RPE FUN ANOVA

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```
## The following objects are masked from RPE.FUN.wide:
##
##     AGE, SEX, SUBJECT, WEEK
```

One-way ANOVA

Summary Stats

```
## # A tibble: 4 x 5
##   outcome  variable     n  mean    sd
##   <fct>    <fct>    <dbl> <dbl> <dbl>
## 1 HIIT.FUN score      271  3.27  1.74
## 2 HIIT.RPE score      271  5.03  2.36
## 3 PLAY.FUN score      271  2.49  1.44
## 4 PLAY.RPE score      271  4.52  2.51
```
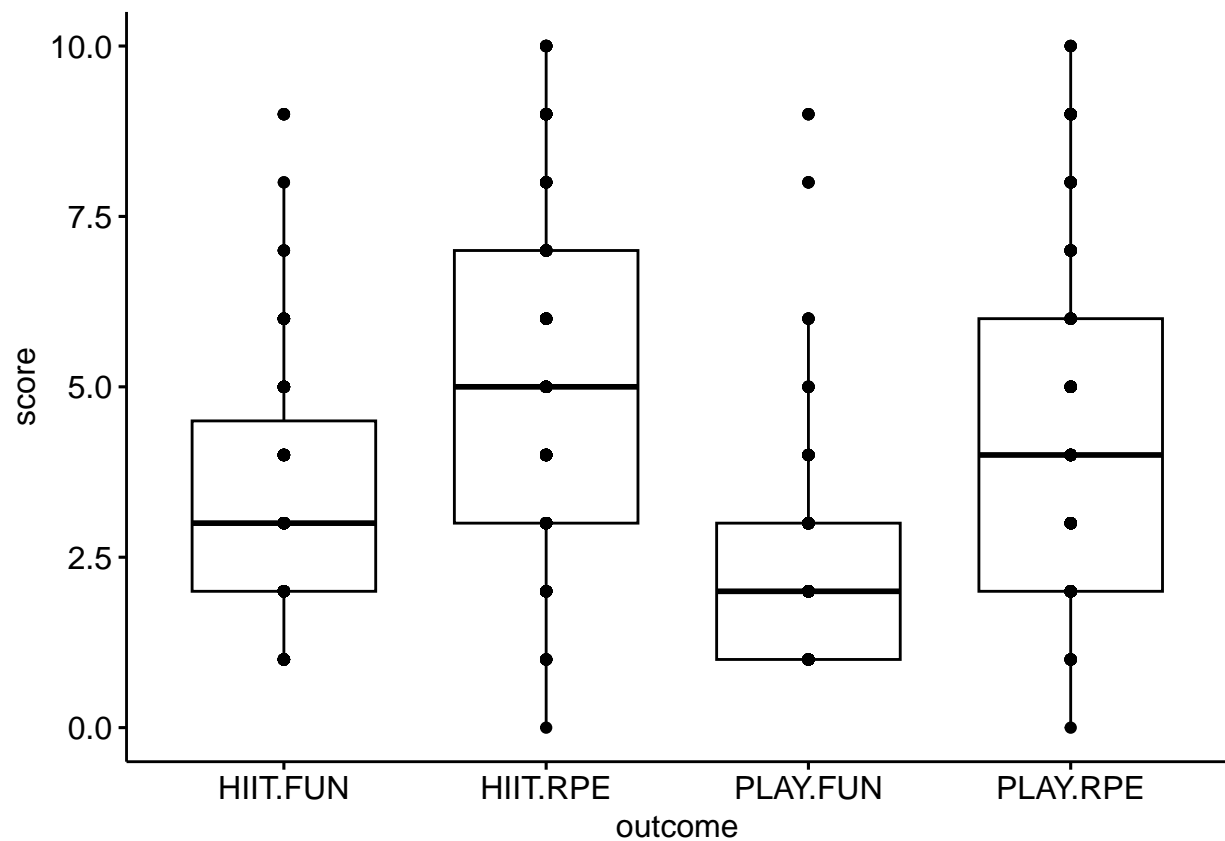
Assumptions

```
## # A tibble: 7 x 8
##   outcome  SUBJECT  AGE SEX   WEEK  score is.outlier is.extreme
##   <fct>    <fct>  <dbl> <chr> <fct> <int> <lgl>      <lgl>
## 1 HIIT.FUN 1       17.3 M     1         9 TRUE       FALSE
## 2 HIIT.FUN 1       17.3 M     2         9 TRUE       FALSE
## 3 HIIT.FUN 23      11.5 M     4         9 TRUE       FALSE
## 4 PLAY.FUN 1       17.3 M     1         8 TRUE       FALSE
## 5 PLAY.FUN 31      14.3 M     9         8 TRUE       FALSE
## 6 PLAY.FUN 32      11.9 M     1         9 TRUE       FALSE
## 7 PLAY.FUN 56      14.7 F     5         9 TRUE       FALSE
```
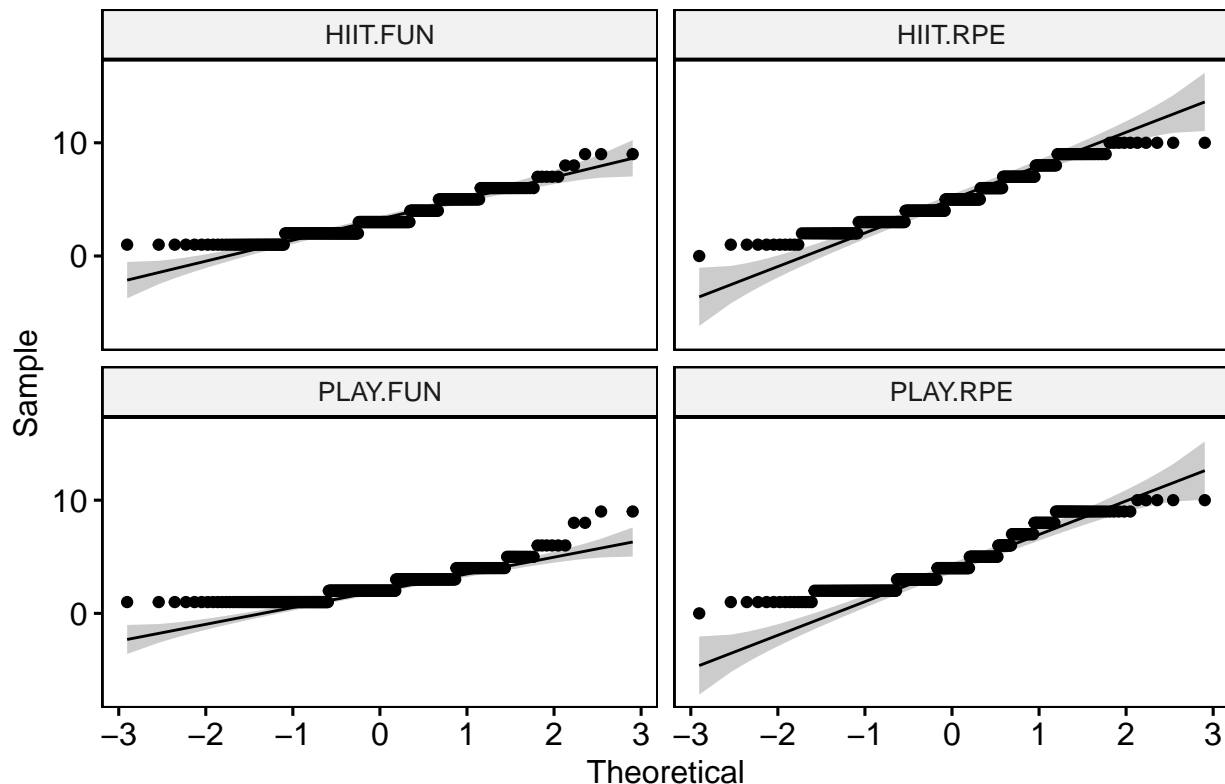
```
## # A tibble: 4 x 4
##   outcome  variable statistic         p
##   <fct>    <chr>        <dbl>     <dbl>
## 1 HIIT.FUN score        0.911 1.33e-11
## 2 HIIT.RPE score        0.955 2.06e- 7
## 3 PLAY.FUN score        0.842 5.91e-16
## 4 PLAY.RPE score        0.913 2.08e-11
```

Non−Transformed

There are no extreme outliers. Did not pass Shapiro-Wilk test, however, due to n>50 this test becomes very sensitive to minor deviations, so QQ-plots were created. Normality assumption based on QQ-plots is on the verge of not being met. Did various transformations of "score" to see if I could get a better distribution. Sphericity is check during computation. All transformations were either about the same or much worse. Analysis run with non-transformed data.

Computation

```
##     Effect DFn    DFd      F        p p..05   ges
## 1 outcome 2.3 622.04 124.12 1.75e-51     * 0.192
```

Post-hoc tests

```
##      .y.    group1   group2 n1  n2  statistic  df        p   p.adj p.adj.signif
## 1 score HIIT.FUN HIIT.RPE 271 271 -11.998899 270 7.16e-27 4.30e-26         ****
## 2 score HIIT.FUN PLAY.FUN 271 271   7.396825 270 1.76e-12 1.06e-11         ****
## 3 score HIIT.FUN PLAY.RPE 271 271  -7.206942 270 5.74e-12 3.44e-11         ****
## 4 score HIIT.RPE PLAY.FUN 271 271  16.111826 270 2.19e-41 1.31e-40         ****
## 5 score HIIT.RPE PLAY.RPE 271 271   3.861633 270 1.41e-04 8.46e-04          ***
## 6 score PLAY.FUN PLAY.RPE 271 271 -12.840034 270 8.91e-30 5.35e-29         ****
```

Box Plots with p-values

Anova, $F(2.3,622.04) = 124.12$, $p = {<}0.0001$, $\eta^2_g = 0.19$
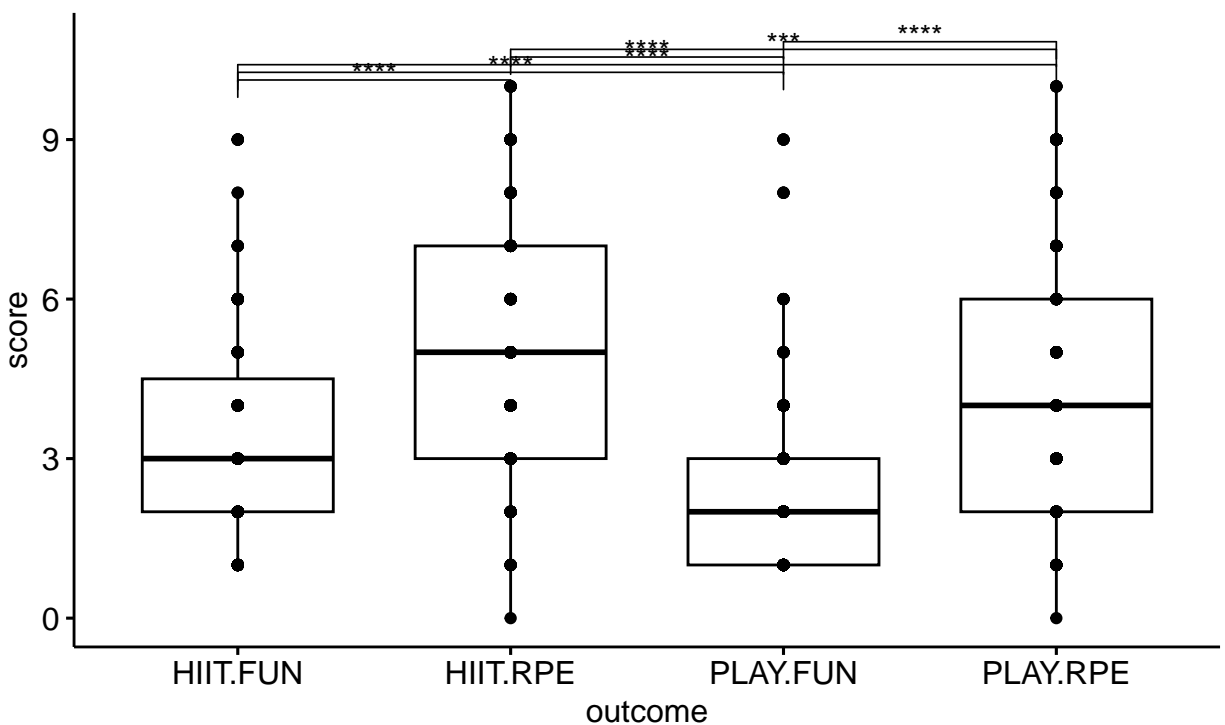
pwc: **T test**; p.adjust: **Bonferroni**

Two-way ANOVA between WEEK (time) and outcome

Summary Stats

```
## # A tibble: 40 x 6
##     WEEK outcome variable     n  mean    sd
##    <fct> <fct>     <fct>  <dbl> <dbl> <dbl>
```

```
## 1 1      HIIT.FUN score     49  3.20  1.78
## 2 2      HIIT.FUN score     39  3.72  1.92
## 3 3      HIIT.FUN score     35  3.14  1.91
## 4 4      HIIT.FUN score     27  3.33  1.78
## 5 5      HIIT.FUN score     26  3.31  1.62
## 6 6      HIIT.FUN score     21  3.14  1.56
## 7 7      HIIT.FUN score     22  3.18  1.89
## 8 8      HIIT.FUN score     20  3.05  1.36
## 9 9      HIIT.FUN score     21  3.43  1.72
## 10 10     HIIT.FUN score     11  2.64  1.57
## # i 30 more rows
```
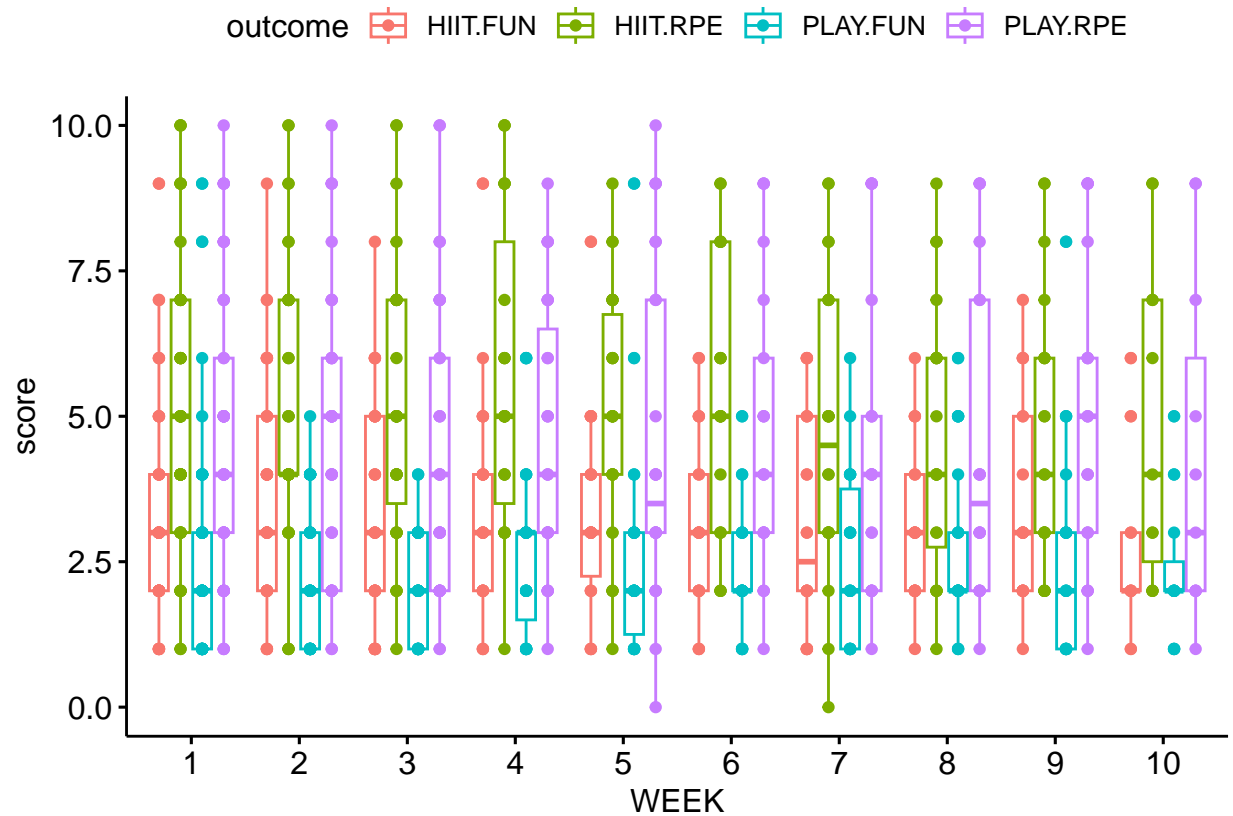

Assumptions

```
## # A tibble: 20 x 8
##     WEEK  outcome  SUBJECT   AGE SEX   score is.outlier is.extreme
##     <fct> <fct>    <fct>   <dbl> <chr> <int> <lgl>      <lgl>
## 1  1     HIIT.FUN 1        17.3 M        9 TRUE       FALSE
## 2  4     HIIT.FUN 23       11.5 M        9 TRUE       FALSE
## 3  5     HIIT.FUN 31       14.3 M        8 TRUE       FALSE
## 4  10    HIIT.FUN 1        17.3 M        6 TRUE       FALSE
## 5  10    HIIT.FUN 27       13.3 F        5 TRUE       FALSE
## 6  1     PLAY.FUN 1        17.3 M        8 TRUE       FALSE
## 7  1     PLAY.FUN 32       11.9 M        9 TRUE       FALSE
## 8  4     PLAY.FUN 1        17.3 M        6 TRUE       FALSE
## 9  4     PLAY.FUN 69       11.5 M        6 TRUE       FALSE
```

```
## 10 5      PLAY.FUN 24      13.6 F      6 TRUE      FALSE
## 11 5      PLAY.FUN 56      14.7 F      9 TRUE      TRUE
## 12 6      PLAY.FUN 22      21.4 F      5 TRUE      FALSE
## 13 8      PLAY.FUN 5       17.1 F      5 TRUE      FALSE
## 14 8      PLAY.FUN 24      13.6 F      6 TRUE      FALSE
## 15 8      PLAY.FUN 46      12.2 F      5 TRUE      FALSE
## 16 9      PLAY.FUN 31      14.3 M      8 TRUE      FALSE
## 17 10     PLAY.FUN 1       17.3 M      5 TRUE      TRUE
## 18 10     PLAY.FUN 16      16.3 M      1 TRUE      FALSE
## 19 10     PLAY.FUN 23      11.5 M      1 TRUE      FALSE
## 20 10     PLAY.FUN 45      14.1 M      4 TRUE      FALSE

## # A tibble: 40 x 5
##    WEEK  outcome  variable statistic         p
##    <fct> <fct>    <chr>        <dbl>     <dbl>
##  1 1     HIIT.FUN score       0.880 0.000130
##  2 2     HIIT.FUN score       0.938 0.0325
##  3 3     HIIT.FUN score       0.893 0.00258
##  4 4     HIIT.FUN score       0.894 0.00954
##  5 5     HIIT.FUN score       0.909 0.0252
##  6 6     HIIT.FUN score       0.918 0.0780
##  7 7     HIIT.FUN score       0.861 0.00524
##  8 8     HIIT.FUN score       0.879 0.0172
##  9 9     HIIT.FUN score       0.870 0.00951
## 10 10    HIIT.FUN score       0.823 0.0191
## # i 30 more rows
```

Non-Transformed
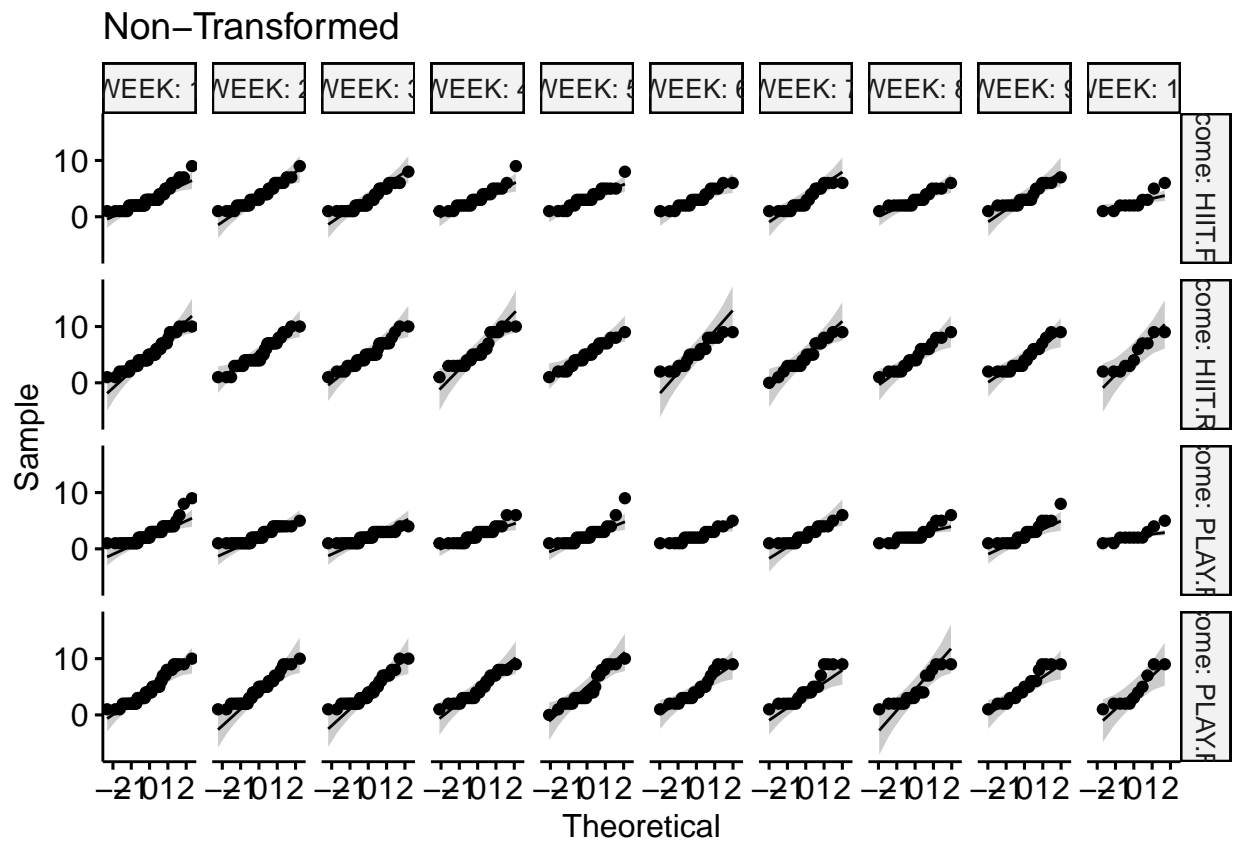
There are 2 extreme outliers (SUBJECT 56 WEEK 5 and SUBJECT 1 WEEK 10). Similar to one-way ANOVA, most groups do not pass the Shapiro-Wilk test for normality. However, there are some groups that do pass it. Most QQ-plots looks similar to those groups that passed the Shapiro-Wilk test.

Computation

```
##           Effect  DFn    DFd     F     p p..05   ges
## 1           WEEK 9.00  45.00 0.517 0.854       0.014
## 2        outcome 1.16   5.81 4.283 0.083       0.194
## 3 WEEK:outcome 27.00 135.00 1.580 0.047     * 0.035
```

Post-hoc tests

```
##     WEEK   .y.    group1   group2 n1 n2  statistic df        p    p.adj
## 1      1 score HIIT.FUN HIIT.RPE 49 49 -5.1120973 48 5.50e-06 3.30e-05
## 2      1 score HIIT.FUN PLAY.FUN 49 49  2.0058123 48 5.10e-02 3.03e-01
## 3      1 score HIIT.FUN PLAY.RPE 49 49 -3.3691817 48 1.00e-03 9.00e-03
## 4      1 score HIIT.RPE PLAY.FUN 49 49  5.6882226 48 7.48e-07 4.49e-06
## 5      1 score HIIT.RPE PLAY.RPE 49 49  1.4375970 48 1.57e-01 9.42e-01
## 6      1 score PLAY.FUN PLAY.RPE 49 49 -5.1827529 48 4.31e-06 2.59e-05
## 7      2 score HIIT.FUN HIIT.RPE 39 39 -3.7336433 38 6.17e-04 4.00e-03
## 8      2 score HIIT.FUN PLAY.FUN 39 39  4.7631881 38 2.77e-05 1.66e-04
## 9      2 score HIIT.FUN PLAY.RPE 39 39 -1.9050495 38 6.40e-02 3.86e-01
## 10     2 score HIIT.RPE PLAY.FUN 39 39  6.8549107 38 3.87e-08 2.32e-07
## 11     2 score HIIT.RPE PLAY.RPE 39 39  1.2575930 38 2.16e-01 1.00e+00
## 12     2 score PLAY.FUN PLAY.RPE 39 39 -5.5000000 38 2.76e-06 1.66e-05
## 13     3 score HIIT.FUN HIIT.RPE 35 35 -4.6758524 34 4.50e-05 2.70e-04
## 14     3 score HIIT.FUN PLAY.FUN 35 35  2.8948716 34 7.00e-03 3.90e-02
## 15     3 score HIIT.FUN PLAY.RPE 35 35 -2.2209591 34 3.30e-02 1.99e-01
## 16     3 score HIIT.RPE PLAY.FUN 35 35  7.4292119 34 1.29e-08 7.74e-08
## 17     3 score HIIT.RPE PLAY.RPE 35 35  2.4480087 34 2.00e-02 1.18e-01
## 18     3 score PLAY.FUN PLAY.RPE 35 35 -5.1375191 34 1.14e-05 6.84e-05
## 19     4 score HIIT.FUN HIIT.RPE 27 27 -4.8459347 26 5.05e-05 3.03e-04
## 20     4 score HIIT.FUN PLAY.FUN 27 27  2.7432327 26 1.10e-02 6.50e-02
## 21     4 score HIIT.FUN PLAY.RPE 27 27 -2.1509232 26 4.10e-02 2.46e-01
## 22     4 score HIIT.RPE PLAY.FUN 27 27  6.2274260 26 1.37e-06 8.22e-06
## 23     4 score HIIT.RPE PLAY.RPE 27 27  2.7660088 26 1.00e-02 6.20e-02
## 24     4 score PLAY.FUN PLAY.RPE 27 27 -4.0741424 26 3.85e-04 2.00e-03
## 25     5 score HIIT.FUN HIIT.RPE 26 26 -3.2737743 25 3.00e-03 1.90e-02
## 26     5 score HIIT.FUN PLAY.FUN 26 26  1.8527990 25 7.60e-02 4.55e-01
## 27     5 score HIIT.FUN PLAY.RPE 26 26 -1.7978663 25 8.40e-02 5.06e-01
## 28     5 score HIIT.RPE PLAY.FUN 26 26  4.4559367 25 1.53e-04 9.18e-04
## 29     5 score HIIT.RPE PLAY.RPE 26 26  1.0767767 25 2.92e-01 1.00e+00
## 30     5 score PLAY.FUN PLAY.RPE 26 26 -2.7657007 25 1.10e-02 6.30e-02
## 31     6 score HIIT.FUN HIIT.RPE 21 21 -4.8623511 20 9.44e-05 5.66e-04
## 32     6 score HIIT.FUN PLAY.FUN 21 21  2.6311741 20 1.60e-02 9.60e-02
## 33     6 score HIIT.FUN PLAY.RPE 21 21 -2.5277713 20 2.00e-02 1.20e-01
## 34     6 score HIIT.RPE PLAY.FUN 21 21  5.9836607 20 7.51e-06 4.51e-05
## 35     6 score HIIT.RPE PLAY.RPE 21 21  2.4301259 20 2.50e-02 1.48e-01
## 36     6 score PLAY.FUN PLAY.RPE 21 21 -4.0318636 20 6.53e-04 4.00e-03
## 37     7 score HIIT.FUN HIIT.RPE 22 22 -2.8972730 21 9.00e-03 5.20e-02
## 38     7 score HIIT.FUN PLAY.FUN 22 22  1.6455682 21 1.15e-01 6.90e-01
## 39     7 score HIIT.FUN PLAY.RPE 22 22 -1.9454235 21 6.50e-02 3.91e-01
## 40     7 score HIIT.RPE PLAY.FUN 22 22  3.8643671 21 8.98e-04 5.00e-03
```

```
## 41     7 score HIIT.RPE PLAY.RPE 22 22  0.7427938 21 4.66e-01 1.00e+00
## 42     7 score PLAY.FUN PLAY.RPE 22 22 -3.5887151 21 2.00e-03 1.00e-02
## 43     8 score HIIT.FUN HIIT.RPE 20 20 -2.9779014 19 8.00e-03 4.60e-02
## 44     8 score HIIT.FUN PLAY.FUN 20 20  1.7561800 19 9.50e-02 5.71e-01
## 45     8 score HIIT.FUN PLAY.RPE 20 20 -2.2687347 19 3.50e-02 2.11e-01
## 46     8 score HIIT.RPE PLAY.FUN 20 20  3.5890606 19 2.00e-03 1.20e-02
## 47     8 score HIIT.RPE PLAY.RPE 20 20  0.3837797 19 7.05e-01 1.00e+00
## 48     8 score PLAY.FUN PLAY.RPE 20 20 -3.7151972 19 1.00e-03 9.00e-03
## 49     9 score HIIT.FUN HIIT.RPE 21 21 -2.0201347 20 5.70e-02 3.42e-01
## 50     9 score HIIT.FUN PLAY.FUN 21 21  1.6984156 20 1.05e-01 6.30e-01
## 51     9 score HIIT.FUN PLAY.RPE 21 21 -2.8788316 20 9.00e-03 5.60e-02
## 52     9 score HIIT.RPE PLAY.FUN 21 21  2.9902956 20 7.00e-03 4.30e-02
## 53     9 score HIIT.RPE PLAY.RPE 21 21 -1.5298449 20 1.42e-01 8.52e-01
## 54     9 score PLAY.FUN PLAY.RPE 21 21 -3.6546575 20 2.00e-03 9.00e-03
## 55    10 score HIIT.FUN HIIT.RPE 11 11 -3.1801366 10 1.00e-02 5.90e-02
## 56    10 score HIIT.FUN PLAY.FUN 11 11  0.8195375 10 4.32e-01 1.00e+00
## 57    10 score HIIT.FUN PLAY.RPE 11 11 -1.7017026 10 1.20e-01 7.20e-01
## 58    10 score HIIT.RPE PLAY.FUN 11 11  3.3708039 10 7.00e-03 4.30e-02
## 59    10 score HIIT.RPE PLAY.RPE 11 11  1.3445853 10 2.08e-01 1.00e+00
## 60    10 score PLAY.FUN PLAY.RPE 11 11 -2.3904572 10 3.80e-02 2.27e-01
##    p.adj.signif
## 1          ****
## 2            ns
## 3            **
## 4          ****
## 5            ns
## 6          ****
## 7            **
## 8           ***
## 9            ns
## 10         ****
## 11           ns
## 12         ****
## 13          ***
## 14            *
## 15           ns
## 16         ****
## 17           ns
## 18         ****
## 19          ***
## 20           ns
## 21           ns
## 22         ****
## 23           ns
## 24           **
## 25            *
## 26           ns
## 27           ns
## 28          ***
## 29           ns
## 30           ns
## 31          ***
## 32           ns
## 33           ns
```

```
## 34            ****
## 35             ns
## 36             **
## 37             ns
## 38             ns
## 39             ns
## 40             **
## 41             ns
## 42              *
## 43              *
## 44             ns
## 45             ns
## 46              *
## 47             ns
## 48             **
## 49             ns
## 50             ns
## 51             ns
## 52              *
## 53             ns
## 54             **
## 55             ns
## 56             ns
## 57             ns
## 58              *
## 59             ns
## 60             ns
```

Box-plots with p-values

Anova, $F(27,135) = 1.58$, $p = 0.047$, $\eta_g^2 = 0.04$