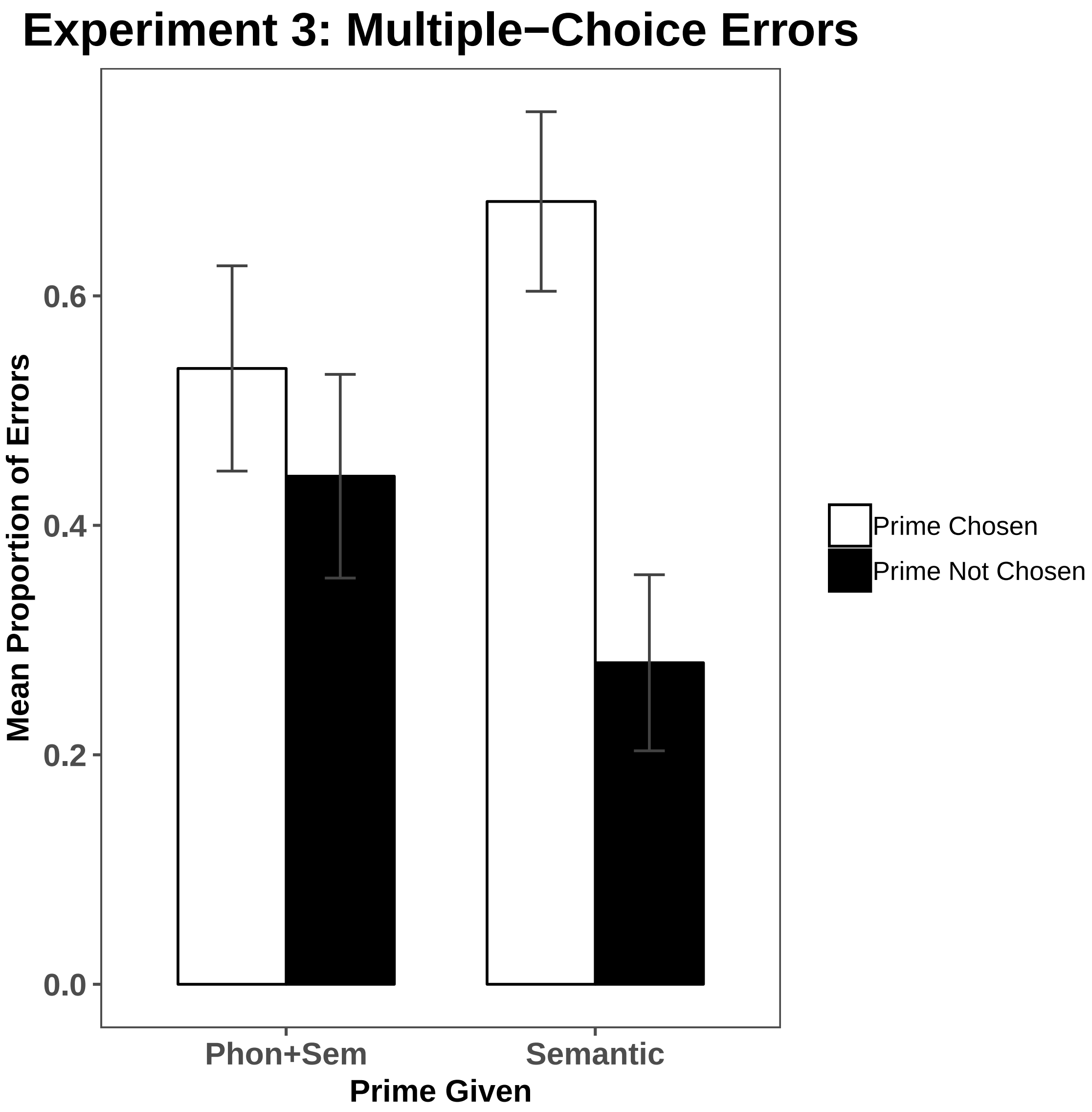
```
> library(ggthemes)
> e2_mcq_main %>% mutate(PrimeCondition = factor(PrimeType,
+                                                levels = unique(PrimeType),
+                     labels = c("Phon+Sem","Semantic")),
+                     Choice = factor(ChoseThePrime,
+                                                levels = unique(ChoseThePrime),
+                     labels = c("Prime Chosen","PrimeNotChosen")),
+                     Age = factor(AgeGroup, levels = unique(AgeGroup),
+                     labels = c("Young", "Old")))%>%
+ ggplot(aes(x = PrimeCondition, y = Proportion,
+                               fill = Choice, group = Choice))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Proportion - ci, ymax=Proportion + ci),
+               width=.2, color = "gray26",
+               position = position_dodge(0.7))+
+   facet_wrap(~Age)+
+  theme_few()+
+   scale_fill_manual(values = c("white", "black"))+
+     xlab("Prime Given") + ylab("Mean Proportion of Errors") +
+   ggtitle("Experiment 2: Multiple-Choice Errors")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_blank(),
+           plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
>
> ## Stored and formatted in excel file: JuliePaperTables.xlsx
>
```



E3 MCQ Table

```
> e3_mcqoverall_agg = group_by(exp3_mcq, AgeGroup, PrimeType, ChosenPrime)%>%
+   summarise_at(vars(MCQAcc), mean)
> ## Plotting
>
> e3_mcq_agg = Rmisc::summarySE(exp3_mcq,
+                          measurevar = "Proportion",
+                          groupvars = c("PrimeType", "ChosenPrime"))
> e3_mcq_main = e3_mcq_agg %>% filter(PrimeType %in% c("b", "r") &
+                                       ChosenPrime %in% c("b", "r"))
```

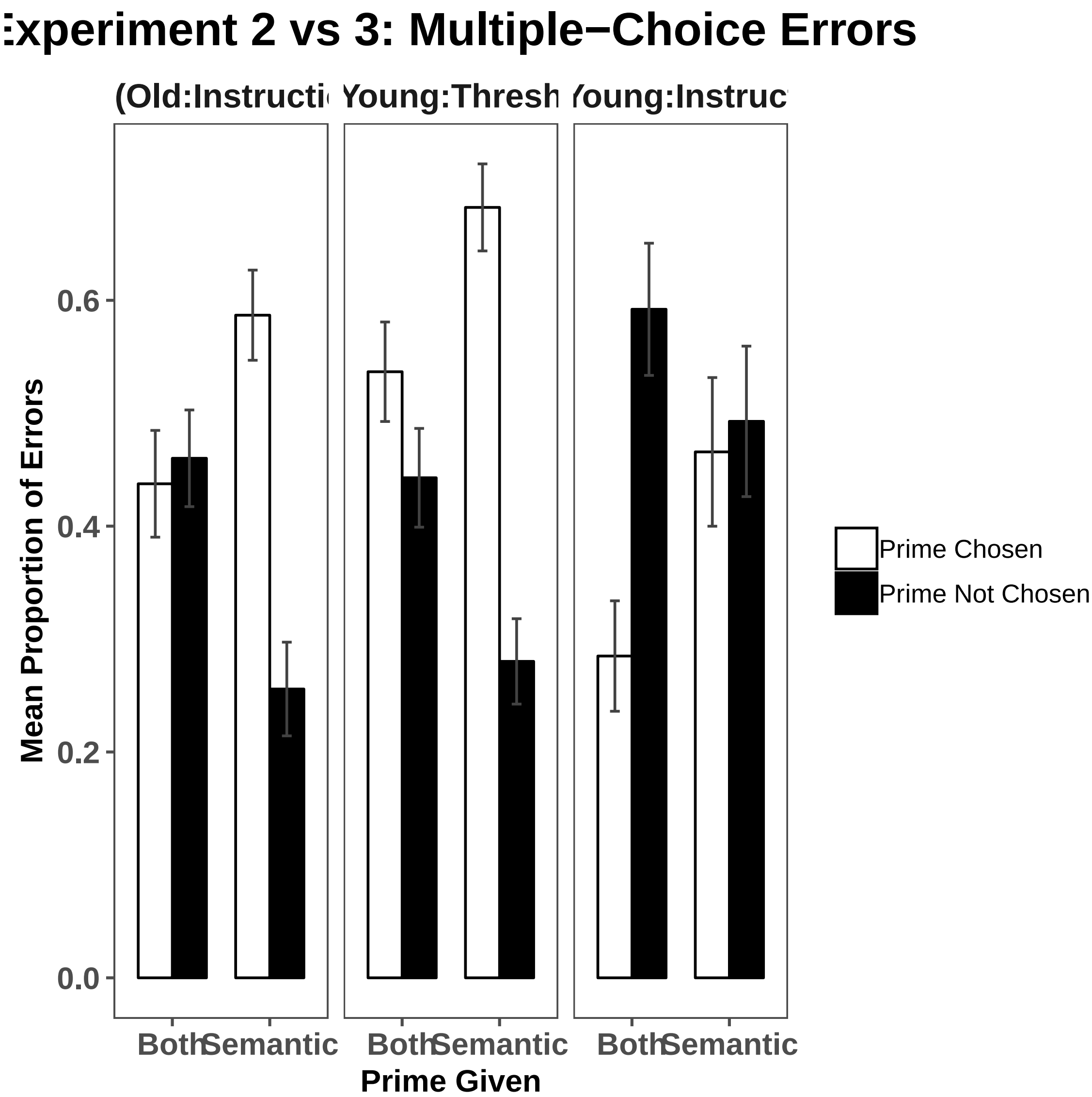
```
> e3_mcq_main$ChoseThePrime = c("1_Yes", "2_No", "2_No", "1_Yes")
> library(ggplot2)
> library(ggthemes)
> e3_mcq_main %>% mutate(PrimeCondition = factor(PrimeType,
+                                                levels = unique(PrimeType),
+                          labels = c("Phon+Sem","Semantic")),
+                          Choice = factor(ChoseThePrime,
+                                                levels = unique(ChoseThePrime),
+                          labels = c("Prime Chosen","Prime Not Chosen")))%>%
+ ggplot(aes(x = PrimeCondition, y = Proportion,
+                                   fill = Choice, group = Choice))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Proportion - ci, ymax=Proportion + ci),
+                 width=.2, color = "gray26",
+                 position = position_dodge(0.7))+
+  theme_few()+
+   scale_fill_manual(values = c("white", "black"))+
+     xlab("Prime Given") + ylab("Mean Proportion of Errors") +
+   ggtitle("Experiment 3: Multiple-Choice Errors")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_blank(),
+           plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
>
> ## Stored and formatted in excel file: JuliePaperTables.xlsx
>
```



E3 and E2 compare

```
> exp3_fig_compare_1 = Rmisc::summarySE(exp3_compare_1,
+                              measurevar = "Proportion",
+                              groupvars = c("StudyNo", "PrimeType", "ChosenPrime"))
> exp3_fig_compare_2 = Rmisc::summarySE(exp3_compare_2,
+                              measurevar = "Proportion",
+                              groupvars = c("StudyNo", "PrimeType", "ChosenPrime"))
> e3_main_1 = exp3_fig_compare_1 %>% filter(PrimeType %in% c("b", "r") &
+                                                ChosenPrime %in% c("b", "r"))
```

```
> e3_main_2 = exp3_fig_compare_2 %>% filter(PrimeType %in% c("b", "r") &
+                                                ChosenPrime %in% c("b", "r"))
> exp3_mainfig =  full_join(e3_main_1, e3_main_2)
> exp3_mainfig$ChoseThePrime = c("1_Yes", "2_No", "2_No", "1_Yes",
+                              "1_Yes", "2_No", "2_No", "1_Yes",
+                              "1_Yes", "2_No", "2_No", "1_Yes")
> exp3_mainfig5 = exp3_mainfig %>% filter(StudyNo== "5")
> exp3_mainfig1 = exp3_mainfig %>% filter(StudyNo == "1")
> exp3_mainfig6 = exp3_mainfig %>% filter(StudyNo == "6")
> final_mainfig = rbind(exp3_mainfig6, exp3_mainfig1, exp3_mainfig5)
> library(ggplot2)
> library(ggthemes)
> final_mainfig %>% mutate(PrimeCondition = factor(PrimeType,
+                                                   levels = unique(PrimeType),
+                    labels = c("Both","Semantic")),
+                    ChosenPrime = factor(ChosenPrime,
+                                                   levels = unique(PrimeType),
+                    labels = c("Both","Semantic")),
+                    Experiment = factor(StudyNo,
+                                                   levels = unique(StudyNo),
+                    labels = c("E2 (Old:Instruction)","E3 (Young:Threshold)",
+                               "E2 (Young:Instruction)")),
+                    Choice = factor(ChoseThePrime,
+                                                   levels = unique(ChoseThePrime),
+                    labels = c("Prime Chosen","Prime Not Chosen")))%>%
+ ggplot(aes(x = PrimeCondition, y = Proportion,
+                              fill = Choice, group = Choice))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Proportion - se, ymax=Proportion + se),
+             width=.2, color = "gray26",
+             position = position_dodge(0.7))+
+   facet_wrap(~Experiment)+
+  theme_few()+
+   scale_fill_manual(values = c("white", "black"))+
+     xlab("Prime Given") + ylab("Mean Proportion of Errors") +
+   ggtitle("Experiment 2 vs 3: Multiple-Choice Errors")  +
+    theme(axis.text = element_text(face = "bold", size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_blank(),
+           plot.title = element_text(face = "bold", size = rel(1.5), hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
```



9 Simple Target Accuracy

```
> main = read.csv("Julie_Main5Studies.csv", header = TRUE, sep = ",")
> main$StudyNo = as.factor(main$StudyNo)
> main$PrimeCondition = as.factor(main$PrimeCondition)
> word_type = read.csv("ItemWordTypes.csv", header = TRUE, sep = ",")
> main_word = merge(main, word_type, by = c("Target"))
> library(dplyr)
> main_word = main_word %>% arrange(Subject, TargetNo)
> proper = main_word %>% filter(Proper == "ProperName")
```

```
> nonname = main_word %>% filter(Proper == "Word")
> exp1_target_nonname = nonname %>% filter(StudyNo == '2' | StudyNo == '4')
> exp2_target_nonname = nonname %>% filter(StudyNo == '5' | StudyNo == '6')
> exp3_target_nonname = nonname %>% filter(StudyNo == '1')
>
```

9.1 E1

```
> exp1_target_nonname_agg = group_by(exp1_target_nonname,
+                                    Subject, AgeGroup, PrimeCondition) %>%
+   summarise_at(vars(Accuracy), mean)
> exp1_target_nonname_agg_item = group_by(exp1_target_nonname,
+                                    Target, AgeGroup, PrimeCondition) %>%
+   summarise_at(vars(Accuracy), mean)
> exp1_target_nonname_agg$Subject = as.factor(exp1_target_nonname_agg$Subject)
> exp1_target_aov = aov(data = exp1_target_nonname_agg,
+                       Accuracy ~ AgeGroup*PrimeCondition +
+                                 Error (Subject/PrimeCondition))
> summary(exp1_target_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup   1 0.0255 0.02549   0.585  0.447
Residuals 71 3.0914 0.04354

Error: Subject:PrimeCondition
                         Df Sum Sq Mean Sq F value   Pr(>F)
PrimeCondition            3 0.7317 0.24390  18.450 1.12e-10 ***
AgeGroup:PrimeCondition   3 0.0228 0.00759   0.574    0.633
Residuals               213 2.8158 0.01322
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> exp1_target_aov_item = aov(data = exp1_target_nonname_agg_item,
+                       Accuracy ~ AgeGroup*PrimeCondition +
+                                 Error (Target/(AgeGroup*PrimeCondition)))
> summary(exp1_target_aov_item)
```

```
Error: Target
          Df Sum Sq Mean Sq F value Pr(>F)
Residuals 59  16.59  0.2812

Error: Target:AgeGroup
          Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup   1 0.0496 0.04957   2.105  0.152
Residuals 59 1.3894 0.02355
```

```
Error: Target:PrimeCondition
                Df Sum Sq Mean Sq F value   Pr(>F)
PrimeCondition   3  1.204  0.4012   29.75 1.27e-15 ***
Residuals      177  2.387  0.0135
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Target:AgeGroup:PrimeCondition
                         Df Sum Sq  Mean Sq F value Pr(>F)
AgeGroup:PrimeCondition   3 0.0318 0.010605   1.064  0.366
Residuals               177 1.7642 0.009967
```

```
> target_p = exp1_target_nonname_agg %>% filter(PrimeCondition == "P")
> target_r = exp1_target_nonname_agg %>% filter(PrimeCondition == "R")
> target_b = exp1_target_nonname_agg %>% filter(PrimeCondition == "B")
> target_u = exp1_target_nonname_agg %>% filter(PrimeCondition == "U")
> t.test(target_p$Accuracy, target_r$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_p$Accuracy and target_r$Accuracy
t = 6.354, df = 72, p-value = 1.676e-08
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.08847884 0.16937711
sample estimates:
mean of the differences
               0.128928
```

```
> t.test(target_p$Accuracy, target_b$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_p$Accuracy and target_b$Accuracy
t = 4.4106, df = 72, p-value = 3.54e-05
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.05347524 0.14167835
sample estimates:
mean of the differences
              0.0975768
```

```
> t.test(target_p$Accuracy, target_u$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_p$Accuracy and target_u$Accuracy
```

```
t = 5.9255, df = 72, p-value = 9.829e-08
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.07410406 0.14924242
sample estimates:
mean of the differences
              0.1116732
```

```
> t.test(target_b$Accuracy, target_r$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_b$Accuracy and target_r$Accuracy
t = 2.0741, df = 72, p-value = 0.04164
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.001219234 0.061483133
sample estimates:
mean of the differences
             0.03135118
```

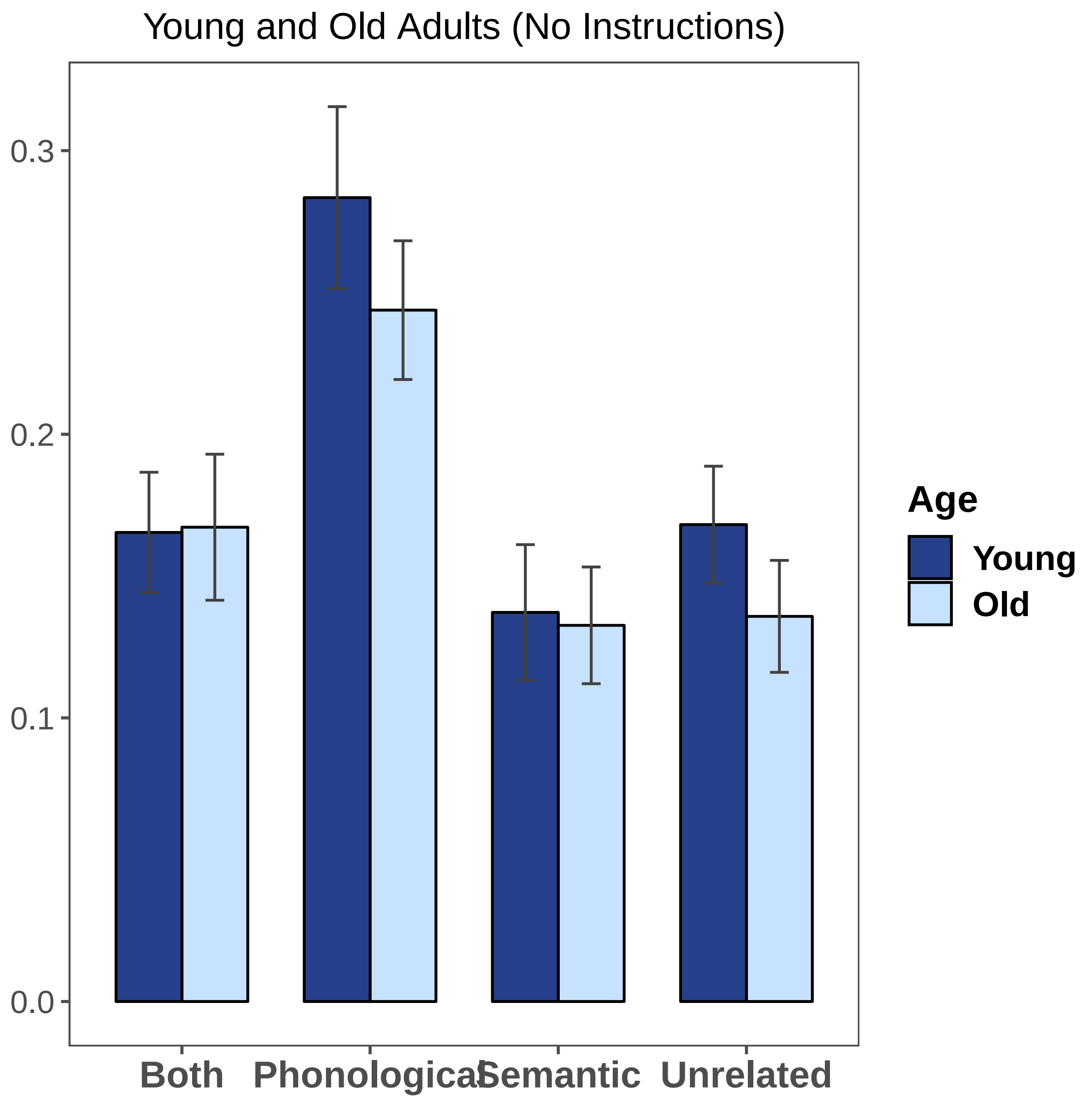
```
> t.test(target_b$Accuracy, target_u$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_b$Accuracy and target_u$Accuracy
t = 0.74264, df = 72, p-value = 0.4601
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.02374250  0.05193539
sample estimates:
mean of the differences
             0.01409644
```

```
> t.test(target_r$Accuracy, target_u$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_r$Accuracy and target_u$Accuracy
t = -0.97197, df = 72, p-value = 0.3343
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.05264344  0.01813396
sample estimates:
mean of the differences
            -0.01725474
```

```
> exp1_fig_target = Rmisc::summarySE(exp1_target_nonname_agg,
+                         measurevar = "Accuracy",
+                         groupvars = c("AgeGroup", "PrimeCondition"))
> exp1_fig_target =  arrange(exp1_fig_target, desc(AgeGroup))
> library(ggplot2)
> library(ggthemes)
> targetacc_1 = exp1_fig_target %>% mutate(PrimeType = factor(PrimeCondition,
+                                                  levels = unique(PrimeCondition),
+                     labels = c("Both", "Phonological",
+                                "Semantic", "Unrelated")),
+                     Age = factor(AgeGroup, levels = unique(AgeGroup),
+                     labels = c("Young", "Old")))%>%
+ ggplot(aes(x = PrimeType, y = Accuracy,
+                               fill = Age, group = Age))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Accuracy - se, ymax=Accuracy + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+  theme_few()+
+   scale_fill_manual(values = c("royalblue4", "slategray1"))+
+     xlab("") + ylab("") +
+   ggtitle("Young and Old Adults (No Instructions)")  +
+   theme(axis.text = element_text(size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1.2)),
+          plot.title = element_text(hjust = .5),
+           legend.text = element_text(face = "bold", size = rel(1.1)),
+          axis.text.x = element_text(face = "bold", size = rel(1.2)),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> targetacc_1
```



9.2 E2

```
> exp2_target_nonname_agg = group_by(exp2_target_nonname,
+                                    Subject, AgeGroup, PrimeCondition) %>%
+   summarise_at(vars(Accuracy), mean)
> exp2_target_nonname_agg_item = group_by(exp2_target_nonname,
+                                    Target, AgeGroup, PrimeCondition) %>%
+   summarise_at(vars(Accuracy), mean)
> exp2_target_nonname_agg$Subject = as.factor(exp2_target_nonname_agg$Subject)
> exp2_target_aov = aov(data = exp2_target_nonname_agg,
```

```
+                        Accuracy ~ AgeGroup*PrimeCondition +
+                                  Error (Subject/PrimeCondition))
> summary(exp2_target_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value   Pr(>F)
AgeGroup   1 0.2775 0.27746    8.68 0.00451 **
Residuals 63 2.0139 0.03197
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Subject:PrimeCondition
                         Df Sum Sq Mean Sq F value   Pr(>F)
PrimeCondition            3 0.2592 0.08640   5.500 0.00121 **
AgeGroup:PrimeCondition   3 0.0378 0.01259   0.801 0.49447
Residuals               189 2.9692 0.01571
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> exp2_target_aov_item = aov(data = exp2_target_nonname_agg_item,
+                        Accuracy ~ AgeGroup*PrimeCondition +
+                                  Error (Target/(AgeGroup*PrimeCondition)))
> summary(exp2_target_aov_item)
```

```
Error: Target
          Df Sum Sq Mean Sq F value Pr(>F)
Residuals 59  15.66  0.2655

Error: Target:AgeGroup
          Df Sum Sq Mean Sq F value    Pr(>F)
AgeGroup   1 0.5141  0.5141   22.07 1.62e-05 ***
Residuals 59 1.3746  0.0233
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Target:PrimeCondition
                Df Sum Sq Mean Sq F value    Pr(>F)
PrimeCondition   3 0.4994 0.16646   14.59 1.56e-08 ***
Residuals      177 2.0198 0.01141
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Error: Target:AgeGroup:PrimeCondition
                         Df Sum Sq Mean Sq F value Pr(>F)
AgeGroup:PrimeCondition   3 0.0373 0.01243   0.996  0.396
Residuals               177 2.2084 0.01248
```

```
> target_p = exp2_target_nonname_agg %>% filter(PrimeCondition == "P")
> target_r = exp2_target_nonname_agg %>% filter(PrimeCondition == "R")
> target_b = exp2_target_nonname_agg %>% filter(PrimeCondition == "B")
> target_u = exp2_target_nonname_agg %>% filter(PrimeCondition == "U")
> t.test(target_p$Accuracy, target_r$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_p$Accuracy and target_r$Accuracy
t = 2.7955, df = 64, p-value = 0.006833
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.01924678 0.11564444
sample estimates:
mean of the differences
             0.06744561
```

```
> t.test(target_p$Accuracy, target_b$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_p$Accuracy and target_b$Accuracy
t = 2.5274, df = 64, p-value = 0.01397
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.01229618 0.10505814
sample estimates:
mean of the differences
             0.05867716
```

```
> t.test(target_p$Accuracy, target_u$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_p$Accuracy and target_u$Accuracy
t = 3.5014, df = 64, p-value = 0.0008491
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.03592075 0.13136752
sample estimates:
mean of the differences
             0.08364413
```

```
> t.test(target_b$Accuracy, target_r$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_b$Accuracy and target_r$Accuracy
t = 0.47519, df = 64, p-value = 0.6363
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.02809488  0.04563179
sample estimates:
mean of the differences
            0.008768454
```

```
> t.test(target_b$Accuracy, target_u$Accuracy, paired = TRUE)
```

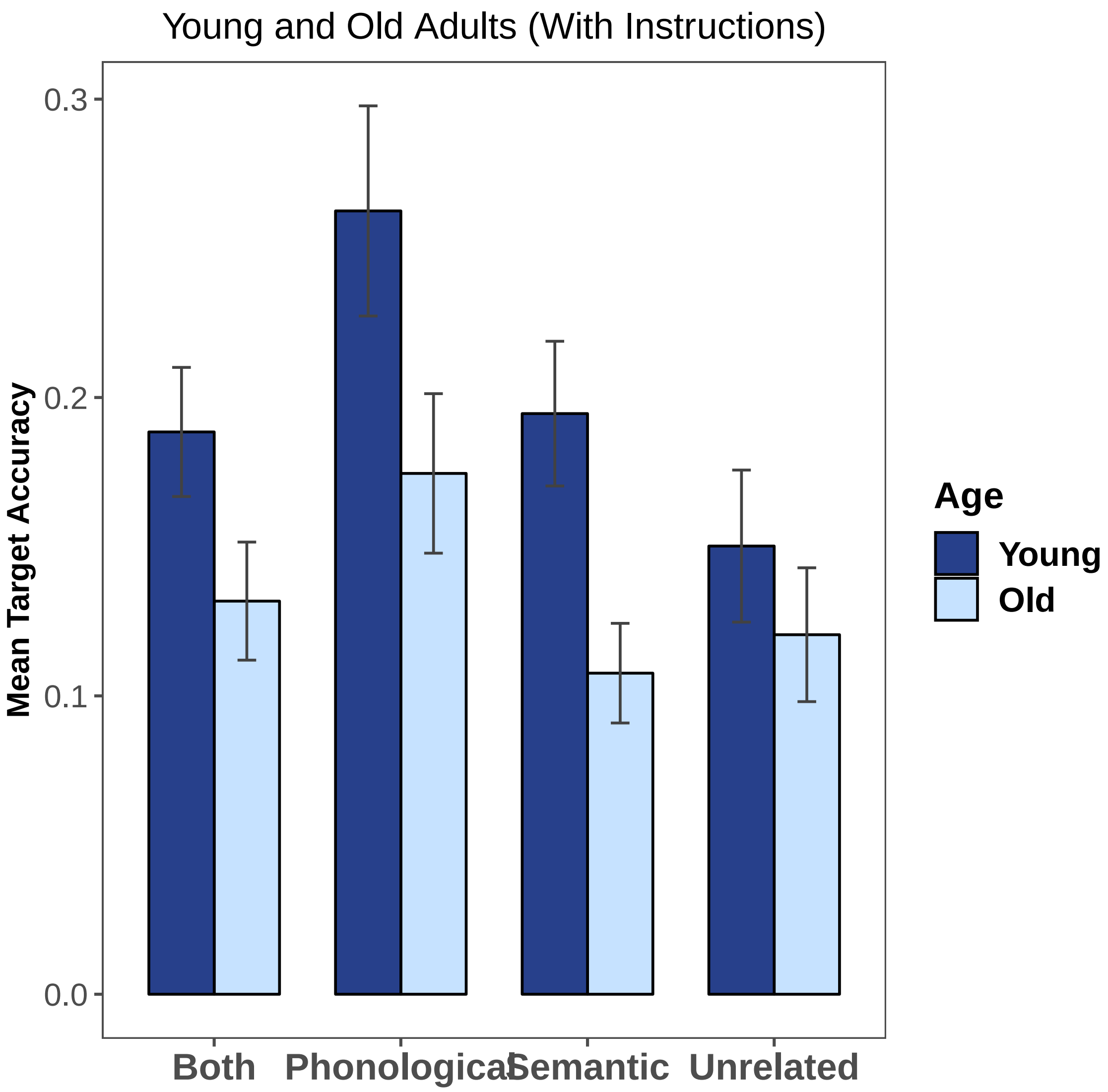
```
        Paired t-test

data:  target_b$Accuracy and target_u$Accuracy
t = 1.3369, df = 64, p-value = 0.186
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.01234076  0.06227471
sample estimates:
mean of the differences
             0.02496698
```

```
> t.test(target_r$Accuracy, target_u$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_r$Accuracy and target_u$Accuracy
t = 0.71712, df = 64, p-value = 0.4759
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.02892649  0.06132354
sample estimates:
mean of the differences
             0.01619852
```

```
> exp2_fig_target = Rmisc::summarySE(exp2_target_nonname_agg,
+                         measurevar = "Accuracy",
+                         groupvars = c("AgeGroup", "PrimeCondition"))
> exp2_fig_target =  arrange(exp2_fig_target,desc(AgeGroup))
> library(ggplot2)
> library(ggthemes)
> targetacc_2 = exp2_fig_target %>% mutate(PrimeType = factor(PrimeCondition,
+                                                  levels = unique(PrimeCondition),
+                      labels = c("Both", "Phonological",
+                                "Semantic", "Unrelated")),
```

```
+                        Age = factor(AgeGroup, levels = unique(AgeGroup),
+                        labels = c("Young", "Old")))%>%
+ ggplot(aes(x = PrimeType, y = Accuracy,
+                                  fill = Age, group = Age))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
+   geom_errorbar(aes(ymin=Accuracy - se, ymax=Accuracy + se),
+                width=.2, color = "gray26",
+                position = position_dodge(0.7))+
+  theme_few()+
+   scale_fill_manual(values = c("royalblue4", "slategray1"))+
+    xlab("") + ylab("Mean Target Accuracy") +
+   ggtitle("Young and Old Adults (With Instructions)")  +
+    theme(axis.text = element_text(size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1.2)),
+          plot.title = element_text(hjust = .5),
+           legend.text = element_text(face = "bold", size = rel(1.1)),
+          axis.text.x = element_text(face = "bold", size = rel(1.2)),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> targetacc_2
```



9.3 E3

```
> exp3_target_nonname_agg = group_by(exp3_target_nonname,
+                                    Subject, AgeGroup, PrimeCondition) %>%
+   summarise_at(vars(Accuracy), mean)
> exp3_target_nonname_agg_item = group_by(exp3_target_nonname,
+                                    Target, AgeGroup, PrimeCondition) %>%
+   summarise_at(vars(Accuracy), mean)
> exp3_target_nonname_agg$Subject = as.factor(exp3_target_nonname_agg$Subject)
> exp3_target_aov = aov(data = exp3_target_nonname_agg,
```

```
+                          Accuracy ~ PrimeCondition +
+                                     Error (Subject/PrimeCondition))
> summary(exp3_target_aov)
```

```
Error: Subject
          Df Sum Sq Mean Sq F value Pr(>F)
Residuals 35   1.51 0.04314

Error: Subject:PrimeCondition
                Df Sum Sq Mean Sq F value Pr(>F)
PrimeCondition   3 0.0656 0.02186   1.495   0.22
Residuals      105 1.5348 0.01462
```

```
> exp3_target_aov_item = aov(data = exp3_target_nonname_agg_item,
+                          Accuracy ~ PrimeCondition +
+                                     Error (Target/PrimeCondition))
> summary(exp3_target_aov_item)
```

```
Error: Target
          Df Sum Sq Mean Sq F value Pr(>F)
Residuals 59  10.54  0.1786

Error: Target:PrimeCondition
                Df Sum Sq Mean Sq F value Pr(>F)
PrimeCondition   3 0.1524 0.05081   3.796 0.0114 *
Residuals      177 2.3692 0.01339
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> target_p = exp3_target_nonname_agg %>% filter(PrimeCondition == "P")
> target_r = exp3_target_nonname_agg %>% filter(PrimeCondition == "R")
> target_b = exp3_target_nonname_agg %>% filter(PrimeCondition == "B")
> target_u = exp3_target_nonname_agg %>% filter(PrimeCondition == "U")
> t.test(target_p$Accuracy, target_r$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_p$Accuracy and target_r$Accuracy
t = 1.091, df = 35, p-value = 0.2827
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.03034907  0.10086674
sample estimates:
mean of the differences
             0.03525884
```

```
> t.test(target_p$Accuracy, target_b$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_p$Accuracy and target_b$Accuracy
t = 0.9008, df = 35, p-value = 0.3739
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.03259919  0.08460537
sample estimates:
mean of the differences
             0.02600309
```

```
> t.test(target_p$Accuracy, target_u$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_p$Accuracy and target_u$Accuracy
t = 2.5082, df = 35, p-value = 0.01692
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.0113674 0.1079017
sample estimates:
mean of the differences
             0.05963454
```

```
> t.test(target_b$Accuracy, target_r$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_b$Accuracy and target_r$Accuracy
t = 0.37419, df = 35, p-value = 0.7105
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.04096045  0.05947195
sample estimates:
mean of the differences
            0.009255752
```

```
> t.test(target_b$Accuracy, target_u$Accuracy, paired = TRUE)
```

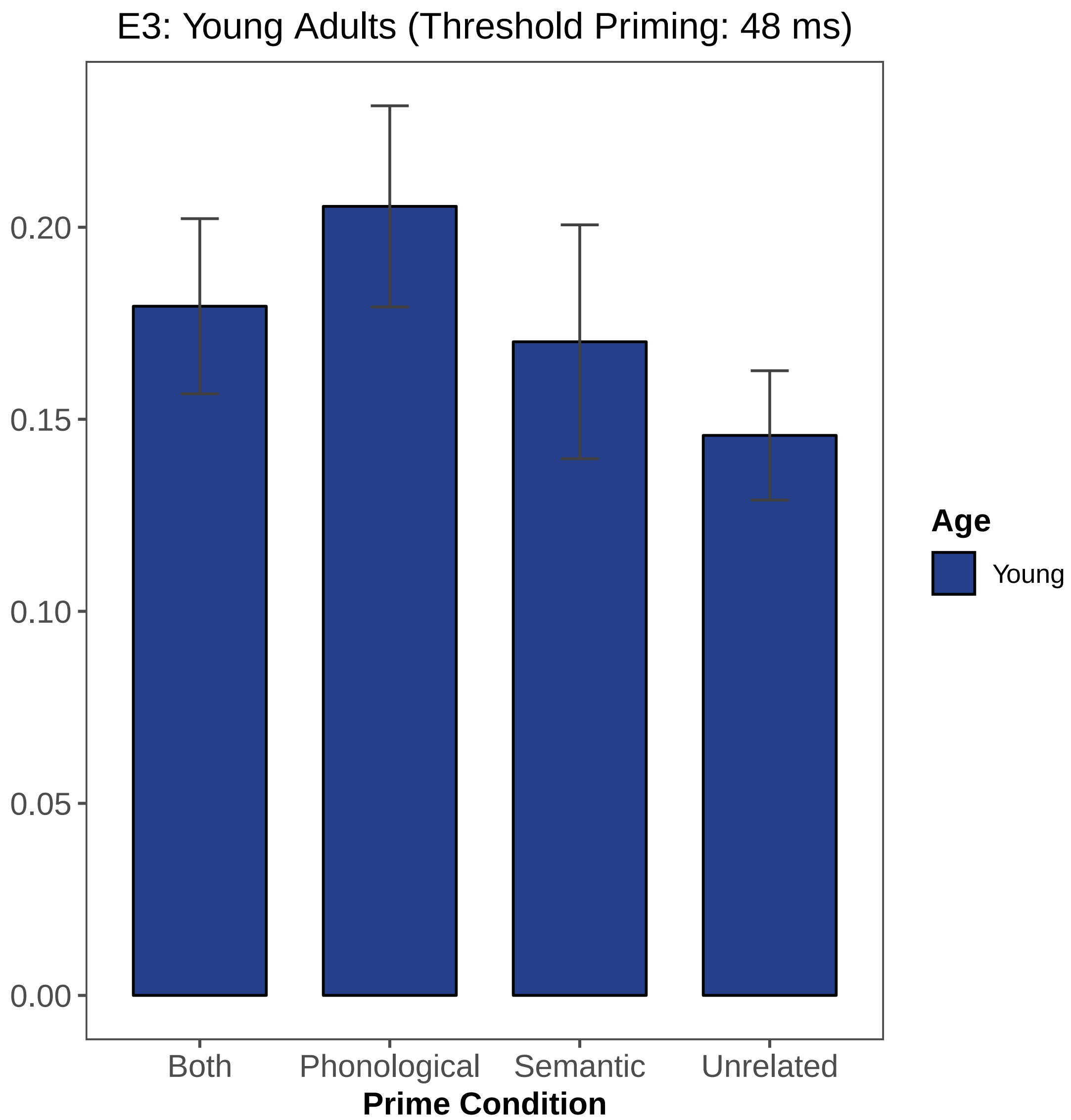
```
        Paired t-test

data:  target_b$Accuracy and target_u$Accuracy
t = 1.2839, df = 35, p-value = 0.2076
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.01954482  0.08680773
```

```
sample estimates:
mean of the differences
             0.03363145
```

```
> t.test(target_r$Accuracy, target_u$Accuracy, paired = TRUE)
```

```
        Paired t-test

data:  target_r$Accuracy and target_u$Accuracy
t = 0.72465, df = 35, p-value = 0.4735
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.0439131  0.0926645
sample estimates:
mean of the differences
              0.0243757
```

```
> exp3_fig_target = Rmisc::summarySE(exp3_target_nonname_agg,
+                        measurevar = "Accuracy",
+                        groupvars = c("AgeGroup", "PrimeCondition"))
> library(ggplot2)
> library(ggthemes)
> targetacc_3 = exp3_fig_target %>% mutate(PrimeType = factor(PrimeCondition,
+                                                  levels = unique(PrimeCondition),
+                    labels = c("Both", "Phonological",
+                               "Semantic", "Unrelated")),
+                    Age = factor(AgeGroup, levels = unique(AgeGroup),
+                    labels = c("Young")))%>%
+ ggplot(aes(x = PrimeType, y = Accuracy, fill = Age, group = Age))+
+  geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
+    geom_errorbar(aes(ymin=Accuracy - se, ymax=Accuracy + se),
+              width=.2, color = "gray26",
+              position = position_dodge(0.7))+
+  theme_few()+
+   scale_fill_manual(values = c("royalblue4", "slategray1"))+
+   #scale_fill_manual(values = c("darkred", "forestgreen"))+
+    xlab("Prime Condition") + ylab("") +
+   ggtitle("E3: Young Adults (Threshold Priming: 48 ms)")  +
+    theme(axis.text = element_text(size = rel(1)),
+           axis.title = element_text(face = "bold", size = rel(1)),
+           legend.title = element_text(face = "bold", size = rel(1)),
+          plot.title = element_text(hjust = .5),
+          strip.text.x = element_text(face = "bold", size = rel(1.4)))
> targetacc_3
```



Match of POS and Syllables

```
> main = read.csv("Julie_Main5Studies.csv", header = TRUE, sep = ",")
> main$StudyNo = as.factor(main$StudyNo)
> main$PrimeCondition = as.factor(main$PrimeCondition)
> word_type = read.csv("ItemWordTypes.csv", header = TRUE, sep = ",",
+                      stringsAsFactors = FALSE)
> main_word = merge(main, word_type, by = c("Target"))
> main_word = main_word %>% arrange(Subject, TargetNo)
> main_word$PrimeClass = NA
```

```
> main_word$PrimeSyll = NA
> main_word$PrimeClass = ifelse(main_word$PrimeCondition == "P", main_word$POS_P,
+                     ifelse(main_word$PrimeCondition == "R", main_word$POS_R,
+                     ifelse(main_word$PrimeCondition == "B", main_word$POS_B,
+                            main_word$POS_U)))
> main_word$PrimeSyll = ifelse(main_word$PrimeCondition == "P", main_word$Nsyll_P,
+                     ifelse(main_word$PrimeCondition == "R", main_word$Nsyll_R,
+                     ifelse(main_word$PrimeCondition == "B", main_word$Nsyll_B,
+                            main_word$Nsyll_U)))
> main_word = main_word[-c(32:54)]
> main_word$SynMatch = ifelse(main_word$WordType == main_word$PrimeClass, 1,0)
> main_word$SyllMatch = ifelse(main_word$TargetSyllables ==
+                                main_word$PrimeSyll, 1,0)
> main_word$WordType = as.factor(main_word$WordType)
> main_word$PrimeClass = as.factor(main_word$PrimeClass)
> exp1_target = main_word %>% filter(StudyNo == '2' | StudyNo == '4')
> exp2_target = main_word %>% filter(StudyNo == '5' | StudyNo == '6')
> exp3_target = main_word %>% filter(StudyNo == '1')
>
```

9.4 Experiment 1

```
> contrasts(exp1_target$PrimeCondition) = contr.treatment(4, base = 1)
> exp1_target$SyllFac = ifelse(exp1_target$SyllMatch == "0", 1, -1)
> exp1_target$SynFac = ifelse(exp1_target$SynMatch == "0", 1, -1)
> e1_syll_aov = glmer(data = exp1_target,
+                     Accuracy ~ PrimeCondition*AgeGroup + SynFac + SyllFac+
+                     (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
+             optCtrl=list(maxfun=100000)))
> summary(e1_syll_aov)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeCondition * AgeGroup + SynFac + SyllFac + (1 |
    Subject) + (1 | Target)
   Data: exp1_target
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  6221.2   6303.9  -3098.6   6197.2     7288

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.1540 -0.4687 -0.2328  0.2251 11.2798
```

```
Random effects:
 Groups  Name        Variance Std.Dev.
 Target  (Intercept) 2.436    1.561
 Subject (Intercept) 1.012    1.006
Number of obs: 7300, groups:  Target, 100; Subject, 73

Fixed effects:
                            Estimate Std. Error z value Pr(>|z|)
(Intercept)                 -1.80270    0.21447  -8.405  < 2e-16 ***
PrimeCondition2              0.77302    0.11737   6.586 4.51e-11 ***
PrimeCondition3             -0.35262    0.09549  -3.693 0.000222 ***
PrimeCondition4             -0.13903    0.12621  -1.102 0.270657
AgeGroup1                    0.07041    0.13499   0.522 0.601922
SynFac                      -0.09385    0.05653  -1.660 0.096851 .
SyllFac                     -0.03234    0.04169  -0.776 0.437882
PrimeCondition2:AgeGroup1 -0.01769    0.08942  -0.198 0.843155
PrimeCondition3:AgeGroup1 -0.06621    0.09459  -0.700 0.483909
PrimeCondition4:AgeGroup1 -0.13346    0.09447  -1.413 0.157753
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmCn2 PrmCn3 PrmCn4 AgGrp1 SynFac SyllFc PC2:AG PC3:AG
PrimeCndtn2 -0.331
PrimeCndtn3 -0.199  0.367
PrimeCndtn4 -0.301  0.688  0.370
AgeGroup1    0.006 -0.002 -0.003 -0.003
SynFac       0.234 -0.641  0.015 -0.621  0.001
SyllFac      0.009 -0.018 -0.126 -0.226  0.000 -0.008
PrmCnd2:AG1 -0.002  0.005  0.005  0.005 -0.356 -0.002  0.002
PrmCnd3:AG1 -0.002  0.007  0.013  0.008 -0.330 -0.008  0.000  0.500
PrmCnd4:AG1  0.000  0.002  0.005  0.019 -0.332  0.001  0.000  0.502  0.471
```

```
> car::Anova(e1_syll_aov)
```

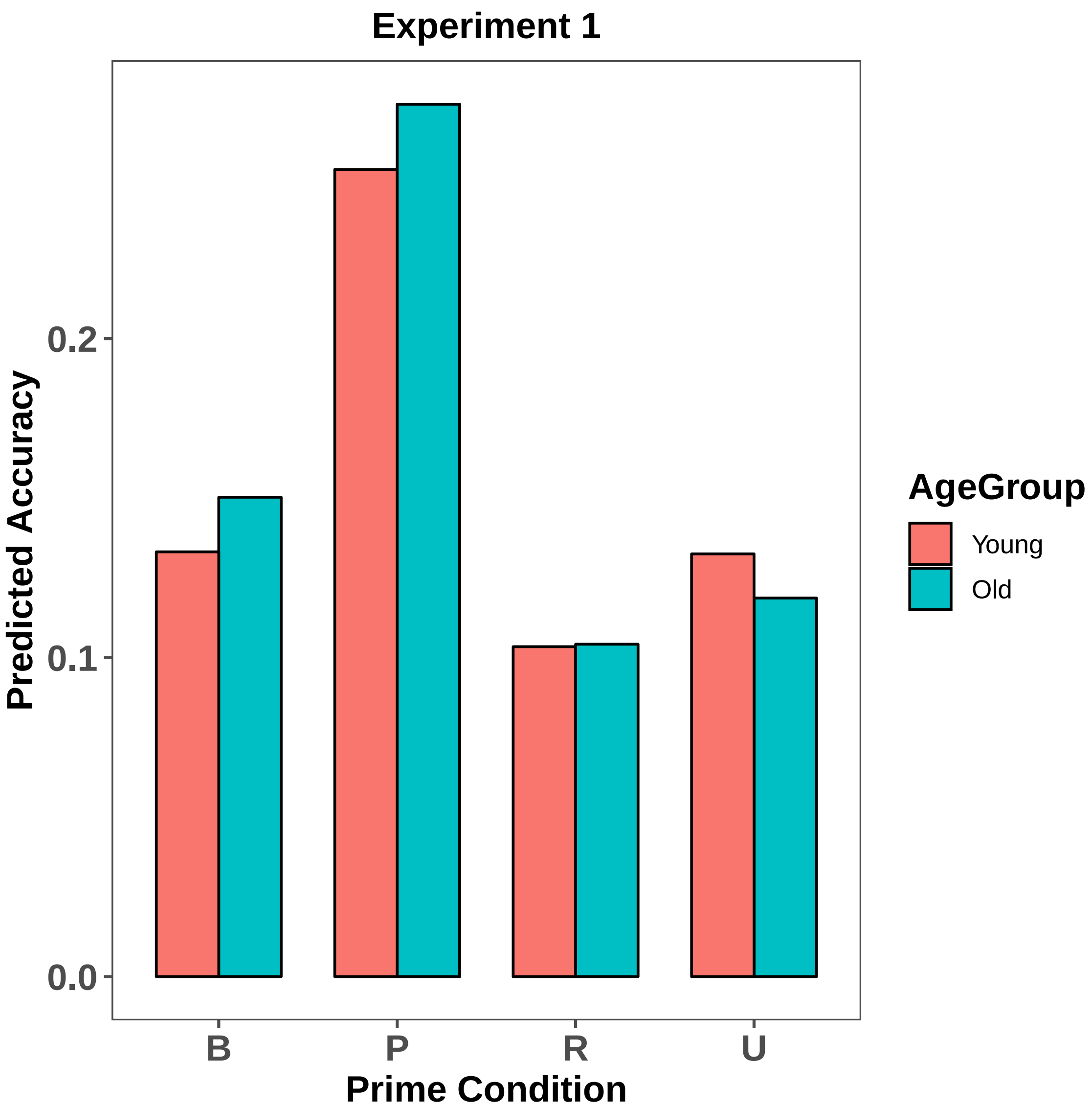
```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                            Chisq Df Pr(>Chisq)
PrimeCondition           131.0672  3    < 2e-16 ***
AgeGroup                   0.0269  1    0.86976
SynFac                     2.7566  1    0.09685 .
SyllFac                    0.6018  1    0.43788
PrimeCondition:AgeGroup    2.4129  3    0.49124
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> options(contrasts = c("contr.sum","contr.poly"))
```

```
> anova(e1_syll_aov)
```

```
Analysis of Variance Table
                       Df  Sum Sq Mean Sq F value
PrimeCondition          3 151.411  50.470 50.4704
AgeGroup                1   0.027   0.027  0.0274
SynFac                  1   2.770   2.770  2.7699
SyllFac                 1   0.606   0.606  0.6057
PrimeCondition:AgeGroup 3   2.410   0.803  0.8033
```

```
> predict_data ← data.frame(expand.grid(PrimeCondition = c("B", "P", "R", "U"),
+                                AgeGroup = c("Young", "Old")))
> predict_data$SyllFac = 0
> predict_data$SynFac = 0
> predictions ← predict(e1_syll_aov, newdata = predict_data, re.form = NA)
> predictions ← cbind(predict_data, predictions)
> predictions$odds = exp(predictions$predictions)
> predictions$prob = predictions$odds / (1+predictions$odds)
> predictions %>%
+   ggplot(aes(x = PrimeCondition, y = prob,
+              fill = AgeGroup, group = AgeGroup)) +
+ geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
xlab("Prime Condition") +
+   ylab ("Predicted Accuracy")+
+   ggtitle("Experiment 1")+
+ theme_few() +
+     theme(axis.text = element_text(face = "bold", size = rel(1.2)),
+           axis.title = element_text(face = "bold", size = rel(1.2)),
+           legend.title = element_text(face = "bold", size = rel(1.2)),
+     plot.title = element_text(face = "bold", size = rel(1.2), hjust = .5))
```



9.5 Experiment 2

```
> contrasts(exp2_target$PrimeCondition) = contr.treatment(4, base = 1)
> exp2_target$SyllFac = ifelse(exp2_target$SyllMatch == "0", 1, -1)
> exp2_target$SynFac = ifelse(exp2_target$SynMatch == "0", 1, -1)
> exp2_target$AgeFac = ifelse(exp2_target$AgeGroup == "Young", 1, -1)
> e2_syll_aov = glmer(data = exp2_target,
+                     Accuracy ~ PrimeCondition*AgeFac + SynFac + SyllFac+
+                     (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
```

```
+              optCtrl=list(maxfun=100000)))
> summary(e2_syll_aov)
```

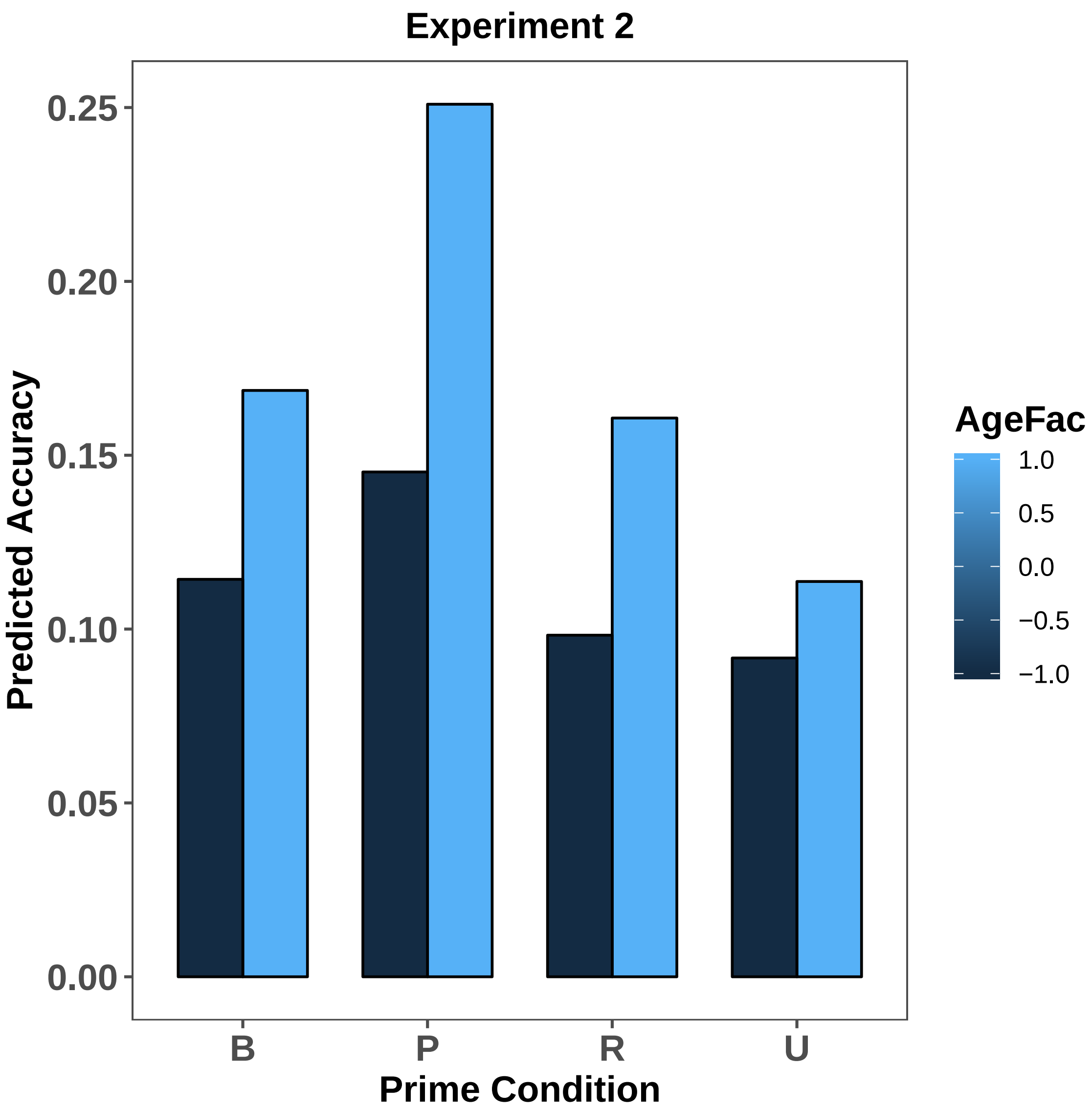
```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeCondition * AgeFac + SynFac + SyllFac + (1 |
    Subject) + (1 | Target)
   Data: exp2_target
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  5338.8   5420.2  -2657.4   5314.8     6488

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.8413 -0.4448 -0.2317 -0.0719 11.0936

Random effects:
 Groups  Name        Variance Std.Dev.
 Target  (Intercept) 2.3636   1.5374
 Subject (Intercept) 0.9932   0.9966
Number of obs: 6500, groups:  Target, 100; Subject, 65

Fixed effects:
                      Estimate Std. Error z value Pr(>|z|)
(Intercept)           -1.82141    0.21922  -8.309  < 2e-16 ***
PrimeCondition2        0.38818    0.13016   2.982  0.00286 **
PrimeCondition3       -0.11356    0.10239  -1.109  0.26743
PrimeCondition4       -0.35207    0.14065  -2.503  0.01231 *
AgeFac                 0.22607    0.14335   1.577  0.11477
SynFac                 0.05440    0.06221   0.874  0.38188
SyllFac               -0.09954    0.04489  -2.217  0.02660 *
PrimeCondition2:AgeFac  0.11360    0.09878   1.150  0.25011
PrimeCondition3:AgeFac  0.05586    0.10179   0.549  0.58321
PrimeCondition4:AgeFac -0.10626    0.10414  -1.020  0.30754
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmCn2 PrmCn3 PrmCn4 AgeFac SynFac SyllFc PC2:AF PC3:AF
PrimeCndtn2 -0.346
PrimeCndtn3 -0.223  0.379
PrimeCndtn4 -0.319  0.697  0.375
AgeFac      -0.029  0.028  0.033  0.021
SynFac       0.245 -0.652  0.008 -0.636  0.002
SyllFac      0.020 -0.030 -0.126 -0.224  0.001  0.003
PrmCndt2:AF  0.022 -0.064 -0.051 -0.031 -0.365 -0.005 -0.006
```

```
PrmCndt3:AF  0.026 -0.043 -0.102 -0.036 -0.349  0.007  0.000  0.510
PrmCndt4:AF  0.023 -0.040 -0.044 -0.059 -0.341  0.004  0.004  0.500  0.478
```

```
> car::Anova(e2_syll_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                         Chisq Df  Pr(>Chisq)
PrimeCondition         53.8150  3  1.229e-11 ***
AgeFac                  3.6984  1    0.05446 .
SynFac                  0.7646  1    0.38188
SyllFac                 4.9163  1    0.02660 *
PrimeCondition:AgeFac   4.9972  3    0.17200
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> predict_data ← data.frame(expand.grid(PrimeCondition = c("B", "P", "R", "U"),
+                                   AgeFac = c(1, -1)))
> predict_data$SyllFac = 0
> predict_data$SynFac = 0
> predictions ← predict(e2_syll_aov, newdata = predict_data, re.form = NA)
> predictions ← cbind(predict_data, predictions)
> predictions$odds = exp(predictions$predictions)
> predictions$prob = predictions$odds / (1+predictions$odds)
> predictions %>%
+   ggplot(aes(x = PrimeCondition, y = prob,
+              fill = AgeFac, group = AgeFac)) +
+ geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
xlab("Prime Condition") +
+   ylab ("Predicted Accuracy")+
+   ggtitle("Experiment 2")+
+ theme_few() +
+     theme(axis.text = element_text(face = "bold", size = rel(1.2)),
+           axis.title = element_text(face = "bold", size = rel(1.2)),
+           legend.title = element_text(face = "bold", size = rel(1.2)),
+     plot.title = element_text(face = "bold", size = rel(1.2), hjust = .5))
```



9.6 Experiment 3

```
> contrasts(exp3_target$PrimeCondition) = contr.treatment(4, base = 1)
> exp3_target$SyllFac = ifelse(exp3_target$SyllMatch == "0", 1, -1)
> exp3_target$SynFac = ifelse(exp3_target$SynMatch == "0", 1, -1)
> e3_syll_aov = glmer(data = exp3_target,
+                     Accuracy ~ PrimeCondition + SynFac + SyllFac+
+                     (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
+             optCtrl=list(maxfun=100000)))
```

```
> summary(e3_syll_aov)
```

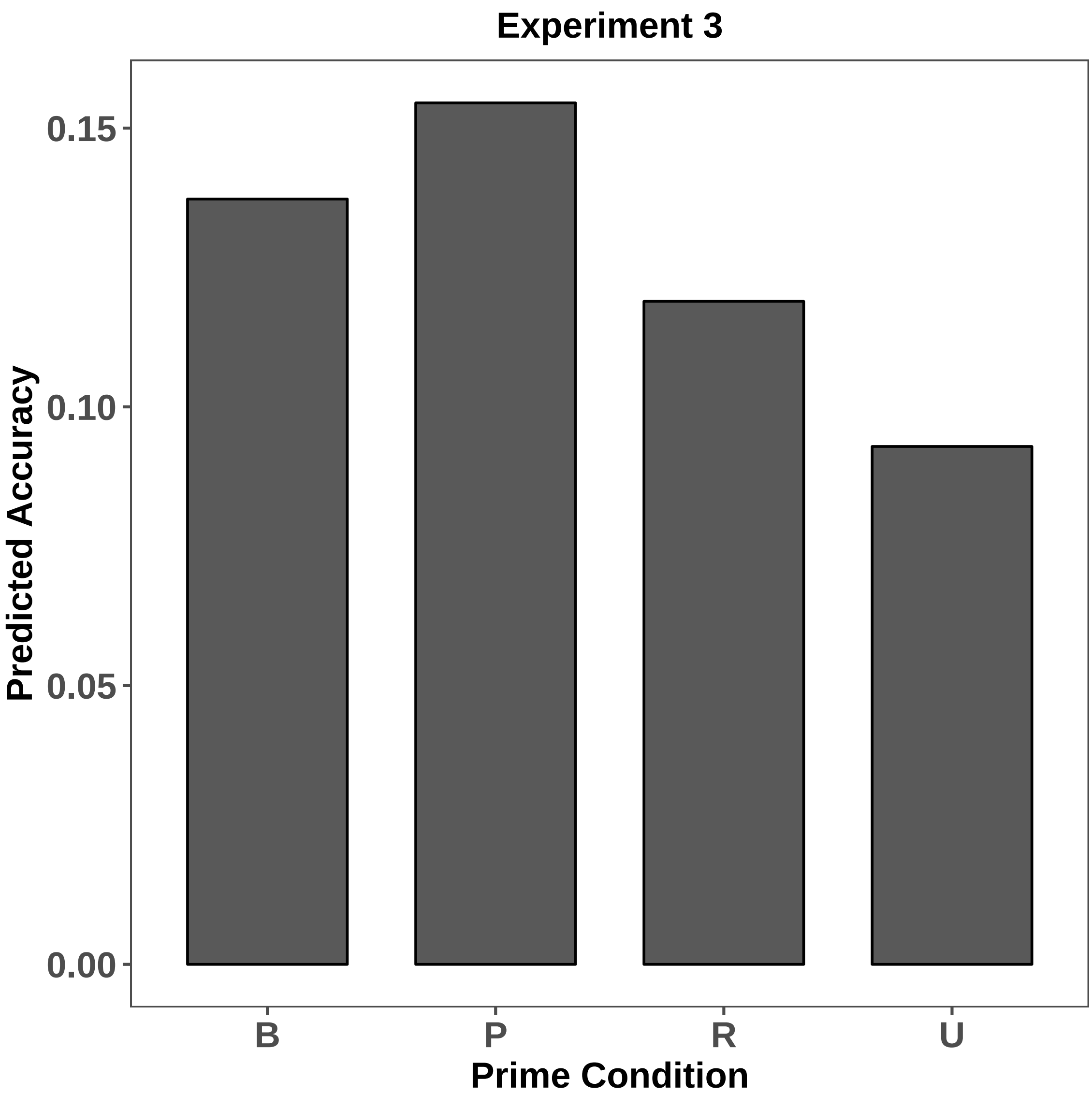
```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeCondition + SynFac + SyllFac + (1 | Subject) +
    (1 | Target)
   Data: exp3_target
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  2901.6   2951.1  -1442.8   2885.6     3592

Scaled residuals:
    Min      1Q  Median      3Q     Max
-5.5081 -0.4149 -0.2212 -0.0831  7.6061

Random effects:
 Groups  Name        Variance Std.Dev.
 Target  (Intercept) 3.0158   1.7366
 Subject (Intercept) 0.8166   0.9037
Number of obs: 3600, groups:  Target, 100; Subject, 36

Fixed effects:
                Estimate Std. Error z value Pr(>|z|)
(Intercept)     -1.83803    0.26445  -6.950 3.64e-12 ***
PrimeCondition2  0.13851    0.17690   0.783   0.4337
PrimeCondition3 -0.16460    0.14073  -1.170   0.2422
PrimeCondition4 -0.44075    0.19070  -2.311   0.0208 *
SynFac           0.10072    0.08531   1.181   0.2377
SyllFac         -0.01127    0.06122  -0.184   0.8539
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmCn2 PrmCn3 PrmCn4 SynFac
PrimeCndtn2 -0.381
PrimeCndtn3 -0.247  0.371
PrimeCndtn4 -0.357  0.692  0.372
SynFac       0.275 -0.652  0.003 -0.639
SyllFac      0.009 -0.012 -0.123 -0.227  0.005
```

```
> car::Anova(e3_syll_aov)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                 Chisq Df Pr(>Chisq)
```

```
PrimeCondition 17.0643  3  0.0006856 ***
SynFac          1.3940  1  0.2377342
SyllFac         0.0339  1  0.8539246
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> predict_data ← data.frame(PrimeCondition = c("B", "P", "R", "U"))
> predict_data$SyllFac = 0
> predict_data$SynFac = 0
> predictions ← predict(e3_syll_aov, newdata = predict_data, re.form = NA)
> predictions ← cbind(predict_data, predictions)
> predictions$odds = exp(predictions$predictions)
> predictions$prob = predictions$odds / (1+predictions$odds)
> predictions %>%
+   ggplot(aes(x = PrimeCondition, y = prob)) +
+ geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
xlab("Prime Condition") +
+   ylab ("Predicted Accuracy")+
+   ggtitle("Experiment 3")+
+ theme_few() +
+     theme(axis.text = element_text(face = "bold", size = rel(1.2)),
+           axis.title = element_text(face = "bold", size = rel(1.2)),
+           legend.title = element_text(face = "bold", size = rel(1.2)),
+     plot.title = element_text(face = "bold", size = rel(1.2), hjust = .5))
```



Controlling Prime POS and Syllables

E1

```
> exp1_target$PrimeSyll.c = as.numeric(scale(exp1_target$PrimeSyll,
+                                             center = TRUE, scale = FALSE))
> contrasts(exp1_target$PrimeCondition) = contr.treatment(4, base = 3)
> exp1_target$AgeFac = ifelse(exp1_target$AgeGroup == "Young", 1, -1)
> e1_syll_control = glmer(data = exp1_target,
+                      Accuracy ~ PrimeCondition*AgeFac  + PrimeClass+
```

```
+                        PrimeSyll.c +
+                      (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
+             optCtrl=list(maxfun=100000)))
> summary(e1_syll_control)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeCondition * AgeFac + PrimeClass + PrimeSyll.c +
    (1 | Subject) + (1 | Target)
   Data: exp1_target
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  6212.5   6309.1  -3092.3   6184.5     7286

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.3452 -0.4683 -0.2304  0.2244 10.4945

Random effects:
 Groups  Name        Variance Std.Dev.
 Target  (Intercept) 2.250    1.500
 Subject (Intercept) 1.009    1.004
Number of obs: 7300, groups:  Target, 100; Subject, 73

Fixed effects:
                        Estimate Std. Error z value Pr(>|z|)
(Intercept)            -2.179014   0.209367 -10.408  < 2e-16 ***
PrimeCondition1         0.373017   0.096297   3.874 0.000107 ***
PrimeCondition2         1.287582   0.118120  10.901  < 2e-16 ***
PrimeCondition4         0.313640   0.140054   2.239 0.025128 *
AgeFac                 -0.004688   0.136932  -0.034 0.972688
PrimeClass1            -0.095227   0.109082  -0.873 0.382672
PrimeClass2            -0.173590   0.073598  -2.359 0.018344 *
PrimeClass3             0.351948   0.102330   3.439 0.000583 ***
PrimeSyll.c            -0.046056   0.051236  -0.899 0.368706
PrimeCondition1:AgeFac -0.066069   0.095354  -0.693 0.488387
PrimeCondition2:AgeFac -0.047520   0.092111  -0.516 0.605928
PrimeCondition4:AgeFac  0.066999   0.097331   0.688 0.491224
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmCn1 PrmCn2 PrmCn4 AgeFac PrmCl1 PrmCl2 PrmCl3 PrmSy.
PrimeCndtn1 -0.244
PrimeCndtn2 -0.304  0.435
```

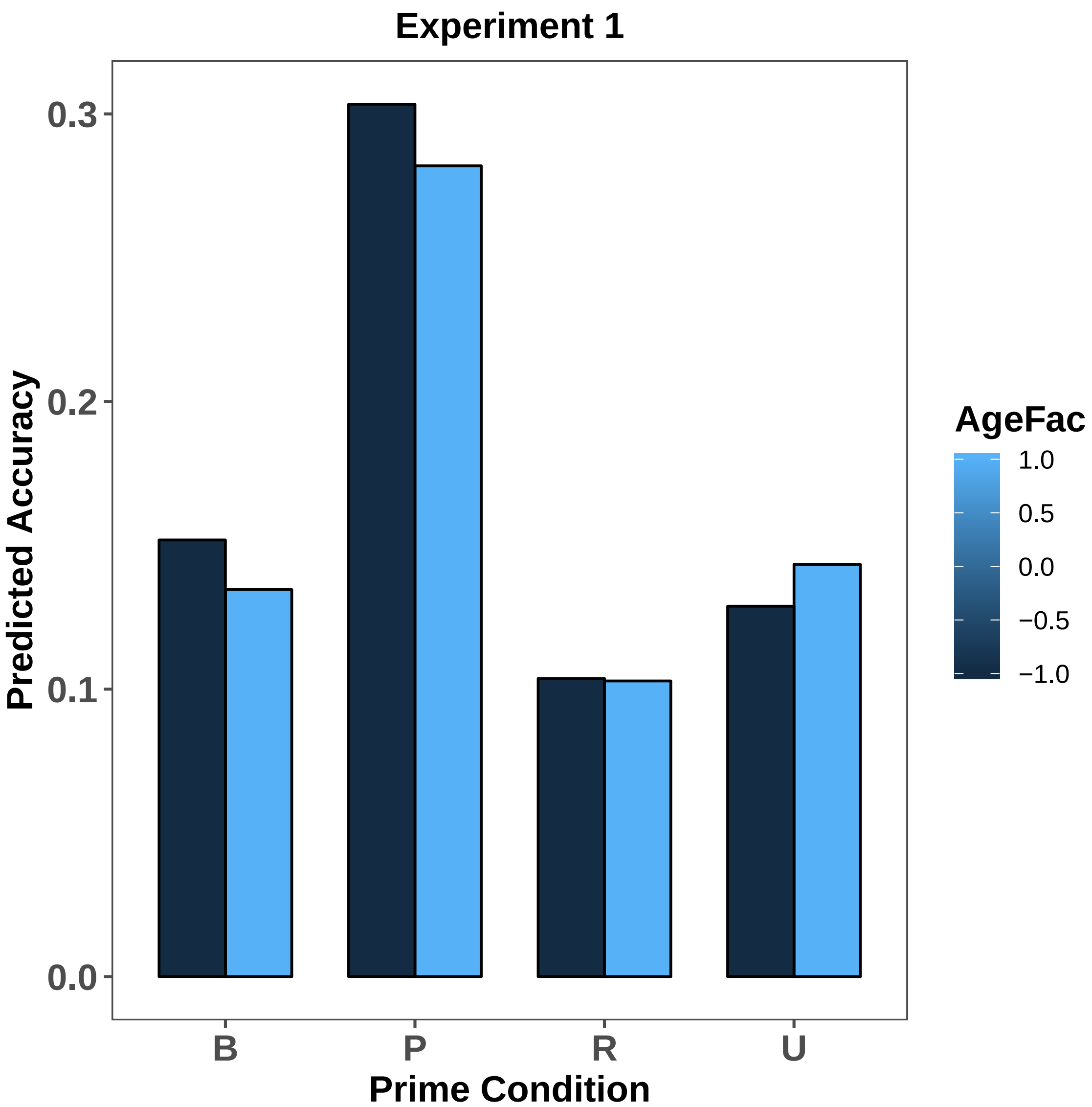
```
PrimeCndtn4 -0.262  0.305  0.627
AgeFac      -0.007  0.005  0.002  0.002
PrimeClass1  0.103 -0.022 -0.167 -0.094  0.003
PrimeClass2  0.022  0.046 -0.371 -0.457  0.000 -0.293
PrimeClass3 -0.174  0.021  0.554  0.498 -0.004 -0.508 -0.238
PrimeSyll.c -0.052 -0.119 -0.003  0.455  0.000 -0.065 -0.119  0.088
PrmCndt1:AF  0.004 -0.012 -0.005 -0.003 -0.367 -0.005  0.003  0.007  0.003
PrmCndt2:AF  0.003 -0.007 -0.005 -0.006 -0.385 -0.002  0.000  0.005 -0.004
PrmCndt4:AF  0.001 -0.006 -0.003 -0.018 -0.361 -0.004  0.001  0.005  0.000
            PC1:AF PC2:AF
PrimeCndtn1
PrimeCndtn2
PrimeCndtn4
AgeFac
PrimeClass1
PrimeClass2
PrimeClass3
PrimeSyll.c
PrmCndt1:AF
PrmCndt2:AF  0.545
PrmCndt4:AF  0.517  0.537
```

```
> car::Anova(e1_syll_control)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                         Chisq Df Pr(>Chisq)
PrimeCondition        153.7250  3  < 2.2e-16 ***
AgeFac                  0.0270  1   0.869409
PrimeClass             14.4147  3   0.002392 **
PrimeSyll.c             0.8080  1   0.368706
PrimeCondition:AgeFac   2.3877  3   0.495931
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> predict_data ← data.frame(expand.grid(PrimeCondition = c("B", "P", "R", "U"),
+                            AgeFac = c(1, -1)))
> predict_data$PrimeSyll.c = 0
> predict_data$PrimeClass = "JJ"
> predictions ← predict(e1_syll_control, newdata = predict_data, re.form = NA)
> predictions1 ← cbind(predict_data, predictions)
> predictions1$odds = exp(predictions1$predictions)
> predictions1$prob = predictions1$odds / (1+predictions1$odds)
> predict_data$PrimeClass = "NN"
> predictions ← predict(e1_syll_control, newdata = predict_data, re.form = NA)
> predictions2 ← cbind(predict_data, predictions)
> predictions2$odds = exp(predictions2$predictions)
```

```
> predictions2$prob = predictions2$odds / (1+predictions2$odds)
> predict_data$PrimeClass = "PN"
> predictions ← predict(e1_syll_control, newdata = predict_data, re.form = NA)
> predictions3 ← cbind(predict_data, predictions)
> predictions3$odds = exp(predictions3$predictions)
> predictions3$prob = predictions3$odds / (1+predictions3$odds)
> predict_data$PrimeClass = "VB"
> predictions ← predict(e1_syll_control, newdata = predict_data, re.form = NA)
> predictions4 ← cbind(predict_data, predictions)
> predictions4$odds = exp(predictions4$predictions)
> predictions4$prob = predictions4$odds / (1+predictions4$odds)
> predictions = rbind(predictions1, predictions2, predictions3, predictions4)
> predictions_means = group_by(predictions, PrimeCondition,
+                              AgeFac) %>%
+   summarise_at(vars(prob), mean)
> predictions_means %>%
+   ggplot(aes(x = PrimeCondition, y = prob,
+              fill = AgeFac, group = AgeFac)) +
+ geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
xlab("Prime Condition") +
+   ylab ("Predicted Accuracy")+
+   ggtitle("Experiment 1")+
+ theme_few() +
+     theme(axis.text = element_text(face = "bold", size = rel(1.2)),
+           axis.title = element_text(face = "bold", size = rel(1.2)),
+           legend.title = element_text(face = "bold", size = rel(1.2)),
+     plot.title = element_text(face = "bold", size = rel(1.2), hjust = .5))
```



E2

```
> exp2_target$PrimeSyll.c = as.numeric(scale(exp2_target$PrimeSyll,
+                                           center = TRUE, scale = FALSE))
> contrasts(exp2_target$PrimeCondition) = contr.treatment(4, base = 3)
> exp2_target$AgeFac = ifelse(exp2_target$AgeGroup == "Young", 1, -1)
> e2_syll_control = glmer(data = exp2_target,
+                    Accuracy ~ PrimeCondition*AgeFac  + PrimeClass+
+                     PrimeSyll.c +
+                    (1|Subject) + (1|Target), family = "binomial",
```

```
+     control=glmerControl(optimizer="bobyqa",
+             optCtrl=list(maxfun=100000)))
> summary(e2_syll_control)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula: Accuracy ~ PrimeCondition * AgeFac + PrimeClass + PrimeSyll.c +
    (1 | Subject) + (1 | Target)
   Data: exp2_target
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  5344.1   5439.1  -2658.1   5316.1     6486

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.0132 -0.4430 -0.2312 -0.0709 10.8001

Random effects:
 Groups  Name        Variance Std.Dev.
 Target  (Intercept) 2.3676   1.5387
 Subject (Intercept) 0.9928   0.9964
Number of obs: 6500, groups:  Target, 100; Subject, 65

Fixed effects:
                      Estimate Std. Error z value Pr(>|z|)
(Intercept)           -2.06187    0.21665  -9.517  < 2e-16 ***
PrimeCondition1        0.13573    0.10290   1.319   0.1871
PrimeCondition2        0.70911    0.12516   5.666 1.47e-08 ***
PrimeCondition4       -0.02986    0.14936  -0.200   0.8416
AgeFac                 0.28266    0.14405   1.962   0.0497 *
PrimeClass1            0.03091    0.11914   0.259   0.7953
PrimeClass2           -0.05327    0.07913  -0.673   0.5008
PrimeClass3            0.16833    0.10996   1.531   0.1258
PrimeSyll.c            0.03946    0.05597   0.705   0.4808
PrimeCondition1:AgeFac -0.05596   0.10219  -0.548   0.5840
PrimeCondition2:AgeFac  0.05675   0.09925   0.572   0.5675
PrimeCondition4:AgeFac -0.16514   0.10522  -1.569   0.1166
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmCn1 PrmCn2 PrmCn4 AgeFac PrmCl1 PrmCl2 PrmCl3 PrmSy.
PrimeCndtn1 -0.237
PrimeCndtn2 -0.283  0.412
PrimeCndtn4 -0.250  0.283  0.606
AgeFac      -0.031  0.039  0.035  0.025
```

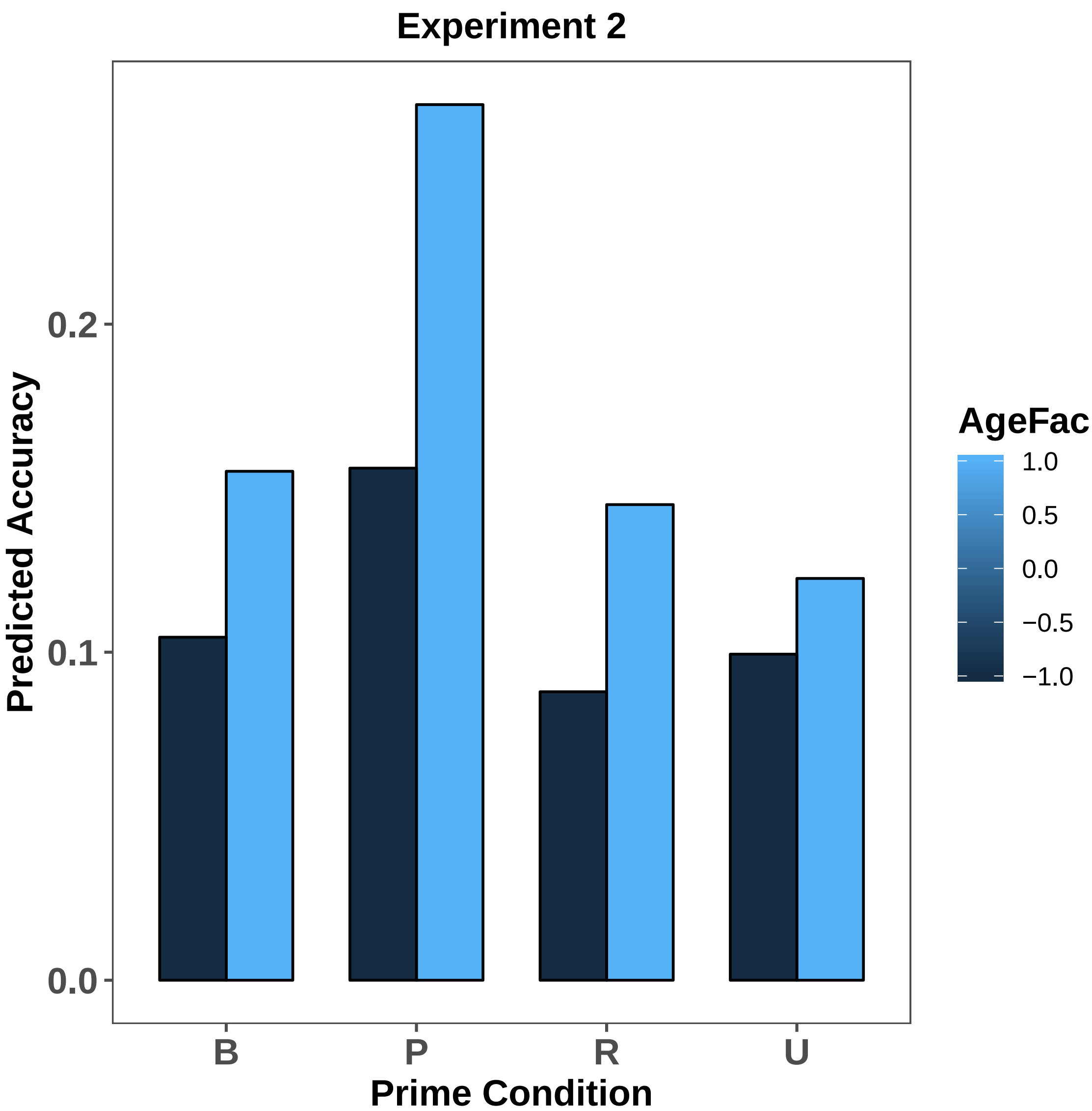
```
PrimeClass1   0.095 -0.022 -0.159 -0.098  0.003
PrimeClass2   0.013  0.052 -0.377 -0.454  0.003 -0.285
PrimeClass3  -0.162  0.011  0.544  0.491  0.002 -0.510 -0.237
PrimeSyll.c  -0.059 -0.126 -0.017  0.450 -0.005 -0.065 -0.117  0.079
PrmCndt1:AF   0.024 -0.101 -0.042 -0.038 -0.360 -0.007 -0.003  0.003  0.002
PrmCndt2:AF   0.024 -0.055 -0.077 -0.034 -0.373 -0.002 -0.003 -0.006  0.018
PrmCndt4:AF   0.027 -0.057 -0.052 -0.063 -0.351 -0.004 -0.006 -0.014  0.009
             PC1:AF PC2:AF
PrimeCndtn1
PrimeCndtn2
PrimeCndtn4
AgeFac
PrimeClass1
PrimeClass2
PrimeClass3
PrimeSyll.c
PrmCndt1:AF
PrmCndt2:AF   0.519
PrmCndt4:AF   0.495  0.511
```

```
> car::Anova(e2_syll_control)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                        Chisq Df Pr(>Chisq)
PrimeCondition        55.5283  3  5.297e-12 ***
AgeFac                 3.6940  1    0.05461 .
PrimeClass             3.8972  3    0.27278
PrimeSyll.c            0.4970  1    0.48080
PrimeCondition:AgeFac  5.1259  3    0.16280
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> predict_data ← data.frame(expand.grid(PrimeCondition = c("B", "P", "R", "U"),
+                             AgeFac = c(1, -1)))
> predict_data$PrimeSyll.c = 0
> predict_data$PrimeClass = "JJ"
> predictions ← predict(e2_syll_control, newdata = predict_data, re.form = NA)
> predictions1 ← cbind(predict_data, predictions)
> predictions1$odds = exp(predictions1$predictions)
> predictions1$prob = predictions1$odds / (1+predictions1$odds)
> predict_data$PrimeClass = "NN"
> predictions ← predict(e2_syll_control, newdata = predict_data, re.form = NA)
> predictions2 ← cbind(predict_data, predictions)
> predictions2$odds = exp(predictions2$predictions)
> predictions2$prob = predictions2$odds / (1+predictions2$odds)
> predict_data$PrimeClass = "PN"
```

```
> predictions <- predict(e2_syll_control, newdata = predict_data, re.form = NA)
> predictions3 <- cbind(predict_data, predictions)
> predictions3$odds = exp(predictions3$predictions)
> predictions3$prob = predictions3$odds / (1+predictions3$odds)
> predict_data$PrimeClass = "VB"
> predictions <- predict(e2_syll_control, newdata = predict_data, re.form = NA)
> predictions4 <- cbind(predict_data, predictions)
> predictions4$odds = exp(predictions4$predictions)
> predictions4$prob = predictions4$odds / (1+predictions4$odds)
> predictions = rbind(predictions1, predictions2, predictions3, predictions4)
> predictions_means = group_by(predictions, PrimeCondition,
+                              AgeFac) %>%
+   summarise_at(vars(prob), mean)
> predictions_means %>%
+   ggplot(aes(x = PrimeCondition, y = prob,
+              fill = AgeFac, group = AgeFac)) +
+ geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
xlab("Prime Condition") +
+   ylab ("Predicted Accuracy")+
+   ggtitle("Experiment 2")+
+ theme_few() +
+     theme(axis.text = element_text(face = "bold", size = rel(1.2)),
+           axis.title = element_text(face = "bold", size = rel(1.2)),
+           legend.title = element_text(face = "bold", size = rel(1.2)),
+     plot.title = element_text(face = "bold", size = rel(1.2), hjust = .5))
```



9.7 E3

```
> exp3_target$PrimeSyll.c = as.numeric(scale(exp3_target$PrimeSyll,
+                                            center = TRUE, scale = FALSE))
> contrasts(exp3_target$PrimeCondition) = contr.treatment(4, base = 1)
> e3_syll_control = glmer(data = exp3_target,
+                    Accuracy ~ PrimeCondition + PrimeClass+
+                       PrimeSyll.c +
+                    (1|Subject) + (1|Target), family = "binomial",
+     control=glmerControl(optimizer="bobyqa",
```

```
+              optCtrl=list(maxfun=100000)))
> summary(e3_syll_control)
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace
  Approximation) [glmerMod]
 Family: binomial  ( logit )
Formula:
Accuracy ~ PrimeCondition + PrimeClass + PrimeSyll.c + (1 | Subject) +
    (1 | Target)
   Data: exp3_target
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 1e+05))

     AIC      BIC   logLik deviance df.resid
  2903.6   2965.5  -1441.8   2883.6     3590

Scaled residuals:
    Min      1Q  Median      3Q     Max
-5.6960 -0.4205 -0.2200 -0.0835  7.2605

Random effects:
 Groups  Name        Variance Std.Dev.
 Target  (Intercept) 2.8633   1.6921
 Subject (Intercept) 0.8112   0.9007
Number of obs: 3600, groups:  Target, 100; Subject, 36

Fixed effects:
                Estimate Std. Error z value Pr(>|z|)
(Intercept)     -1.96702    0.25731  -7.645 2.09e-14 ***
PrimeCondition2  0.35205    0.16912   2.082   0.0374 *
PrimeCondition3 -0.18764    0.14142  -1.327   0.1846
PrimeCondition4 -0.31731    0.20940  -1.515   0.1297
PrimeClass1     -0.26483    0.16563  -1.599   0.1098
PrimeClass2      0.05235    0.10730   0.488   0.6257
PrimeClass3      0.18994    0.14935   1.272   0.2035
PrimeSyll.c     -0.04634    0.07410  -0.625   0.5318
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1

Correlation of Fixed Effects:
            (Intr) PrmCn2 PrmCn3 PrmCn4 PrmCl1 PrmCl2 PrmCl3
PrimeCndtn2 -0.318
PrimeCndtn3 -0.266  0.408
PrimeCndtn4 -0.302  0.620  0.392
PrimeClass1  0.117 -0.150  0.020 -0.052
PrimeClass2  0.035 -0.401 -0.066 -0.467 -0.318
PrimeClass3 -0.181  0.537 -0.010  0.447 -0.502 -0.232
PrimeSyll.c -0.131  0.105  0.127  0.534 -0.062 -0.128  0.089
```

```
> car::Anova(e3_syll_control)
```

```
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Accuracy
                 Chisq Df  Pr(>Chisq)
PrimeCondition 20.0636  3  0.0001647 ***
PrimeClass      2.9234  3  0.4035874
PrimeSyll.c     0.3910  1  0.5317829
---
Signif. codes:  0 âĂŸ***âĂŹ 0.001 âĂŸ**âĂŹ 0.01 âĂŸ*âĂŹ 0.05 âĂŸ.âĂŹ 0.1 âĂŸ âĂŹ 1
```

```
> predict_data ← data.frame(expand.grid(PrimeCondition = c("B", "P", "R", "U")))
> predict_data$PrimeSyll.c = 0
> predict_data$PrimeClass = "JJ"
> predictions ← predict(e3_syll_control, newdata = predict_data, re.form = NA)
> predictions1 ← cbind(predict_data, predictions)
> predictions1$odds = exp(predictions1$predictions)
> predictions1$prob = predictions1$odds / (1+predictions1$odds)
> predict_data$PrimeClass = "NN"
> predictions ← predict(e3_syll_control, newdata = predict_data, re.form = NA)
> predictions2 ← cbind(predict_data, predictions)
> predictions2$odds = exp(predictions2$predictions)
> predictions2$prob = predictions2$odds / (1+predictions2$odds)
> predict_data$PrimeClass = "PN"
> predictions ← predict(e3_syll_control, newdata = predict_data, re.form = NA)
> predictions3 ← cbind(predict_data, predictions)
> predictions3$odds = exp(predictions3$predictions)
> predictions3$prob = predictions3$odds / (1+predictions3$odds)
> predict_data$PrimeClass = "VB"
> predictions ← predict(e3_syll_control, newdata = predict_data, re.form = NA)
> predictions4 ← cbind(predict_data, predictions)
> predictions4$odds = exp(predictions4$predictions)
> predictions4$prob = predictions4$odds / (1+predictions4$odds)
> predictions = rbind(predictions1, predictions2, predictions3, predictions4)
> predictions_means = group_by(predictions, PrimeCondition) %>%
+   summarise_at(vars(prob), mean)
> predictions_means %>%
+   ggplot(aes(x = PrimeCondition, y = prob)) +
+ geom_bar(stat = "identity", position = "dodge", width = 0.7, color = "black")+
xlab("Prime Condition") +
+   ylab ("Predicted Accuracy")+
+   ggtitle("Experiment 3")+
+ theme_few() +
+     theme(axis.text = element_text(face = "bold", size = rel(1.2)),
+           axis.title = element_text(face = "bold", size = rel(1.2)),
+           legend.title = element_text(face = "bold", size = rel(1.2)),
```

```
+       plot.title = element_text(face = "bold", size = rel(1.2), hjust = .5))
```