Feedback MTurk Study

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Introduction

Load Data

```r
# ?register_google
# register_google(key = "AIzaSyCTk2a5vIEqcvgz9KmQmItoNF7J8_hiMMk")
#
# #uses Google API to obtain location data based on longitude and latitude....dont use unless necessary
# d_respondents_only[ , c("housenumber", "street", "city", "county", "state", "zip", "country") := revg
# #
# head(d_respondents_only)
# #
# #
# fwrite(d_respondents_only, file='datatable_clean_survey_responses_v2.dta')

d_respondents <- fread('datatable_clean_survey_responses_v2.dta')

setnames(d_respondents,
         old = c('Duration (in seconds)'),
         new = c('Survey_Duration'))
head(d_respondents)
```

```
##              StartDate             EndDate     Status      IPAddress Progress
## 1: 2020-11-09 20:46:55 2020-11-09 20:50:39 IP Address 174.88.123.135      100
## 2: 2020-11-09 20:47:33 2020-11-09 20:51:24 IP Address  172.93.166.91      100
## 3: 2020-11-09 20:47:23 2020-11-09 20:51:35 IP Address  68.36.215.223      100
## 4: 2020-11-09 20:46:32 2020-11-09 20:51:43 IP Address   99.75.53.174      100
## 5: 2020-11-09 20:47:44 2020-11-09 20:52:08 IP Address   24.35.119.43      100
## 6: 2020-11-09 20:46:47 2020-11-09 20:52:39 IP Address  98.212.214.93      100
##    Survey_Duration Finished        RecordedDate        ResponseId
## 1:             223     TRUE 2020-11-09 20:50:39 R_VLuUQ4C82PP9HEd
## 2:             231     TRUE 2020-11-09 20:51:25 R_29cCZD1XK1dpmdY
## 3:             251     TRUE 2020-11-09 20:51:35 R_3lVN8EncJofnqnV
## 4:             310     TRUE 2020-11-09 20:51:43 R_50vJlfmoFTK1IeB
## 5:             264     TRUE 2020-11-09 20:52:08 R_1dFaKMSjyE3FJHg
## 6:             351     TRUE 2020-11-09 20:52:39 R_25vjj4Ik4Dkm2UN
##    RecipientLastName RecipientFirstName RecipientEmail ExternalReference
## 1:                NA                 NA             NA                NA
## 2:                NA                 NA             NA                NA
## 3:                NA                 NA             NA                NA
## 4:                NA                 NA             NA                NA
## 5:                NA                 NA             NA                NA
## 6:                NA                 NA             NA                NA
```

```
##    LocationLatitude LocationLongitude DistributionChannel UserLanguage
## 1:            43.68            -79.29           anonymous           EN
## 2:            33.75            -84.39           anonymous           EN
## 3:            42.66            -83.12           anonymous           EN
## 4:            42.00            -88.14           anonymous           EN
## 5:            40.08            -82.97           anonymous           EN
## 6:            42.01            -88.10           anonymous           EN
##    Amazon_Turk_ID Gender Q82_3_TEXT Age_Range           Education_Level
## 1:  A4D99Y82KOLC8   Male         NA     35-44              Trade school
## 2: A1AC47WJLNW4G7   Male         NA     25-34 Master's degree and above
## 3:  A77K8W55MJEKX Female         NA     45-54         Bachelor's degree
## 4: A17TKHT8FEVH0R   Male         NA     25-34        Associate's degree
## 5: A1AOWMOOJMOF7Z Female         NA     25-34              Trade school
## 6: A2VO8C41JJIQY9   Male         NA     25-34 Master's degree and above
##           Q1        Q2        Q3        Q4        Q5        Q6        Q7
## 1: Pneumonia    Normal    Normal Pneumonia    Normal Pneumonia Pneumonia
## 2: Pneumonia    Normal    Normal Pneumonia    Normal    Normal    Normal
## 3: Pneumonia Pneumonia Pneumonia Pneumonia Pneumonia Pneumonia    Normal
## 4:    Normal Pneumonia Pneumonia    Normal Pneumonia Pneumonia Pneumonia
## 5:    Normal Pneumonia Pneumonia    Normal Pneumonia Pneumonia Pneumonia
## 6: Pneumonia    Normal    Normal Pneumonia Pneumonia Pneumonia    Normal
##           Q8        Q9       Q10
## 1:    Normal Pneumonia Pneumonia
## 2:    Normal    Normal Pneumonia
## 3:    Normal Pneumonia Pneumonia
## 4:    Normal Pneumonia    Normal
## 5:    Normal Pneumonia    Normal
## 6: Pneumonia Pneumonia Pneumonia
##
## 1:
## 2:
## 3:
## 4:
## 5: The sentiment that this place brings, and how much hospitality means to them. How open, diverse ar
## 6:
##    Q70_First Click Q70_Last Click Q70_Page Submit Q70_Click Count       Q11
## 1:              NA             NA              NA              NA    Normal
## 2:              NA             NA              NA              NA    Normal
## 3:              NA             NA              NA              NA Pneumonia
## 4:              NA             NA              NA              NA Pneumonia
## 5:           31.08          31.08           77.39               1    Normal
## 6:              NA             NA              NA              NA    Normal
##          Q12       Q13       Q14       Q15       Q16       Q17       Q18
## 1:    Normal Pnuemonia Pneumonia Pneumonia    Normal    Normal Pneumonia
## 2:    Normal Pnuemonia    Normal    Normal Pneumonia    Normal Pneumonia
## 3:    Normal Pnuemonia Pneumonia Pneumonia Pneumonia Pneumonia Pneumonia
## 4:    Normal Pnuemonia    Normal    Normal    Normal Pneumonia    Normal
## 5: Pneumonia    Normal Pneumonia Pneumonia    Normal Pneumonia Pneumonia
## 6:    Normal Pnuemonia Pneumonia    Normal    Normal Pneumonia Pneumonia
##          Q19       Q20
## 1: Pneumonia    Normal
## 2:    Normal Pneumonia
## 3: Pneumonia Pneumonia
## 4: Pneumonia Pneumonia
```

```
## 5:    Normal Pneumonia
## 6: Pneumonia Pneumonia
##
## 1:
## 2:
## 3:
## 4:
## 5: It brings awareness to a serious issue that can harm people. It's an advertisement to bring peopl
## 6:
##    Q90_First Click Q90_Last Click Q90_Page Submit Q90_Click Count       Q21
## 1:              NA             NA              NA              NA Pneumonia
## 2:              NA             NA              NA              NA    Normal
## 3:              NA             NA              NA              NA Pneumonia
## 4:              NA             NA              NA              NA    Normal
## 5:           10.13          68.74           70.97               2 Pneumonia
## 6:              NA             NA              NA              NA    Normal
##          Q22       Q23       Q24       Q25       Q26       Q27       Q28
## 1: Pneumonia    Normal Pneumonia    Normal Pneumonia Pneumonia    Normal
## 2: Pneumonia Pneumonia    Normal    Normal    Normal Pneumonia    Normal
## 3: Pneumonia    Normal Pneumonia Pneumonia Pneumonia Pneumonia Pneumonia
## 4: Pneumonia Pneumonia Pneumonia Pneumonia Pneumonia    Normal Pneumonia
## 5: Pneumonia Pneumonia    Normal Pneumonia    Normal    Normal Pneumonia
## 6: Pneumonia Pneumonia    Normal Pneumonia    Normal    Normal Pneumonia
##          Q29       Q30 Q36
## 1:    Normal Pneumonia
## 2: Pneumonia    Normal
## 3: Pneumonia Pneumonia
## 4: Pneumonia    Normal
## 5: Pneumonia Pneumonia
## 6:    Normal    Normal
##                                                         Self_Reflect_Q1
## 1:
## 2:
## 3:
## 4: I think I did pretty good. I was not expecting to do as well as I did.
## 5:
## 6:
##    Q61_First Click Q61_Last Click Q61_Page Submit Q61_Click Count Q41
## 1:              NA             NA              NA              NA
## 2:              NA             NA              NA              NA
## 3:              NA             NA              NA              NA
## 4:           32.36          43.79           111.6               3
## 5:              NA             NA              NA              NA
## 6:              NA             NA              NA              NA
##                                                                      Self_Reflect_Q2
## 1:
## 2:
## 3:
## 4: I think I did incredible. I only got 2 wrong. This was harder than the previous page.
## 5:
## 6:
##    Q62_First Click Q62_Last Click Q62_Page Submit Q62_Click Count
## 1:              NA             NA              NA              NA
## 2:              NA             NA              NA              NA
```

```
## 3:             NA            NA              NA              NA
## 4:          10.06         10.06           100.3               1
## 5:             NA            NA              NA              NA
## 6:             NA            NA              NA              NA
##                                                                                   Q38
## 1:
## 2:
## 3:
## 4:
## 5:
## 6: Image 2Correct diagnosis: Normal\nYou chose: ${q://QID5/ChoiceGroup/SelectedChoices}\n
##    Q63_First Click Q63_Last Click Q63_Page Submit Q63_Click Count Q43
## 1:             NA            NA              NA              NA
## 2:             NA            NA              NA              NA
## 3:             NA            NA              NA              NA
## 4:             NA            NA              NA              NA
## 5:             NA            NA              NA              NA
## 6:          1.205         100.7             108              16
##    Q64_First Click Q64_Last Click Q64_Page Submit Q64_Click Count Q45
## 1:             NA            NA              NA              NA  NA
## 2:             NA            NA              NA              NA  NA
## 3:             NA            NA              NA              NA  NA
## 4:             NA            NA              NA              NA  NA
## 5:             NA            NA              NA              NA  NA
## 6:          76.03         101.2           102.4               3  NA
##    Q65_First Click Q65_Last Click Q65_Page Submit Q65_Click Count Q47
## 1:             NA            NA              NA              NA  NA
## 2:          14.69         16.23           47.68               2  NA
## 3:             NA            NA              NA              NA  NA
## 4:             NA            NA              NA              NA  NA
## 5:             NA            NA              NA              NA  NA
## 6:             NA            NA              NA              NA  NA
##    Q66_First Click Q66_Last Click Q66_Page Submit Q66_Click Count Q46
## 1:             NA            NA              NA              NA  NA
## 2:           5.75         18.28           46.59               2  NA
## 3:             NA            NA              NA              NA  NA
## 4:             NA            NA              NA              NA  NA
## 5:             NA            NA              NA              NA  NA
## 6:             NA            NA              NA              NA  NA
##    Q67_First Click Q67_Last Click Q67_Page Submit Q67_Click Count Q48
## 1:          0.855         57.41           58.20              29  NA
## 2:             NA            NA              NA              NA  NA
## 3:         16.263         16.26           50.06               1  NA
## 4:             NA            NA              NA              NA  NA
## 5:             NA            NA              NA              NA  NA
## 6:             NA            NA              NA              NA  NA
##    Q68_First Click Q68_Last Click Q68_Page Submit Q68_Click Count Total_Score
## 1:          0.530        60.605           61.22              15          16
## 2:             NA            NA              NA              NA          12
## 3:          9.427         9.427           49.63               1          15
## 4:             NA            NA              NA              NA          21
## 5:             NA            NA              NA              NA          14
## 6:             NA            NA              NA              NA          18
##    Random ID Assignment Q1_Score Q2_Score Q3_Score Q4_Score Q5_Score Q6_Score
```

```
## 1:     14409      FL_41        0        1        0        1        1        1
## 2:     58508      FL_16        0        1        0        1        1        0
## 3:     96075      FL_41        0        0        1        1        0        1
## 4:     74553      FL_14        1        0        1        0        0        1
## 5:     35543      FL_17        1        0        1        0        0        1
## 6:     84565      FL_15        0        1        0        1        0        1
##    Q7_Score Q8_Score Q9_Score Q10_Score Q11_Score Q12_Score Q13_Score Q14_Score
## 1:        1        1        1         0         0         1         0         1
## 2:        0        1        0         0         0         1         0         0
## 3:        0        1        1         0         1         1         0         1
## 4:        1        1        1         1         1         1         0         0
## 5:        1        1        1         1         0         0         0         1
## 6:        0        0        1         0         0         1         0         1
##    Q15_Score Q16_Score Q17_Score Q18_Score Q19_Score Q20_Score Q21_Score
## 1:         0         1         0         0         1         1         0
## 2:         1         0         0         0         0         0         1
## 3:         0         0         1         0         1         0         0
## 4:         1         1         1         1         1         0         1
## 5:         0         1         1         0         0         0         0
## 6:         1         1         1         0         1         0         1
##    Q22_Score Q23_Score Q24_Score Q25_Score Q26_Score Q27_Score Q28_Score
## 1:         0         0         0         0         1         1         0
## 2:         0         1         1         0         0         1         0
## 3:         0         0         0         1         1         1         1
## 4:         0         1         0         1         1         0         1
## 5:         0         1         1         1         0         0         1
## 6:         0         1         1         1         0         0         1
##    Q29_Score Q30_Score Assignment_Group TaskPhase1_Score TaskPhase2_Score
## 1:         1         0  Negative Images              0.7              0.5
## 2:         0         1  Positive Images              0.4              0.2
## 3:         0         0  Negative Images              0.5              0.5
## 4:         0         1      Self-Reflect              0.7              0.7
## 5:         0         0          Control              0.7              0.3
## 6:         1         1 Medical Feedback              0.4              0.6
##    TaskPhase3_Score housenumber                street            city
## 1:              0.3         351     Glen Manor Drive          Toronto
## 2:              0.5         262 Capitol Avenue Southeast      Atlanta
## 3:              0.4         440      Bedlington Drive Rochester Hills
## 4:              0.6        1200       Sycamore Avenue    Hanover Park
## 5:              0.4        1913       Brookfield Road        Columbus
## 6:              0.7         617         Boxwood Drive      Schaumburg
##           county    state     zip       country
## 1:        Canada  Ontario M4E 2X8        Canada
## 2: United States  Georgia   30312 United States
## 3: United States Michigan   48307 United States
## 4: United States Illinois   60133 United States
## 5: United States     Ohio   43229 United States
## 6: United States Illinois   60193 United States
```

```
nrow(d_respondents)
```

```
## [1] 350
```

```
#remove duplicate Amazon Turk IDs
nrow(d_respondents)  #350 rows
```

```
## [1] 350
```

```r
d_respondents <- d_respondents[ !duplicated(d_respondents$Amazon_Turk_ID) , ]  #350 rows
```

EDA

Helper Functions

```r
create_heatmap <- function(var1, var2) {
  ### Create a heatmap for a table of frequencies between two variables ###
  df <- data.frame(table(var1,var2))

  ggplot(df,aes(x=var1,y=var2)) +
    geom_tile(aes(fill=Freq,color=Freq),show.legend=FALSE,alpha=.8) +
    geom_text(aes(label=Freq)) +
    scale_fill_continuous(high = "darkslategray4", low = "powderblue")
}

g_legend<-function(a.gplot){
  #extract legend from a ggplot object
  #https://stackoverflow.com/questions/13649473/add-a-common-legend-for-combined-ggplots
  #https://github.com/hadley/ggplot2/wiki/Share-a-legend-between-two-ggplot2-graphs
  tmp <- ggplot_gtable(ggplot_build(a.gplot))
  leg <- which(sapply(tmp$grobs, function(x) x$name) == "guide-box")
  legend <- tmp$grobs[[leg]]
  return(legend)}
```

```r
#some EDA

#d_respondents[ , table(state, country)]


table(d_respondents$state, d_respondents$country) %>%
        as.data.frame() %>%
        arrange(desc(Freq)) %>%
        filter(Freq>0)
```

```
##                      Var1          Var2 Freq
## 1              Tamil Nadu         India  107
## 2              California United States   72
## 3                New York United States   22
## 4                  Kansas United States   21
## 5                   Texas United States   15
## 6                 Florida United States    9
## 7           Massachusetts United States    7
## 8                Missouri United States    6
## 9             Connecticut United States    5
## 10                Georgia United States    5
## 11                Indiana United States    5
## 12               Michigan United States    5
## 13             New Jersey United States    5
## 14               Illinois United States    4
## 15               Virginia United States    4
## 16                 Kerala         India    3
```

```
## 17                 Maharashtra          India     3
## 18                    Colorado  United States     3
## 19                    Kentucky  United States     3
## 20                    Maryland  United States     3
## 21              North Carolina  United States     3
## 22                      Oregon  United States     3
## 23                     Ontario         Canada     2
## 24                     Alabama  United States     2
## 25                       Idaho  United States     2
## 26                   Minnesota  United States     2
## 27                 Mississippi  United States     2
## 28                      Nevada  United States     2
## 29                        Ohio  United States     2
## 30                Pennsylvania  United States     2
## 31                  Washington  United States     2
## 32               Qarku i Tiranës        Albania     1
## 33             Khulna Division     Bangladesh     1
## 34                       Bahia         Brazil     1
## 35                     Atacama          Chile     1
## 36 Provence-Alpes-Côte d'Azur         France     1
## 37    Departamento de Olancho       Honduras     1
## 38              Andhra Pradesh          India     1
## 39                   Karnataka          India     1
## 40                    Sardegna          Italy     1
## 41                     England United Kingdom     1
## 42                     Arizona  United States     1
## 43                        Iowa  United States     1
## 44                   Louisiana  United States     1
## 45                       Maine  United States     1
## 46                    Nebraska  United States     1
## 47                    Oklahoma  United States     1
## 48              South Carolina  United States     1
## 49                South Dakota  United States     1
## 50                   Tennessee  United States     1
```

```
table(d_respondents$country) %>%
        as.data.frame() %>%
        arrange(desc(Freq))
```

```
##              Var1 Freq
## 1   United States  225
## 2           India  115
## 3          Canada    2
## 4         Albania    1
## 5      Bangladesh    1
## 6          Brazil    1
## 7           Chile    1
## 8          France    1
## 9        Honduras    1
## 10          Italy    1
## 11 United Kingdom    1
```

```
table(d_respondents$Total_Score) %>%
  as.data.frame() %>%
  arrange(desc(Var1))
```

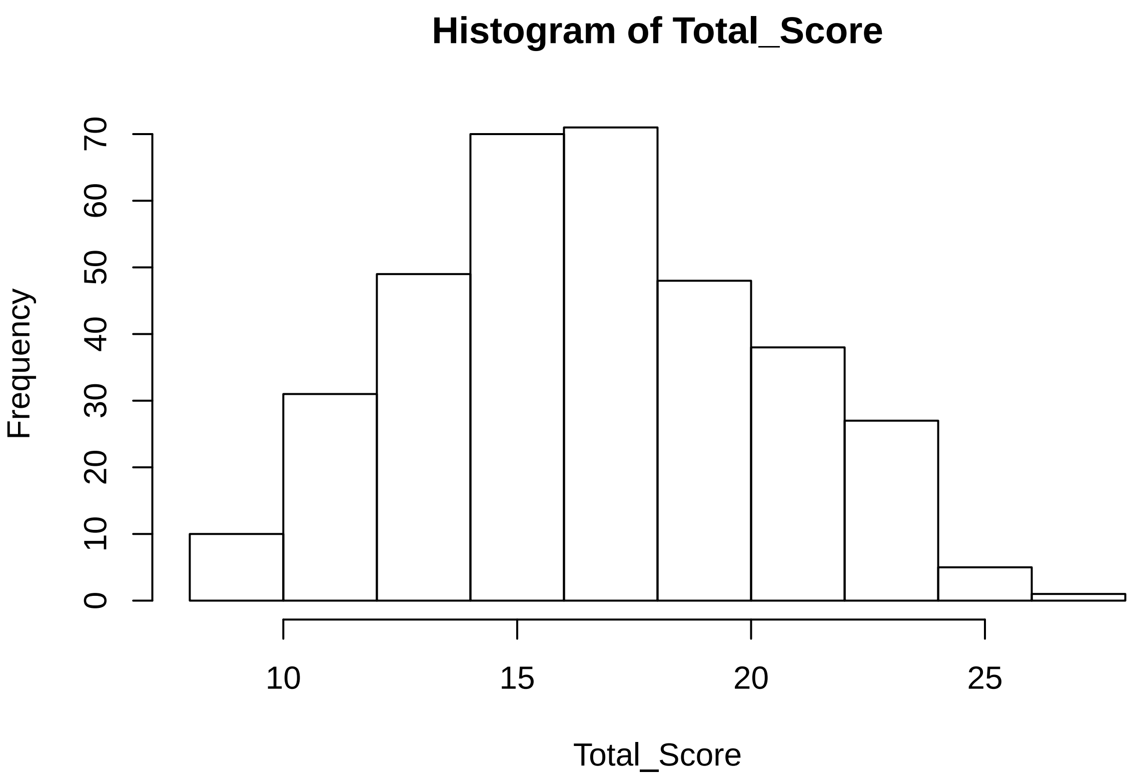
```
##    Var1 Freq
## 1    27    1
## 2    26    1
## 3    25    4
## 4    24   12
## 5    23   15
## 6    22   16
## 7    21   22
## 8    20   27
## 9    19   21
## 10   18   31
## 11   17   40
## 12   16   40
## 13   15   30
## 14   14   30
## 15   13   19
## 16   12   18
## 17   11   13
## 18   10    6
## 19    9    3
## 20    8    1
```

```
d_respondents %>%
  group_by(Assignment_Group) %>%
  summarise(mean = mean(Total_Score),
            count = n(),
            time_duration = mean(Survey_Duration))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
## # A tibble: 5 x 4
##   Assignment_Group  mean count time_duration
##   <chr>            <dbl> <int>         <dbl>
## 1 Control           16.7    69          638.
## 2 Medical Feedback  17.8    70          656.
## 3 Negative Images   16.5    72          783
## 4 Positive Images   17.3    70          505.
## 5 Self-Reflect      17.2    69          612.
```

```
#d_respondents[ , .(count = .N, avg = mean(Total_Score)), by=Assignment_Group] #same thing

d_respondents[ , hist(Total_Score)]
```




```
## $breaks
##  [1]  8 10 12 14 16 18 20 22 24 26 28
##
## $counts
##  [1] 10 31 49 70 71 48 38 27  5  1
##
## $density
##  [1] 0.014286 0.044286 0.070000 0.100000 0.101429 0.068571 0.054286 0.038571
##  [9] 0.007143 0.001429
##
## $mids
##  [1]  9 11 13 15 17 19 21 23 25 27
##
## $xname
## [1] "Total_Score"
##
## $equidist
## [1] TRUE
##
## attr(,"class")
## [1] "histogram"
```

```
tapply(d_respondents$Total_Score, d_respondents$Assignment_Group, summary)
```

```
## $Control
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     8.0    14.0    16.0    16.7    19.0    24.0
##
## $`Medical Feedback`
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
```

```
##    10.0    16.0    17.5    17.8    20.0    24.0
##
## $`Negative Images`
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     9.0    13.0    16.0    16.5    19.2    25.0
##
## $`Positive Images`
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     9.0    15.0    17.0    17.3    20.0    27.0
##
## $`Self-Reflect`
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     9.0    14.0    17.0    17.2    20.0    25.0
```

```
tapply(d_respondents$Total_Score, d_respondents$Assignment_Group, sd)
```

```
##          Control Medical Feedback  Negative Images  Positive Images
##            3.659            3.279            3.996            3.817
##     Self-Reflect
##            3.882
```

```
d_respondents[ , sd(Total_Score)]
```

```
## [1] 3.743
```

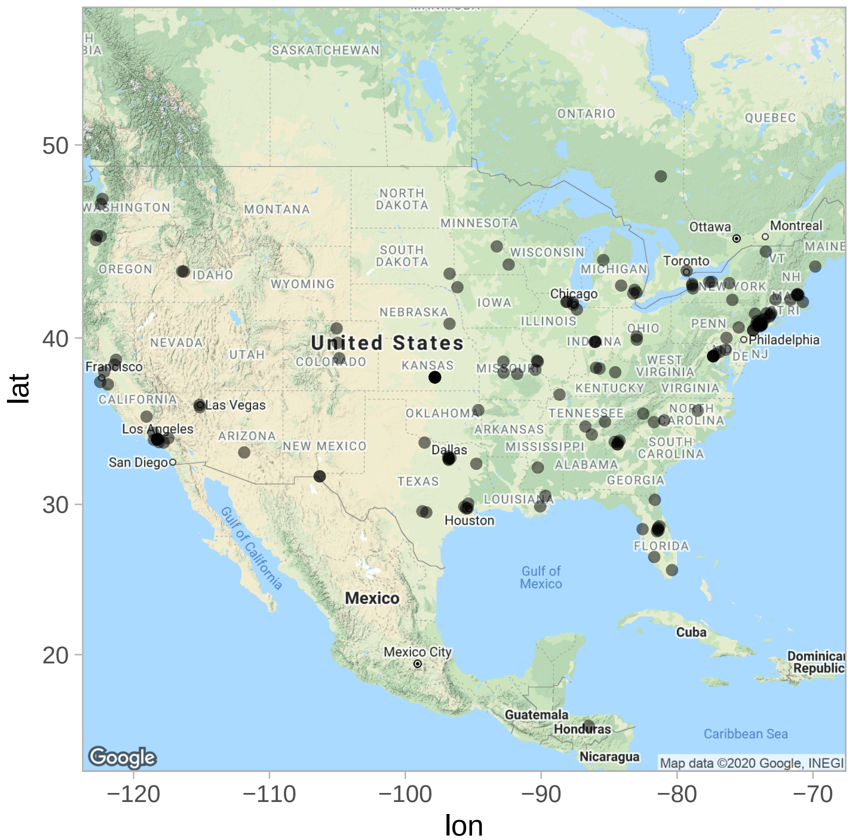
```
library(ggmap)
?register_google
register_google(key = "AIzaSyCTk2a5vIEqcvgz9KmQmItoNF7J8_hiMMk")
# ggmap_show_api_key()

us_map<-get_map(location='united states', zoom=4, maptype = "terrain",
             source='google',color='color')
```

```
## Source : https://maps.googleapis.com/maps/api/staticmap?center=united%20states&zoom=4&size=640x640&s
```

```
## Source : https://maps.googleapis.com/maps/api/geocode/json?address=united+states&key=xxx
```

```
ggmap(us_map) + geom_point(x=d_respondents$LocationLongitude, y = d_respondents$LocationLatitude, show_
```

```
## Warning: `show_guide` has been deprecated. Please use `show.legend` instead.
```



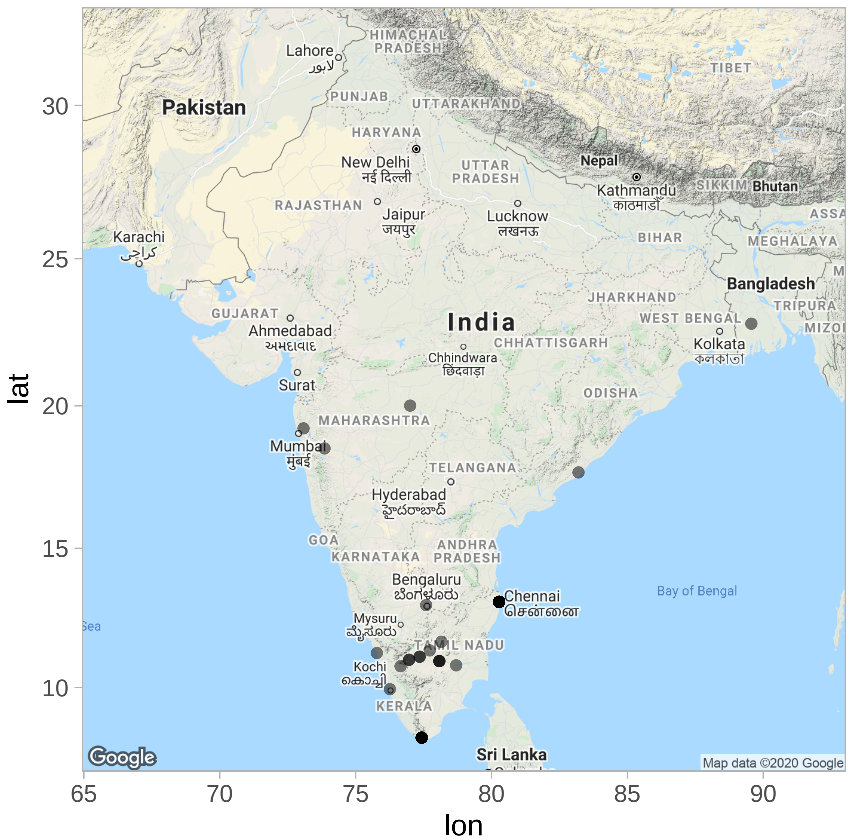

```r
india_map<-get_map(location='india', zoom=5, maptype = "terrain",
              source='google',color='color')
```

```
## Source : https://maps.googleapis.com/maps/api/staticmap?center=india&zoom=5&size=640x640&scale=2&map
```

```
## Source : https://maps.googleapis.com/maps/api/geocode/json?address=india&key=xxx
```

```r
ggmap(india_map) + geom_point(x=d_respondents$LocationLongitude, y = d_respondents$LocationLatitude, sh
```

```
## Warning: `show_guide` has been deprecated. Please use `show.legend` instead.
```



Randomization Check

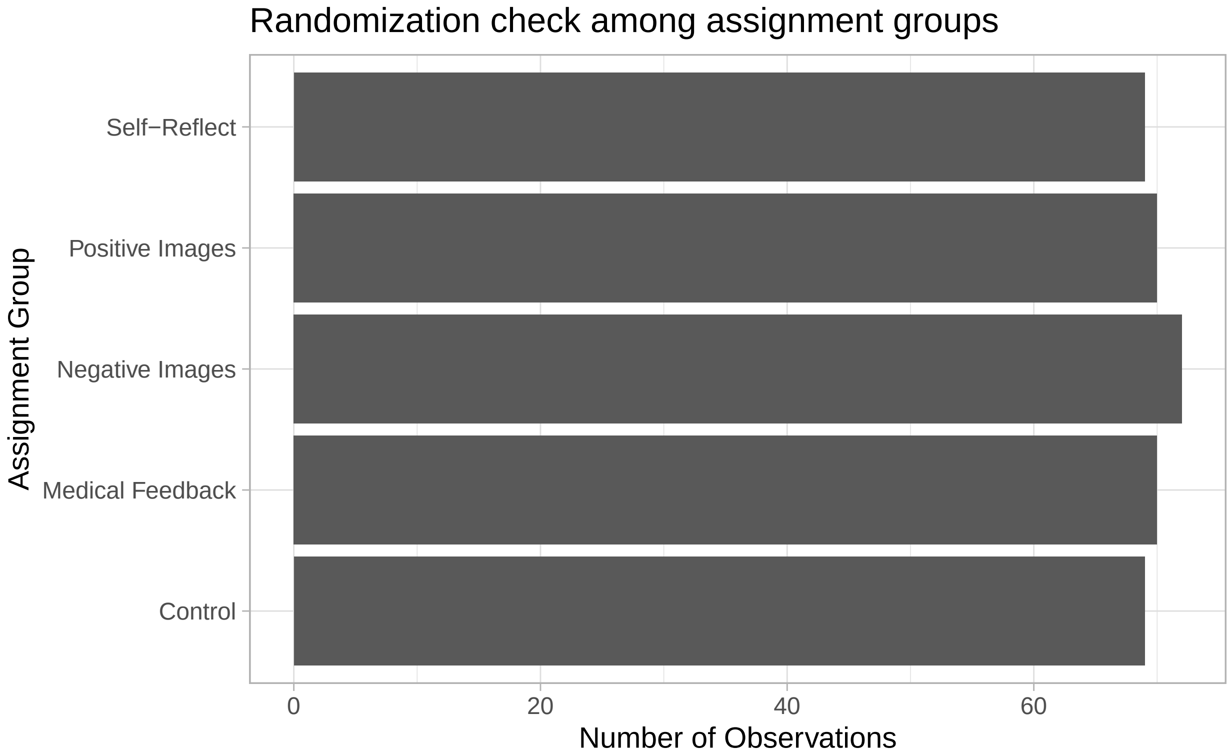
```
#http://www.sthda.com/english/wiki/chi-square-goodness-of-fit-test-in-r

respondent_counts <- d_respondents[ , .(.N), keyby=Assignment_Group]

respondent_counts_chisq_test <- chisq.test(respondent_counts[,2], p=c(1/5, 1/5, 1/5, 1/5, 1/5))
pander(respondent_counts_chisq_test,style ='rmarkdown')
```

Table 1: Chi-squared test for given probabilities: `respondent_counts[, 2]`

Test statistic	df	P value
0.08571	4	0.9991

```
respondent_counts %>%
  ggplot(aes(x = Assignment_Group,y=N)) +
  geom_bar(stat = 'identity') +
  coord_flip() +
  xlab('Assignment Group') +
  ylab('Number of Observations') +
  labs(title='Randomization check among assignment groups',
       caption = paste0('Assuming equal distribution among assignment groups, a chi-squared goodness of
                        round(respondent_counts_chisq_test$parameter,4),' degrees of \nfreedom ', 'yiel
                        round(respondent_counts_chisq_test$p.value,4),
```

```
                    ', suggesting that the observed proportions are not significantly different fro
  theme(plot.caption = element_text(hjust = 0))
```



Assuming equal distribution among assignment groups, a chi−squared goodness of fit test wit
freedom yields p=0.9991, suggesting that the observed proportions are not significantly differe
expected proportions at a significance level of 0.05.

```
#p-value = 0.9991, which is greater than significance level of 0.05.
#We can conclude that the observed proportions are not significantly different from the expected propor
```

Covariate Balance Check

```
#let's consider adding age bins and education bins

d_respondents[ Age_Range == "18-24", age_bin := 1]
d_respondents[ Age_Range == "25-34", age_bin := 2]
d_respondents[ Age_Range == "35-44", age_bin := 3]
d_respondents[ Age_Range == "45-54", age_bin := 4]
d_respondents[ Age_Range == "55-64", age_bin := 5]
d_respondents[ Age_Range == "Above 65", age_bin := 6]

d_respondents[ Education_Level == "Associate's degree", edu_bin := 1]
d_respondents[ Education_Level == "Bachelor's degree", edu_bin := 2]
d_respondents[ Education_Level == "High school", edu_bin := 3]
d_respondents[ Education_Level == "Master's degree and above", edu_bin := 4]
d_respondents[ Education_Level == "Some high school", edu_bin := 5]
d_respondents[ Education_Level == "Trade school", edu_bin := 6]

d_respondents[ Assignment_Group == "Control", assign_bin := 1]
d_respondents[ Assignment_Group == "Medical Feedback", assign_bin := 2]
```

```r
d_respondents[ Assignment_Group == "Negative Images", assign_bin := 3]
d_respondents[ Assignment_Group == "Positive Images", assign_bin := 4]
d_respondents[ Assignment_Group == "Self-Reflect", assign_bin := 5]

d_respondents[ , US_Dummy := ifelse(country == "United States", 1, 0)]

d_respondents[ , Male_Dummy := ifelse(Gender == "Male", 1, 0)]

#add treatment dummy

d_respondents[ , Treatment_Dummy := ifelse(Assignment_Group != "Control", 1, 0)]

#head(d_respondents)
```

```r
d_respondents %>%
  group_by(Assignment_Group) %>%
  summarise(num_respondents = n(),
            pre_treatment_avg = mean(TaskPhase1_Score),
            taskphase2_avg = mean(TaskPhase2_Score),
            taskphase3_avg = mean(TaskPhase3_Score))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)

## # A tibble: 5 x 5
##   Assignment_Group num_respondents pre_treatment_a~ taskphase2_avg
##   <chr>                      <int>            <dbl>          <dbl>
## 1 Control                       69            0.607          0.461
## 2 Medical Feedback              70            0.634          0.523
## 3 Negative Images               72            0.578          0.494
## 4 Positive Images               70            0.614          0.514
## 5 Self-Reflect                  69            0.599          0.526
## # ... with 1 more variable: taskphase3_avg <dbl>
```

```r
d_respondents %>%
  group_by(Assignment_Group) %>%
  summarise(num_respondents = n(),
            avg_age_bin = mean(age_bin),
            avg_edu_bin = mean(edu_bin),
            male = mean(Male_Dummy),
            US = mean(US_Dummy))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)

## # A tibble: 5 x 6
##   Assignment_Group num_respondents avg_age_bin avg_edu_bin  male    US
##   <chr>                      <int>       <dbl>       <dbl> <dbl> <dbl>
## 1 Control                       69        2.68        2.61 0.609 0.652
## 2 Medical Feedback              70        2.63        2.47 0.586 0.529
## 3 Negative Images               72        2.62        2.58 0.583 0.625
## 4 Positive Images               70        2.86        2.6  0.586 0.714
## 5 Self-Reflect                  69        2.83        2.42 0.594 0.696
```

```r
d_respondents %>%
  group_by(Assignment_Group) %>%
  summarise(num_respondents = n(),
            )
```

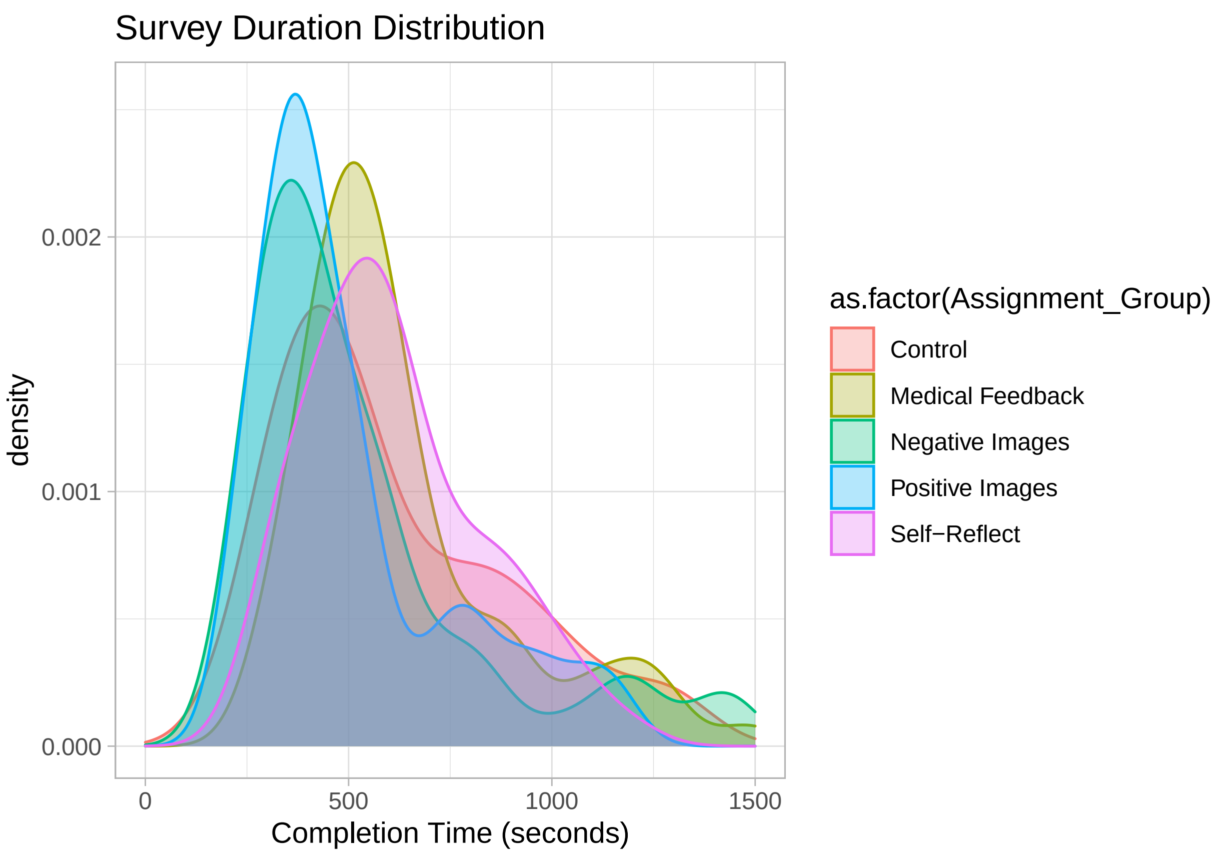
```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
## # A tibble: 5 x 2
##   Assignment_Group num_respondents
##   <chr>                      <int>
## 1 Control                       69
## 2 Medical Feedback              70
## 3 Negative Images               72
## 4 Positive Images               70
## 5 Self-Reflect                  69
```

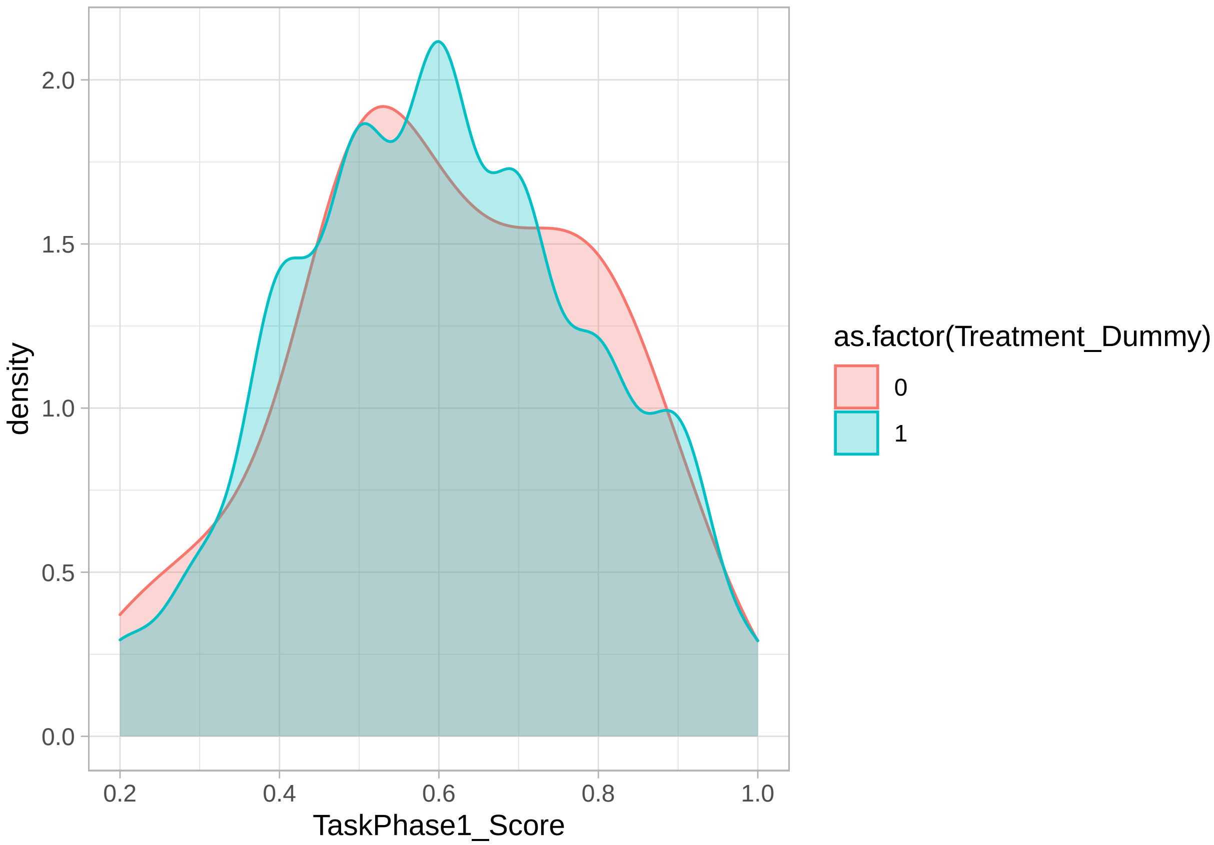
Visuals

```
#Density distribution of Survey Duration
ggplot(d_respondents, aes(x=Survey_Duration, colour=as.factor(Assignment_Group), fill = as.factor(Assig
  geom_density(alpha = 0.3) +
  xlim(0, 1500) +
  xlab("Completion Time (seconds)") +
  ggtitle("Survey Duration Distribution")
```

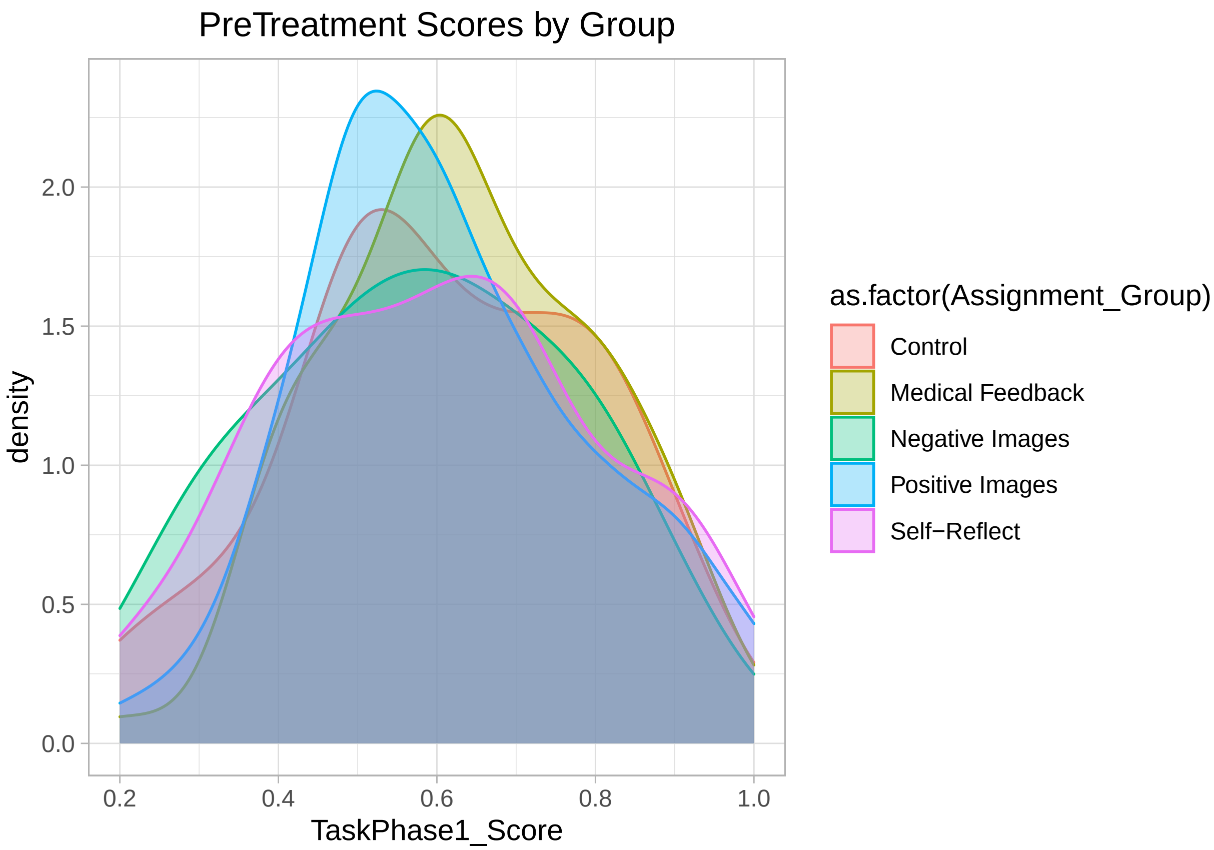
```
## Warning: Removed 6 rows containing non-finite values (stat_density).
```



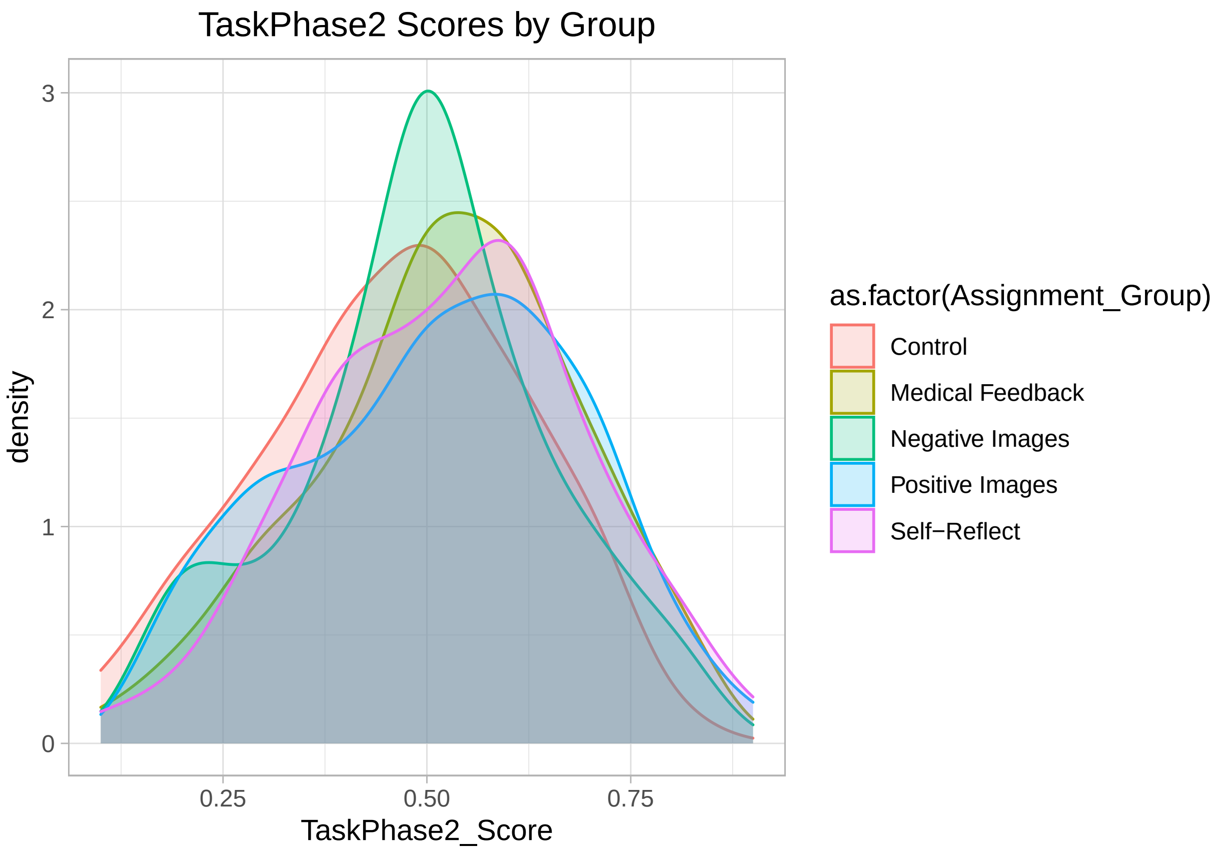

```
#Comparing pretreatment values
ggplot(d_respondents, aes(x=TaskPhase1_Score, fill = as.factor(Treatment_Dummy), colour=as.factor(Treat
```



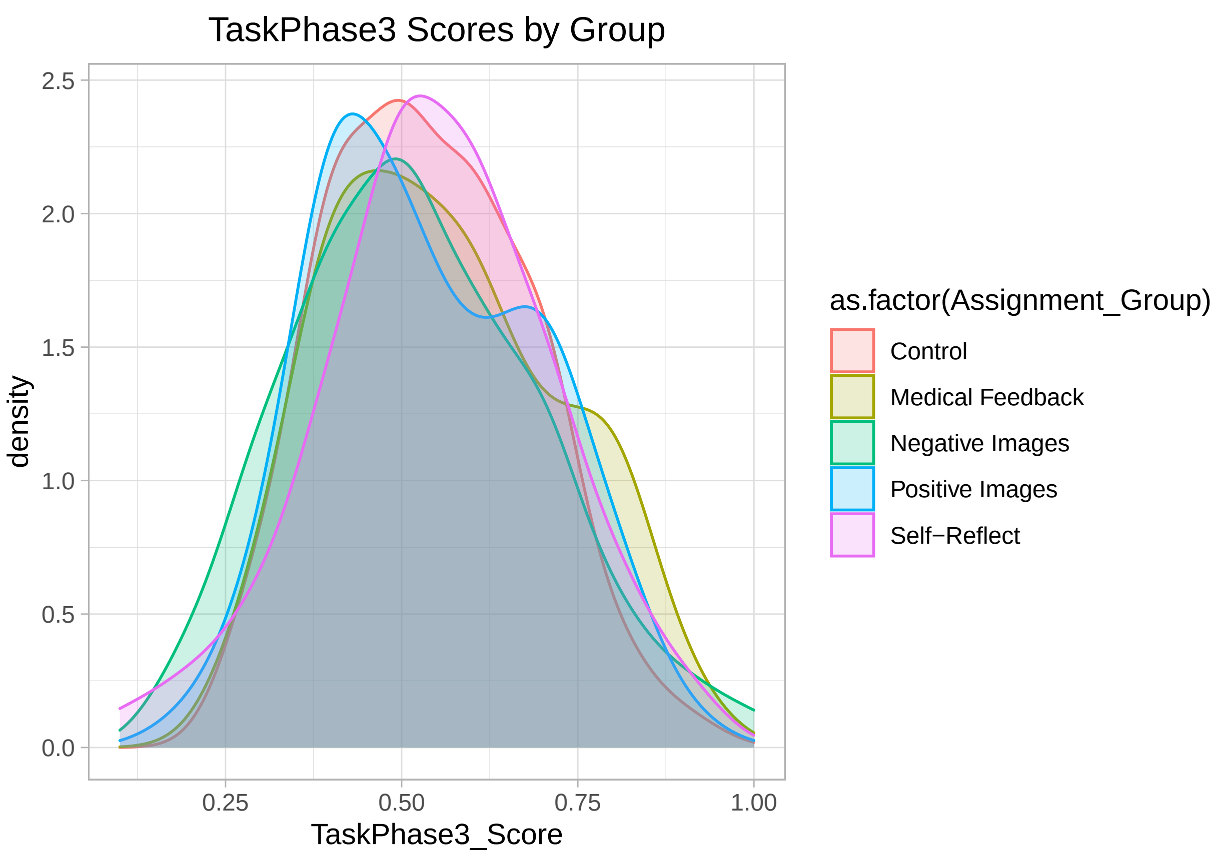

```
ggplot(d_respondents, aes(x=TaskPhase1_Score, fill = as.factor(Assignment_Group), colour=as.factor(Assig
```




```
#Comparing taskphase2 values
ggplot(d_respondents, aes(x=TaskPhase2_Score, fill = as.factor(Assignment_Group), colour=as.factor(Assig
```




```
#Comparing taskphase3 values
ggplot(d_respondents, aes(x=TaskPhase3_Score, fill = as.factor(Assignment_Group), colour=as.factor(Assig
```




```
# TODO add these boxplots for binary treatment/control groups

task2a_bp <- ggplot(d_respondents, aes(x = Treatment_Dummy, y=TaskPhase1_Score, colour=as.factor(Treatme
  geom_boxplot() +
  stat_summary(fun.y = mean, geom = "errorbar", aes(ymax = ..y.., ymin = ..y..), width = .75, linetype =
  xlab('') +
  ylab('Task Score (%)') +
  ggtitle("Pre Treatment Scores") +
  scale_y_continuous(labels = scales::percent,limits = c(0,1)) +
  theme(axis.text.x = element_blank(),
        axis.ticks = element_blank(),
        plot.title = element_text(hjust = 0.5,size=10),
        legend.position = "bottom",
        legend.title = element_blank())
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

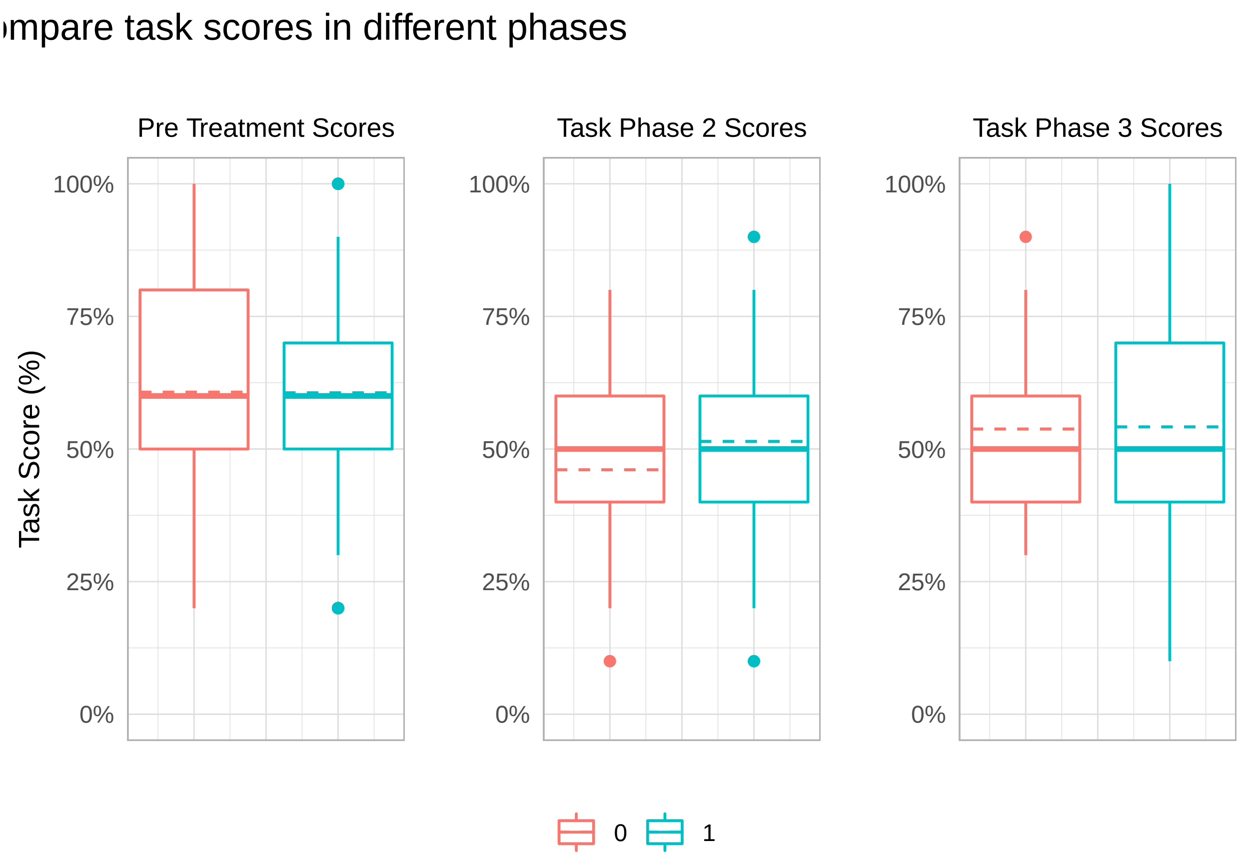
```
task2b_bp <- ggplot(d_respondents, aes(x = Treatment_Dummy, y=TaskPhase2_Score, colour=as.factor(Treatme
  geom_boxplot() +
  stat_summary(fun.y = mean, geom = "errorbar", aes(ymax = ..y.., ymin = ..y..), width = .75, linetype =
  xlab('') +
  ylab('') +
  ggtitle("Task Phase 2 Scores") +
  scale_y_continuous(labels = scales::percent,limits = c(0,1)) +
  theme(axis.text.x = element_blank(),
        axis.ticks = element_blank(),
        plot.title = element_text(hjust = 0.5,size=10),
        legend.position = "none")
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

```
task2c_bp <- ggplot(d_respondents, aes(x = Treatment_Dummy, y=TaskPhase3_Score, colour=as.factor(Treatme
  geom_boxplot() +
  stat_summary(fun.y = mean, geom = "errorbar", aes(ymax = ..y.., ymin = ..y..), width = .75, linetype =
  xlab('') +
  ylab('') +
  ggtitle("Task Phase 3 Scores") +
  scale_y_continuous(labels = scales::percent,limits = c(0,1)) +
  theme(axis.text.x = element_blank(),
        axis.ticks = element_blank(),
        plot.title = element_text(hjust = 0.5,size=10),
        legend.position = "none")
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

```
mylegend_2<-g_legend(task2a_bp)

grid.arrange(arrangeGrob(task2a_bp + theme(legend.position="none"),task2b_bp,task2c_bp,ncol=3),
             mylegend_2,
             nrow=2,
             heights=c(10,1),
             top = textGrob("Compare task scores in different phases\n",just='right',gp=gpar(fontsize=14
```




```
# boxplots for multiple treatment groups
task1a_bp <- ggplot(d_respondents, aes(x = Assignment_Group, y=TaskPhase1_Score, colour=as.factor(Assign
  geom_boxplot() +
```

```r
  stat_summary(fun.y = mean, geom = "errorbar", aes(ymax = ..y.., ymin = ..y..), width = .75, linetype =
  xlab('') +
  ylab('Task Score (%)') +
  ggtitle("Pre Treatment Scores") +
  scale_y_continuous(labels = scales::percent,limits = c(0,1)) +
  theme(axis.text.x = element_blank(),
        axis.ticks = element_blank(),
        plot.title = element_text(hjust = 0.5,size=10),
        legend.position = "bottom",
        legend.title = element_blank())
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

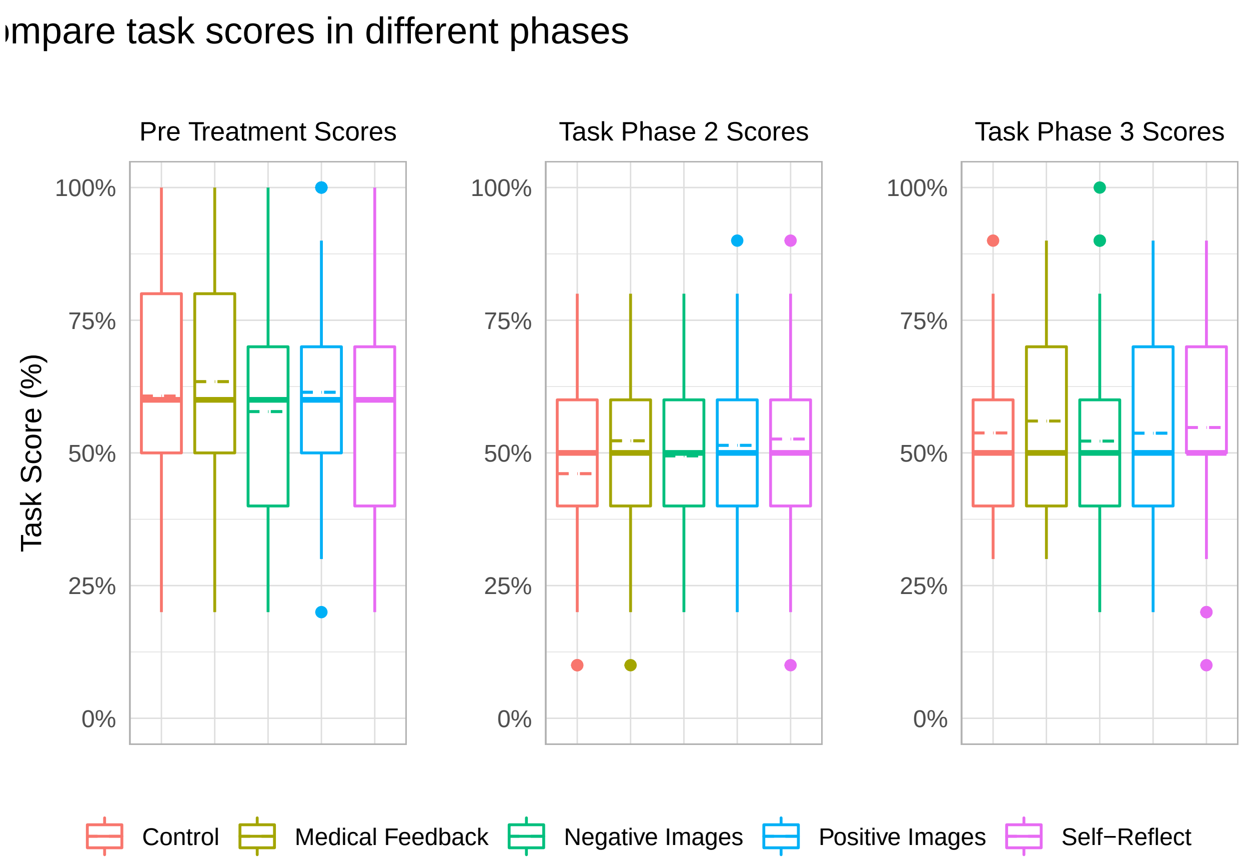
```r
task1b_bp <- ggplot(d_respondents, aes(x = Assignment_Group, y=TaskPhase2_Score, colour=as.factor(Assign
  geom_boxplot() +
  stat_summary(fun.y = mean, geom = "errorbar", aes(ymax = ..y.., ymin = ..y..), width = .75, linetype =
  xlab('') +
  ylab('') +
  ggtitle("Task Phase 2 Scores") +
  scale_y_continuous(labels = scales::percent,limits = c(0,1)) +
  theme(axis.text.x = element_blank(),
        axis.ticks = element_blank(),
        plot.title = element_text(hjust = 0.5,size=10),
        legend.position = "none")
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

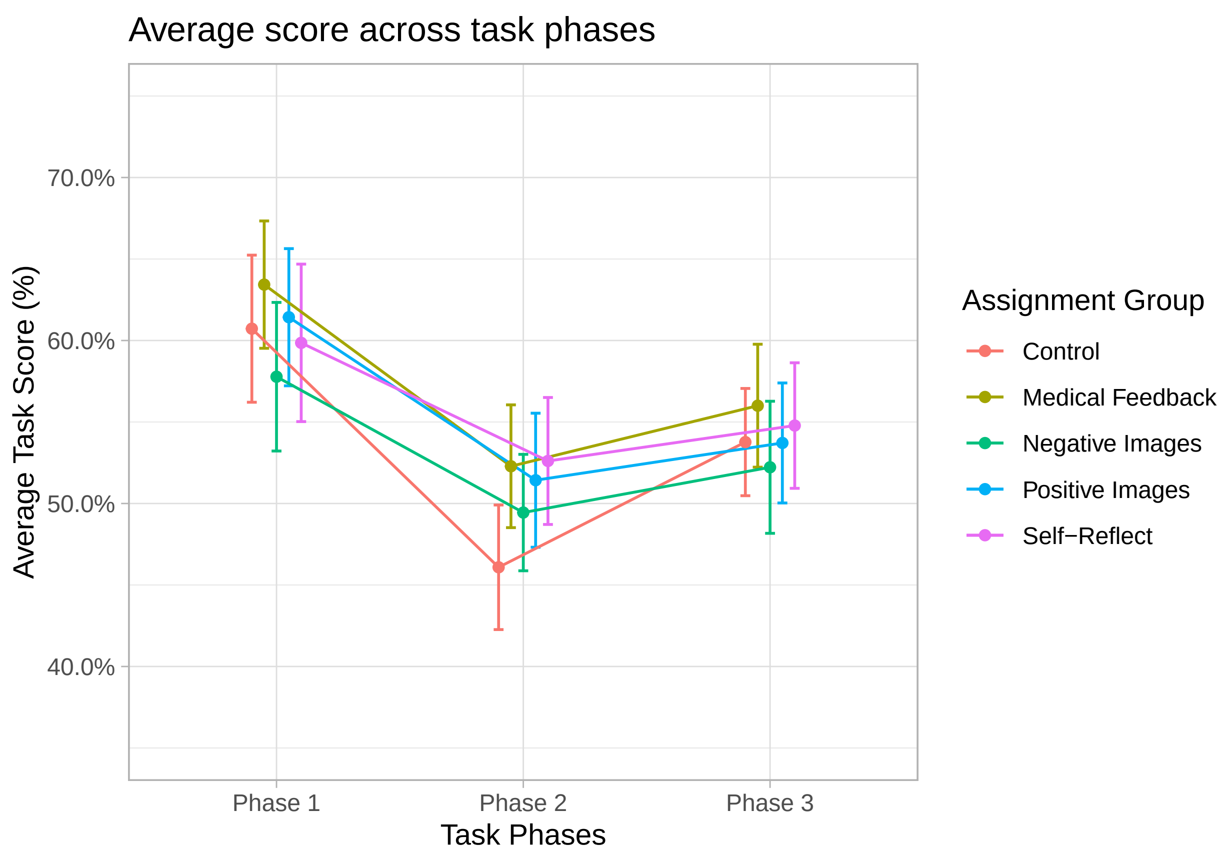
```r
task1c_bp <- ggplot(d_respondents, aes(x = Assignment_Group, y=TaskPhase3_Score, colour=as.factor(Assign
  geom_boxplot() +
  stat_summary(fun.y = mean, geom = "errorbar", aes(ymax = ..y.., ymin = ..y..), width = .75, linetype =
  xlab('') +
  ylab('') +
  ggtitle("Task Phase 3 Scores") +
  scale_y_continuous(labels = scales::percent,limits = c(0,1)) +
  theme(axis.text.x = element_blank(),
        axis.ticks = element_blank(),
        plot.title = element_text(hjust = 0.5,size=10),
        legend.position = "none")
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

```r
mylegend_1<-g_legend(task1a_bp)

grid.arrange(arrangeGrob(task1a_bp + theme(legend.position="none"),task1b_bp,task1c_bp,ncol=3),
             mylegend_1,
             nrow=2,
             heights=c(10,1),
             top = textGrob("Compare task scores in different phases\n",just='right',gp=gpar(fontsize=14
```




```
# Compare score across time for all groups
# https://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/BS704_Confidence_Intervals/BS704_Confidence_Intervals_
# TODO finish formatting
# TODO duplicate for treatment dummy as well
summary_task_score <- (melt(d_respondents,id.vars=c('Assignment_Group'),
                            measure.vars = c('TaskPhase1_Score','TaskPhase2_Score','TaskPhase3_Score'))
  ,.('avg_score'=mean(value),'sd_score'=sd(value),'obs'=.N),keyby=.(Assignment_Group,variable)])[
    ,se:=1.96*sd_score/sqrt(obs)]

summary_task_score %>%
  ggplot( aes(x=variable, y=avg_score, group=Assignment_Group, color=Assignment_Group)) +
  geom_errorbar(aes(ymin=avg_score-1.96*sd_score/sqrt(obs), ymax=avg_score+1.96*sd_score/sqrt(obs)),
                width=.2,
                position=position_dodge(0.25)) +
  geom_line(position=position_dodge(0.25)) +
  geom_point(position=position_dodge(0.25)) +
  scale_y_continuous(labels = scales::percent,limits = c(.35,.75)) +
  scale_x_discrete(breaks=c("TaskPhase1_Score", "TaskPhase2_Score","TaskPhase3_Score"),
                   labels=c("Phase 1", "Phase 2", "Phase 3")) +
  xlab('Task Phases') +
  ylab('Average Task Score (%)') +
  labs(title='Average score across task phases', color = "Assignment Group")
```




```r
# TODO add this to the appendix
kable(summary_task_score)
```

Assignment_Group	variable	avg_score	sd_score	obs	se
Control	TaskPhase1_Score	0.6072	0.1912	69	0.0451
Control	TaskPhase2_Score	0.4609	0.1620	69	0.0382
Control	TaskPhase3_Score	0.5377	0.1394	69	0.0329
Medical Feedback	TaskPhase1_Score	0.6343	0.1667	70	0.0391
Medical Feedback	TaskPhase2_Score	0.5229	0.1608	70	0.0377
Medical Feedback	TaskPhase3_Score	0.5600	0.1610	70	0.0377
Negative Images	TaskPhase1_Score	0.5778	0.1973	72	0.0456
Negative Images	TaskPhase2_Score	0.4944	0.1546	72	0.0357
Negative Images	TaskPhase3_Score	0.5222	0.1754	72	0.0405
Positive Images	TaskPhase1_Score	0.6143	0.1796	70	0.0421
Positive Images	TaskPhase2_Score	0.5143	0.1755	70	0.0411
Positive Images	TaskPhase3_Score	0.5371	0.1571	70	0.0368
Self-Reflect	TaskPhase1_Score	0.5986	0.2047	69	0.0483
Self-Reflect	TaskPhase2_Score	0.5261	0.1651	69	0.0390
Self-Reflect	TaskPhase3_Score	0.5478	0.1632	69	0.0385

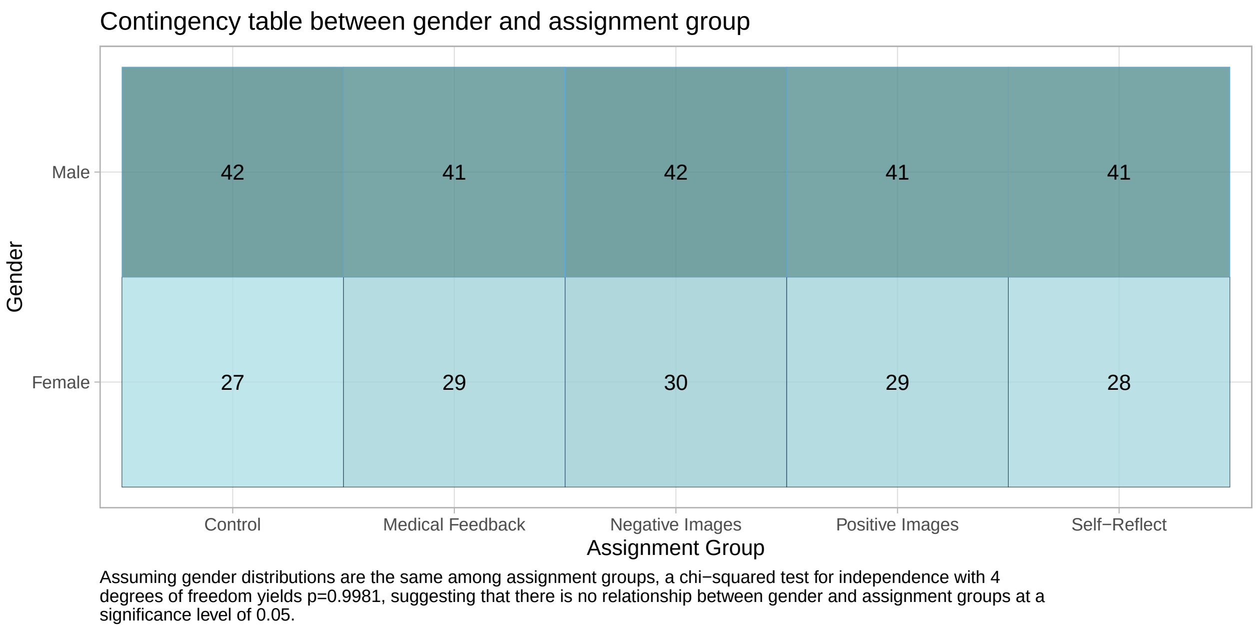
Gender

```r
# TODO format figures and captions
#check balance between gender

gender_chiqq <- chisq.test(d_respondents[ , table(Assignment_Group, Gender)])
```

```
pander(gender_chiq,style='rmarkdown')
```

Quitting from lines 570-586 (EDA.Rmd) Error in pander(gender_chiq, style = "rmarkdown") : object 'gender_chiq' not found Calls: ... withCallingHandlers -> withVisible -> eval -> eval -> pander

```
create_heatmap(var1 = d_respondents$Assignment_Group,var2 = d_respondents$Gender) +
  xlab('Assignment Group') +
  ylab('Gender') +
  labs(title = 'Contingency table between gender and assignment group',
       caption = paste0('Assuming gender distributions are the same among assignment groups, a chi-squa
                        round(gender_chiqq$parameter,4),' \ndegrees of freedom ', 'yields p=',
                        round(gender_chiqq$p.value,4),
                        ', suggesting that there is no relationship between gender and assignment group
  theme(plot.caption = element_text(hjust = 0))
```



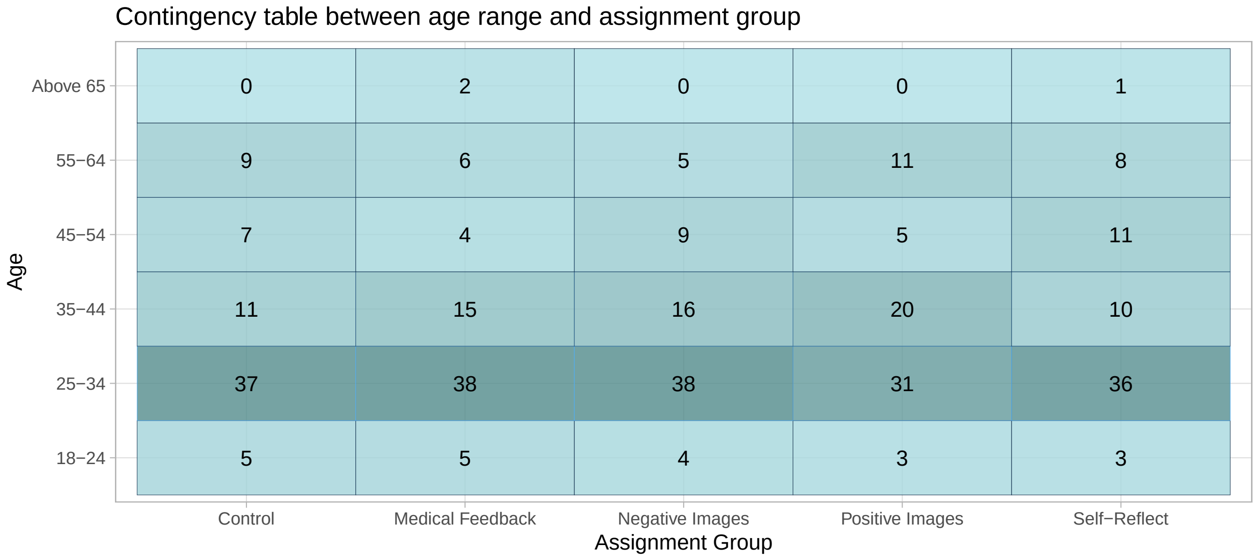
Age Range

```
# TODO format figures and captions
#check balance between age-range

# expected frequency count for each cell of the contingency table should be at least 5. Since this is n
# https://stats.stackexchange.com/questions/81483/warning-in-r-chi-squared-approximation-may-be-incorre
age_chisq <- chisq.test(d_respondents[ , table(Assignment_Group, Age_Range)],simulate.p.value = TRUE)
pander(age_chisq,style='rmarkdown')
```

Table 3: Pearson's Chi-squared test with simulated p-value (based on 2000 replicates): `d_respondents[, table(Assignment_Group, Age_Range)]`

Test statistic	df	P value
19.22	NA	0.5142

```r
create_heatmap(var1 = d_respondents$Assignment_Group,var2 = d_respondents$Age_Range) +
  xlab('Assignment Group') +
  ylab('Age') +
  labs(title = 'Contingency table between age range and assignment group',
       caption = paste0('Assuming age distributions are the same among assignment groups, a chi-squared
                        round(age_chisq$p.value,4),
                        ', suggesting that there is no relationship between age and assignment groups a
  theme(plot.caption = element_text(hjust = 0))
```



Assuming age distributions are the same among assignment groups, a chi−squared test for independence with Monte Carlo simulation yields p=0.5142, suggesting that there is no relationship between age and assignment groups at a significance level of 0.05.

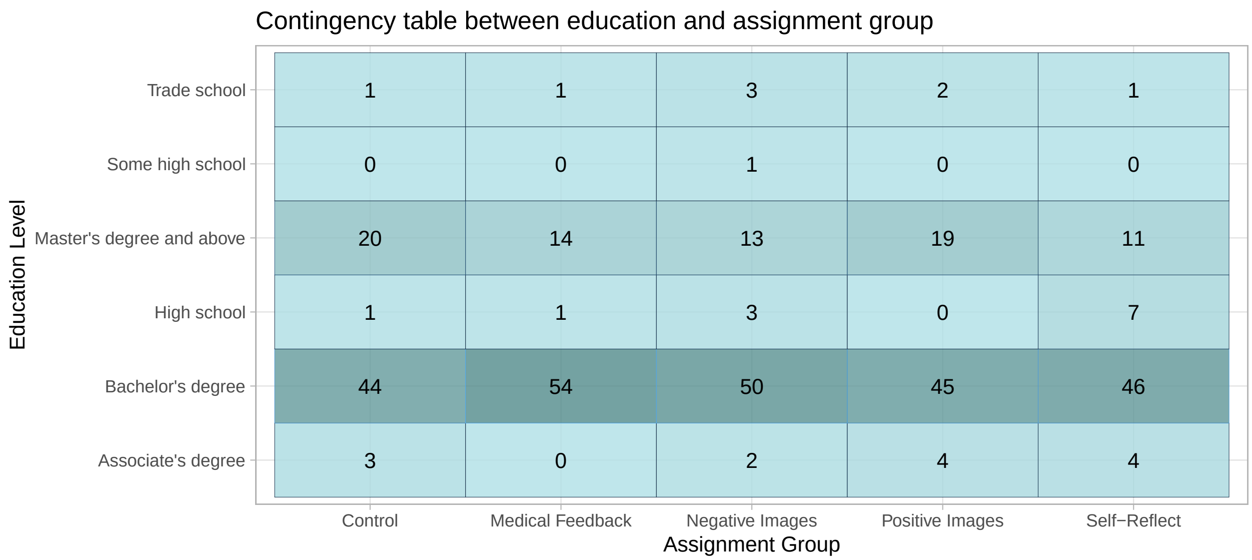
Education Level

```r
# TODO format figures and captions
#check balance between education levels
edu_chisq <- chisq.test(d_respondents[ , table(Assignment_Group, Education_Level)],simulate.p.value = T
pander(edu_chisq,style='rmarkdown')
```

Table 4: Pearson's Chi-squared test with simulated p-value (based on 2000 replicates): `d_respondents[, table(Assignment_Group, Education_Level)]`

Test statistic	df	P value
28.7	NA	0.07146

```r
create_heatmap(var1 = d_respondents$Assignment_Group,var2 = d_respondents$Education_Level) +
  xlab('Assignment Group') +
  ylab('Education Level') +
  labs(title = 'Contingency table between education and assignment group',
       caption = paste0('Assuming education distributions are the same among assignment groups, a chi-s
                        round(edu_chisq$p.value,4),
                        ', suggesting that there is no relationship \nbetween education and assignment
  theme(plot.caption = element_text(hjust = 0))
```



Assuming education distributions are the same among assignment groups, a chi−squared test for independence with Monte Carlo simulation yields p=0.0715, suggesting that there is no relationship between education and assignment groups at a significance level of 0.05.

Country: US, non-US

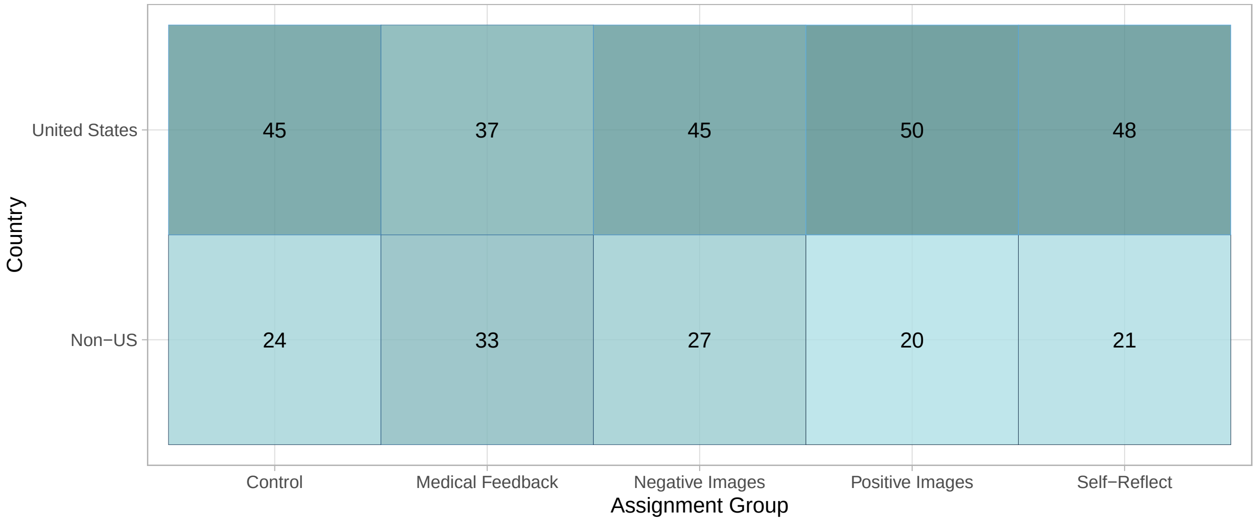
```
# TODO format figures and captions
# out.width = "80%"
# check balance between US and non-US respondents

us_chisq <- chisq.test(d_respondents[ , table(Assignment_Group, US_Dummy)])
pander(us_chisq,style='rmarkdown')
```

Table 5: Pearson's Chi-squared test: `d_respondents[, table(Assignment_Group, US_Dummy)]`

Test statistic	df	P value
6.502	4	0.1647

```
create_heatmap(var1 = d_respondents$Assignment_Group,var2 = d_respondents$US_Dummy) +
  xlab('Assignment Group') +
  ylab('Country') +
  scale_y_discrete(breaks=c("0", "1"),
                      labels=c("Non-US", "United States")) +
  labs(title = 'Contingency table between country and assignment group',
      caption = paste0('Assuming country distributions are the same among assignment groups, a chi-squa
                        round(us_chisq$parameter,4),' degrees of freedom ', 'yields p=',
                        round(us_chisq$p.value,4),
                        ', suggesting that there is no relationship between country and assignment \ngro
  theme(plot.caption = element_text(hjust = 0))
```

Contingency table between country and assignment group



Assuming country distributions are the same among assignment groups, a chi−squared test for independence with 4 degrees of freedom yields p=0.1647, suggesting that there is no relationship between country and assignment groups at a significance level of 0.05.

```
# ATE of treatment on Total Score

d_respondents[ Treatment_Dummy == 1, mean(Total_Score)] - d_respondents[ Treatment_Dummy == 0, mean(Tota
```

```
## [1] 0.5143
```

```
sd(d_respondents$Total_Score)
```

```
## [1] 3.743
```

```
# ATE of treatment on TaskPhase2 Score

d_respondents[ Treatment_Dummy == 1, mean(TaskPhase2_Score)] - d_respondents[ Treatment_Dummy == 0, mean
```

```
## [1] 0.05337
```

```
sd(d_respondents$TaskPhase2_Score)
```

```
## [1] 0.1645
```

```
#trying 2SLS...but dont think it applies here

# d_respondents[ , lm(Total_Score ~ Education_Level)]
# d_respondents[ , ivreg(Total_Score ~ Education_Level | Assignment_Group)]
```

```
power.t.test( delta = .05, sd=.16, sig.level = 0.05, power=0.8)
```

```
##
##      Two-sample t test power calculation
##
##               n = 161.7
##           delta = 0.05
##              sd = 0.16
##       sig.level = 0.05
##           power = 0.8
##     alternative = two.sided
##
## NOTE: n is number in *each* group
```

Analysis

Helper Functions

```r
get_robust_se <- function(model){
  # Get robust SE for use in stargazer
  vcov <- vcovHC(model,type = "HC1")
  return(sqrt(diag(vcov)))
}
```

Task Phase 2 Analysis

```r
# does any treatment have an effect on task phase 2 score?
mod_task2_a <- d_respondents[, lm(TaskPhase2_Score ~ Treatment_Dummy)]

mod_task2_b <- d_respondents[, lm(TaskPhase2_Score ~ Treatment_Dummy +
                                                     TaskPhase1_Score +
                                                     as.factor(Gender) +
                                                     as.factor(Education_Level) +
                                                     as.factor(Age_Range))]

stargazer(mod_task2_a,
          mod_task2_b,
          se = list(get_robust_se(mod_task2_a),get_robust_se(mod_task2_b)),
          omit = c("Education_Level","Age_Range"),
          add.lines = list(c('Education Fixed Effects', 'No','Yes'),
                           c('Age Fixed Effects','No','Yes')),
          header=FALSE,
          type='latex')
```

```r
#add an F test to compare
pander(anova(mod_task2_a, mod_task2_b, test='F'),stle='rmarkdown')
```

Table 7: Analysis of Variance Table

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
348	9.287	NA	NA	NA	NA
336	8.338	12	0.9498	3.19	0.0002426

```r
#does the specific treatment group have an effect on task phase 2 score?
mod_task2_c <- d_respondents[, lm(TaskPhase2_Score ~ as.factor(Assignment_Group))]

mod_task2_d <- d_respondents[, lm(TaskPhase2_Score ~ as.factor(Assignment_Group) +
                                                     TaskPhase1_Score +
                                                     as.factor(Gender) +
                                                     as.factor(Education_Level) +
                                                     as.factor(Age_Range))]

# Do you think that there are features of the data that might systematically predict that people will r
# TODO update this heterogeneity issue. I'm not quite sure this applies because they're both considered
# mod5 <- d_respondents[, lm(TaskPhase2_Score ~ Treatment_Dummy + as.factor(assign_bin) +
#                               Treatment_Dummy * as.factor(assign_bin))]
```

Table 6:

	Dependent variable:	
	TaskPhase2_Score	
	(1)	(2)
Treatment_Dummy	0.053**	0.051**
	(0.022)	(0.022)
TaskPhase1_Score		0.240***
		(0.047)
as.factor(Gender)Male		−0.010
		(0.017)
Constant	0.461***	0.281***
	(0.019)	(0.072)
Education Fixed Effects	No	Yes
Age Fixed Effects	No	Yes
Observations	350	350
R^2	0.017	0.117
Adjusted R^2	0.014	0.083
Residual Std. Error	0.163 (df = 348)	0.158 (df = 336)
F Statistic	5.911** (df = 1; 348)	3.433*** (df = 13; 336)
Note:		*p<0.1; **p<0.05; ***p<0.01

```r
stargazer(mod_task2_c,
          mod_task2_d,
          se = list(get_robust_se(mod_task2_c),get_robust_se(mod_task2_d)),
          omit = c("Education_Level","Age_Range"),
          add.lines = list(c('Education Fixed Effects', 'No','Yes'),
                           c('Age Fixed Effects','No','Yes')),
          header=FALSE,
          type='latex')
```

Table 8:

	Dependent variable:	
	TaskPhase2_Score	
	(1)	(2)
as.factor(Assignment_Group)Medical Feedback	0.062^{**}	0.055^{*}
	(0.027)	(0.029)
as.factor(Assignment_Group)Negative Images	0.034	0.039
	(0.027)	(0.027)
as.factor(Assignment_Group)Positive Images	0.053^{*}	0.050^{*}
	(0.029)	(0.027)
as.factor(Assignment_Group)Self-Reflect	0.065^{**}	0.058^{**}
	(0.028)	(0.029)
TaskPhase1_Score		0.238^{***}
		(0.048)
as.factor(Gender)Male		−0.010
		(0.017)
Constant	0.461^{***}	0.282^{***}
	(0.019)	(0.073)
Education Fixed Effects	No	Yes
Age Fixed Effects	No	Yes
Observations	350	350
R^2	0.021	0.119
Adjusted R^2	0.010	0.076
Residual Std. Error	0.164 (df = 345)	0.158 (df = 333)
F Statistic	1.874 (df = 4; 345)	2.805^{***} (df = 16; 333)
Note:		*p<0.1; **p<0.05; ***p<0.01

```r
pander(anova(mod_task2_c, mod_task2_d, test='F'),style='rmarkdown')
```

Table 9: Analysis of Variance Table

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
345	9.244	NA	NA	NA	NA

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
333	8.323	12	0.921	3.071	0.0003943

Task Phase 3 Analysis

```
# test final task and any treatment
mod_task3_a <- d_respondents[, lm(TaskPhase3_Score ~ Treatment_Dummy)]
mod_task3_b <- d_respondents[, lm(TaskPhase3_Score ~ Treatment_Dummy +
                                                     TaskPhase1_Score +
                                                     as.factor(Gender) +
                                                     as.factor(Education_Level) +
                                                     as.factor(Age_Range))]

stargazer(mod_task3_a,
          mod_task3_b,
          se = list(get_robust_se(mod_task3_a),get_robust_se(mod_task3_b)),
          omit = c("Education_Level","Age_Range"),
          add.lines = list(c('Education Fixed Effects', 'No','Yes'),
                           c('Age Fixed Effects','No','Yes')),
          header=FALSE,
          type='latex')
```

```
pander(anova(mod_task3_a, mod_task3_b, test='F'),style='rmarkdown')
```

Table 11: Analysis of Variance Table

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
348	8.865	NA	NA	NA	NA
336	8.117	12	0.7479	2.58	0.002743

```
# test final task and specific treatment
mod_task3_c <- d_respondents[, lm(TaskPhase3_Score ~ as.factor(Assignment_Group))]
mod_task3_d <- d_respondents[, lm(TaskPhase3_Score ~ as.factor(Assignment_Group) +
                                                     TaskPhase1_Score +
                                                     as.factor(Gender) +
                                                     as.factor(Education_Level) +
                                                     as.factor(Age_Range))]

stargazer(mod_task3_c,
          mod_task3_d,
          se = list(get_robust_se(mod_task3_c),get_robust_se(mod_task3_d)),
          omit = c("Education_Level","Age_Range"),
          add.lines = list(c('Education Fixed Effects', 'No','Yes'),
                           c('Age Fixed Effects','No','Yes')),
          header=FALSE,
          type='latex')
```

```
pander(anova(mod_task3_c, mod_task3_d, test='F'),style='rmarkdown')
```

Table 10:

	Dependent variable:	
	TaskPhase3_Score	
	(1)	(2)
Treatment_Dummy	0.004	0.002
	(0.019)	(0.019)
TaskPhase1_Score		0.161***
		(0.047)
as.factor(Gender)Male		−0.004
		(0.017)
Constant	0.538***	0.515***
	(0.017)	(0.064)
Education Fixed Effects	No	Yes
Age Fixed Effects	No	Yes
Observations	350	350
R^2	0.0001	0.084
Adjusted R^2	−0.003	0.049
Residual Std. Error	0.160 (df = 348)	0.155 (df = 336)
F Statistic	0.034 (df = 1; 348)	2.384*** (df = 13; 336)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 12:

	Dependent variable:	
	TaskPhase3_Score	
	(1)	(2)
as.factor(Assignment_Group)Medical Feedback	0.022	0.011
	(0.026)	(0.026)
as.factor(Assignment_Group)Negative Images	−0.015	−0.011
	(0.027)	(0.026)
as.factor(Assignment_Group)Positive Images	−0.001	0.004
	(0.025)	(0.025)
as.factor(Assignment_Group)Self-Reflect	0.010	0.005
	(0.026)	(0.026)
TaskPhase1_Score		0.157^{***}
		(0.047)
as.factor(Gender)Male		−0.004
		(0.017)
Constant	0.538^{***}	0.518^{***}
	(0.017)	(0.064)
Education Fixed Effects	No	Yes
Age Fixed Effects	No	Yes
Observations	350	350
R^2	0.006	0.087
Adjusted R^2	−0.005	0.043
Residual Std. Error	0.160 (df = 345)	0.156 (df = 333)
F Statistic	0.545 (df = 4; 345)	1.971^{**} (df = 16; 333)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 13: Analysis of Variance Table

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
345	8.81	NA	NA	NA	NA
333	8.099	12	0.7113	2.437	0.004751

Wearing Off Effects

```
mod_task3_e <- d_respondents[ , lm(TaskPhase3_Score ~ TaskPhase2_Score)]
mod_task3_f <- d_respondents[ , lm(TaskPhase3_Score ~ TaskPhase2_Score + Treatment_Dummy)]
mod_task3_g <- d_respondents[ , lm(TaskPhase3_Score ~ TaskPhase2_Score + as.factor(Assignment_Group))]
mod_task3_h <- d_respondents[ , lm(TaskPhase3_Score ~ TaskPhase2_Score +
                                       as.factor(Assignment_Group) +
                                       as.factor(Gender) +
                                       as.factor(Education_Level) +
                                       as.factor(Age_Range))]

stargazer(mod_task3_e,
          mod_task3_f,
          mod_task3_g,
          mod_task3_h,
          se = list(get_robust_se(mod_task3_e),
                    get_robust_se(mod_task3_f),
                    get_robust_se(mod_task3_h)),
                    get_robust_se(mod_task3_g),
          omit = c("Education_Level","Age_Range"),
          add.lines = list(c('Education Fixed Effects', 'No','No','No','Yes'),
                           c('Age Fixed Effects','No','No','No','Yes')),
          header=FALSE,
          type='latex')
```

```
pander(anova(mod_task3_e, mod_task3_f, test='F'),style='rmarkdown')
```

Table 16: Analysis of Variance Table

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
348	8.326	NA	NA	NA	NA
347	8.322	1	0.004358	0.1817	0.6702

```
pander(anova(mod_task3_g, mod_task3_h, test='F'),style='rmarkdown')
```

Table 17: Analysis of Variance Table

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
344	8.286	NA	NA	NA	NA
333	7.863	11	0.4227	1.627	0.08955

```
##
mod_task3_i <- d_respondents[ , lm(TaskPhase3_Score ~ TaskPhase1_Score + TaskPhase2_Score)]
mod_task3_j <- d_respondents[ , lm(TaskPhase3_Score ~ TaskPhase1_Score + TaskPhase2_Score + Treatment_Du
```

Table 14:

	Dependent variable:		
	TaskPhase3_Score		
	(1)	(2)	(3)
TaskPhase2_Score	0.239***	0.242***	0.238***
	(0.050)	(0.051)	(0.052)
Treatment_Dummy		−0.009	
		(0.019)	
as.factor(Assignment_Group)Medical Feedback			0.008
			(0.027)
as.factor(Assignment_Group)Negative Images			−0.023
			(0.026)
as.factor(Assignment_Group)Positive Images			−0.013
			(0.025)
as.factor(Assignment_Group)Self-Reflect			−0.005
			(0.025)
as.factor(Gender)Male			
Constant	0.420***	0.426***	0.428***
	(0.026)	(0.028)	(0.062)
Education Fixed Effects	No	No	No
Age Fixed Effects	No	No	No
Observations	350	350	350
R^2	0.061	0.061	0.065
Adjusted R^2	0.058	0.056	0.052
Residual Std. Error	0.155 (df = 348)	0.155 (df = 347)	0.155 (df = 344
F Statistic	22.540*** (df = 1; 348)	11.330*** (df = 2; 347)	4.815*** (df = 5; 3

Note:

Table 15:

(Intercept)	TaskPhase2_Score	as.factor(Assignment_Group)Medical Feedback	as.factor(Assignment_Group)Nega
0.028	0.051	0.026	0.026

```
mod_task3_k <- d_respondents[ , lm(TaskPhase3_Score ~ TaskPhase1_Score + TaskPhase2_Score + as.factor(A
mod_task3_l <- d_respondents[, lm(TaskPhase3_Score ~ TaskPhase1_Score + TaskPhase2_Score +
                                                      as.factor(Assignment_Group) +
                                                      as.factor(Gender) +
                                                      as.factor(Education_Level) +
                                                      as.factor(Age_Range))]

stargazer(mod_task3_i,
          mod_task3_j,
          mod_task3_k,
          mod_task3_l,
          se = list(get_robust_se(mod_task3_i),
                    get_robust_se(mod_task3_j),
                    get_robust_se(mod_task3_k),
                    get_robust_se(mod_task3_l)),
          header=FALSE,
          type='latex')
```

```
pander(anova(mod_task3_i, mod_task3_j, test = 'F'),style='rmarkdown')
```

Table 19: Analysis of Variance Table

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
347	8.181	NA	NA	NA	NA
346	8.178	1	0.002531	0.1071	0.7437

```
pander(anova(mod_task3_k, mod_task3_l, test = 'F'),style='rmarkdown')
```

Table 20: Analysis of Variance Table

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
343	8.151	NA	NA	NA	NA
332	7.739	11	0.4128	1.61	0.09435

```
# lm(TaskPhase3_Score ~ TaskPhase2_Score) vs lm(TaskPhase3_Score ~ TaskPhase1_Score + TaskPhase2_Score)
pander(anova(mod_task3_e, mod_task3_i, test = 'F'),style='rmarkdown')
```

Table 21: Analysis of Variance Table

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
348	8.326	NA	NA	NA	NA
347	8.181	1	0.1455	6.172	0.01345

Playground

```
# compare self-reflect against medical feedback groups?
#make dummies
d_respondents[ , Self_Reflect_Dummy := ifelse(Assignment_Group == "Self-Reflect", 1, 0)]
d_respondents[ , Med_Feedback_Dummy := ifelse(Assignment_Group == "Medical Feedback", 1, 0)]
```

Table 18:

	Dependent variable:		
	TaskPhase3_Score		
	(1)	(2)	(3)
TaskPhase1_Score	0.113**	0.113**	0.109*
	(0.046)	(0.046)	(0.046
TaskPhase2_Score	0.202***	0.204***	0.202*
	(0.053)	(0.054)	(0.053
Treatment_Dummy		−0.007	
		(0.019)	
as.factor(Assignment_Group)Medical Feedback			0.007
			(0.026
as.factor(Assignment_Group)Negative Images			−0.01
			(0.026
as.factor(Assignment_Group)Positive Images			−0.01
			(0.024
as.factor(Assignment_Group)Self-Reflect			−0.00
			(0.024
as.factor(Gender)Male			
as.factor(Education_Level)Bachelor's degree			
as.factor(Education_Level)High school			
as.factor(Education_Level)Master's degree and above			
as.factor(Education_Level)Some high school			
as.factor(Education_Level)Trade school			
as.factor(Age_Range)25-34			
as.factor(Age_Range)35-44			
as.factor(Age_Range)45-54			
as.factor(Age_Range)55-64			
as.factor(Age_Range)Above 65			

```r
mod_test_dummies1 <- d_respondents[ , lm(TaskPhase2_Score ~ Treatment_Dummy + Self_Reflect_Dummy)]
mod_test_dummies2 <- d_respondents[ , lm(TaskPhase2_Score ~ Treatment_Dummy + Med_Feedback_Dummy)]

stargazer(mod_test_dummies1,
          mod_test_dummies2,
          se = list(get_robust_se(mod_test_dummies1),
                    get_robust_se(mod_test_dummies2)),
          header=FALSE,
          type = 'latex')
```

```
##
## \begin{table}[!htbp] \centering
##   \caption{}
##   \label{}
## \begin{tabular}{@{\extracolsep{5pt}}lcc}
## \\[-1.8ex]\hline
## \hline \\[-1.8ex]
##  & \multicolumn{2}{c}{\textit{Dependent variable:}} \\
## \cline{2-3}
## \\[-1.8ex] & \multicolumn{2}{c}{TaskPhase2\_Score} \\
## \\[-1.8ex] & (1) & (2)\\
## \hline \\[-1.8ex]
##  Treatment\_Dummy & 0.050$^{**}$ & 0.051$^{**}$ \\
##   & (0.022) & (0.023) \\
##   & & \\
##  Self\_Reflect\_Dummy & 0.016 &  \\
##   & (0.023) &  \\
##   & & \\
##  Med\_Feedback\_Dummy &  & 0.011 \\
##   &  & (0.022) \\
##   & & \\
##  Constant & 0.461$^{***}$ & 0.461$^{***}$ \\
##   & (0.019) & (0.019) \\
##   & & \\
## \hline \\[-1.8ex]
## Observations & 350 & 350 \\
## R$^{2}$ & 0.018 & 0.017 \\
## Adjusted R$^{2}$ & 0.012 & 0.012 \\
## Residual Std. Error (df = 347) & 0.163 & 0.164 \\
## F Statistic (df = 2; 347) & 3.192$^{**}$ & 3.079$^{**}$ \\
## \hline
## \hline \\[-1.8ex]
## \textit{Note:}  & \multicolumn{2}{r}{$^{*}$p$<$0.1; $^{**}$p$<$0.05; $^{***}$p$<$0.01} \\
## \end{tabular}
## \end{table}
```

Playground 2

```r
### linear model playground
d_test <- d_respondents[,c("Assignment_Group","TaskPhase1_Score","TaskPhase2_Score","TaskPhase3_Score",

#does treatment have an effect on total score?
mod_test1 <- d_test[ , lm(TaskPhase2_Score ~ TaskPhase1_Score + Treatment_Dummy)]
```

```r
mod_test2 <- d_test[, lm(TaskPhase2_Score ~ TaskPhase1_Score + Treatment_Dummy + (TaskPhase1_Score * Tr

#does treatment and pretreatment score have an effect on total score?


###
# seems that if i ad in TaskPhase1 to the linear model, the RSEs disappear...
mod_test3 <- d_test[, lm(TaskPhase2_Score ~  Treatment_Dummy  +
                                  TaskPhase1_Score +
                                  as.factor(Education_Level) +
                                  as.factor(Gender) +
                                  as.factor(Age_Range)
                         )]

coeftest(mod_test3, vcov = vcovHC(mod_test3,"HC1"))
```

```
##
## t test of coefficients:
##
##                                                    Estimate Std. Error t value
## (Intercept)                                         0.28108    0.07213    3.90
## Treatment_Dummy                                     0.05071    0.02217    2.29
## TaskPhase1_Score                                    0.24027    0.04682    5.13
## as.factor(Education_Level)Bachelor's degree        -0.00683    0.04856   -0.14
## as.factor(Education_Level)High school               0.04068    0.05619    0.72
## as.factor(Education_Level)Master's degree and above -0.01698    0.05128   -0.33
## as.factor(Education_Level)Some high school         -0.12065    0.05108   -2.36
## as.factor(Education_Level)Trade school              0.02867    0.06926    0.41
## as.factor(Gender)Male                              -0.00995    0.01735   -0.57
## as.factor(Age_Range)25-34                           0.04469    0.03768    1.19
## as.factor(Age_Range)35-44                           0.04198    0.03952    1.06
## as.factor(Age_Range)45-54                           0.06975    0.04178    1.67
## as.factor(Age_Range)55-64                           0.08035    0.04252    1.89
## as.factor(Age_Range)Above 65                        0.12575    0.05172    2.43
##                                                    Pr(>|t|)
## (Intercept)                                         0.00012 ***
## Treatment_Dummy                                     0.02281 *
## TaskPhase1_Score                                    4.9e-07 ***
## as.factor(Education_Level)Bachelor's degree         0.88827
## as.factor(Education_Level)High school               0.46957
## as.factor(Education_Level)Master's degree and above  0.74080
## as.factor(Education_Level)Some high school          0.01874 *
## as.factor(Education_Level)Trade school              0.67922
## as.factor(Gender)Male                               0.56658
## as.factor(Age_Range)25-34                           0.23642
## as.factor(Age_Range)35-44                           0.28890
## as.factor(Age_Range)45-54                           0.09593 .
## as.factor(Age_Range)55-64                           0.05968 .
## as.factor(Age_Range)Above 65                        0.01556 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
summary(d_respondents$TaskPhase1_Score)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   0.200   0.500   0.600   0.606   0.700   1.000
```

```r
stargazer(mod_test1,
          mod_test2,
          mod_test3,
          se = list(get_robust_se(mod_test1),get_robust_se(mod_test2), get_robust_se(mod_test3)),
          type='latex')
```

```
##
## % Table created by stargazer v.5.2.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harva
## % Date and time: Sun, Nov 29, 2020 - 19:05:13
## \begin{table}[!htbp] \centering
##   \caption{}
##   \label{}
## \begin{tabular}{@{\extracolsep{5pt}}lccc}
## \\[-1.8ex]\hline
## \hline \\[-1.8ex]
##  & \multicolumn{3}{c}{\textit{Dependent variable:}} \\
## \cline{2-4}
## \\[-1.8ex] & \multicolumn{3}{c}{TaskPhase2\_Score} \\
## \\[-1.8ex] & (1) & (2) & (3)\\
## \hline \\[-1.8ex]
##  TaskPhase1\_Score & 0.249$^{***}$ & 0.153 & 0.240$^{***}$ \\
##   & (0.044) & (0.095) & (0.047) \\
##   & & & \\
##  as.factor(Education\_Level)Bachelor's degree &  &  & $-$0.007 \\
##   &  &  & (0.049) \\
##   & & & \\
##  as.factor(Education\_Level)High school &  &  & 0.041 \\
##   &  &  & (0.056) \\
##   & & & \\
##  as.factor(Education\_Level)Master's degree and above &  &  & $-$0.017 \\
##   &  &  & (0.051) \\
##   & & & \\
##  as.factor(Education\_Level)Some high school &  &  & $-$0.121$^{**}$ \\
##   &  &  & (0.051) \\
##   & & & \\
##  as.factor(Education\_Level)Trade school &  &  & 0.029 \\
##   &  &  & (0.069) \\
##   & & & \\
##  as.factor(Gender)Male &  &  & $-$0.010 \\
##   &  &  & (0.017) \\
##   & & & \\
##  as.factor(Age\_Range)25-34 &  &  & 0.045 \\
##   &  &  & (0.038) \\
##   & & & \\
##  as.factor(Age\_Range)35-44 &  &  & 0.042 \\
##   &  &  & (0.040) \\
##   & & & \\
##  as.factor(Age\_Range)45-54 &  &  & 0.070$^{*}$ \\
##   &  &  & (0.042) \\
```

```
##   & & & \\
##  as.factor(Age\_Range)55-64 &  &  & 0.080$^{*}$ \\
##   &  &  & (0.043) \\
##   & & & \\
##  as.factor(Age\_Range)Above 65 &  &  & 0.126$^{**}$ \\
##   &  &  & (0.052) \\
##   & & & \\
##  Treatment\_Dummy & 0.054$^{**}$ & $-$0.019 & 0.051$^{**}$ \\
##   & (0.021) & (0.065) & (0.022) \\
##   & & & \\
##  TaskPhase1\_Score:Treatment\_Dummy &  & 0.120 &  \\
##   &  & (0.107) &  \\
##   & & & \\
##  Constant & 0.310$^{***}$ & 0.368$^{***}$ & 0.281$^{***}$ \\
##   & (0.032) & (0.057) & (0.072) \\
##   & & & \\
## \hline \\[-1.8ex]
## Observations & 350 & 350 & 350 \\
## R$^{2}$ & 0.098 & 0.101 & 0.117 \\
## Adjusted R$^{2}$ & 0.092 & 0.093 & 0.083 \\
## Residual Std. Error & 0.157 (df = 347) & 0.157 (df = 346) & 0.158 (df = 336) \\
## F Statistic & 18.780$^{***}$ (df = 2; 347) & 12.920$^{***}$ (df = 3; 346) & 3.433$^{***}$ (df = 13; 3
## \hline
## \hline \\[-1.8ex]
## \textit{Note:}  & \multicolumn{3}{r}{$^{*}$p$<$0.1; $^{**}$p$<$0.05; $^{***}$p$<$0.01} \\
## \end{tabular}
## \end{table}
```

```
mod_test4 <- d_test[ , lm(TaskPhase3_Score ~ TaskPhase2_Score)]
coeftest(mod_test4)
```

```
##
## t test of coefficients:
##
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)        0.4205     0.0267   15.77   <2e-16 ***
## TaskPhase2_Score   0.2389     0.0503    4.75    3e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# use Robust SE
mod_test2 <- d_respondents[, lm(TaskPhase2_Score ~ Treatment_Dummy  + as.factor(Education_Level) + (Trea
mod_test2$vcovHC_ <- vcovHC(mod_test2)
coeftest(mod_test2, vcov = mod_test2$vcovHC_)
```

```
##
## t test of coefficients:
##
##                                                                  Estimate
## (Intercept)                                                       0.53333
## Treatment_Dummy                                                   0.00667
## as.factor(Education_Level)Bachelor's degree                      -0.07424
## as.factor(Education_Level)High school                            -0.03333
## as.factor(Education_Level)Master's degree and above              -0.07333
## as.factor(Education_Level)Some high school                       -0.14000
## as.factor(Education_Level)Trade school                           -0.23333
```

```
## Treatment_Dummy:as.factor(Education_Level)Bachelor's degree          0.04142
## Treatment_Dummy:as.factor(Education_Level)High school                0.07515
## Treatment_Dummy:as.factor(Education_Level)Master's degree and above  0.04386
## Treatment_Dummy:as.factor(Education_Level)Trade school               0.30762
##                                                                    Std. Error
## (Intercept)                                                                NA
## Treatment_Dummy                                                            NA
## as.factor(Education_Level)Bachelor's degree                                NA
## as.factor(Education_Level)High school                                      NA
## as.factor(Education_Level)Master's degree and above                        NA
## as.factor(Education_Level)Some high school                                 NA
## as.factor(Education_Level)Trade school                                     NA
## Treatment_Dummy:as.factor(Education_Level)Bachelor's degree                NA
## Treatment_Dummy:as.factor(Education_Level)High school                      NA
## Treatment_Dummy:as.factor(Education_Level)Master's degree and above        NA
## Treatment_Dummy:as.factor(Education_Level)Trade school                     NA
##                                                                    t value
## (Intercept)                                                             NA
## Treatment_Dummy                                                         NA
## as.factor(Education_Level)Bachelor's degree                             NA
## as.factor(Education_Level)High school                                   NA
## as.factor(Education_Level)Master's degree and above                     NA
## as.factor(Education_Level)Some high school                              NA
## as.factor(Education_Level)Trade school                                  NA
## Treatment_Dummy:as.factor(Education_Level)Bachelor's degree             NA
## Treatment_Dummy:as.factor(Education_Level)High school                   NA
## Treatment_Dummy:as.factor(Education_Level)Master's degree and above     NA
## Treatment_Dummy:as.factor(Education_Level)Trade school                  NA
##                                                                    Pr(>|t|)
## (Intercept)                                                              NA
## Treatment_Dummy                                                          NA
## as.factor(Education_Level)Bachelor's degree                              NA
## as.factor(Education_Level)High school                                    NA
## as.factor(Education_Level)Master's degree and above                      NA
## as.factor(Education_Level)Some high school                               NA
## as.factor(Education_Level)Trade school                                   NA
## Treatment_Dummy:as.factor(Education_Level)Bachelor's degree              NA
## Treatment_Dummy:as.factor(Education_Level)High school                    NA
## Treatment_Dummy:as.factor(Education_Level)Master's degree and above      NA
## Treatment_Dummy:as.factor(Education_Level)Trade school                   NA
```