DAIE Pair Project

Descriptive & Inferential Analysis of a Jungian Sandplay VR Project

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Contents

Repo

https://github.com/joeaoregan/2022_DAIE_GCA_JOR_MG

Abstract

Aim and Rationale

The purpose of this assignment was to form a hypothesis based on data collected at the beginning and end of a 12 week period of Cognitive Behavioural Therapy (CBT). The data was collected to investigate the effect of Jungian Sandplay therapy in a Virtual Reality environment. Patients were being treated for PTSD. Psychological interventions like this have been shown to have a positive impact.

Participants and Setting

The study consisted of 150 patients divided equally into 3 groups. An equal representation of male and female patients is present in each group. All patients were young adults aged 18 to 25 with no age information recorded.

- Control (Cognitive Behavioural Therapy patients who did not use the VR app)
- Static (Patients who used a non-animated version of the VR app)
- Animated (Patients who used the animated version of the VR app)

Experiment Design

Clean the raw data from the CSV file. Split the data into the 3 testing groups: control, static, animated. Split each group into male and female. Use histograms and boxplots to visually inspect outliers.

Results Gathering

First, cleaning the data to remove errors such as typos and missing values. We used Descriptive Statistics to examine and look at the data. Looking for outliers in the data. Form a hypothesis based on visual inspection of the data in graphs. Then using Inferential Statistics to make predictions and generalizations based on the data. Performing Hypothesis tests to check the validity of the hypothesis based on the data provided.

Major Findings XXX To do XXX

Findings / Implications XXX To do XXX

Introduction

Topic and Context

Post-traumatic stress disorder (PTSD) is seen as one of the most common psychiatric disorder to follow after exposure to a traumatic event. It has been recorded (by ptsd.va.gov) that approx. 6% of the population will have PTSD at some point in time. It has been known that trauma-focused cognitive behaviour therapy is the best-validated threat for PTSD. Although not all PTSD patients respond adequately to this type of treatment. There has also been studies that most people with PTSD do not access evidence-based treatment, and this situation is much worse for lower and middle income countries. This identify that there is still a lot to overcome in the style of treatment to better improve people's lives with PTSD and remains a challenge.

Rationale

While CBT is effective in the management of symptoms of PTSD, it doesn't specifically deal with the underlying cause. Furthermore, not all patients respond to CBT. Therefore, in an effort to improve the outcomes for patients with PTSD we aim to explore the effectiveness of virtual reality assisted cognitive behavioral therapy compared to standard CBT practices.

Kind of simple. We only have a small amount of information, the change in PTSD Levels after 12 weeks, with one possible variable gender that may influence the outcome. Using 3 different treatment methods, with 2 different ratings.

So, we would expect there is either some change, or no change after 12 weeks. Each of the methods may have different outcomes, and the gender of the patients may be a factor in how they respond to each treatment, or to treatment in general by any of the 3 treatments.

Hypothesis

For a treatment to be a success, the average PTSD levels for both observer rated and self-reported should improve over a 12 week period, across all groups (control, static, animated), and for all patient types (male, female).

H0 (Null hypothesis): There is no difference between the median values of male and female patients measurements over a 12 week period.

H1 (Alternative): There is a difference between the median values of male and female patients measurements over a 12 week period.

Method

Participants

The participants involved in the study were all young adults with PTSD in the age range of 18 - 25 years. There were 150 students, equally divided into 75 males and 75 females.

Design

The patients were allocated into one of three groups;

- Control, static (traditional CBT, no VR)
- Static (non-animated model content, VR)
- Animated (animated model content, VR)

Non-animated means the objects in the virtual environment would be still and not interact. Animated means when you add objects onto the Jungian Sand play they would interact and move around the environment

Materials

The 3 groups underwent 12 weeks of treatment for 50 minutes per week with a therapist. During that time the patients either underwent traditional CBT; or used one of the two (quality) versions of the VR app.

Procedure

During the study, PTSD was assessed using observer-rated (i.e., therapist-rated) and self-report (i.e., Child PTSD Symptom Scale Self-Report Version (CPSS-SR)) measurements, respectively. Both measurements are scaled to the range of 0 to 10. Measurements were taken at the start and end of the study.

Results

Descriptive Statistics

1. Frequency Distribution
2. Central Tendency
3. Variability

1. Frequency Distibution

1.1 Histograms

1.2 Boxplots

2. Central Tendancy

2.1 Mean

2.2 Median

2.3 Mode

3. Variability

3.1 Standard Deviation

Raw Data

Load Raw Data from CSV File The raw data is loaded from an external CSV file.

```
csv_file_name = "daie_ca3_data_5.csv"
raw_data <- read.csv(csv_file_name)

# names(raw_data) # find name for column1, it's called ...1 elsewhere
```

Explore Raw Data Get column names

```
names(raw_data)
```

```
## [1] "X"               "gender"          "test_group"      "pre_trial_cpss"
## [5] "post_trial_cpss" "pre_trial_or"    "post_trial_or"
```

Get column data type

```
sapply(raw_data, typeof)
```

```
##               X          gender      test_group  pre_trial_cpss post_trial_cpss
##       "integer"     "character"     "character"        "double"        "double"
##    pre_trial_or   post_trial_or
##        "double"        "double"
```

Raw Data Table Display the raw data in a paged table.

```
# show a "prettier" paged table
rmarkdown::paged_table(raw_data)
```

Rows with values out of Range (0 to 10) Check for any values less than 0 or greater than 10. Self-Report and Observer-Rated measurements are scaled to the range 0 to 10.

```
# identify_rows <- raw_data$pre_trial_cpss < 0 | raw_data$pre_trial_cpss > 10 | raw_data$post_trial_cps

# function to do same thing as above for 1 column at a time
check_range <- function(value) {
  return(value < 0 | value > 10) # return true if the value is less than 0 or greater than 10, otherwis
}

identify_rows <- check_range(raw_data$pre_trial_cpss) | check_range(raw_data$post_trial_cpss) | check_ra

data_not_in_range <- raw_data %>%
```

```
  select(X, gender, test_group, pre_trial_cpss, post_trial_cpss, pre_trial_or, post_trial_or) %>%
  subset(., identify_rows)

rmarkdown::paged_table(data_not_in_range)
```

Rows with missing data Show rows with missing data. We will remove this later.

```
missing_data <- raw_data %>%
  select(X, gender, test_group, pre_trial_cpss, post_trial_cpss, pre_trial_or, post_trial_or) %>%
  filter(!complete.cases(.))

rmarkdown::paged_table(missing_data)
```

Values in "gender" should be "Female" and "Male" Use unique() to find all the different values in the gender column to find/rule out errors

```
gender_values = unique(raw_data$gender)
gender_values
```

```
## [1] "Male"   "Female" "Feale"
```

Values in test_group should be "Control", "Static", "Animated" Use unique() to find all the different values in the test_group column to find/rule out errors

```
test_group_values = unique(raw_data$test_group)
test_group_values
```

```
## [1] "Static"   "Control"  "Animated" "Anmated"
```

Show Rows with Typos After previously finding the typos "Feale" and "Anmated" with unique(), in gender and test_group columns. Show the rows, so we can be sure they were corrected in the cleaned data later.

```
typos <- raw_data %>%
  select(X, gender, test_group, pre_trial_cpss, post_trial_cpss, pre_trial_or, post_trial_or) %>%
  filter(gender == "Feale" | test_group == "Anmated")
typos
```

```
##     X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1 125   Male    Anmated           7.52            5.69         8.06
## 2 148  Feale   Animated           4.21            2.86         4.58
##   post_trial_or
## 1          5.44
## 2          2.62
```

Show Rows with Typos or Missing Data Show all errors. Only Typos and Missing Data have been identified.

```
typos <- raw_data %>%
  select(X, gender, test_group, pre_trial_cpss, post_trial_cpss, pre_trial_or, post_trial_or) %>%
  filter(gender == "Feale" | test_group == "Anmated" | !complete.cases(.))
typos
```

```
##     X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1  73   Male    Control           6.41              NA         6.87
## 2 125   Male    Anmated           7.52            5.69         8.06
## 3 148  Feale   Animated           4.21            2.86         4.58
##   post_trial_or
## 1          5.78
## 2          5.44
## 3          2.62
```

Clean Data

The following has been performed to clean the data:

- **Remove rows with missing data:** filter()
  - **Row 73:** removed, as missing value could skew the results, as we don't know what value should be. Therefore we can't replace it.
- **Fix typos:** mutate()
  - **Row 125:** "Anmated" becomes "Animated".
  - **Row 148:** "Feale" becomes "Female".
- **Check for duplicates:** distinct()
  - No duplicates found

```
data <- raw_data %>%
  select(X, gender, test_group, pre_trial_cpss, post_trial_cpss, pre_trial_or, post_trial_or) %>%
  distinct() %>% # remove duplicates (none anyway)
  filter(complete.cases(.)) %>% # remove rows with incomplete data
  mutate(gender = recode(gender, "Feale" = "Female")) %>% # change typo in gender column
  mutate(test_group = recode(test_group, "Anmated" = "Animated")) # change typo in test_group column
data
```

```
##       X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1     1   Male     Static           6.70            6.48         7.23
## 2     2   Male     Static           5.54            6.31         5.06
## 3     3   Male     Static           6.30            4.35         6.75
## 4     4   Male     Static           5.71            5.30         5.61
## 5     5   Male     Static           4.01            4.93         3.74
## 6     6   Male     Static           6.24            4.46         6.61
## 7     7   Male     Static           5.19            4.79         5.46
## 8     8   Male     Static           5.21            6.58         4.75
```

```
## 9     9   Male     Static          6.31          5.67          6.24
## 10   10   Male     Static          6.44          5.55          6.54
## 11   11   Male     Static          6.95          5.37          6.75
## 12   12   Male     Static          6.13          5.51          6.56
## 13   13   Male     Static          5.43          7.13          5.37
## 14   14   Male     Static          6.20          5.22          6.43
## 15   15   Male     Static          7.60          5.81          7.39
## 16   16   Male     Static          6.77          5.41          7.25
## 17   17   Male     Static          7.14          4.44          7.14
## 18   18   Male     Static          4.87          6.88          4.35
## 19   19   Male     Static          6.14          4.75          5.74
## 20   20   Male     Static          7.54          6.92          8.06
## 21   21   Male     Static          5.27          5.80          4.75
## 22   22   Male     Static          5.56          5.14          5.98
## 23   23   Male     Static          8.02          3.55          8.30
## 24   24   Male     Static          6.42          5.64          6.51
## 25   25   Male     Static          6.48          5.52          6.64
## 26   26 Female     Static          5.60          4.79          5.62
## 27   27 Female     Static          7.29          7.13          6.95
## 28   28 Female     Static          5.52          4.67          5.48
## 29   29 Female     Static          5.64          4.84          5.29
## 30   30 Female     Static          7.47          7.38          7.45
## 31   31 Female     Static          6.19          5.60          6.59
## 32   32 Female     Static          5.09          4.08          5.55
## 33   33 Female     Static          6.29          5.74          6.27
## 34   34 Female     Static          4.71          3.55          4.20
## 35   35 Female     Static          7.10          6.86          7.43
## 36   36 Female     Static          5.04          4.01          5.13
## 37   37 Female     Static          5.87          5.16          5.88
## 38   38 Female     Static          5.55          4.72          5.94
## 39   39 Female     Static          6.25          5.68          5.80
## 40   40 Female     Static          5.54          4.70          5.12
## 41   41 Female     Static          6.43          5.93          6.53
## 42   42 Female     Static          5.07          4.04          5.01
## 43   43 Female     Static          7.42          7.30          7.25
## 44   44 Female     Static          5.79          5.04          5.99
## 45   45 Female     Static          6.46          5.98          6.41
## 46   46 Female     Static          5.46          4.60          5.66
## 47   47 Female     Static          5.54          4.70          5.66
## 48   48 Female     Static          5.40          4.51          5.90
## 49   49 Female     Static          5.77          5.02          5.63
## 50   50 Female     Static          7.52          7.44          7.37
## 51   51   Male    Control          6.99          5.40          7.25
## 52   52   Male    Control          8.01          4.32          8.38
## 53   53   Male    Control          5.32          6.00          5.13
## 54   54   Male    Control          6.46          4.69          7.01
## 55   55   Male    Control          6.11          4.89          6.07
## 56   56   Male    Control          7.10          5.67          6.75
## 57   57   Male    Control          7.62          5.63          8.14
## 58   58   Male    Control          6.75          5.02          6.75
## 59   59   Male    Control          4.98          6.22          5.38
## 60   60   Male    Control          7.56          6.69          7.81
## 61   61   Male    Control          6.74          4.69          7.30
## 62   62   Male    Control          7.63          4.56          7.44
```

```
## 63   63   Male    Control          4.68          6.41          5.19
## 64   64   Male    Control          5.78          7.06          5.86
## 65   65   Male    Control          6.01          5.71          6.11
## 66   66   Male    Control          6.86          5.64          6.48
## 67   67   Male    Control          6.13          6.09          6.24
## 68   68   Male    Control          5.87          6.73          6.36
## 69   69   Male    Control          5.52          5.96          5.00
## 70   70   Male    Control          6.01          4.79          6.45
## 71   71   Male    Control          4.70          5.03          5.03
## 72   72   Male    Control          8.08          5.53          7.84
## 73   74   Male    Control          5.12          4.47          5.26
## 74   75   Male    Control          6.38          5.65          5.90
## 75   76 Female    Control          6.00          5.34          6.47
## 76   77 Female    Control          6.16          5.56          6.48
## 77   78 Female    Control          4.51          3.28          5.04
## 78   79 Female    Control          6.11          5.49          5.65
## 79   80 Female    Control          5.11          4.11          4.90
## 80   81 Female    Control          7.70          7.69          7.98
## 81   82 Female    Control          6.24          5.67          6.48
## 82   83 Female    Control          5.80          5.06          5.91
## 83   84 Female    Control          4.24          2.90          4.03
## 84   85 Female    Control          5.86          5.14          5.87
## 85   86 Female    Control          6.00          5.34          6.36
## 86   87 Female    Control          6.02          5.36          5.86
## 87   88 Female    Control          6.56          6.11          7.12
## 88   89 Female    Control          4.73          3.58          4.98
## 89   90 Female    Control          6.81          6.46          7.29
## 90   91 Female    Control          4.74          3.59          4.88
## 91   92 Female    Control          5.31          4.38          4.86
## 92   93 Female    Control          4.47          3.22          4.43
## 93   94 Female    Control          7.31          7.15          6.80
## 94   95 Female    Control          6.40          5.89          6.54
## 95   96 Female    Control          4.00          2.57          4.02
## 96   97 Female    Control          5.17          4.18          5.13
## 97   98 Female    Control          5.31          4.39          5.40
## 98   99 Female    Control          6.59          6.15          6.83
## 99  100 Female    Control          6.57          6.13          7.03
## 100 101   Male   Animated          5.25          5.21          5.79
## 101 102   Male   Animated          5.73          5.63          6.14
## 102 103   Male   Animated          4.68          4.39          4.87
## 103 104   Male   Animated          5.12          6.54          5.52
## 104 105   Male   Animated          6.75          4.78          7.10
## 105 106   Male   Animated          7.11          5.22          7.04
## 106 107   Male   Animated          5.59          5.23          5.52
## 107 108   Male   Animated          6.67          4.10          6.14
## 108 109   Male   Animated          5.82          5.71          5.66
## 109 110   Male   Animated          8.02          4.86          8.36
## 110 111   Male   Animated          5.97          6.70          6.50
## 111 112   Male   Animated          3.87          6.04          4.04
## 112 113   Male   Animated          5.15          5.03          5.47
## 113 114   Male   Animated          7.57          6.41          7.55
## 114 115   Male   Animated          4.86          6.28          4.58
## 115 116   Male   Animated          7.15          5.99          6.67
## 116 117   Male   Animated          6.91          6.33          6.40
```

```
## 117 118   Male   Animated          6.29          5.58         6.59
## 118 119   Male   Animated          7.18          5.60         6.83
## 119 120   Male   Animated          7.64          6.53         7.38
## 120 121   Male   Animated          8.14          6.46         7.71
## 121 122   Male   Animated          7.61          6.57         7.92
## 122 123   Male   Animated          5.46          6.81         5.49
## 123 124   Male   Animated          6.55          6.60         6.07
## 124 125   Male   Animated          7.52          5.69         8.06
## 125 126 Female   Animated          5.36          4.45         5.74
## 126 127 Female   Animated          6.34          5.80         5.80
## 127 128 Female   Animated          4.85          3.74         4.68
## 128 129 Female   Animated          5.44          4.56         5.08
## 129 130 Female   Animated          6.34          5.81         6.52
## 130 131 Female   Animated          3.65          2.08         3.35
## 131 132 Female   Animated          5.27          4.32         5.72
## 132 133 Female   Animated          6.56          6.12         6.28
## 133 134 Female   Animated          5.10          4.08         5.67
## 134 135 Female   Animated          6.17          5.57         6.46
## 135 136 Female   Animated          5.37          4.47         5.65
## 136 137 Female   Animated          4.97          3.92         5.45
## 137 138 Female   Animated          5.93          5.25         6.00
## 138 139 Female   Animated          5.15          4.16         4.96
## 139 140 Female   Animated          5.38          4.48         5.27
## 140 141 Female   Animated          6.82          6.48         6.94
## 141 142 Female   Animated          5.92          5.22         6.41
## 142 143 Female   Animated          5.83          5.11         5.50
## 143 144 Female   Animated          6.75          6.37         7.05
## 144 145 Female   Animated          6.16          5.56         6.13
## 145 146 Female   Animated          5.78          5.03         6.20
## 146 147 Female   Animated          6.94          6.64         7.49
## 147 148 Female   Animated          4.21          2.86         4.58
## 148 149 Female   Animated          5.39          4.50         5.96
## 149 150 Female   Animated          4.48          3.23         4.30
##     post_trial_or
## 1            6.51
## 2            6.45
## 3            4.13
## 4            5.19
## 5            5.04
## 6            4.25
## 7            4.87
## 8            6.54
## 9            5.57
## 10           5.70
## 11           5.50
## 12           5.71
## 13           7.04
## 14           4.97
## 15           5.94
## 16           5.46
## 17           4.38
## 18           7.08
## 19           4.88
## 20           6.81
```

```
## 21          5.70
## 22          5.02
## 23          3.55
## 24          5.41
## 25          5.77
## 26          4.69
## 27          6.95
## 28          4.47
## 29          4.99
## 30          7.14
## 31          5.59
## 32          4.17
## 33          5.53
## 34          3.65
## 35          6.72
## 36          4.20
## 37          5.17
## 38          4.68
## 39          5.78
## 40          4.66
## 41          6.16
## 42          4.28
## 43          7.26
## 44          4.81
## 45          6.09
## 46          4.84
## 47          4.69
## 48          4.68
## 49          4.79
## 50          7.24
## 51          5.55
## 52          4.49
## 53          6.13
## 54          4.50
## 55          5.04
## 56          5.80
## 57          5.42
## 58          5.24
## 59          6.12
## 60          6.71
## 61          4.58
## 62          4.38
## 63          6.45
## 64          7.29
## 65          5.63
## 66          5.42
## 67          5.97
## 68          6.89
## 69          5.91
## 70          4.69
## 71          4.99
## 72          5.46
## 73          4.30
## 74          5.77
```

```
## 75          5.32
## 76          5.62
## 77          3.44
## 78          5.24
## 79          4.25
## 80          7.64
## 81          5.61
## 82          5.25
## 83          2.71
## 84          5.09
## 85          5.51
## 86          5.47
## 87          6.36
## 88          3.40
## 89          6.52
## 90          3.73
## 91          4.15
## 92          3.13
## 93          7.07
## 94          5.77
## 95          2.47
## 96          3.95
## 97          4.62
## 98          6.25
## 99          5.92
## 100         5.31
## 101         5.81
## 102         4.15
## 103         6.43
## 104         4.83
## 105         5.42
## 106         5.21
## 107         4.27
## 108         5.47
## 109         5.04
## 110         6.46
## 111         6.19
## 112         4.94
## 113         6.62
## 114         6.31
## 115         6.20
## 116         6.50
## 117         5.34
## 118         5.61
## 119         6.50
## 120         6.31
## 121         6.59
## 122         6.64
## 123         6.67
## 124         5.44
## 125         4.37
## 126         5.67
## 127         3.69
## 128         4.61
```

```
## 129          5.79
## 130          1.90
## 131          4.08
## 132          6.04
## 133          4.09
## 134          5.77
## 135          4.38
## 136          3.83
## 137          5.45
## 138          4.19
## 139          4.50
## 140          6.60
## 141          5.27
## 142          4.86
## 143          6.55
## 144          5.61
## 145          5.03
## 146          6.58
## 147          2.62
## 148          4.57
## 149          3.16
```

Add Columns for Difference in Pre and Post values

```
data$cpss_diff <- data$pre_trial_cpss - data$post_trial_cpss
```

Self-Report Measures

```
data$or_diff <- data$pre_trial_or - data$post_trial_or
```

Observer-Rated Measures

```
data
```

Table with difference columns

```
##       X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1     1   Male     Static           6.70            6.48         7.23
## 2     2   Male     Static           5.54            6.31         5.06
## 3     3   Male     Static           6.30            4.35         6.75
## 4     4   Male     Static           5.71            5.30         5.61
## 5     5   Male     Static           4.01            4.93         3.74
## 6     6   Male     Static           6.24            4.46         6.61
## 7     7   Male     Static           5.19            4.79         5.46
```

```
## 8     8   Male     Static          5.21          6.58         4.75
## 9     9   Male     Static          6.31          5.67         6.24
## 10   10   Male     Static          6.44          5.55         6.54
## 11   11   Male     Static          6.95          5.37         6.75
## 12   12   Male     Static          6.13          5.51         6.56
## 13   13   Male     Static          5.43          7.13         5.37
## 14   14   Male     Static          6.20          5.22         6.43
## 15   15   Male     Static          7.60          5.81         7.39
## 16   16   Male     Static          6.77          5.41         7.25
## 17   17   Male     Static          7.14          4.44         7.14
## 18   18   Male     Static          4.87          6.88         4.35
## 19   19   Male     Static          6.14          4.75         5.74
## 20   20   Male     Static          7.54          6.92         8.06
## 21   21   Male     Static          5.27          5.80         4.75
## 22   22   Male     Static          5.56          5.14         5.98
## 23   23   Male     Static          8.02          3.55         8.30
## 24   24   Male     Static          6.42          5.64         6.51
## 25   25   Male     Static          6.48          5.52         6.64
## 26   26 Female     Static          5.60          4.79         5.62
## 27   27 Female     Static          7.29          7.13         6.95
## 28   28 Female     Static          5.52          4.67         5.48
## 29   29 Female     Static          5.64          4.84         5.29
## 30   30 Female     Static          7.47          7.38         7.45
## 31   31 Female     Static          6.19          5.60         6.59
## 32   32 Female     Static          5.09          4.08         5.55
## 33   33 Female     Static          6.29          5.74         6.27
## 34   34 Female     Static          4.71          3.55         4.20
## 35   35 Female     Static          7.10          6.86         7.43
## 36   36 Female     Static          5.04          4.01         5.13
## 37   37 Female     Static          5.87          5.16         5.88
## 38   38 Female     Static          5.55          4.72         5.94
## 39   39 Female     Static          6.25          5.68         5.80
## 40   40 Female     Static          5.54          4.70         5.12
## 41   41 Female     Static          6.43          5.93         6.53
## 42   42 Female     Static          5.07          4.04         5.01
## 43   43 Female     Static          7.42          7.30         7.25
## 44   44 Female     Static          5.79          5.04         5.99
## 45   45 Female     Static          6.46          5.98         6.41
## 46   46 Female     Static          5.46          4.60         5.66
## 47   47 Female     Static          5.54          4.70         5.66
## 48   48 Female     Static          5.40          4.51         5.90
## 49   49 Female     Static          5.77          5.02         5.63
## 50   50 Female     Static          7.52          7.44         7.37
## 51   51   Male    Control          6.99          5.40         7.25
## 52   52   Male    Control          8.01          4.32         8.38
## 53   53   Male    Control          5.32          6.00         5.13
## 54   54   Male    Control          6.46          4.69         7.01
## 55   55   Male    Control          6.11          4.89         6.07
## 56   56   Male    Control          7.10          5.67         6.75
## 57   57   Male    Control          7.62          5.63         8.14
## 58   58   Male    Control          6.75          5.02         6.75
## 59   59   Male    Control          4.98          6.22         5.38
## 60   60   Male    Control          7.56          6.69         7.81
## 61   61   Male    Control          6.74          4.69         7.30
```

```
## 62   62   Male    Control          7.63          4.56          7.44
## 63   63   Male    Control          4.68          6.41          5.19
## 64   64   Male    Control          5.78          7.06          5.86
## 65   65   Male    Control          6.01          5.71          6.11
## 66   66   Male    Control          6.86          5.64          6.48
## 67   67   Male    Control          6.13          6.09          6.24
## 68   68   Male    Control          5.87          6.73          6.36
## 69   69   Male    Control          5.52          5.96          5.00
## 70   70   Male    Control          6.01          4.79          6.45
## 71   71   Male    Control          4.70          5.03          5.03
## 72   72   Male    Control          8.08          5.53          7.84
## 73   74   Male    Control          5.12          4.47          5.26
## 74   75   Male    Control          6.38          5.65          5.90
## 75   76 Female    Control          6.00          5.34          6.47
## 76   77 Female    Control          6.16          5.56          6.48
## 77   78 Female    Control          4.51          3.28          5.04
## 78   79 Female    Control          6.11          5.49          5.65
## 79   80 Female    Control          5.11          4.11          4.90
## 80   81 Female    Control          7.70          7.69          7.98
## 81   82 Female    Control          6.24          5.67          6.48
## 82   83 Female    Control          5.80          5.06          5.91
## 83   84 Female    Control          4.24          2.90          4.03
## 84   85 Female    Control          5.86          5.14          5.87
## 85   86 Female    Control          6.00          5.34          6.36
## 86   87 Female    Control          6.02          5.36          5.86
## 87   88 Female    Control          6.56          6.11          7.12
## 88   89 Female    Control          4.73          3.58          4.98
## 89   90 Female    Control          6.81          6.46          7.29
## 90   91 Female    Control          4.74          3.59          4.88
## 91   92 Female    Control          5.31          4.38          4.86
## 92   93 Female    Control          4.47          3.22          4.43
## 93   94 Female    Control          7.31          7.15          6.80
## 94   95 Female    Control          6.40          5.89          6.54
## 95   96 Female    Control          4.00          2.57          4.02
## 96   97 Female    Control          5.17          4.18          5.13
## 97   98 Female    Control          5.31          4.39          5.40
## 98   99 Female    Control          6.59          6.15          6.83
## 99  100 Female    Control          6.57          6.13          7.03
## 100 101   Male   Animated          5.25          5.21          5.79
## 101 102   Male   Animated          5.73          5.63          6.14
## 102 103   Male   Animated          4.68          4.39          4.87
## 103 104   Male   Animated          5.12          6.54          5.52
## 104 105   Male   Animated          6.75          4.78          7.10
## 105 106   Male   Animated          7.11          5.22          7.04
## 106 107   Male   Animated          5.59          5.23          5.52
## 107 108   Male   Animated          6.67          4.10          6.14
## 108 109   Male   Animated          5.82          5.71          5.66
## 109 110   Male   Animated          8.02          4.86          8.36
## 110 111   Male   Animated          5.97          6.70          6.50
## 111 112   Male   Animated          3.87          6.04          4.04
## 112 113   Male   Animated          5.15          5.03          5.47
## 113 114   Male   Animated          7.57          6.41          7.55
## 114 115   Male   Animated          4.86          6.28          4.58
## 115 116   Male   Animated          7.15          5.99          6.67
```

```
## 116 117   Male   Animated          6.91           6.33        6.40
## 117 118   Male   Animated          6.29           5.58        6.59
## 118 119   Male   Animated          7.18           5.60        6.83
## 119 120   Male   Animated          7.64           6.53        7.38
## 120 121   Male   Animated          8.14           6.46        7.71
## 121 122   Male   Animated          7.61           6.57        7.92
## 122 123   Male   Animated          5.46           6.81        5.49
## 123 124   Male   Animated          6.55           6.60        6.07
## 124 125   Male   Animated          7.52           5.69        8.06
## 125 126 Female   Animated          5.36           4.45        5.74
## 126 127 Female   Animated          6.34           5.80        5.80
## 127 128 Female   Animated          4.85           3.74        4.68
## 128 129 Female   Animated          5.44           4.56        5.08
## 129 130 Female   Animated          6.34           5.81        6.52
## 130 131 Female   Animated          3.65           2.08        3.35
## 131 132 Female   Animated          5.27           4.32        5.72
## 132 133 Female   Animated          6.56           6.12        6.28
## 133 134 Female   Animated          5.10           4.08        5.67
## 134 135 Female   Animated          6.17           5.57        6.46
## 135 136 Female   Animated          5.37           4.47        5.65
## 136 137 Female   Animated          4.97           3.92        5.45
## 137 138 Female   Animated          5.93           5.25        6.00
## 138 139 Female   Animated          5.15           4.16        4.96
## 139 140 Female   Animated          5.38           4.48        5.27
## 140 141 Female   Animated          6.82           6.48        6.94
## 141 142 Female   Animated          5.92           5.22        6.41
## 142 143 Female   Animated          5.83           5.11        5.50
## 143 144 Female   Animated          6.75           6.37        7.05
## 144 145 Female   Animated          6.16           5.56        6.13
## 145 146 Female   Animated          5.78           5.03        6.20
## 146 147 Female   Animated          6.94           6.64        7.49
## 147 148 Female   Animated          4.21           2.86        4.58
## 148 149 Female   Animated          5.39           4.50        5.96
## 149 150 Female   Animated          4.48           3.23        4.30
##     post_trial_or cpss_diff or_diff
## 1            6.51      0.22    0.72
## 2            6.45     -0.77   -1.39
## 3            4.13      1.95    2.62
## 4            5.19      0.41    0.42
## 5            5.04     -0.92   -1.30
## 6            4.25      1.78    2.36
## 7            4.87      0.40    0.59
## 8            6.54     -1.37   -1.79
## 9            5.57      0.64    0.67
## 10           5.70      0.89    0.84
## 11           5.50      1.58    1.25
## 12           5.71      0.62    0.85
## 13           7.04     -1.70   -1.67
## 14           4.97      0.98    1.46
## 15           5.94      1.79    1.45
## 16           5.46      1.36    1.79
## 17           4.38      2.70    2.76
## 18           7.08     -2.01   -2.73
## 19           4.88      1.39    0.86
```

```
## 20          6.81      0.62    1.25
## 21          5.70     -0.53   -0.95
## 22          5.02      0.42    0.96
## 23          3.55      4.47    4.75
## 24          5.41      0.78    1.10
## 25          5.77      0.96    0.87
## 26          4.69      0.81    0.93
## 27          6.95      0.16    0.00
## 28          4.47      0.85    1.01
## 29          4.99      0.80    0.30
## 30          7.14      0.09    0.31
## 31          5.59      0.59    1.00
## 32          4.17      1.01    1.38
## 33          5.53      0.55    0.74
## 34          3.65      1.16    0.55
## 35          6.72      0.24    0.71
## 36          4.20      1.03    0.93
## 37          5.17      0.71    0.71
## 38          4.68      0.83    1.26
## 39          5.78      0.57    0.02
## 40          4.66      0.84    0.46
## 41          6.16      0.50    0.37
## 42          4.28      1.03    0.73
## 43          7.26      0.12   -0.01
## 44          4.81      0.75    1.18
## 45          6.09      0.48    0.32
## 46          4.84      0.86    0.82
## 47          4.69      0.84    0.97
## 48          4.68      0.89    1.22
## 49          4.79      0.75    0.84
## 50          7.24      0.08    0.13
## 51          5.55      1.59    1.70
## 52          4.49      3.69    3.89
## 53          6.13     -0.68   -1.00
## 54          4.50      1.77    2.51
## 55          5.04      1.22    1.03
## 56          5.80      1.43    0.95
## 57          5.42      1.99    2.72
## 58          5.24      1.73    1.51
## 59          6.12     -1.24   -0.74
## 60          6.71      0.87    1.10
## 61          4.58      2.05    2.72
## 62          4.38      3.07    3.06
## 63          6.45     -1.73   -1.26
## 64          7.29     -1.28   -1.43
## 65          5.63      0.30    0.48
## 66          5.42      1.22    1.06
## 67          5.97      0.04    0.27
## 68          6.89     -0.86   -0.53
## 69          5.91     -0.44   -0.91
## 70          4.69      1.22    1.76
## 71          4.99     -0.33    0.04
## 72          5.46      2.55    2.38
## 73          4.30      0.65    0.96
```

```
## 74          5.77      0.73    0.13
## 75          5.32      0.66    1.15
## 76          5.62      0.60    0.86
## 77          3.44      1.23    1.60
## 78          5.24      0.62    0.41
## 79          4.25      1.00    0.65
## 80          7.64      0.01    0.34
## 81          5.61      0.57    0.87
## 82          5.25      0.74    0.66
## 83          2.71      1.34    1.32
## 84          5.09      0.72    0.78
## 85          5.51      0.66    0.85
## 86          5.47      0.66    0.39
## 87          6.36      0.45    0.76
## 88          3.40      1.15    1.58
## 89          6.52      0.35    0.77
## 90          3.73      1.15    1.15
## 91          4.15      0.93    0.71
## 92          3.13      1.25    1.30
## 93          7.07      0.16   -0.27
## 94          5.77      0.51    0.77
## 95          2.47      1.43    1.55
## 96          3.95      0.99    1.18
## 97          4.62      0.92    0.78
## 98          6.25      0.44    0.58
## 99          5.92      0.44    1.11
## 100         5.31      0.04    0.48
## 101         5.81      0.10    0.33
## 102         4.15      0.29    0.72
## 103         6.43     -1.42   -0.91
## 104         4.83      1.97    2.27
## 105         5.42      1.89    1.62
## 106         5.21      0.36    0.31
## 107         4.27      2.57    1.87
## 108         5.47      0.11    0.19
## 109         5.04      3.16    3.32
## 110         6.46     -0.73    0.04
## 111         6.19     -2.17   -2.15
## 112         4.94      0.12    0.53
## 113         6.62      1.16    0.93
## 114         6.31     -1.42   -1.73
## 115         6.20      1.16    0.47
## 116         6.50      0.58   -0.10
## 117         5.34      0.71    1.25
## 118         5.61      1.58    1.22
## 119         6.50      1.11    0.88
## 120         6.31      1.68    1.40
## 121         6.59      1.04    1.33
## 122         6.64     -1.35   -1.15
## 123         6.67     -0.05   -0.60
## 124         5.44      1.83    2.62
## 125         4.37      0.91    1.37
## 126         5.67      0.54    0.13
## 127         3.69      1.11    0.99
```

```
## 128          4.61      0.88    0.47
## 129          5.79      0.53    0.73
## 130          1.90      1.57    1.45
## 131          4.08      0.95    1.64
## 132          6.04      0.44    0.24
## 133          4.09      1.02    1.58
## 134          5.77      0.60    0.69
## 135          4.38      0.90    1.27
## 136          3.83      1.05    1.62
## 137          5.45      0.68    0.55
## 138          4.19      0.99    0.77
## 139          4.50      0.90    0.77
## 140          6.60      0.34    0.34
## 141          5.27      0.70    1.14
## 142          4.86      0.72    0.64
## 143          6.55      0.38    0.50
## 144          5.61      0.60    0.52
## 145          5.03      0.75    1.17
## 146          6.58      0.30    0.91
## 147          2.62      1.35    1.96
## 148          4.57      0.89    1.39
## 149          3.16      1.25    1.14
```

Split Clean Data into Groups

The 150 patients are divided into 3 groups of 50 in the Raw Data. Each group had an equal number of male and female participants. In the cleaned data 1 record has been removed.

- Control (traditional CBT, no VR)
- Static (non-animated model content, VR)
- Animated (animated model contend, VR)

Control Group The control group has 1 less patient record after cleaning the data

```
control_group <- filter(data, test_group == "Control")
control_group
```

```
##      X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1   51   Male    Control           6.99            5.40         7.25
## 2   52   Male    Control           8.01            4.32         8.38
## 3   53   Male    Control           5.32            6.00         5.13
## 4   54   Male    Control           6.46            4.69         7.01
## 5   55   Male    Control           6.11            4.89         6.07
## 6   56   Male    Control           7.10            5.67         6.75
## 7   57   Male    Control           7.62            5.63         8.14
## 8   58   Male    Control           6.75            5.02         6.75
## 9   59   Male    Control           4.98            6.22         5.38
## 10  60   Male    Control           7.56            6.69         7.81
## 11  61   Male    Control           6.74            4.69         7.30
## 12  62   Male    Control           7.63            4.56         7.44
## 13  63   Male    Control           4.68            6.41         5.19
## 14  64   Male    Control           5.78            7.06         5.86
```

```
## 15  65   Male    Control          6.01           5.71         6.11
## 16  66   Male    Control          6.86           5.64         6.48
## 17  67   Male    Control          6.13           6.09         6.24
## 18  68   Male    Control          5.87           6.73         6.36
## 19  69   Male    Control          5.52           5.96         5.00
## 20  70   Male    Control          6.01           4.79         6.45
## 21  71   Male    Control          4.70           5.03         5.03
## 22  72   Male    Control          8.08           5.53         7.84
## 23  74   Male    Control          5.12           4.47         5.26
## 24  75   Male    Control          6.38           5.65         5.90
## 25  76 Female    Control          6.00           5.34         6.47
## 26  77 Female    Control          6.16           5.56         6.48
## 27  78 Female    Control          4.51           3.28         5.04
## 28  79 Female    Control          6.11           5.49         5.65
## 29  80 Female    Control          5.11           4.11         4.90
## 30  81 Female    Control          7.70           7.69         7.98
## 31  82 Female    Control          6.24           5.67         6.48
## 32  83 Female    Control          5.80           5.06         5.91
## 33  84 Female    Control          4.24           2.90         4.03
## 34  85 Female    Control          5.86           5.14         5.87
## 35  86 Female    Control          6.00           5.34         6.36
## 36  87 Female    Control          6.02           5.36         5.86
## 37  88 Female    Control          6.56           6.11         7.12
## 38  89 Female    Control          4.73           3.58         4.98
## 39  90 Female    Control          6.81           6.46         7.29
## 40  91 Female    Control          4.74           3.59         4.88
## 41  92 Female    Control          5.31           4.38         4.86
## 42  93 Female    Control          4.47           3.22         4.43
## 43  94 Female    Control          7.31           7.15         6.80
## 44  95 Female    Control          6.40           5.89         6.54
## 45  96 Female    Control          4.00           2.57         4.02
## 46  97 Female    Control          5.17           4.18         5.13
## 47  98 Female    Control          5.31           4.39         5.40
## 48  99 Female    Control          6.59           6.15         6.83
## 49 100 Female    Control          6.57           6.13         7.03
##    post_trial_or cpss_diff or_diff
## 1           5.55      1.59    1.70
## 2           4.49      3.69    3.89
## 3           6.13     -0.68   -1.00
## 4           4.50      1.77    2.51
## 5           5.04      1.22    1.03
## 6           5.80      1.43    0.95
## 7           5.42      1.99    2.72
## 8           5.24      1.73    1.51
## 9           6.12     -1.24   -0.74
## 10          6.71      0.87    1.10
## 11          4.58      2.05    2.72
## 12          4.38      3.07    3.06
## 13          6.45     -1.73   -1.26
## 14          7.29     -1.28   -1.43
## 15          5.63      0.30    0.48
## 16          5.42      1.22    1.06
## 17          5.97      0.04    0.27
## 18          6.89     -0.86   -0.53
```

```
## 19          5.91     -0.44   -0.91
## 20          4.69      1.22    1.76
## 21          4.99     -0.33    0.04
## 22          5.46      2.55    2.38
## 23          4.30      0.65    0.96
## 24          5.77      0.73    0.13
## 25          5.32      0.66    1.15
## 26          5.62      0.60    0.86
## 27          3.44      1.23    1.60
## 28          5.24      0.62    0.41
## 29          4.25      1.00    0.65
## 30          7.64      0.01    0.34
## 31          5.61      0.57    0.87
## 32          5.25      0.74    0.66
## 33          2.71      1.34    1.32
## 34          5.09      0.72    0.78
## 35          5.51      0.66    0.85
## 36          5.47      0.66    0.39
## 37          6.36      0.45    0.76
## 38          3.40      1.15    1.58
## 39          6.52      0.35    0.77
## 40          3.73      1.15    1.15
## 41          4.15      0.93    0.71
## 42          3.13      1.25    1.30
## 43          7.07      0.16   -0.27
## 44          5.77      0.51    0.77
## 45          2.47      1.43    1.55
## 46          3.95      0.99    1.18
## 47          4.62      0.92    0.78
## 48          6.25      0.44    0.58
## 49          5.92      0.44    1.11
```

```
static_group <- filter(data, test_group == "Static")
static_group
```

Static Group

```
##     X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1   1   Male     Static           6.70            6.48         7.23
## 2   2   Male     Static           5.54            6.31         5.06
## 3   3   Male     Static           6.30            4.35         6.75
## 4   4   Male     Static           5.71            5.30         5.61
## 5   5   Male     Static           4.01            4.93         3.74
## 6   6   Male     Static           6.24            4.46         6.61
## 7   7   Male     Static           5.19            4.79         5.46
## 8   8   Male     Static           5.21            6.58         4.75
## 9   9   Male     Static           6.31            5.67         6.24
## 10 10   Male     Static           6.44            5.55         6.54
## 11 11   Male     Static           6.95            5.37         6.75
## 12 12   Male     Static           6.13            5.51         6.56
## 13 13   Male     Static           5.43            7.13         5.37
```

```
## 14 14   Male     Static           6.20            5.22         6.43
## 15 15   Male     Static           7.60            5.81         7.39
## 16 16   Male     Static           6.77            5.41         7.25
## 17 17   Male     Static           7.14            4.44         7.14
## 18 18   Male     Static           4.87            6.88         4.35
## 19 19   Male     Static           6.14            4.75         5.74
## 20 20   Male     Static           7.54            6.92         8.06
## 21 21   Male     Static           5.27            5.80         4.75
## 22 22   Male     Static           5.56            5.14         5.98
## 23 23   Male     Static           8.02            3.55         8.30
## 24 24   Male     Static           6.42            5.64         6.51
## 25 25   Male     Static           6.48            5.52         6.64
## 26 26 Female     Static           5.60            4.79         5.62
## 27 27 Female     Static           7.29            7.13         6.95
## 28 28 Female     Static           5.52            4.67         5.48
## 29 29 Female     Static           5.64            4.84         5.29
## 30 30 Female     Static           7.47            7.38         7.45
## 31 31 Female     Static           6.19            5.60         6.59
## 32 32 Female     Static           5.09            4.08         5.55
## 33 33 Female     Static           6.29            5.74         6.27
## 34 34 Female     Static           4.71            3.55         4.20
## 35 35 Female     Static           7.10            6.86         7.43
## 36 36 Female     Static           5.04            4.01         5.13
## 37 37 Female     Static           5.87            5.16         5.88
## 38 38 Female     Static           5.55            4.72         5.94
## 39 39 Female     Static           6.25            5.68         5.80
## 40 40 Female     Static           5.54            4.70         5.12
## 41 41 Female     Static           6.43            5.93         6.53
## 42 42 Female     Static           5.07            4.04         5.01
## 43 43 Female     Static           7.42            7.30         7.25
## 44 44 Female     Static           5.79            5.04         5.99
## 45 45 Female     Static           6.46            5.98         6.41
## 46 46 Female     Static           5.46            4.60         5.66
## 47 47 Female     Static           5.54            4.70         5.66
## 48 48 Female     Static           5.40            4.51         5.90
## 49 49 Female     Static           5.77            5.02         5.63
## 50 50 Female     Static           7.52            7.44         7.37
##    post_trial_or cpss_diff or_diff
## 1           6.51      0.22    0.72
## 2           6.45     -0.77   -1.39
## 3           4.13      1.95    2.62
## 4           5.19      0.41    0.42
## 5           5.04     -0.92   -1.30
## 6           4.25      1.78    2.36
## 7           4.87      0.40    0.59
## 8           6.54     -1.37   -1.79
## 9           5.57      0.64    0.67
## 10          5.70      0.89    0.84
## 11          5.50      1.58    1.25
## 12          5.71      0.62    0.85
## 13          7.04     -1.70   -1.67
## 14          4.97      0.98    1.46
## 15          5.94      1.79    1.45
## 16          5.46      1.36    1.79
```

```
## 17          4.38      2.70    2.76
## 18          7.08     -2.01   -2.73
## 19          4.88      1.39    0.86
## 20          6.81      0.62    1.25
## 21          5.70     -0.53   -0.95
## 22          5.02      0.42    0.96
## 23          3.55      4.47    4.75
## 24          5.41      0.78    1.10
## 25          5.77      0.96    0.87
## 26          4.69      0.81    0.93
## 27          6.95      0.16    0.00
## 28          4.47      0.85    1.01
## 29          4.99      0.80    0.30
## 30          7.14      0.09    0.31
## 31          5.59      0.59    1.00
## 32          4.17      1.01    1.38
## 33          5.53      0.55    0.74
## 34          3.65      1.16    0.55
## 35          6.72      0.24    0.71
## 36          4.20      1.03    0.93
## 37          5.17      0.71    0.71
## 38          4.68      0.83    1.26
## 39          5.78      0.57    0.02
## 40          4.66      0.84    0.46
## 41          6.16      0.50    0.37
## 42          4.28      1.03    0.73
## 43          7.26      0.12   -0.01
## 44          4.81      0.75    1.18
## 45          6.09      0.48    0.32
## 46          4.84      0.86    0.82
## 47          4.69      0.84    0.97
## 48          4.68      0.89    1.22
## 49          4.79      0.75    0.84
## 50          7.24      0.08    0.13
```

```
animated_group <- filter(data, test_group == "Animated")
animated_group
```

Animated Group

```
##      X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1  101   Male   Animated           5.25            5.21         5.79
## 2  102   Male   Animated           5.73            5.63         6.14
## 3  103   Male   Animated           4.68            4.39         4.87
## 4  104   Male   Animated           5.12            6.54         5.52
## 5  105   Male   Animated           6.75            4.78         7.10
## 6  106   Male   Animated           7.11            5.22         7.04
## 7  107   Male   Animated           5.59            5.23         5.52
## 8  108   Male   Animated           6.67            4.10         6.14
## 9  109   Male   Animated           5.82            5.71         5.66
## 10 110   Male   Animated           8.02            4.86         8.36
```

```
## 11 111   Male   Animated          5.97           6.70         6.50
## 12 112   Male   Animated          3.87           6.04         4.04
## 13 113   Male   Animated          5.15           5.03         5.47
## 14 114   Male   Animated          7.57           6.41         7.55
## 15 115   Male   Animated          4.86           6.28         4.58
## 16 116   Male   Animated          7.15           5.99         6.67
## 17 117   Male   Animated          6.91           6.33         6.40
## 18 118   Male   Animated          6.29           5.58         6.59
## 19 119   Male   Animated          7.18           5.60         6.83
## 20 120   Male   Animated          7.64           6.53         7.38
## 21 121   Male   Animated          8.14           6.46         7.71
## 22 122   Male   Animated          7.61           6.57         7.92
## 23 123   Male   Animated          5.46           6.81         5.49
## 24 124   Male   Animated          6.55           6.60         6.07
## 25 125   Male   Animated          7.52           5.69         8.06
## 26 126 Female   Animated          5.36           4.45         5.74
## 27 127 Female   Animated          6.34           5.80         5.80
## 28 128 Female   Animated          4.85           3.74         4.68
## 29 129 Female   Animated          5.44           4.56         5.08
## 30 130 Female   Animated          6.34           5.81         6.52
## 31 131 Female   Animated          3.65           2.08         3.35
## 32 132 Female   Animated          5.27           4.32         5.72
## 33 133 Female   Animated          6.56           6.12         6.28
## 34 134 Female   Animated          5.10           4.08         5.67
## 35 135 Female   Animated          6.17           5.57         6.46
## 36 136 Female   Animated          5.37           4.47         5.65
## 37 137 Female   Animated          4.97           3.92         5.45
## 38 138 Female   Animated          5.93           5.25         6.00
## 39 139 Female   Animated          5.15           4.16         4.96
## 40 140 Female   Animated          5.38           4.48         5.27
## 41 141 Female   Animated          6.82           6.48         6.94
## 42 142 Female   Animated          5.92           5.22         6.41
## 43 143 Female   Animated          5.83           5.11         5.50
## 44 144 Female   Animated          6.75           6.37         7.05
## 45 145 Female   Animated          6.16           5.56         6.13
## 46 146 Female   Animated          5.78           5.03         6.20
## 47 147 Female   Animated          6.94           6.64         7.49
## 48 148 Female   Animated          4.21           2.86         4.58
## 49 149 Female   Animated          5.39           4.50         5.96
## 50 150 Female   Animated          4.48           3.23         4.30
##    post_trial_or cpss_diff or_diff
## 1           5.31      0.04    0.48
## 2           5.81      0.10    0.33
## 3           4.15      0.29    0.72
## 4           6.43     -1.42   -0.91
## 5           4.83      1.97    2.27
## 6           5.42      1.89    1.62
## 7           5.21      0.36    0.31
## 8           4.27      2.57    1.87
## 9           5.47      0.11    0.19
## 10          5.04      3.16    3.32
## 11          6.46     -0.73    0.04
## 12          6.19     -2.17   -2.15
## 13          4.94      0.12    0.53
```

```
## 14          6.62      1.16    0.93
## 15          6.31     -1.42   -1.73
## 16          6.20      1.16    0.47
## 17          6.50      0.58   -0.10
## 18          5.34      0.71    1.25
## 19          5.61      1.58    1.22
## 20          6.50      1.11    0.88
## 21          6.31      1.68    1.40
## 22          6.59      1.04    1.33
## 23          6.64     -1.35   -1.15
## 24          6.67     -0.05   -0.60
## 25          5.44      1.83    2.62
## 26          4.37      0.91    1.37
## 27          5.67      0.54    0.13
## 28          3.69      1.11    0.99
## 29          4.61      0.88    0.47
## 30          5.79      0.53    0.73
## 31          1.90      1.57    1.45
## 32          4.08      0.95    1.64
## 33          6.04      0.44    0.24
## 34          4.09      1.02    1.58
## 35          5.77      0.60    0.69
## 36          4.38      0.90    1.27
## 37          3.83      1.05    1.62
## 38          5.45      0.68    0.55
## 39          4.19      0.99    0.77
## 40          4.50      0.90    0.77
## 41          6.60      0.34    0.34
## 42          5.27      0.70    1.14
## 43          4.86      0.72    0.64
## 44          6.55      0.38    0.50
## 45          5.61      0.60    0.52
## 46          5.03      0.75    1.17
## 47          6.58      0.30    0.91
## 48          2.62      1.35    1.96
## 49          4.57      0.89    1.39
## 50          3.16      1.25    1.14
```

---

1. Frequency Distribution

1.1 Histograms Histograms for each group.

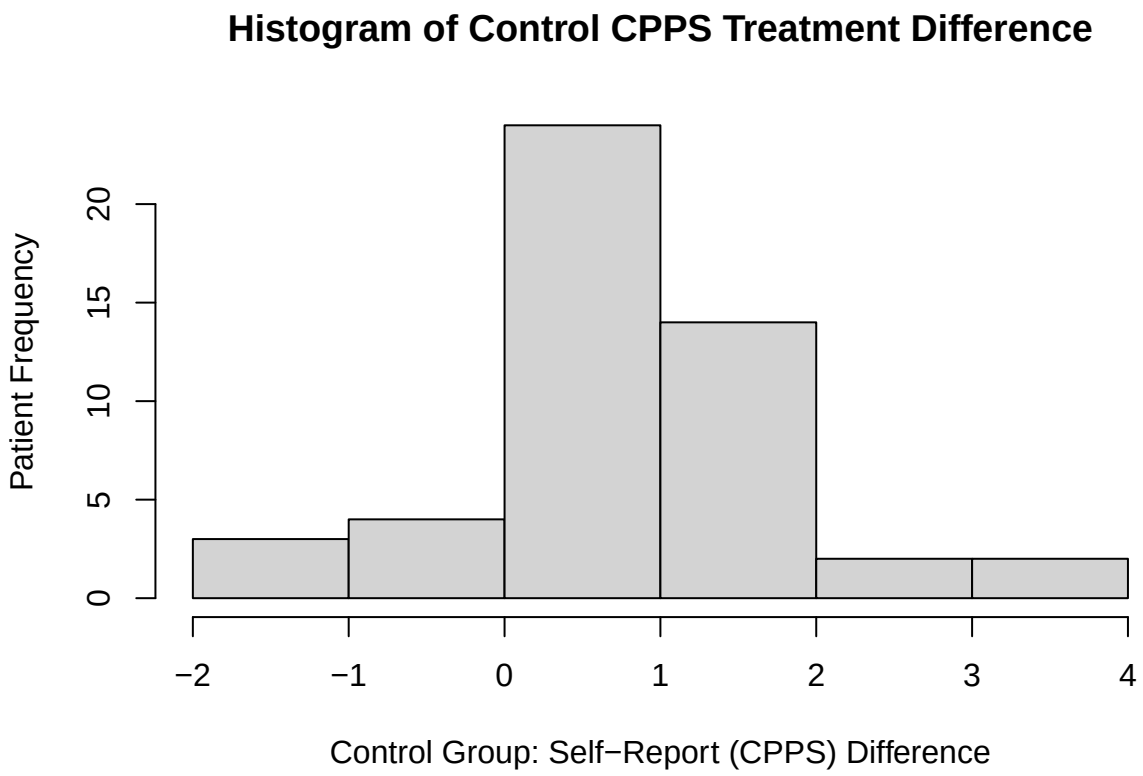
Control

```
mean_control_cpss <- mean(control_group$cpss_diff)
sd_control_cpss <- sd(control_group$cpss_diff)

# right skewed
```

```r
hist(control_group$cpss_diff,
     main="Histogram of Control CPPS Treatment Difference",
     xlab="Control Group: Self-Report (CPPS) Difference",
     ylab="Patient Frequency")
```

Histogram of Control Group Self-Report (CPPS) Treatment Difference between Start and End

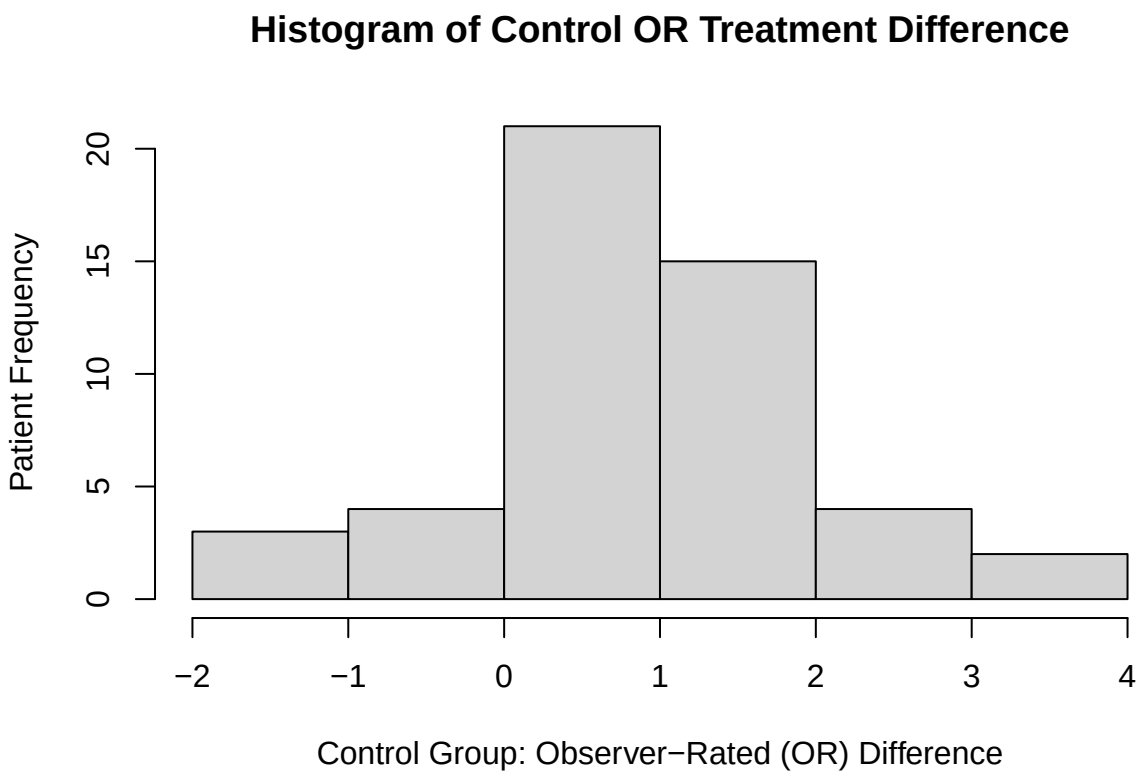



```r
# hist(rnorm(control_group, mean_control_cpss, sd_control_cpss))  # normal distibution (random sample v
```

```r
mean_control_or <- mean(control_group$or_diff)
sd_control_or <- sd(control_group$or_diff)

# symmetric? / right?
hist(control_group$or_diff,
     main="Histogram of Control OR Treatment Difference",
     xlab="Control Group: Observer-Rated (OR) Difference",
     ylab="Patient Frequency")
```

Histogram of Control Group Observer-Rated (OR) Treatment Difference between Start and



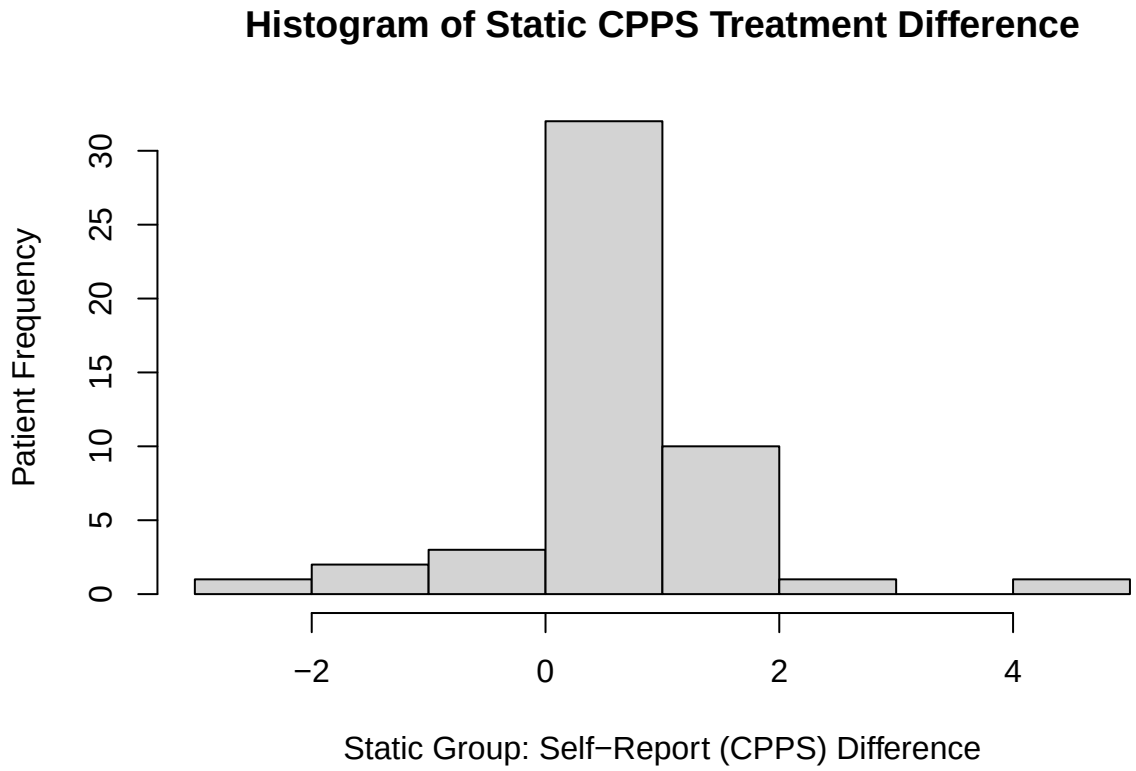
End

```
# hist(rnorm(control_group, mean_control_or, sd_control_or))
```

Static

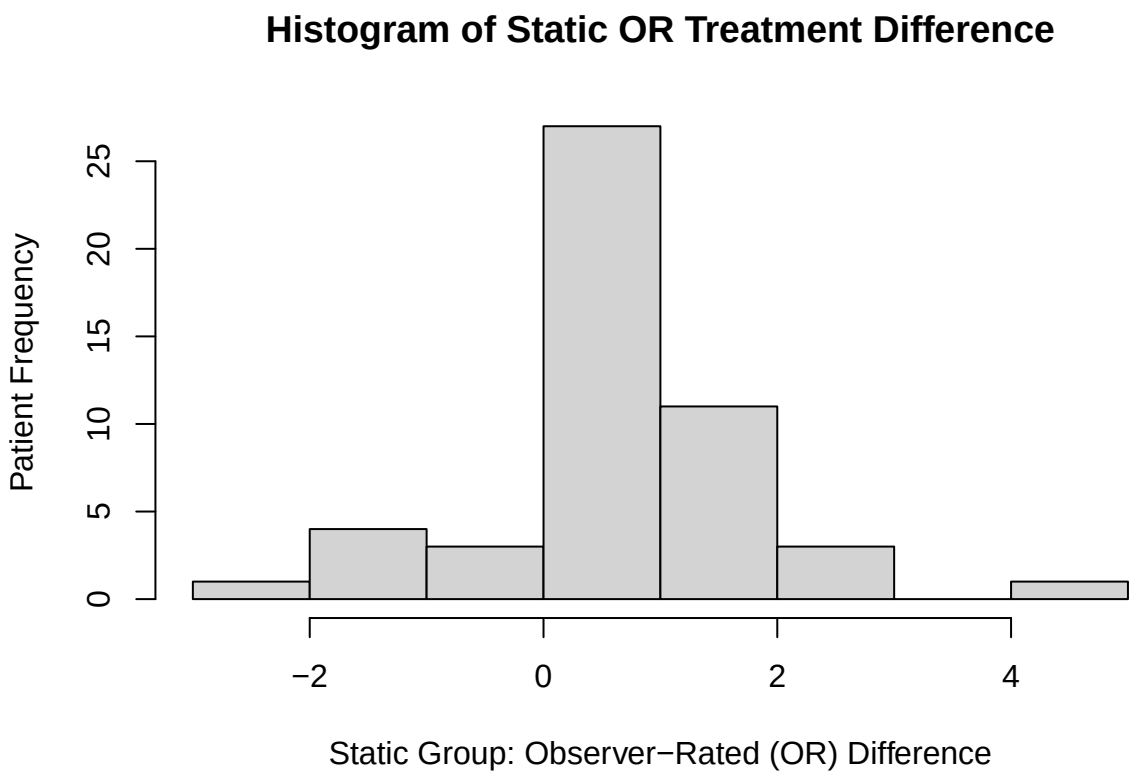
```
# left skewed (outliers on right)
hist(static_group$cpss_diff,
     main="Histogram of Static CPPS Treatment Difference",
     xlab="Static Group: Self-Report (CPPS) Difference",
     ylab="Patient Frequency")
```

Histogram of Static Group Self-Report (CPPS) Treatment Difference between Start and End




```
hist(static_group$or_diff,
     main="Histogram of Static OR Treatment Difference",
     xlab="Static Group: Observer-Rated (OR) Difference",
     ylab="Patient Frequency")
```

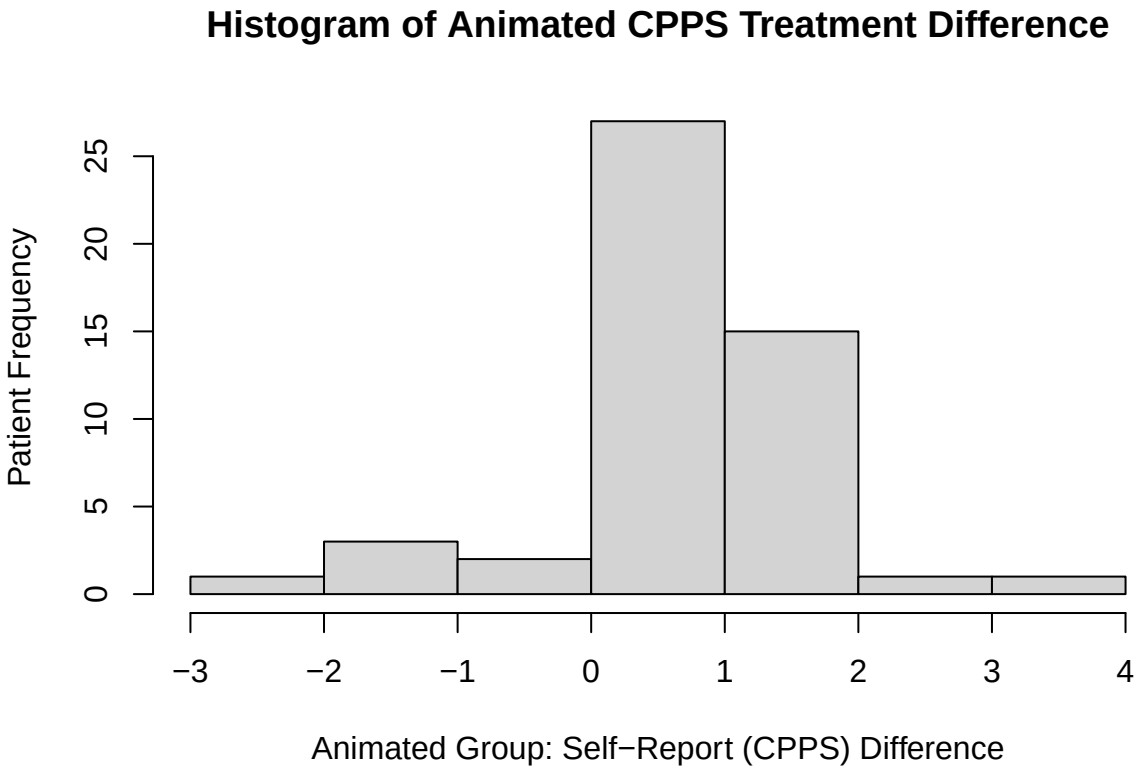
Histogram of Static Group Observer-Rated (OR) Treatment Difference between Start and End



Animated

```
# left skewed
hist(animated_group$cpss_diff,
     main="Histogram of Animated CPPS Treatment Difference",
     xlab="Animated Group: Self-Report (CPPS) Difference",
     ylab="Patient Frequency")
```

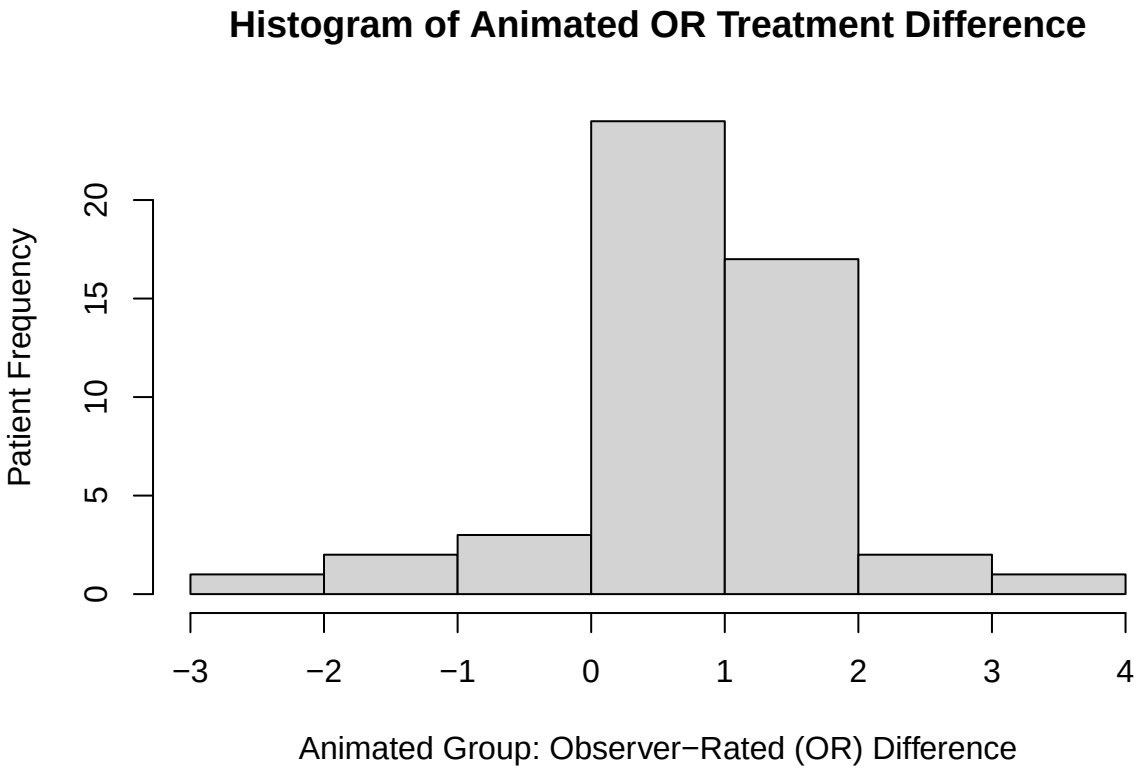
Histogram of Animated Group Self-Report (CPPS) Treatment Difference between Start and



End

```
# left skewed
hist(animated_group$or_diff,
     main="Histogram of Animated OR Treatment Difference",
     xlab="Animated Group: Observer-Rated (OR) Difference",
     ylab="Patient Frequency")
```

Histogram of Animated Group Observer-Rated (OR) Treatment Difference between Start and



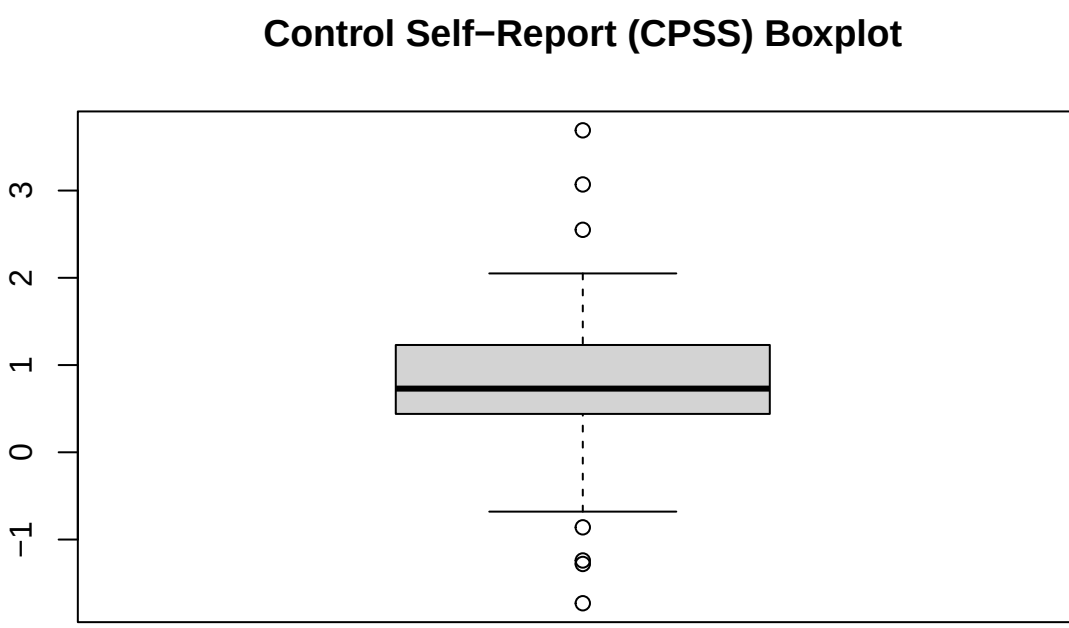
End

1.2 Boxplots Boxplots of each groups treatment difference between Start and End.

Outside the boxplot whiskers, outliers are visible for all groups and for both measurement methods.

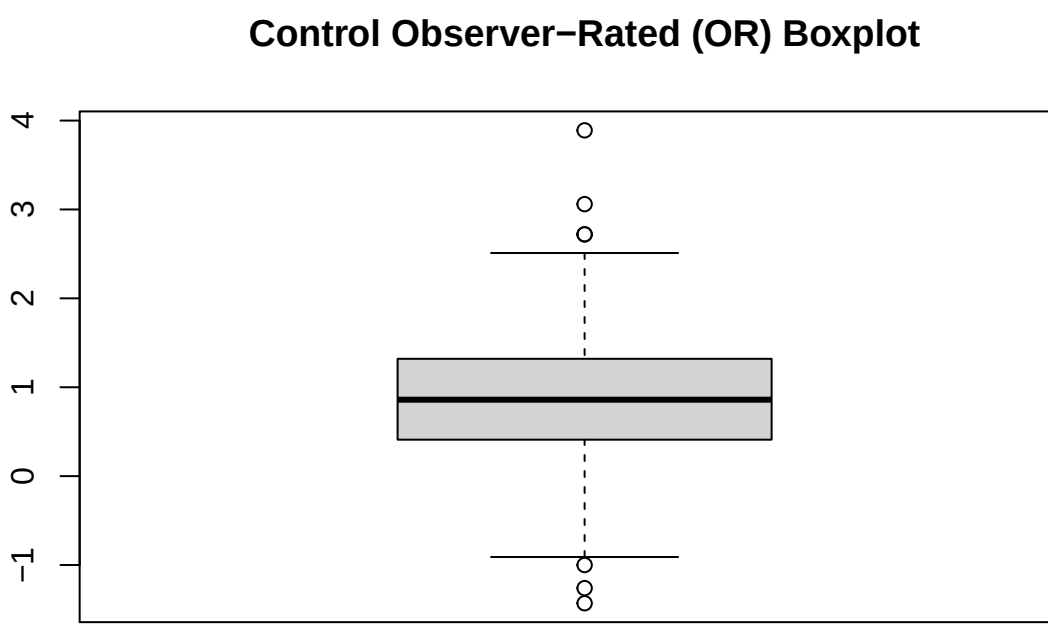
Control Group For the control group, outliers are visible for the whole group for both Self-Report and Observer-Rated measurements. When data is divided into Male and Female, outliers are visible only for Female Observer-Rated.

```
boxplot(control_group$cpss_diff,
        main="Control Self-Report (CPSS) Boxplot")
```



Self-Report (CPPS)

```
boxplot(control_group$or_diff,
        main="Control Observer-Rated (OR) Boxplot")
```



Observer-Rated (OR)

```
control_male <- filter(control_group, gender == "Male")
control_male
```

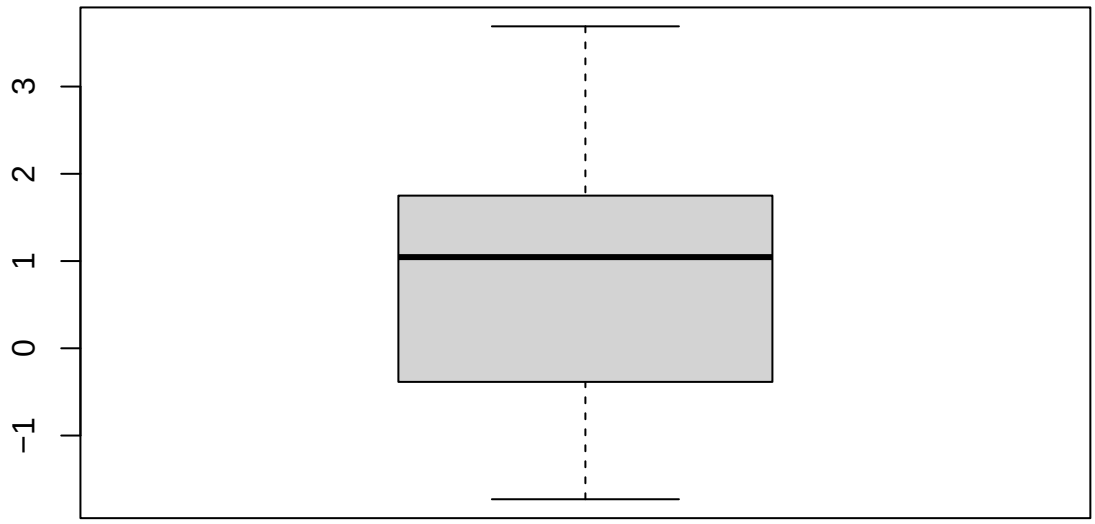
Control - Male

```
##     X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1  51   Male    Control           6.99            5.40         7.25
## 2  52   Male    Control           8.01            4.32         8.38
## 3  53   Male    Control           5.32            6.00         5.13
## 4  54   Male    Control           6.46            4.69         7.01
## 5  55   Male    Control           6.11            4.89         6.07
## 6  56   Male    Control           7.10            5.67         6.75
## 7  57   Male    Control           7.62            5.63         8.14
## 8  58   Male    Control           6.75            5.02         6.75
## 9  59   Male    Control           4.98            6.22         5.38
## 10 60   Male    Control           7.56            6.69         7.81
## 11 61   Male    Control           6.74            4.69         7.30
## 12 62   Male    Control           7.63            4.56         7.44
## 13 63   Male    Control           4.68            6.41         5.19
## 14 64   Male    Control           5.78            7.06         5.86
## 15 65   Male    Control           6.01            5.71         6.11
## 16 66   Male    Control           6.86            5.64         6.48
## 17 67   Male    Control           6.13            6.09         6.24
```

```
## 18 68   Male    Control           5.87            6.73         6.36
## 19 69   Male    Control           5.52            5.96         5.00
## 20 70   Male    Control           6.01            4.79         6.45
## 21 71   Male    Control           4.70            5.03         5.03
## 22 72   Male    Control           8.08            5.53         7.84
## 23 74   Male    Control           5.12            4.47         5.26
## 24 75   Male    Control           6.38            5.65         5.90
##    post_trial_or cpss_diff or_diff
## 1           5.55      1.59    1.70
## 2           4.49      3.69    3.89
## 3           6.13     -0.68   -1.00
## 4           4.50      1.77    2.51
## 5           5.04      1.22    1.03
## 6           5.80      1.43    0.95
## 7           5.42      1.99    2.72
## 8           5.24      1.73    1.51
## 9           6.12     -1.24   -0.74
## 10          6.71      0.87    1.10
## 11          4.58      2.05    2.72
## 12          4.38      3.07    3.06
## 13          6.45     -1.73   -1.26
## 14          7.29     -1.28   -1.43
## 15          5.63      0.30    0.48
## 16          5.42      1.22    1.06
## 17          5.97      0.04    0.27
## 18          6.89     -0.86   -0.53
## 19          5.91     -0.44   -0.91
## 20          4.69      1.22    1.76
## 21          4.99     -0.33    0.04
## 22          5.46      2.55    2.38
## 23          4.30      0.65    0.96
## 24          5.77      0.73    0.13
```

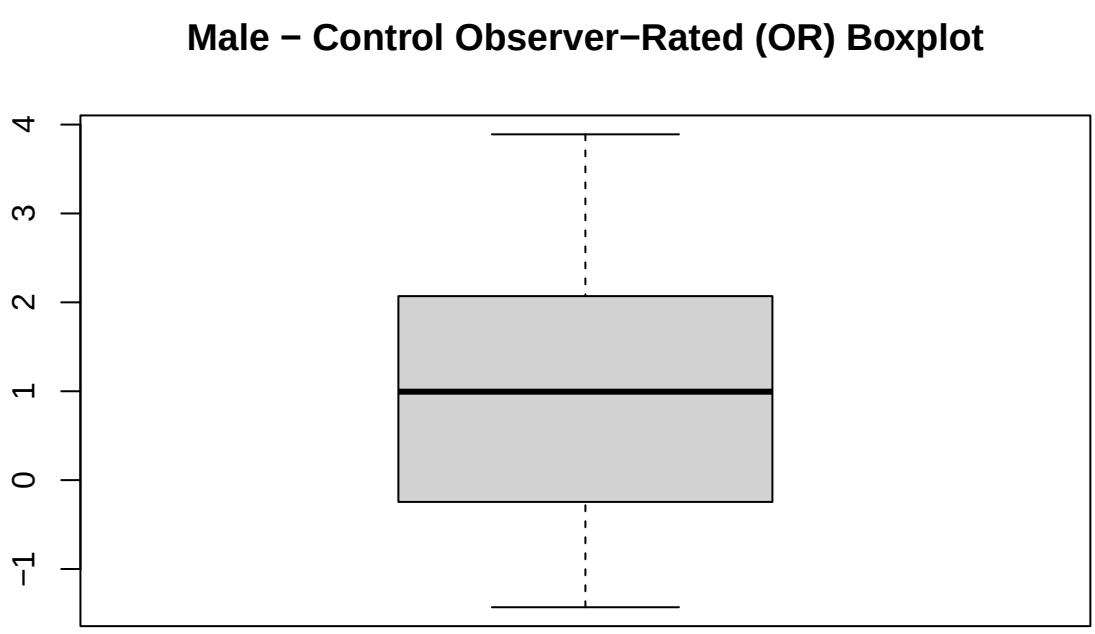
Control Male - Self-Report (CPPS)

```
boxplot(control_male$cpss_diff,
        main="Male - Control Self-Report (CPSS) Boxplot")
```



Control Male - Observer-Rated (OR)

```
boxplot(control_male$or_diff,
        main="Male - Control Observer-Rated (OR) Boxplot")
```




```
control_female <- filter(control_group, gender == "Female")
control_female
```

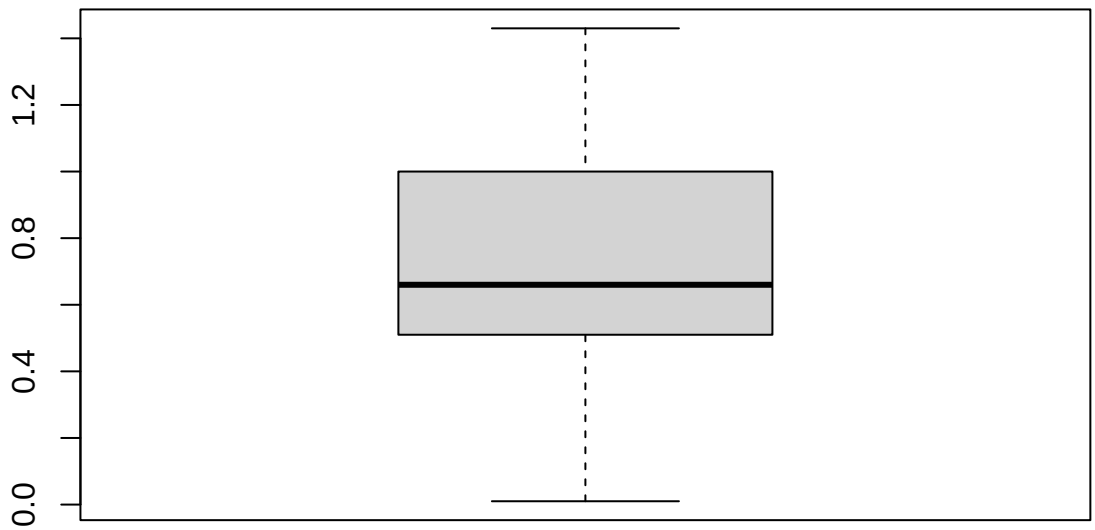
Control - Female

```
##      X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1   76 Female    Control           6.00            5.34         6.47
## 2   77 Female    Control           6.16            5.56         6.48
## 3   78 Female    Control           4.51            3.28         5.04
## 4   79 Female    Control           6.11            5.49         5.65
## 5   80 Female    Control           5.11            4.11         4.90
## 6   81 Female    Control           7.70            7.69         7.98
## 7   82 Female    Control           6.24            5.67         6.48
## 8   83 Female    Control           5.80            5.06         5.91
## 9   84 Female    Control           4.24            2.90         4.03
## 10  85 Female    Control           5.86            5.14         5.87
## 11  86 Female    Control           6.00            5.34         6.36
## 12  87 Female    Control           6.02            5.36         5.86
## 13  88 Female    Control           6.56            6.11         7.12
## 14  89 Female    Control           4.73            3.58         4.98
## 15  90 Female    Control           6.81            6.46         7.29
## 16  91 Female    Control           4.74            3.59         4.88
## 17  92 Female    Control           5.31            4.38         4.86
```

```
## 18  93 Female    Control           4.47            3.22         4.43
## 19  94 Female    Control           7.31            7.15         6.80
## 20  95 Female    Control           6.40            5.89         6.54
## 21  96 Female    Control           4.00            2.57         4.02
## 22  97 Female    Control           5.17            4.18         5.13
## 23  98 Female    Control           5.31            4.39         5.40
## 24  99 Female    Control           6.59            6.15         6.83
## 25 100 Female    Control           6.57            6.13         7.03
##    post_trial_or cpss_diff or_diff
## 1           5.32      0.66    1.15
## 2           5.62      0.60    0.86
## 3           3.44      1.23    1.60
## 4           5.24      0.62    0.41
## 5           4.25      1.00    0.65
## 6           7.64      0.01    0.34
## 7           5.61      0.57    0.87
## 8           5.25      0.74    0.66
## 9           2.71      1.34    1.32
## 10          5.09      0.72    0.78
## 11          5.51      0.66    0.85
## 12          5.47      0.66    0.39
## 13          6.36      0.45    0.76
## 14          3.40      1.15    1.58
## 15          6.52      0.35    0.77
## 16          3.73      1.15    1.15
## 17          4.15      0.93    0.71
## 18          3.13      1.25    1.30
## 19          7.07      0.16   -0.27
## 20          5.77      0.51    0.77
## 21          2.47      1.43    1.55
## 22          3.95      0.99    1.18
## 23          4.62      0.92    0.78
## 24          6.25      0.44    0.58
## 25          5.92      0.44    1.11
```

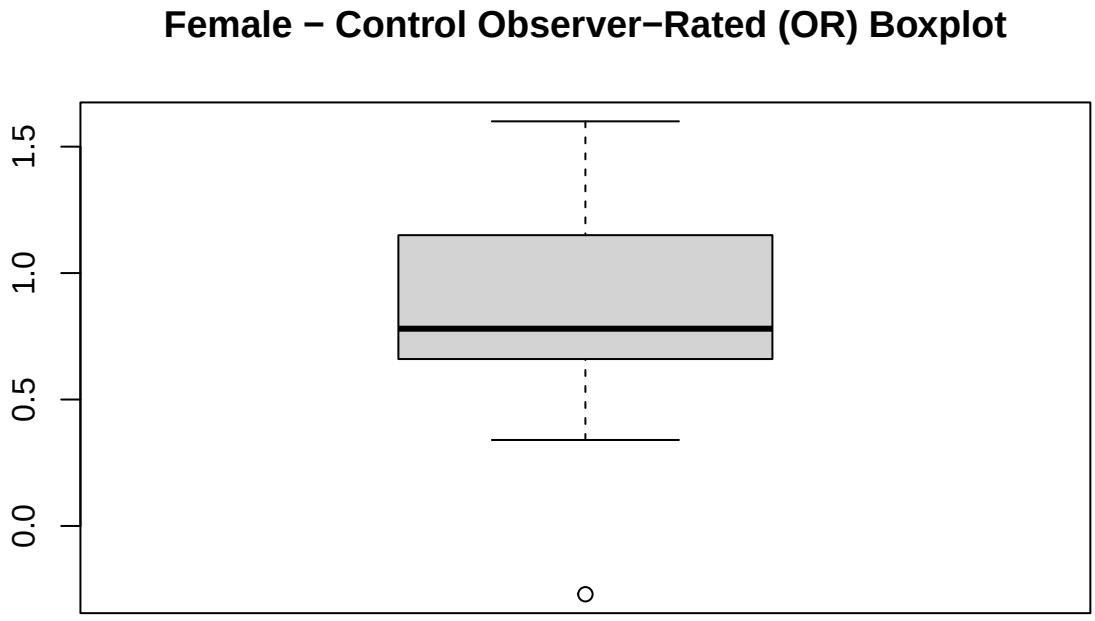
Control Female - Self-Report (CPPS)

```
boxplot(control_female$cpss_diff,
        main="Female - Control Self-Report (CPSS) Boxplot")
```



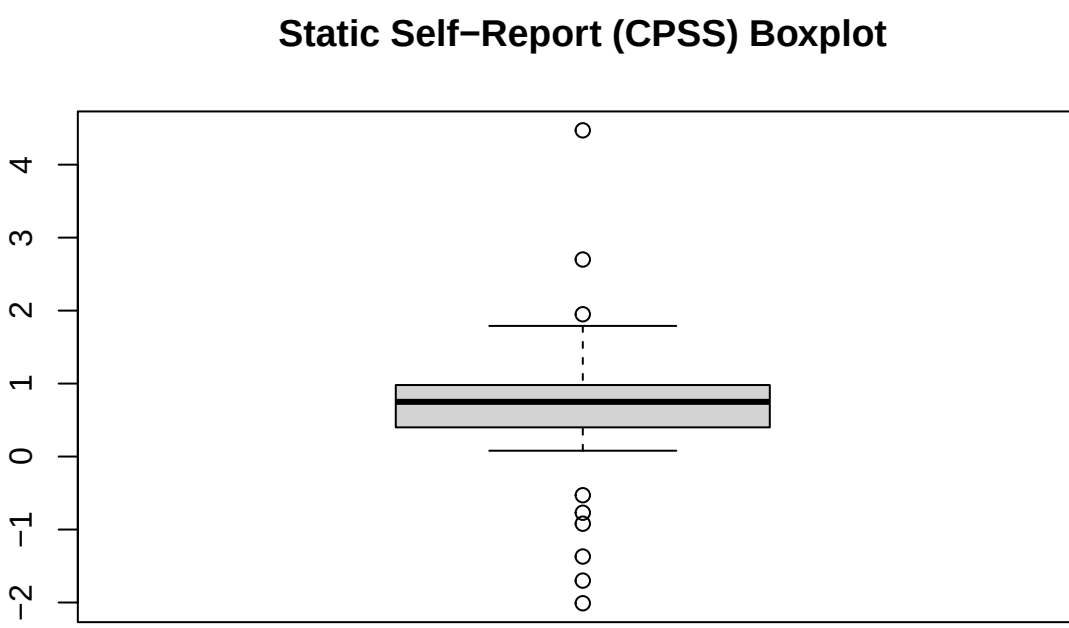
Control Female - Observer-Rated (OR)

```
boxplot(control_female$or_diff,
        main="Female - Control Observer-Rated (OR) Boxplot")
```



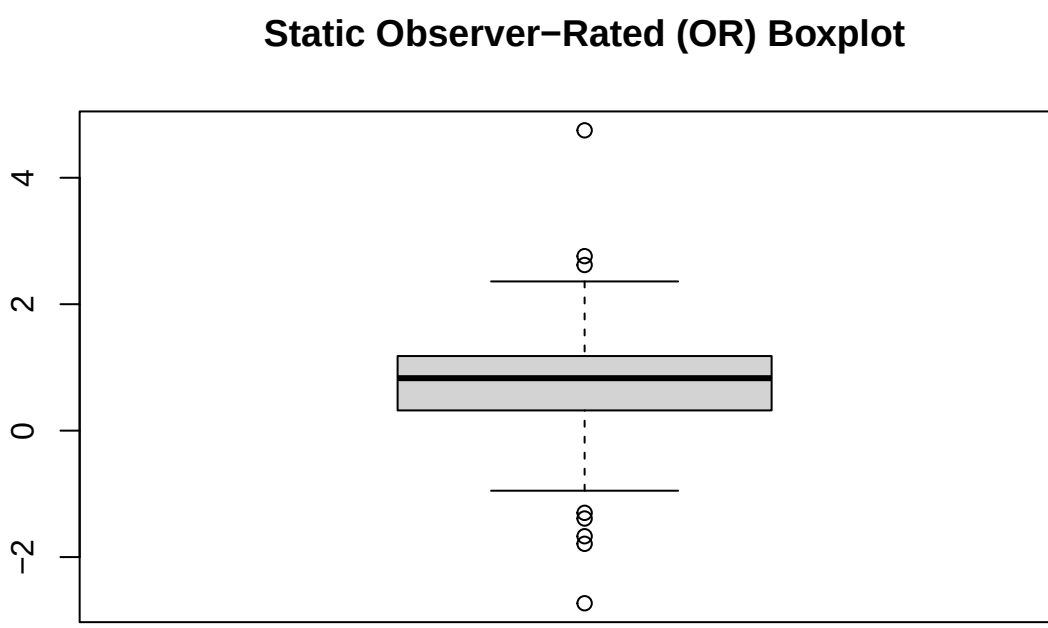
Static Group For the static group, outliers are visible for the whole group for both Self-Report and Observer-Rated measurements. When data is divided into Male and Female, outliers are visible only for male measurements, and in both Self-Report and Observer-Rated measurements.

```
boxplot(static_group$cpss_diff,
        main="Static Self-Report (CPSS) Boxplot")
```



Self-Report (CPPS)

```
boxplot(static_group$or_diff,
        main="Static Observer-Rated (OR) Boxplot")
```



Observer-Rated (OR)

Static Group Male Outliers are visible for both male measurement methods.

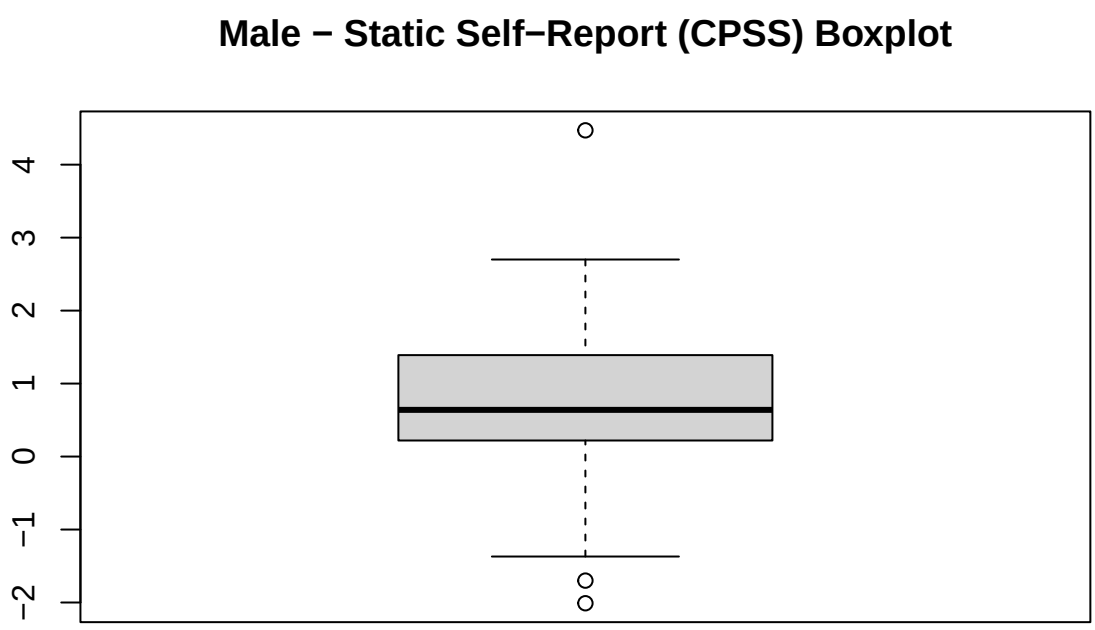
```
static_male <- filter(static_group, gender == "Male")
static_male
```

```
##     X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1   1   Male     Static           6.70            6.48         7.23
## 2   2   Male     Static           5.54            6.31         5.06
## 3   3   Male     Static           6.30            4.35         6.75
## 4   4   Male     Static           5.71            5.30         5.61
## 5   5   Male     Static           4.01            4.93         3.74
## 6   6   Male     Static           6.24            4.46         6.61
## 7   7   Male     Static           5.19            4.79         5.46
## 8   8   Male     Static           5.21            6.58         4.75
## 9   9   Male     Static           6.31            5.67         6.24
## 10 10   Male     Static           6.44            5.55         6.54
## 11 11   Male     Static           6.95            5.37         6.75
## 12 12   Male     Static           6.13            5.51         6.56
## 13 13   Male     Static           5.43            7.13         5.37
## 14 14   Male     Static           6.20            5.22         6.43
## 15 15   Male     Static           7.60            5.81         7.39
## 16 16   Male     Static           6.77            5.41         7.25
```

```
## 17 17   Male     Static           7.14            4.44         7.14
## 18 18   Male     Static           4.87            6.88         4.35
## 19 19   Male     Static           6.14            4.75         5.74
## 20 20   Male     Static           7.54            6.92         8.06
## 21 21   Male     Static           5.27            5.80         4.75
## 22 22   Male     Static           5.56            5.14         5.98
## 23 23   Male     Static           8.02            3.55         8.30
## 24 24   Male     Static           6.42            5.64         6.51
## 25 25   Male     Static           6.48            5.52         6.64
##    post_trial_or cpss_diff or_diff
## 1           6.51      0.22    0.72
## 2           6.45     -0.77   -1.39
## 3           4.13      1.95    2.62
## 4           5.19      0.41    0.42
## 5           5.04     -0.92   -1.30
## 6           4.25      1.78    2.36
## 7           4.87      0.40    0.59
## 8           6.54     -1.37   -1.79
## 9           5.57      0.64    0.67
## 10          5.70      0.89    0.84
## 11          5.50      1.58    1.25
## 12          5.71      0.62    0.85
## 13          7.04     -1.70   -1.67
## 14          4.97      0.98    1.46
## 15          5.94      1.79    1.45
## 16          5.46      1.36    1.79
## 17          4.38      2.70    2.76
## 18          7.08     -2.01   -2.73
## 19          4.88      1.39    0.86
## 20          6.81      0.62    1.25
## 21          5.70     -0.53   -0.95
## 22          5.02      0.42    0.96
## 23          3.55      4.47    4.75
## 24          5.41      0.78    1.10
## 25          5.77      0.96    0.87
```

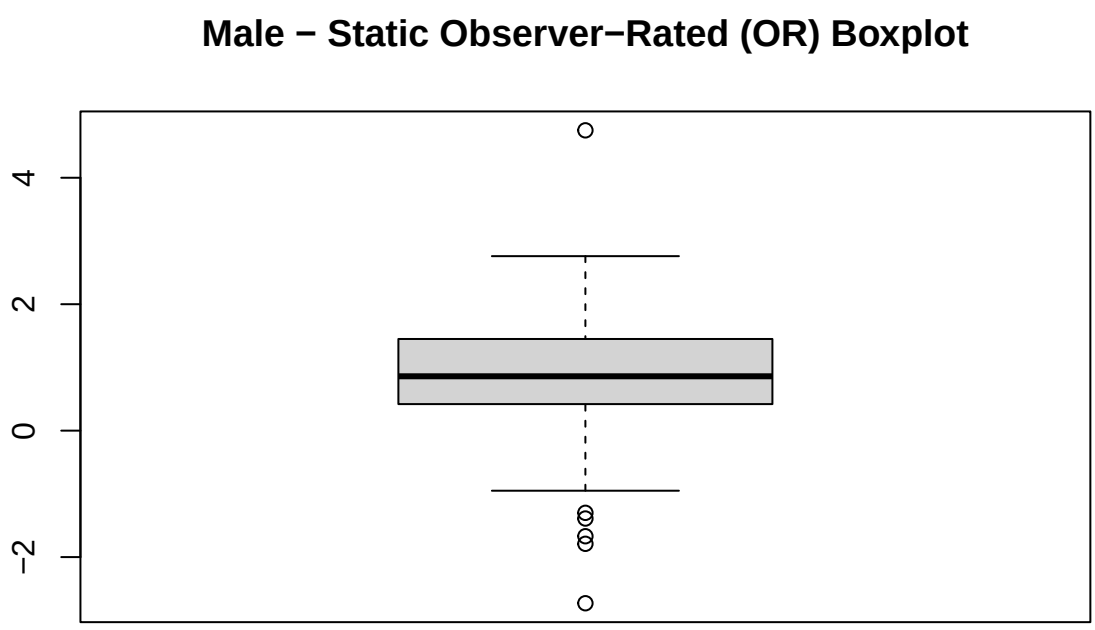
Static Male - Self-Report (CPPS)

```
boxplot(static_male$cpss_diff,
        main="Male - Static Self-Report (CPSS) Boxplot")
```



Static Male - Observer-Rated (OR)

```
boxplot(static_male$or_diff,
        main="Male - Static Observer-Rated (OR) Boxplot")
```



Static Group Female No outliers are visible for female measurement methods.

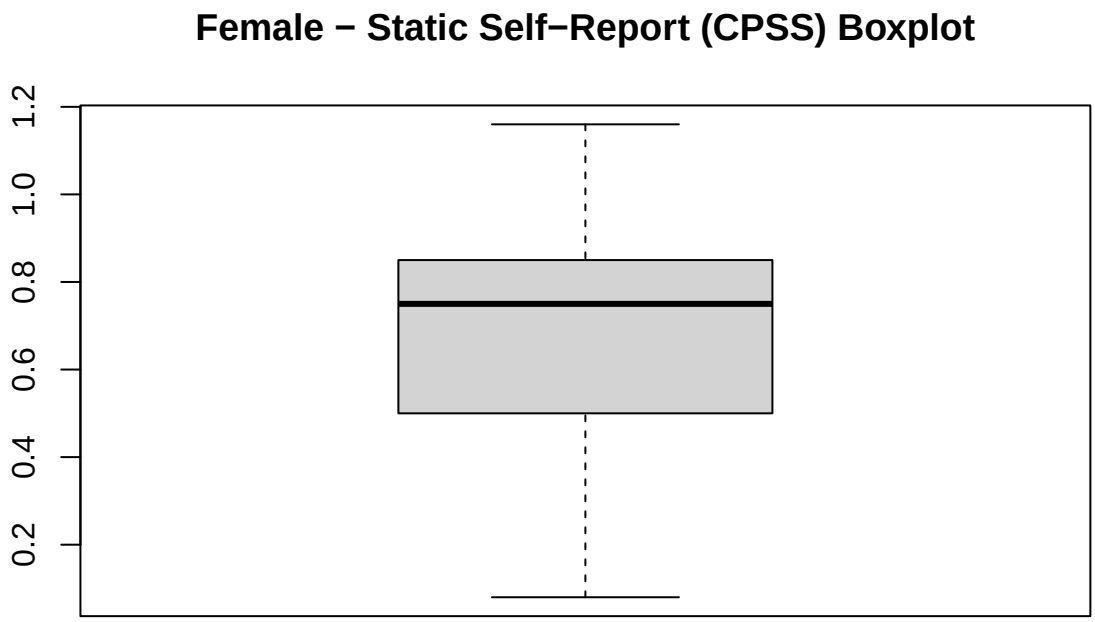
```
static_female <- filter(static_group, gender == "Female")
static_female
```

```
##     X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1  26 Female     Static           5.60            4.79         5.62
## 2  27 Female     Static           7.29            7.13         6.95
## 3  28 Female     Static           5.52            4.67         5.48
## 4  29 Female     Static           5.64            4.84         5.29
## 5  30 Female     Static           7.47            7.38         7.45
## 6  31 Female     Static           6.19            5.60         6.59
## 7  32 Female     Static           5.09            4.08         5.55
## 8  33 Female     Static           6.29            5.74         6.27
## 9  34 Female     Static           4.71            3.55         4.20
## 10 35 Female     Static           7.10            6.86         7.43
## 11 36 Female     Static           5.04            4.01         5.13
## 12 37 Female     Static           5.87            5.16         5.88
## 13 38 Female     Static           5.55            4.72         5.94
## 14 39 Female     Static           6.25            5.68         5.80
## 15 40 Female     Static           5.54            4.70         5.12
## 16 41 Female     Static           6.43            5.93         6.53
```

```
## 17 42 Female     Static           5.07            4.04         5.01
## 18 43 Female     Static           7.42            7.30         7.25
## 19 44 Female     Static           5.79            5.04         5.99
## 20 45 Female     Static           6.46            5.98         6.41
## 21 46 Female     Static           5.46            4.60         5.66
## 22 47 Female     Static           5.54            4.70         5.66
## 23 48 Female     Static           5.40            4.51         5.90
## 24 49 Female     Static           5.77            5.02         5.63
## 25 50 Female     Static           7.52            7.44         7.37
##    post_trial_or cpss_diff or_diff
## 1           4.69      0.81    0.93
## 2           6.95      0.16    0.00
## 3           4.47      0.85    1.01
## 4           4.99      0.80    0.30
## 5           7.14      0.09    0.31
## 6           5.59      0.59    1.00
## 7           4.17      1.01    1.38
## 8           5.53      0.55    0.74
## 9           3.65      1.16    0.55
## 10          6.72      0.24    0.71
## 11          4.20      1.03    0.93
## 12          5.17      0.71    0.71
## 13          4.68      0.83    1.26
## 14          5.78      0.57    0.02
## 15          4.66      0.84    0.46
## 16          6.16      0.50    0.37
## 17          4.28      1.03    0.73
## 18          7.26      0.12   -0.01
## 19          4.81      0.75    1.18
## 20          6.09      0.48    0.32
## 21          4.84      0.86    0.82
## 22          4.69      0.84    0.97
## 23          4.68      0.89    1.22
## 24          4.79      0.75    0.84
## 25          7.24      0.08    0.13
```

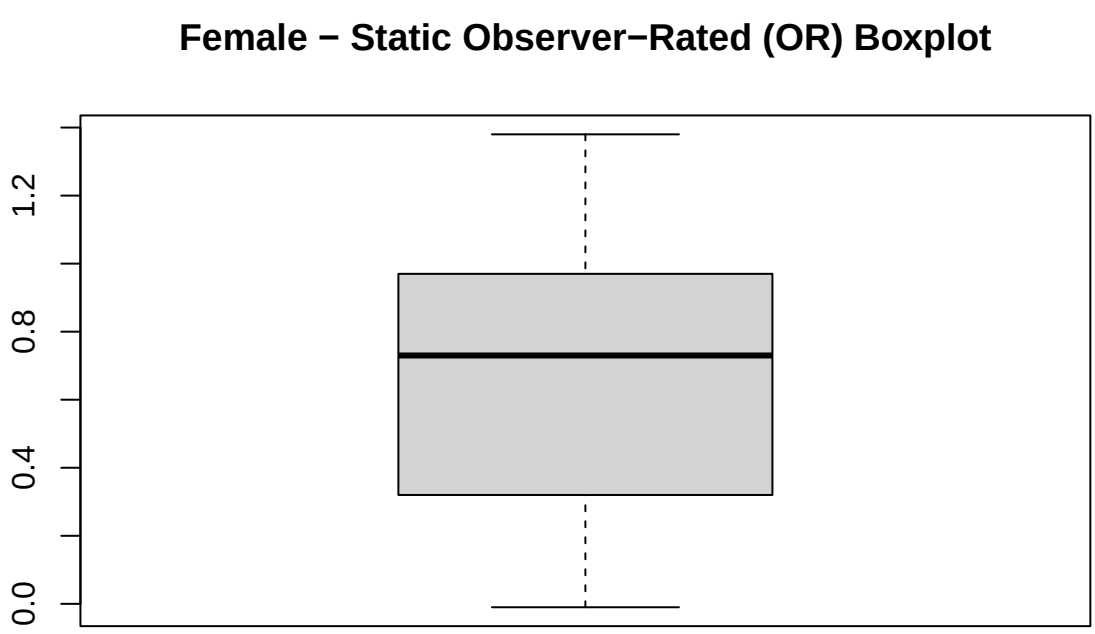
Static Female - Self-Report (CPPS)

```
boxplot(static_female$cpss_diff,
        main="Female - Static Self-Report (CPSS) Boxplot")
```



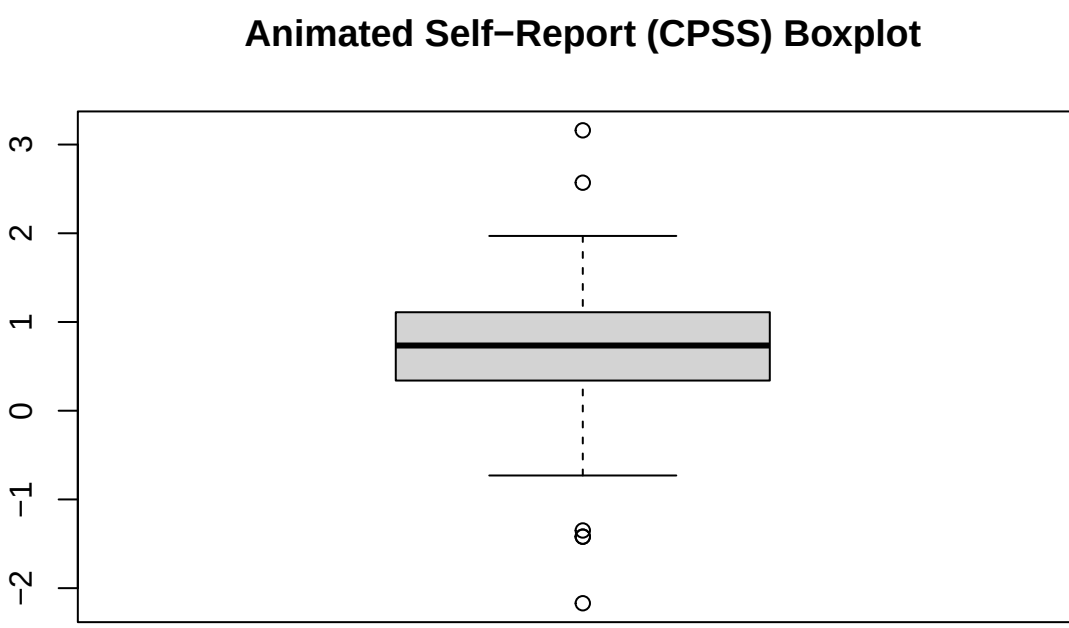
Static Female - Observer-Rated (OR)

```
boxplot(static_female$or_diff,
        main="Female - Static Observer-Rated (OR) Boxplot")
```



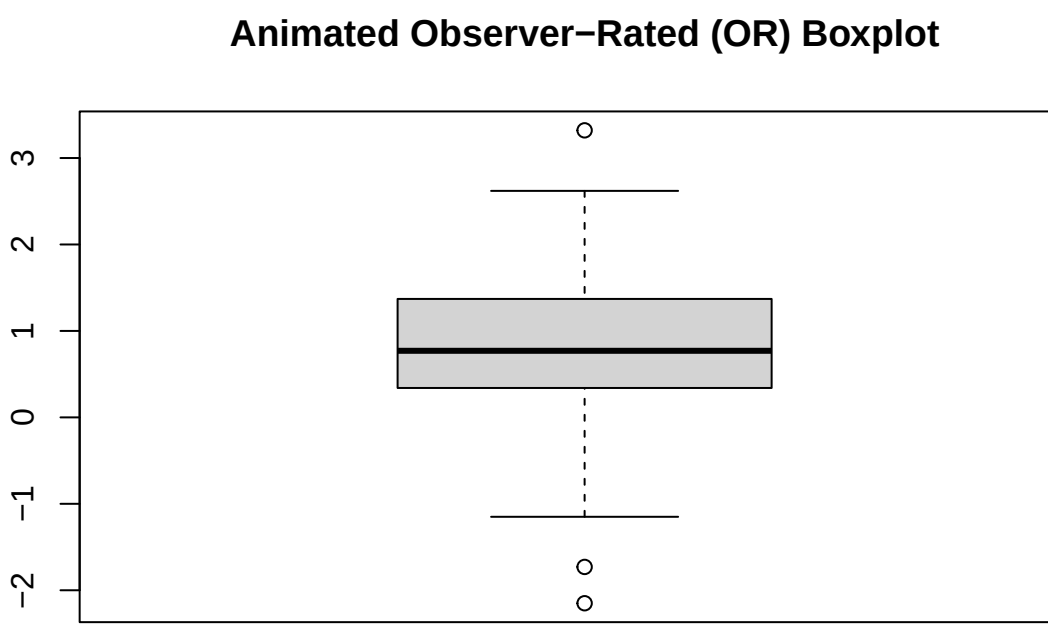
Animated Group For the animated group, outliers are visible for the whole group for both Self-Report and Observer-Rated measurements. When data is divided into Male and Female, outliers are visible for male Observer-Rated measurements only.

```
boxplot(animated_group$cpss_diff,
        main="Animated Self-Report (CPSS) Boxplot")
```



Self-Report (CPPS)

```
boxplot(animated_group$or_diff,
        main="Animated Observer-Rated (OR) Boxplot")
```



Observer-Rated (OR)

Animated Group Male Outliers are visible for both male measurement methods.

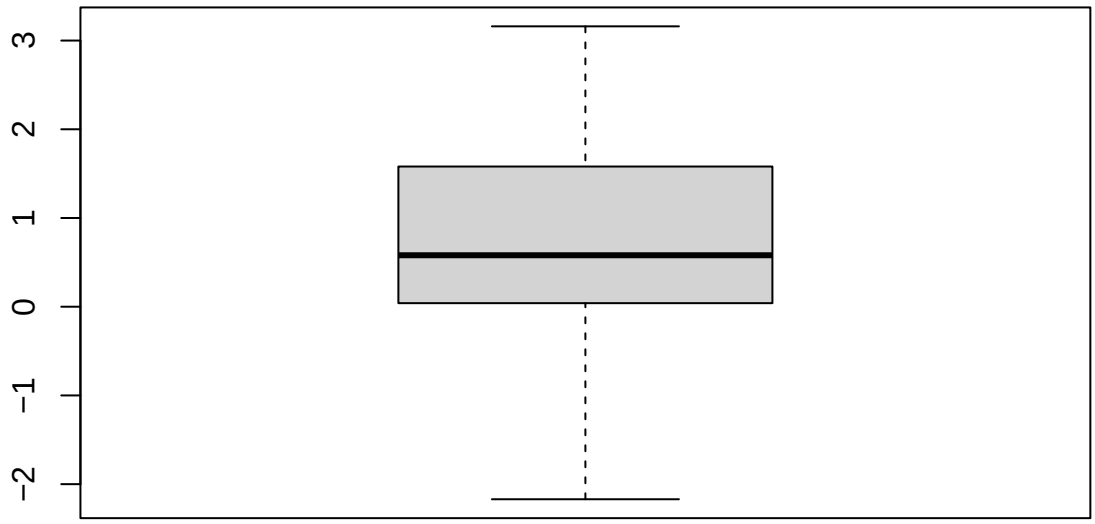
```
animated_male <- filter(animated_group, gender == "Male")
animated_male
```

```
##      X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1  101   Male   Animated           5.25            5.21         5.79
## 2  102   Male   Animated           5.73            5.63         6.14
## 3  103   Male   Animated           4.68            4.39         4.87
## 4  104   Male   Animated           5.12            6.54         5.52
## 5  105   Male   Animated           6.75            4.78         7.10
## 6  106   Male   Animated           7.11            5.22         7.04
## 7  107   Male   Animated           5.59            5.23         5.52
## 8  108   Male   Animated           6.67            4.10         6.14
## 9  109   Male   Animated           5.82            5.71         5.66
## 10 110   Male   Animated           8.02            4.86         8.36
## 11 111   Male   Animated           5.97            6.70         6.50
## 12 112   Male   Animated           3.87            6.04         4.04
## 13 113   Male   Animated           5.15            5.03         5.47
## 14 114   Male   Animated           7.57            6.41         7.55
## 15 115   Male   Animated           4.86            6.28         4.58
## 16 116   Male   Animated           7.15            5.99         6.67
```

```
## 17 117   Male   Animated          6.91            6.33        6.40
## 18 118   Male   Animated          6.29            5.58        6.59
## 19 119   Male   Animated          7.18            5.60        6.83
## 20 120   Male   Animated          7.64            6.53        7.38
## 21 121   Male   Animated          8.14            6.46        7.71
## 22 122   Male   Animated          7.61            6.57        7.92
## 23 123   Male   Animated          5.46            6.81        5.49
## 24 124   Male   Animated          6.55            6.60        6.07
## 25 125   Male   Animated          7.52            5.69        8.06
##    post_trial_or cpss_diff or_diff
## 1           5.31      0.04    0.48
## 2           5.81      0.10    0.33
## 3           4.15      0.29    0.72
## 4           6.43     -1.42   -0.91
## 5           4.83      1.97    2.27
## 6           5.42      1.89    1.62
## 7           5.21      0.36    0.31
## 8           4.27      2.57    1.87
## 9           5.47      0.11    0.19
## 10          5.04      3.16    3.32
## 11          6.46     -0.73    0.04
## 12          6.19     -2.17   -2.15
## 13          4.94      0.12    0.53
## 14          6.62      1.16    0.93
## 15          6.31     -1.42   -1.73
## 16          6.20      1.16    0.47
## 17          6.50      0.58   -0.10
## 18          5.34      0.71    1.25
## 19          5.61      1.58    1.22
## 20          6.50      1.11    0.88
## 21          6.31      1.68    1.40
## 22          6.59      1.04    1.33
## 23          6.64     -1.35   -1.15
## 24          6.67     -0.05   -0.60
## 25          5.44      1.83    2.62
```

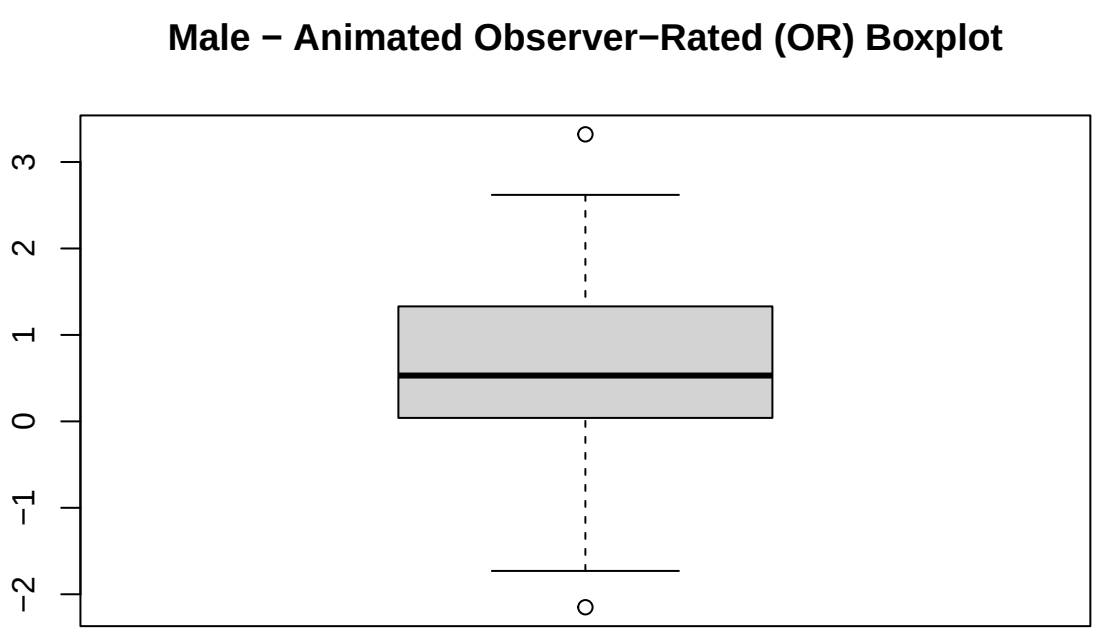
Animated Male - Self-Report (CPPS)

```
boxplot(animated_male$cpss_diff,
        main="Male - Animated Self-Report (CPSS) Boxplot")
```



Animated Male - Observer-Rated (OR)

```
boxplot(animated_male$or_diff,
        main="Male - Animated Observer-Rated (OR) Boxplot")
```



Animated Group Female No outliers are visible for female measurement methods.

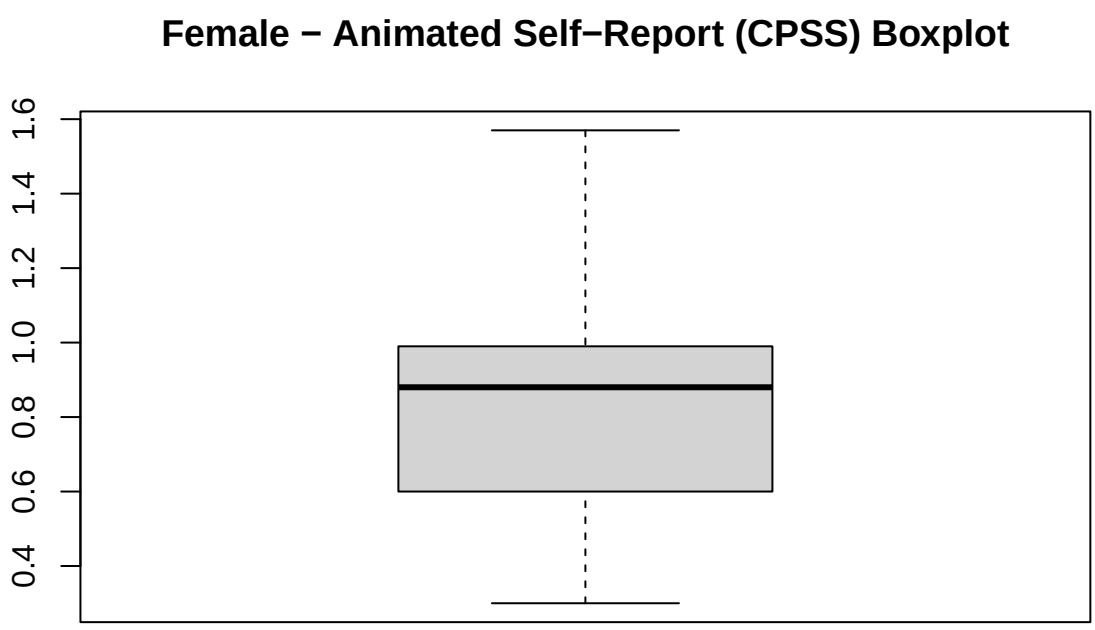
```
animated_female <- filter(animated_group, gender == "Female")
animated_female
```

```
##      X gender test_group pre_trial_cpss post_trial_cpss pre_trial_or
## 1  126 Female   Animated           5.36            4.45         5.74
## 2  127 Female   Animated           6.34            5.80         5.80
## 3  128 Female   Animated           4.85            3.74         4.68
## 4  129 Female   Animated           5.44            4.56         5.08
## 5  130 Female   Animated           6.34            5.81         6.52
## 6  131 Female   Animated           3.65            2.08         3.35
## 7  132 Female   Animated           5.27            4.32         5.72
## 8  133 Female   Animated           6.56            6.12         6.28
## 9  134 Female   Animated           5.10            4.08         5.67
## 10 135 Female   Animated           6.17            5.57         6.46
## 11 136 Female   Animated           5.37            4.47         5.65
## 12 137 Female   Animated           4.97            3.92         5.45
## 13 138 Female   Animated           5.93            5.25         6.00
## 14 139 Female   Animated           5.15            4.16         4.96
## 15 140 Female   Animated           5.38            4.48         5.27
## 16 141 Female   Animated           6.82            6.48         6.94
```

```
## 17 142 Female   Animated           5.92            5.22        6.41
## 18 143 Female   Animated           5.83            5.11        5.50
## 19 144 Female   Animated           6.75            6.37        7.05
## 20 145 Female   Animated           6.16            5.56        6.13
## 21 146 Female   Animated           5.78            5.03        6.20
## 22 147 Female   Animated           6.94            6.64        7.49
## 23 148 Female   Animated           4.21            2.86        4.58
## 24 149 Female   Animated           5.39            4.50        5.96
## 25 150 Female   Animated           4.48            3.23        4.30
##    post_trial_or cpss_diff or_diff
## 1           4.37      0.91    1.37
## 2           5.67      0.54    0.13
## 3           3.69      1.11    0.99
## 4           4.61      0.88    0.47
## 5           5.79      0.53    0.73
## 6           1.90      1.57    1.45
## 7           4.08      0.95    1.64
## 8           6.04      0.44    0.24
## 9           4.09      1.02    1.58
## 10          5.77      0.60    0.69
## 11          4.38      0.90    1.27
## 12          3.83      1.05    1.62
## 13          5.45      0.68    0.55
## 14          4.19      0.99    0.77
## 15          4.50      0.90    0.77
## 16          6.60      0.34    0.34
## 17          5.27      0.70    1.14
## 18          4.86      0.72    0.64
## 19          6.55      0.38    0.50
## 20          5.61      0.60    0.52
## 21          5.03      0.75    1.17
## 22          6.58      0.30    0.91
## 23          2.62      1.35    1.96
## 24          4.57      0.89    1.39
## 25          3.16      1.25    1.14
```

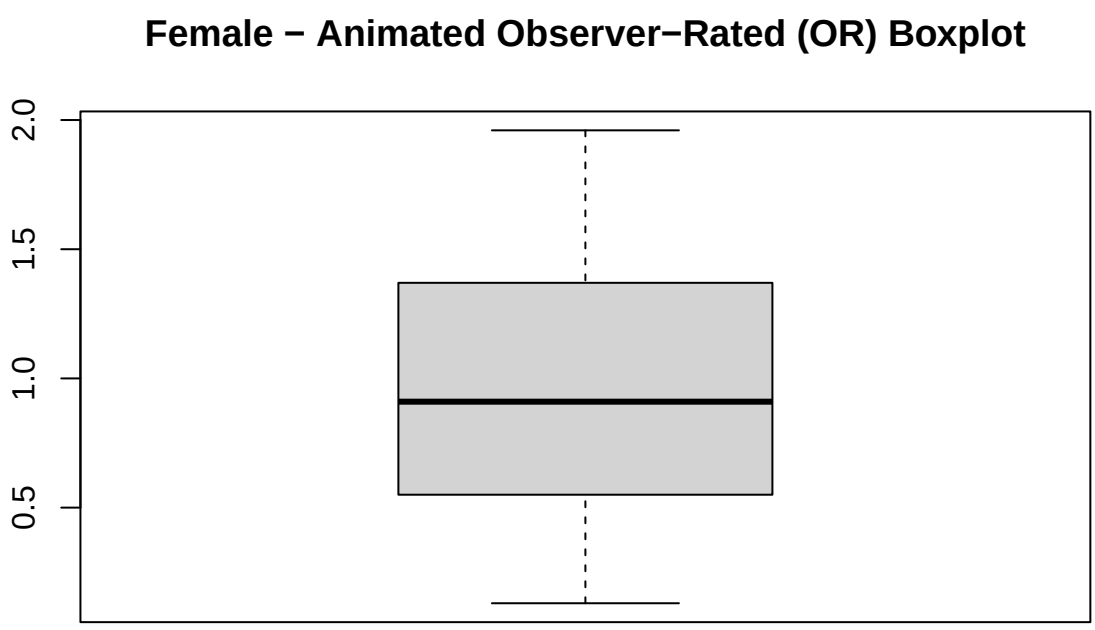
Animated Female - Self-Report (CPPS)

```
boxplot(animated_female$cpss_diff,
        main="Female - Animated Self-Report (CPSS) Boxplot")
```



Animated Female - Observer-Rated (OR)

```
boxplot(animated_female$or_diff,
        main="Female - Animated Observer-Rated (OR) Boxplot")
```



---

2. Central Tendancy

Mean, Median, Mode

2.1 Mean

Control Mean Values Mean Self-Report Difference

```
mean_control_cpss <- mean(control_group$cpss_diff)
mean_control_cpss
```

```
## [1] 0.7865306
```

Mean Self-Report Difference - Male

```
mean_control_cpss_male <- mean(control_male$cpss_diff)
mean_control_cpss_male
```

```
## [1] 0.815
```

Mean Self-Report Difference - Female

```
mean_control_cpss_female <- mean(control_female$cpss_diff)
mean_control_cpss_female
```

```
## [1] 0.7592
```

Mean Observer-Rated Difference

```
mean_control_or <- mean(control_male$or_diff)
mean_control_or
```

```
## [1] 0.9333333
```

Mean Observer-Rated Difference - Male

```
mean_control_or_male <- mean(control_female$or_diff)
mean_control_or_male
```

```
## [1] 0.874
```

Mean Observer-Rated Difference - Female

```
mean_control_or_female <- mean(control_group$or_diff)
mean_control_or_female
```

```
## [1] 0.9030612
```

Static Mean Values Mean Self-Report Difference

```
mean_static_cpss <- mean(static_group$cpss_diff)
mean_static_cpss
```

```
## [1] 0.664
```

Mean Self-Report Difference - Male

```
mean_static_cpss_male <- mean(static_male$cpss_diff)
mean_static_cpss_male
```

```
## [1] 0.6664
```

Mean Self-Report Difference - Female

```
mean_static_cpss_female <- mean(static_female$cpss_diff)
mean_static_cpss_female
```

```
## [1] 0.6616
```

Mean Observer-Rated Difference

```
mean_static_or <- mean(static_male$or_diff)
mean_static_or
```

```
## [1] 0.7096
```

Mean Observer-Rated Difference - Male

```
mean_static_or_male <- mean(static_female$or_diff)
mean_static_or_male
```

```
## [1] 0.6752
```

Mean Observer-Rated Difference - Female

```
mean_static_or_female <- mean(static_group$or_diff)
mean_static_or_female
```

```
## [1] 0.6924
```

Animated Mean Values Mean Self-Report Difference

```
mean_animated_cpss <- mean(animated_group$cpss_diff)
mean_animated_cpss
```

```
## [1] 0.6934
```

Mean Self-Report Difference - Male

```
mean_animated_cpss_male <- mean(animated_male$cpss_diff)
mean_animated_cpss_male
```

```
## [1] 0.5728
```

Mean Self-Report Difference - Female

```
mean_animated_cpss_female <- mean(animated_female$cpss_diff)
mean_animated_cpss_female
```

```
## [1] 0.814
```

Mean Observer-Rated Difference

```
mean_animated_or <- mean(animated_male$or_diff)
mean_animated_or
```

```
## [1] 0.6056
```

Mean Observer-Rated Difference - Male

```
mean_animated_or_male <- mean(animated_female$or_diff)
mean_animated_or_male
```

```
## [1] 0.9592
```

Mean Observer-Rated Difference - Female

```
mean_animated_or_female <- mean(animated_group$or_diff)
mean_animated_or_female
```

```
## [1] 0.7824
```

2.2 Median

Control Median Values Median Self-Report Difference

```
median_control_cpss <- median(control_group$cpss_diff)
median_control_cpss
```

```
## [1] 0.73
```

Median Self-Report Difference - Male

```
median_control_cpss_male <- median(control_male$cpss_diff)
median_control_cpss_male
```

```
## [1] 1.045
```

Median Self-Report Difference - Female

```
median_control_cpss_female <- median(control_female$cpss_diff)
median_control_cpss_female
```

```
## [1] 0.66
```

Median Observer-Rated Difference

```
median_control_or <- median(control_male$or_diff)
median_control_or
```

```
## [1] 0.995
```

Median Observer-Rated Difference - Male

```
median_control_or_male <- median(control_female$or_diff)
median_control_or_male
```

```
## [1] 0.78
```

Median Observer-Rated Difference - Female

```
median_control_or_female <- median(control_group$or_diff)
median_control_or_female
```

```
## [1] 0.86
```

2.3 Mode Function used to calculate mode (tutorialspoint):

```
getmode <- function(v) {
  uniqv <- unique(v)
  uniqv[which.max(tabulate(match(v, uniqv)))]
}
```

Control Mode Values Mode Self-Report Difference

```
mode_control_cpss <- getmode(control_group$cpss_diff)
mode_control_cpss
```

```
## [1] 1.22
```

Mode Self-Report Difference - Male

```
mode_control_cpss_male <- getmode(control_male$cpss_diff)
mode_control_cpss_male
```

```
## [1] 1.22
```

Mode Self-Report Difference - Female

```
mode_control_cpss_female <- getmode(control_female$cpss_diff)
mode_control_cpss_female
```

```
## [1] 0.66
```

Mode Observer-Rated Difference

```
mode_control_or <- getmode(control_male$or_diff)
mode_control_or
```

```
## [1] 1.7
```

Mode Observer-Rated Difference - Male

```
mode_control_or_male <- getmode(control_female$or_diff)
mode_control_or_male
```

```
## [1] 0.78
```

Mode Observer-Rated Difference - Female

```
mode_control_or_female <- getmode(control_group$or_diff)
mode_control_or_female
```

```
## [1] 0.78
```

---

3. Central Tendancy

3.1 Standard Deviation

Control Standard Deviation Values Standard Deviation Self-Report Difference

```
sd_control_cpss <- sd(control_group$cpss_diff)
sd_control_cpss
```

```
## [1] 1.01783
```

Standard Deviation Self-Report Difference - Male

```
sd_control_cpss_male <- sd(control_male$cpss_diff)
sd_control_cpss_male
```

```
## [1] 1.420441
```

Standard Deviation Self-Report Difference - Female

```
sd_control_cpss_female <- sd(control_female$cpss_diff)
sd_control_cpss_female
```

```
## [1] 0.3698414
```

Standard Deviation Observer-Rated Difference

```
sd_control_or <- sd(control_male$or_diff)
sd_control_or
```

```
## [1] 1.481003
```

Standard Deviation Observer-Rated Difference - Male

```
sd_control_or_male <- sd(control_female$or_diff)
sd_control_or_male
```

```
## [1] 0.4315862
```

Standard Deviation Observer-Rated Difference - Female

```
sd_control_or_female <- sd(control_group$or_diff)
sd_control_or_female
```

```
## [1] 1.070057
```

Static Standard Deviation Values Standard Deviation Self-Report Difference

```
sd_static_cpss <- sd(static_group$cpss_diff)
sd_static_cpss
```

```
## [1] 1.015745
```

Standard Deviation Self-Report Difference - Male

```
sd_static_cpss_male <- sd(static_male$cpss_diff)
sd_static_cpss_male
```

```
## [1] 1.416609
```

Standard Deviation Self-Report Difference - Female

```
sd_static_cpss_female <- sd(static_female$cpss_diff)
sd_static_cpss_female
```

```
## [1] 0.3157093
```

Standard Deviation Observer-Rated Difference

```
sd_static_or <- sd(static_male$or_diff)
sd_static_or
```

```
## [1] 1.647062
```

Standard Deviation Observer-Rated Difference - Male

```
sd_static_or_male <- sd(static_female$or_diff)
sd_static_or_male
```

```
## [1] 0.4128067
```

Standard Deviation Observer-Rated Difference - Female

```
sd_static_or_female <- sd(static_group$or_diff)
sd_static_or_female
```

```
## [1] 1.188483
```

Animated Standard Deviation Values Standard Deviation Self-Report Difference

```
sd_animated_cpss <- sd(animated_group$cpss_diff)
sd_animated_cpss
```

```
## [1] 0.9568157
```

Standard Deviation Self-Report Difference - Male

```
sd_animated_cpss_male <- sd(animated_male$cpss_diff)
sd_animated_cpss_male
```

```
## [1] 1.31823
```

Standard Deviation Self-Report Difference - Female

```
sd_animated_cpss_female <- sd(animated_female$cpss_diff)
sd_animated_cpss_female
```

```
## [1] 0.3179754
```

Standard Deviation Observer-Rated Difference

```
sd_animated_or <- sd(animated_male$or_diff)
sd_animated_or
```

```
## [1] 1.29165
```

Standard Deviation Observer-Rated Difference - Male

```r
sd_animated_or_male <- sd(animated_female$or_diff)
sd_animated_or_male
```

```
## [1] 0.4911459
```

Standard Deviation Observer-Rated Difference - Female

```r
sd_animated_or_female <- sd(animated_group$or_diff)
sd_animated_or_female
```

```
## [1] 0.9834644
```

Inferential Statistics

T-test

```r
if(!require("tidyr")) install.packages("tidyr")
```

```
## Loading required package: tidyr
```

```r
library(tidyr)

# 95% confidence level is default setting
data %>%
  select(gender, cpss_diff) %>%
  filter(gender %in% c("Male", "Female")) %>%
  drop_na(cpss_diff) %>%
  t.test(cpss_diff ~ gender, data = .)
```

```
##
##  Welch Two Sample t-test
##
## data:  cpss_diff by gender
## t = 0.37796, df = 81.685, p-value = 0.7064
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
## 95 percent confidence interval:
##  -0.2641789  0.3880997
## sample estimates:
## mean in group Female   mean in group Male
##            0.7449333            0.6829730
```

```r
control_group %>%
  select(gender, cpss_diff) %>%
  filter(gender %in% c("Male", "Female")) %>%
  drop_na(cpss_diff) %>%
  t.test(cpss_diff ~ gender, data = .)
```

```
##
##  Welch Two Sample t-test
##
## data:  cpss_diff by gender
## t = -0.18648, df = 25.986, p-value = 0.8535
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
## 95 percent confidence interval:
##  -0.6708979  0.5592979
## sample estimates:
## mean in group Female   mean in group Male
##               0.7592               0.8150
```

```
static_group %>%
  select(gender, cpss_diff) %>%
  filter(gender %in% c("Male", "Female")) %>%
  drop_na(cpss_diff) %>%
  t.test(cpss_diff ~ gender, data = .)
```

```
##
##  Welch Two Sample t-test
##
## data:  cpss_diff by gender
## t = -0.016536, df = 26.378, p-value = 0.9869
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
## 95 percent confidence interval:
##  -0.6010478  0.5914478
## sample estimates:
## mean in group Female   mean in group Male
##               0.6616               0.6664
```

```
animated_group %>%
  select(gender, cpss_diff) %>%
  filter(gender %in% c("Male", "Female")) %>%
  drop_na(cpss_diff) %>%
  t.test(cpss_diff ~ gender, data = .)
```

```
##
##  Welch Two Sample t-test
##
## data:  cpss_diff by gender
## t = 0.88936, df = 26.783, p-value = 0.3817
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
## 95 percent confidence interval:
##  -0.3154824  0.7978824
## sample estimates:
## mean in group Female   mean in group Male
##               0.8140               0.5728
```

```
data %>%
  select(gender, or_diff) %>%
  filter(gender %in% c("Male", "Female")) %>%
  drop_na(or_diff) %>%
  t.test(or_diff ~ gender, data = .)
```

```
##
##  Welch Two Sample t-test
##
## data:  or_diff by gender
## t = 0.49942, df = 86.837, p-value = 0.6187
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
## 95 percent confidence interval:
##  -0.2655308  0.4437434
## sample estimates:
## mean in group Female   mean in group Male
##            0.8361333            0.7470270
```

```
control_group %>%
  select(gender, or_diff) %>%
  filter(gender %in% c("Male", "Female")) %>%
  drop_na(or_diff) %>%
  t.test(or_diff ~ gender, data = .)
```

```
##
##  Welch Two Sample t-test
##
## data:  or_diff by gender
## t = -0.18873, df = 26.733, p-value = 0.8517
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
## 95 percent confidence interval:
##  -0.7047104  0.5860437
## sample estimates:
## mean in group Female   mean in group Male
##            0.8740000            0.9333333
```

```
static_group %>%
  select(gender, or_diff) %>%
  filter(gender %in% c("Male", "Female")) %>%
  drop_na(or_diff) %>%
  t.test(or_diff ~ gender, data = .)
```

```
##
##  Welch Two Sample t-test
##
## data:  or_diff by gender
## t = -0.1013, df = 27.003, p-value = 0.9201
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
## 95 percent confidence interval:
##  -0.7311997  0.6623997
## sample estimates:
## mean in group Female   mean in group Male
##               0.6752               0.7096
```

```
animated_group %>%
  select(gender, or_diff) %>%
  filter(gender %in% c("Male", "Female")) %>%
  drop_na(or_diff) %>%
  t.test(or_diff ~ gender, data = .)
```

```
##
##  Welch Two Sample t-test
##
## data:  or_diff by gender
## t = 1.2794, df = 30.798, p-value = 0.2103
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
## 95 percent confidence interval:
##  -0.2102211  0.9174211
## sample estimates:
## mean in group Female   mean in group Male
##               0.9592               0.6056
```

```
data %>%
  select(gender, cpss_diff) %>%
  filter(gender %in% c("Male", "Female")) %>%
  drop_na(cpss_diff) %>%
  t.test(cpss_diff ~ gender, data = .)
```

```
##
##  Welch Two Sample t-test
##
## data:  cpss_diff by gender
## t = 0.37796, df = 81.685, p-value = 0.7064
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
## 95 percent confidence interval:
##  -0.2641789  0.3880997
## sample estimates:
## mean in group Female   mean in group Male
##            0.7449333            0.6829730
```

Statistical Tests

Magnitude and Direction of Results

Discussion

Outline Findings and Relation to the Hypothesis

??? Hypothesis testing conclusion ??? change in anxiety over time + compare 3 groups

Limitations (If confounding variables are clearly identified by your group)

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