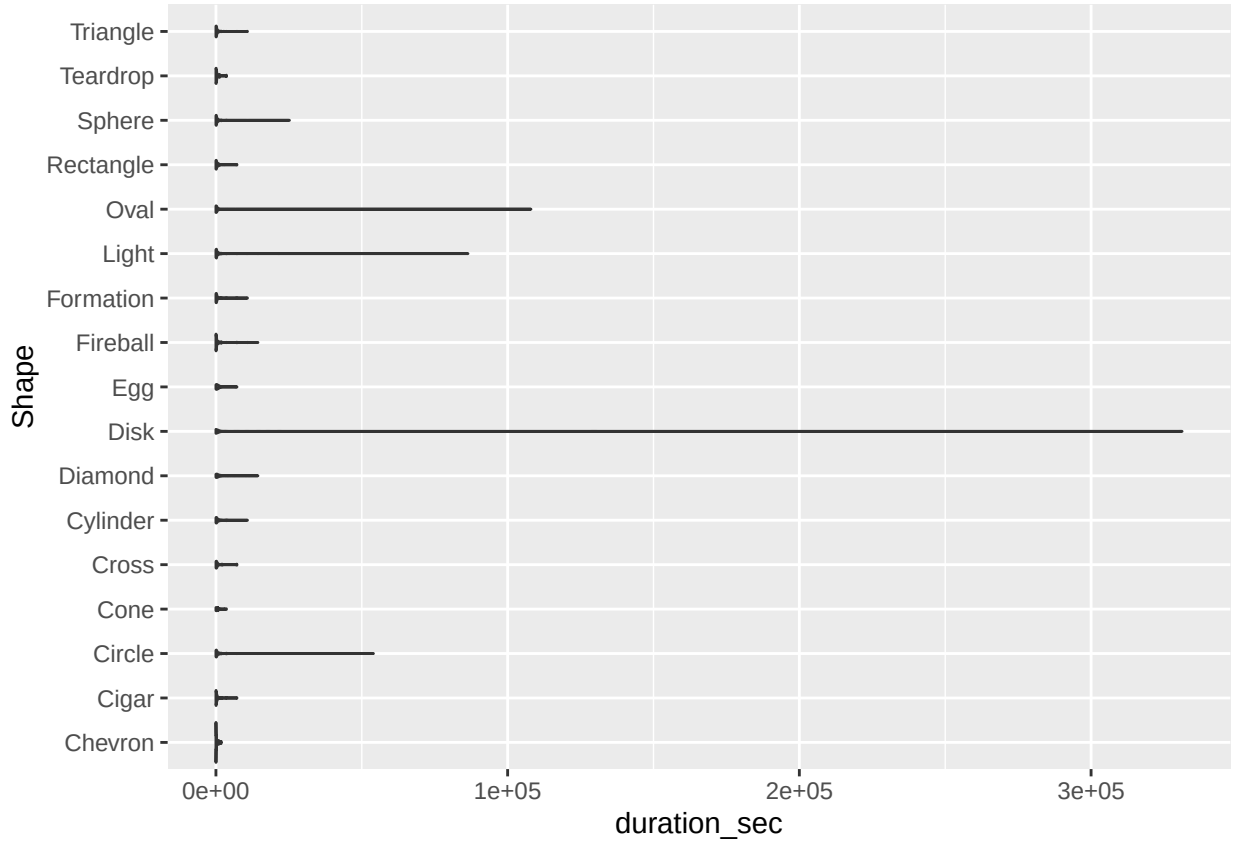
ROUGH_ANALYSIS

SP

26/11/2020

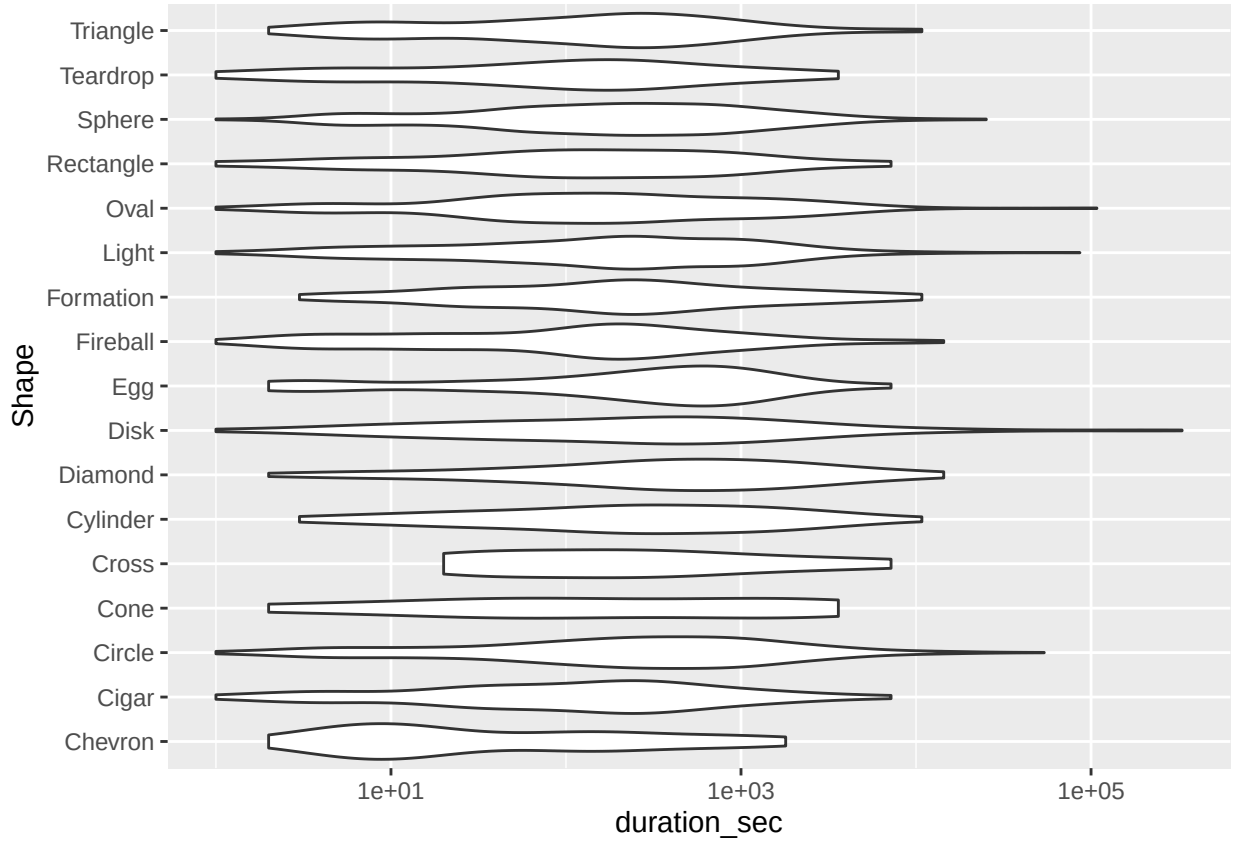
```
df <- read_feather('../data/processed/aliens_pro.feather')
df <- df %>%
  select(Shape, duration_sec) %>%
  filter(Shape != 'Flash') %>%
  group_by(Shape) %>%
  mutate('duration_log_sec' = log10(duration_sec))
```

```
ggplot(df) +
  aes(x = duration_sec,
      y = Shape)+
  geom_violin()
```




```
ggplot(df) +
  aes(x = duration_sec,
      y = Shape)+
```

```
  geom_violin() +
  scale_x_log10()
```




```
library(FSA)
```

```
## ## FSA v0.8.31. See citation('FSA') if used in publication.
## ## Run fishR() for related website and fishR('IFAR') for related book.
```

```
df$Shape <- factor(df$Shape)

kusk <- kruskal.test(duration_sec ~ Shape, data = df)
tidy(kusk)
```

```
## # A tibble: 1 x 4
##   statistic     p.value parameter method
##       <dbl>       <dbl>     <int> <chr>
## 1      60.5 0.000000436        16 Kruskal-Wallis rank sum test
```

```
dunn <- dunnTest(duration_sec ~ Shape, data = df)
dunn_table <- dunn$res
dunn_table
```

```
##               Comparison           Z      P.unadj        P.adj
## 1         Chevron - Cigar -2.10381865 3.539427e-02 1.0000000000
## 2        Chevron - Circle -4.45562224 8.365021e-06 0.0011209129
## 3          Cigar - Circle -2.37783428 1.741465e-02 1.0000000000
## 4          Chevron - Cone -2.24827330 2.455877e-02 1.0000000000
## 5            Cigar - Cone -0.79093164 4.289839e-01 1.0000000000
```

```
## 6           Circle - Cone  0.45635202 6.481369e-01 1.0000000000
## 7         Chevron - Cross -2.23211719 2.560722e-02 1.0000000000
## 8           Cigar - Cross -0.96077570 3.366650e-01 1.0000000000
## 9          Circle - Cross  0.07796225 9.378581e-01 1.0000000000
## 10           Cone - Cross -0.23655637 8.130010e-01 1.0000000000
## 11     Chevron - Cylinder -3.76392856 1.672647e-04 0.0212426156
## 12       Cigar - Cylinder -1.96391703 4.953972e-02 1.0000000000
## 13      Circle - Cylinder -0.29734824 7.662007e-01 1.0000000000
## 14        Cone - Cylinder -0.56150444 5.744537e-01 1.0000000000
## 15       Cross - Cylinder -0.20772836 8.354411e-01 1.0000000000
## 16      Chevron - Diamond -4.91098939 9.061799e-07 0.0001232405
## 17        Cigar - Diamond -3.24911283 1.157655e-03 0.1412339709
## 18       Circle - Diamond -1.92572168 5.413914e-02 1.0000000000
## 19         Cone - Diamond -1.40445286 1.601840e-01 1.0000000000
## 20        Cross - Diamond -0.93065701 3.520310e-01 1.0000000000
## 21     Cylinder - Diamond -1.19614670 2.316393e-01 1.0000000000
## 22         Chevron - Disk -4.09301312 4.258036e-05 0.0056206078
## 23           Cigar - Disk -2.05510720 3.986865e-02 1.0000000000
## 24          Circle - Disk  0.16291022 8.705891e-01 1.0000000000
## 25            Cone - Disk -0.38060000 7.035001e-01 1.0000000000
## 26           Cross - Disk -0.02475758 9.802483e-01 0.9802483296
## 27        Cylinder - Disk  0.36915244 7.120141e-01 1.0000000000
## 28        Diamond - Disk  1.85591221 6.346607e-02 1.0000000000
## 29          Chevron - Egg -3.26588690 1.091218e-03 0.1342198427
## 30            Cigar - Egg -1.62471342 1.042236e-01 1.0000000000
## 31           Circle - Egg -0.18035743 8.568720e-01 1.0000000000
## 32             Cone - Egg -0.48450580 6.280269e-01 1.0000000000
## 33            Cross - Egg -0.16632923 8.678979e-01 1.0000000000
## 34         Cylinder - Egg  0.04311370 9.656109e-01 1.0000000000
## 35         Diamond - Egg  1.06514262 2.868114e-01 1.0000000000
## 36            Disk - Egg -0.24860884 8.036634e-01 1.0000000000
## 37     Chevron - Fireball -2.37496197 1.755076e-02 1.0000000000
## 38       Cigar - Fireball  0.15974681 8.730805e-01 1.0000000000
## 39      Circle - Fireball  4.47532314 7.629583e-06 0.0010299937
## 40        Cone - Fireball  0.96126862 3.364171e-01 1.0000000000
## 41       Cross - Fireball  1.10537980 2.689951e-01 1.0000000000
## 42    Cylinder - Fireball  2.60355690 9.226195e-03 1.0000000000
## 43     Diamond - Fireball  4.26447998 2.003683e-05 0.0026648985
## 44        Disk - Fireball  3.31325176 9.221793e-04 0.1143502307
## 45         Egg - Fireball  2.00657183 4.479527e-02 1.0000000000
## 46    Chevron - Formation -3.81108897 1.383560e-04 0.0181246301
## 47      Cigar - Formation -1.76065844 7.829623e-02 1.0000000000
## 48     Circle - Formation  0.49913018 6.176877e-01 1.0000000000
## 49       Cone - Formation -0.23637114 8.131447e-01 1.0000000000
## 50      Cross - Formation  0.09359347 9.254321e-01 1.0000000000
## 51   Cylinder - Formation  0.57530975 5.650818e-01 1.0000000000
## 52    Diamond - Formation  2.02228782 4.314663e-02 1.0000000000
## 53       Disk - Formation  0.29614257 7.671212e-01 1.0000000000
## 54        Egg - Formation  0.42071653 6.739621e-01 1.0000000000
## 55   Fireball - Formation -2.75616240 5.848395e-03 0.6784138395
## 56        Chevron - Light -3.78551033 1.533935e-04 0.0197877564
## 57          Cigar - Light -1.48548747 1.374147e-01 1.0000000000
## 58         Circle - Light  2.16947967 3.004629e-02 1.0000000000
## 59           Cone - Light  0.07524444 9.400202e-01 1.0000000000
```

```
## 60          Cross - Light  0.36782066 7.130070e-01 1.0000000000
## 61       Cylinder - Light  1.21921937 2.227609e-01 1.0000000000
## 62        Diamond - Light  2.93998681 3.282262e-03 0.3938714629
## 63           Disk - Light  1.30905520 1.905157e-01 1.0000000000
## 64            Egg - Light  0.88883396 3.740923e-01 1.0000000000
## 65       Fireball - Light -3.17920483 1.476797e-03 0.1786924276
## 66      Formation - Light  0.82102820 4.116302e-01 1.0000000000
## 67         Chevron - Oval -3.38219046 7.191027e-04 0.0898878361
## 68           Cigar - Oval -1.16902151 2.423950e-01 1.0000000000
## 69          Circle - Oval  1.68003536 9.295044e-02 1.0000000000
## 70            Cone - Oval  0.16224170 8.711155e-01 1.0000000000
## 71           Cross - Oval  0.43367522 6.645243e-01 1.0000000000
## 72        Cylinder - Oval  1.24260880 2.140120e-01 1.0000000000
## 73         Diamond - Oval  2.77975264 5.440032e-03 0.6364837294
## 74            Disk - Oval  1.23580341 2.165316e-01 1.0000000000
## 75             Egg - Oval  0.94849688 3.428766e-01 1.0000000000
## 76        Fireball - Oval -2.02809247 4.255081e-02 1.0000000000
## 77       Formation - Oval  0.86092066 3.892817e-01 1.0000000000
## 78           Light - Oval  0.27172260 7.858353e-01 1.0000000000
## 79    Chevron - Rectangle -2.33158518 1.972252e-02 1.0000000000
## 80      Cigar - Rectangle -0.37225863 7.097003e-01 1.0000000000
## 81     Circle - Rectangle  1.66722314 9.547004e-02 1.0000000000
## 82       Cone - Rectangle  0.51111833 6.092682e-01 1.0000000000
## 83      Cross - Rectangle  0.71749512 4.730686e-01 1.0000000000
## 84   Cylinder - Rectangle  1.49156305 1.358137e-01 1.0000000000
## 85    Diamond - Rectangle  2.68861946 7.174816e-03 0.8179290068
## 86       Disk - Rectangle  1.44552581 1.483102e-01 1.0000000000
## 87        Egg - Rectangle  1.24532915 2.130108e-01 1.0000000000
## 88   Fireball - Rectangle -0.60355966 5.461364e-01 1.0000000000
## 89  Formation - Rectangle  1.19629124 2.315829e-01 1.0000000000
## 90      Light - Rectangle  0.84136556 4.001432e-01 1.0000000000
## 91       Oval - Rectangle  0.62616253 5.312083e-01 1.0000000000
## 92       Chevron - Sphere -3.78621633 1.529585e-04 0.0198846086
## 93         Cigar - Sphere -1.59354448 1.110381e-01 1.0000000000
## 94        Circle - Sphere  1.25740296 2.086078e-01 1.0000000000
## 95          Cone - Sphere -0.04791899 9.617808e-01 1.0000000000
## 96         Cross - Sphere  0.26033149 7.946081e-01 1.0000000000
## 97      Cylinder - Sphere  0.94657055 3.438577e-01 1.0000000000
## 98       Diamond - Sphere  2.54307384 1.098820e-02 1.0000000000
## 99          Disk - Sphere  0.82897982 4.071158e-01 1.0000000000
## 100          Egg - Sphere  0.69821639 4.850419e-01 1.0000000000
## 101     Fireball - Sphere -2.88429948 3.922855e-03 0.4668197402
## 102    Formation - Sphere  0.44567966 6.558287e-01 1.0000000000
## 103        Light - Sphere -0.42644169 6.697860e-01 1.0000000000
## 104         Oval - Sphere -0.53670818 5.914692e-01 1.0000000000
## 105    Rectangle - Sphere -0.98501521 3.246166e-01 1.0000000000
## 106    Chevron - Teardrop -1.32084979 1.865515e-01 1.0000000000
## 107      Cigar - Teardrop  0.32700640 7.436630e-01 1.0000000000
## 108     Circle - Teardrop  1.85568521 6.349844e-02 1.0000000000
## 109       Cone - Teardrop  0.92242653 3.563061e-01 1.0000000000
## 110      Cross - Teardrop  1.07103712 2.841527e-01 1.0000000000
## 111   Cylinder - Teardrop  1.77152702 7.647310e-02 1.0000000000
## 112    Diamond - Teardrop  2.70185313 6.895421e-03 0.7929734697
## 113       Disk - Teardrop  1.71505507 8.633513e-02 1.0000000000
```

```
## 114        Egg - Teardrop  1.57540482 1.151630e-01 1.0000000000
## 115   Fireball - Teardrop  0.26516466 7.908826e-01 1.0000000000
## 116  Formation - Teardrop  1.53650946 1.244135e-01 1.0000000000
## 117      Light - Teardrop  1.28304471 1.994764e-01 1.0000000000
## 118       Oval - Teardrop  1.12469898 2.607166e-01 1.0000000000
## 119  Rectangle - Teardrop  0.59395168 5.525444e-01 1.0000000000
## 120     Sphere - Teardrop  1.38230397 1.668784e-01 1.0000000000
## 121    Chevron - Triangle -2.79021816 5.267254e-03 0.6215359347
## 122      Cigar - Triangle -0.35117444 7.254575e-01 1.0000000000
## 123     Circle - Triangle  3.56589585 3.626154e-04 0.0456895365
## 124       Cone - Triangle  0.66916216 5.033920e-01 1.0000000000
## 125      Cross - Triangle  0.86091500 3.892849e-01 1.0000000000
## 126   Cylinder - Triangle  2.12739763 3.338706e-02 1.0000000000
## 127    Diamond - Triangle  3.77441792 1.603817e-04 0.0205288577
## 128       Disk - Triangle  2.60324768 9.234521e-03 1.0000000000
## 129        Egg - Triangle  1.62935526 1.032378e-01 1.0000000000
## 130   Fireball - Triangle -0.85113640 3.946936e-01 1.0000000000
## 131  Formation - Triangle  2.09298085 3.635086e-02 1.0000000000
## 132      Light - Triangle  2.14458278 3.198622e-02 1.0000000000
## 133       Oval - Triangle  1.28711589 1.980539e-01 1.0000000000
## 134  Rectangle - Triangle  0.14223000 8.868983e-01 1.0000000000
## 135     Sphere - Triangle  2.05641957 3.974209e-02 1.0000000000
## 136   Teardrop - Triangle -0.59002853 5.551715e-01 1.0000000000
```

```
library(coin)
```

```
## Loading required package: survival
```

```
##
## Attaching package: 'coin'
```

```
## The following object is masked from 'package:testthat':
##
##     expectation
```

```
library(rcompanion)

df$Shape <- factor(df$Shape)

one_anova <- independence_test(duration_log_sec ~ Shape, data = df)
one_anova
```

```
##
##  Asymptotic General Independence Test
##
## data:  duration_log_sec by
##   Shape (Chevron, Cigar, Circle, Cone, Cross, Cylinder, Diamond, Disk, Egg, Fireball, Formation, Ligh
## maxT = 3.9678, p-value = 0.001239
## alternative hypothesis: two.sided
```

```
pairwise_perm <- pairwisePermutationTest(duration_log_sec ~ Shape, data = df)
pairwise_perm
```

```
##                    Comparison      Stat   p.value  p.adjust
## 1         Chevron - Cigar = 0    -2.234   0.02552 0.1032000
## 2        Chevron - Circle = 0    -4.346 1.384e-05 0.0009411
## 3          Chevron - Cone = 0    -2.093    0.0363 0.1371000
```

```
## 4         Chevron - Cross = 0     -2.46    0.0139 0.0700100
## 5      Chevron - Cylinder = 0    -3.696 0.0002189 0.0029770
## 6       Chevron - Diamond = 0    -4.486 7.249e-06 0.0009411
## 7          Chevron - Disk = 0    -3.806 0.0001415 0.0024060
## 8           Chevron - Egg = 0    -2.949  0.003187 0.0228100
## 9      Chevron - Fireball = 0    -2.433   0.01499 0.0703000
## 10    Chevron - Formation = 0    -4.111 3.933e-05 0.0010700
## 11        Chevron - Light = 0    -3.931 8.463e-05 0.0016440
## 12         Chevron - Oval = 0    -3.569 0.0003587 0.0044350
## 13    Chevron - Rectangle = 0    -2.359   0.01833 0.0831000
## 14       Chevron - Sphere = 0    -4.161 3.169e-05 0.0010700
## 15     Chevron - Teardrop = 0    -1.341    0.1799 0.3823000
## 16     Chevron - Triangle = 0    -3.054  0.002262 0.0172600
## 17         Cigar - Circle = 0     -2.23   0.02575 0.1032000
## 18           Cigar - Cone = 0   -0.6809    0.4959 0.7252000
## 19          Cigar - Cross = 0    -1.166    0.2437 0.4419000
## 20       Cigar - Cylinder = 0    -1.974   0.04833 0.1603000
## 21        Cigar - Diamond = 0    -3.105  0.001905 0.0172600
## 22           Cigar - Disk = 0     -2.01   0.04442 0.1510000
## 23            Cigar - Egg = 0    -1.358    0.1746 0.3823000
## 24       Cigar - Fireball = 0    0.1791    0.8578 0.9408000
## 25      Cigar - Formation = 0    -2.041   0.04127 0.1510000
## 26          Cigar - Light = 0    -1.471    0.1413 0.3453000
## 27           Cigar - Oval = 0    -1.326    0.1848 0.3867000
## 28      Cigar - Rectangle = 0   -0.3703    0.7112 0.8436000
## 29         Cigar - Sphere = 0    -1.774   0.07608 0.2201000
## 30       Cigar - Teardrop = 0       0.4    0.6891 0.8436000
## 31       Cigar - Triangle = 0   -0.4095    0.6822 0.8436000
## 32          Circle - Cone = 0    0.4876    0.6259 0.8185000
## 33         Circle - Cross = 0   -0.1564    0.8757 0.9452000
## 34      Circle - Cylinder = 0   -0.3701    0.7113 0.8436000
## 35       Circle - Diamond = 0     -1.91   0.05614 0.1818000
## 36          Circle - Disk = 0   -0.2178    0.8276 0.9408000
## 37           Circle - Egg = 0   0.05192    0.9586 0.9882000
## 38      Circle - Fireball = 0     4.185  2.85e-05 0.0010700
## 39     Circle - Formation = 0   0.04655    0.9629 0.9882000
## 40         Circle - Light = 0     2.019   0.04344 0.1510000
## 41          Circle - Oval = 0     1.266    0.2054 0.4068000
## 42     Circle - Rectangle = 0     1.539    0.1239 0.3240000
## 43        Circle - Sphere = 0    0.9686    0.3328 0.5591000
## 44      Circle - Teardrop = 0     1.826   0.06778 0.2077000
## 45      Circle - Triangle = 0       3.3 0.0009666 0.0101100
## 46           Cone - Cross = 0   -0.4194    0.6749 0.8436000
## 47        Cone - Cylinder = 0   -0.6297    0.5289 0.7493000
## 48         Cone - Diamond = 0    -1.391    0.1641 0.3783000
## 49            Cone - Disk = 0   -0.5033    0.6147 0.8116000
## 50             Cone - Egg = 0    -0.346    0.7294 0.8552000
## 51        Cone - Fireball = 0    0.8444    0.3984 0.6300000
## 52       Cone - Formation = 0   -0.4734    0.6359 0.8236000
## 53           Cone - Light = 0 -0.008034    0.9936 0.9936000
## 54            Cone - Oval = 0  -0.02388    0.9809 0.9882000
## 55       Cone - Rectangle = 0    0.3932    0.6941 0.8436000
## 56          Cone - Sphere = 0   -0.2014    0.8404 0.9408000
## 57        Cone - Teardrop = 0    0.8066    0.4199 0.6489000
```

```
## 58        Cone - Triangle = 0    0.5616    0.5744 0.7812000
## 59       Cross - Cylinder = 0  -0.02799    0.9777 0.9882000
## 60       Cross - Diamond = 0   -0.7421     0.458 0.6921000
## 61          Cross - Disk = 0   0.07475    0.9404 0.9882000
## 62           Cross - Egg = 0    0.1673    0.8671 0.9434000
## 63      Cross - Fireball = 0     1.276    0.2019 0.4068000
## 64     Cross - Formation = 0    0.1815     0.856 0.9408000
## 65         Cross - Light = 0    0.5843     0.559 0.7679000
## 66          Cross - Oval = 0    0.5525    0.5806 0.7818000
## 67     Cross - Rectangle = 0    0.8754    0.3813 0.6101000
## 68        Cross - Sphere = 0    0.4487    0.6537 0.8387000
## 69      Cross - Teardrop = 0     1.245    0.2131 0.4082000
## 70      Cross - Triangle = 0     1.077    0.2813 0.4905000
## 71    Cylinder - Diamond = 0    -1.179    0.2386 0.4413000
## 72       Cylinder - Disk = 0    0.1921    0.8477 0.9408000
## 73        Cylinder - Egg = 0      0.29    0.7718 0.8895000
## 74   Cylinder - Fireball = 0     2.545   0.01094 0.0601100
## 75  Cylinder - Formation = 0     0.384     0.701 0.8436000
## 76      Cylinder - Light = 0     1.254    0.2097 0.4074000
## 77       Cylinder - Oval = 0       1.1    0.2712 0.4790000
## 78  Cylinder - Rectangle = 0     1.468    0.1422 0.3453000
## 79     Cylinder - Sphere = 0    0.9272    0.3538 0.5728000
## 80   Cylinder - Teardrop = 0     1.812   0.06996 0.2077000
## 81   Cylinder - Triangle = 0      2.15   0.03152 0.1225000
## 82        Diamond - Disk = 0     1.493    0.1354 0.3410000
## 83         Diamond - Egg = 0     1.264    0.2064 0.4068000
## 84    Diamond - Fireball = 0      4.03 5.573e-05 0.0012630
## 85   Diamond - Formation = 0      1.82    0.0688 0.2077000
## 86       Diamond - Light = 0     2.927  0.003427 0.0233000
## 87        Diamond - Oval = 0      2.55   0.01077 0.0601100
## 88   Diamond - Rectangle = 0     2.526   0.01154 0.0603600
## 89      Diamond - Sphere = 0     2.541   0.01105 0.0601100
## 90    Diamond - Teardrop = 0     2.593  0.009513 0.0588100
## 91    Diamond - Triangle = 0     3.726 0.0001949 0.0029450
## 92            Disk - Egg = 0    0.1435    0.8859 0.9487000
## 93       Disk - Fireball = 0     3.318 0.0009054 0.0101100
## 94      Disk - Formation = 0    0.2091    0.8344 0.9408000
## 95          Disk - Light = 0     1.614    0.1065 0.2872000
## 96           Disk - Oval = 0     1.175    0.2401 0.4413000
## 97      Disk - Rectangle = 0     1.426    0.1539 0.3611000
## 98         Disk - Sphere = 0    0.9517    0.3412 0.5591000
## 99       Disk - Teardrop = 0      1.68   0.09305 0.2624000
## 100      Disk - Triangle = 0     2.697  0.007006 0.0453700
## 101       Egg - Fireball = 0     1.672   0.09454 0.2624000
## 102      Egg - Formation = 0   -0.0267    0.9787 0.9882000
## 103          Egg - Light = 0    0.6091    0.5425 0.7547000
## 104           Egg - Oval = 0    0.5431     0.587 0.7827000
## 105      Egg - Rectangle = 0      0.96    0.3371 0.5591000
## 106         Egg - Sphere = 0    0.3674    0.7133 0.8436000
## 107       Egg - Teardrop = 0     1.357    0.1747 0.3823000
## 108       Egg - Triangle = 0     1.342    0.1796 0.3823000
## 109 Fireball - Formation = 0    -3.051  0.002284 0.0172600
## 110     Fireball - Light = 0     -3.16  0.001577 0.0153200
## 111      Fireball - Oval = 0    -2.247   0.02466 0.1032000
```

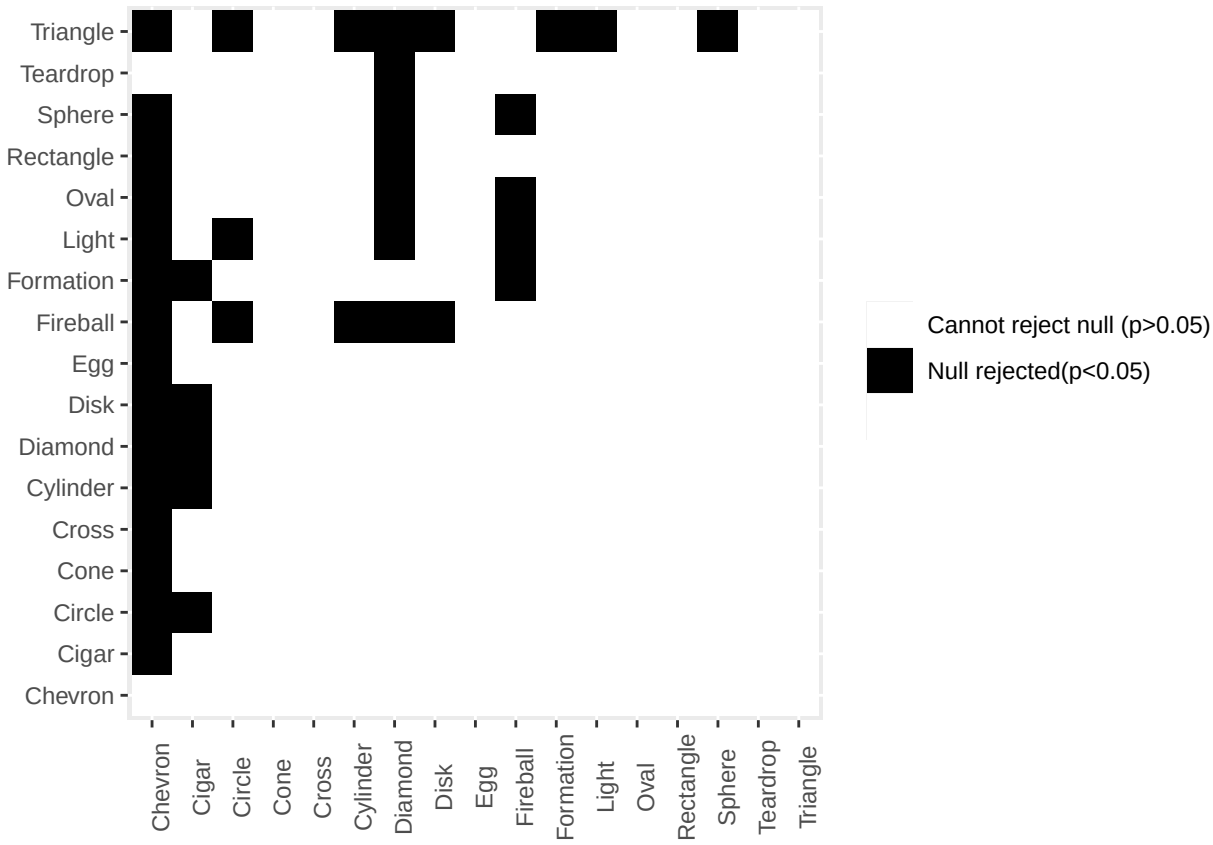
```
## 112  Fireball - Rectangle = 0   -0.6071    0.5438 0.7547000
## 113     Fireball - Sphere = 0    -3.082  0.002053 0.0172600
## 114   Fireball - Teardrop = 0    0.3236    0.7463 0.8675000
## 115   Fireball - Triangle = 0   -0.9667    0.3337 0.5591000
## 116     Formation - Light = 0     1.233    0.2176 0.4110000
## 117      Formation - Oval = 0    0.9762     0.329 0.5591000
## 118 Formation - Rectangle = 0     1.425     0.154 0.3611000
## 119    Formation - Sphere = 0    0.6993    0.4844 0.7161000
## 120  Formation - Teardrop = 0      1.81   0.07025 0.2077000
## 121  Formation - Triangle = 0     2.441   0.01466 0.0703000
## 122          Light - Oval = 0  -0.05058    0.9597 0.9882000
## 123     Light - Rectangle = 0    0.8204     0.412 0.6440000
## 124        Light - Sphere = 0   -0.6564    0.5116 0.7402000
## 125      Light - Teardrop = 0     1.361    0.1734 0.3823000
## 126      Light - Triangle = 0     2.031   0.04227 0.1510000
## 127      Oval - Rectangle = 0    0.7591    0.4478 0.6843000
## 128         Oval - Sphere = 0   -0.4371     0.662 0.8414000
## 129       Oval - Teardrop = 0     1.296    0.1951 0.4020000
## 130       Oval - Triangle = 0     1.495     0.135 0.3410000
## 131    Rectangle - Sphere = 0    -1.114    0.2654 0.4749000
## 132  Rectangle - Teardrop = 0    0.6361    0.5247 0.7493000
## 133  Rectangle - Triangle = 0    0.1072    0.9146 0.9718000
## 134     Sphere - Teardrop = 0     1.608    0.1077 0.2872000
## 135     Sphere - Triangle = 0     2.229    0.0258 0.1032000
## 136   Teardrop - Triangle = 0   -0.7241     0.469 0.7009000
```

```
#Visualization
alpha <- 0.05
pairwise_matrix <- pairwisePermutationMatrix(duration_log_sec ~ Shape, data = df)
pairwise_matrix_sig <- pairwise_matrix$Unadjusted < alpha

library(ggplot2)
library(reshape2)
```

```
##
## Attaching package: 'reshape2'
```

```
## The following object is masked from 'package:tidyr':
##
##     smiths
```

```
pairwise_melted = melt(pairwise_matrix_sig)


ggplot(pairwise_melted) +
  aes(x = Var1,
      y = Var2,
      fill = value) +
  geom_tile() +
  scale_fill_manual(labels = c('Cannot reject null (p>0.05)','Null rejected(p<0.05)', ''),values=c('whi
  theme(axis.text.x = element_text(angle = 90),
        axis.title.x=element_blank(),
        axis.title.y=element_blank(),
        legend.title=element_blank())
```




```
# pairwise_matrix_sig <- tibble(ifelse(pairwise_matrix > alpha, FALSE, TRUE))
# pairwise_matrix_sig
```

```
# # ATTEMPTING TO FIGURE OUT HOW ADONIS WORKS
# test_data <- data.frame(c(1,2,3,1,1,5))
# test_class <- data.frame(shape = c('s','s','s','r','r','r'))
# data_dist <- dist(test_data, method='euclidean')
#
# adonis(data_dist ~ shape, data=test_class)
```

```
# # EXAMPLES OF PERMANOVA FROM VEGAN DOCUMENTATION
#
# ### Example of use with strata, for nested (e.g., block) designs.
# dat <- expand.grid(rep=gl(2,1), NO3=factor(c(0,10)),field=gl(3,1) )
# dat
# Agropyron <- with(dat, as.numeric(field) + as.numeric(NO3)+2) +rnorm(12)/2
# Schizachyrium <- with(dat, as.numeric(field) - as.numeric(NO3)+2) +rnorm(12)/2
# total <- Agropyron + Schizachyrium
# dotplot(total ~ NO3, dat, jitter.x=TRUE, groups=field,
#         type=c('p','a'), xlab="NO3", auto.key=list(columns=3, lines=TRUE) )
#
# Y <- data.frame(Agropyron, Schizachyrium)
# mod <- metaMDS(Y, trace = FALSE)
# plot(mod)
# ### Ellipsoid hulls show treatment
# with(dat, ordiellipse(mod, field, kind = "ehull", label = TRUE))
# ### Spider shows fields
```

```
# with(dat, ordispider(mod, field, lty=3, col="red"))
#
# ### Incorrect (no strata)
# perm <- how(nperm = 199)
# adonis2 (Y ~ NO3, data = dat, permutations = perm)
#
# ## Correct with strata
# setBlocks(perm) <- with(dat, field)
# adonis2(Y ~ NO3, data = dat, permutations = perm)
```