MOT ADHD: Behavioral data analysis

Ben Cowley (adapted from Sami Karadeniz)

Contents

Setup

Preprocessing

Pruning

Discarding subjects before preprocessing. First, we use the following criteria for choosing the subjects to be preprocessed in the first place:

- subjects have been measured with the photodetector
- subjects have the full number of usable sets (= 4)
- subjects do not have too many trial-rejections

Check trial-RTs

Let's take a look at the reaction time distribution for each subject.

If we believe that the RT distribution tails reflect theoretically invalid processes, we could consider trimming them, i.e. discard trials whose RT's are above or below some theoretical limit.

- less than 180 ms (which is mean minus 2SD, based on Table 2 from Woods, et al., 2015 Front Hum Neurosci. 2015; 9:131)
- above median + 5 times the median absolute deviation (but we have no theoretical justification for this)

However, we actually have no strong motivation for this approach, since

(a) it is not clear where the threshold should be
(b) we aim to use parametric test statistics (based on fitting ex-gaussian distribution), for which it is better to have the original data for fitting and rely on the robustness of the statistics to account for outliers.

Still, we visualise how many trials would be rejected based on such thresholds

Results

Results are given for each **task** x **distractor state** combination at the group and single subject levels. We will look at:

Speed

- reaction time mean, estimated from ex-gaussian fit (mu of the gaussian part)
- reaction time variability, estimated from ex-gaussian fit (sigma of the gaussian part)
- reaction time slowing, estimated from long-tail of ex-gaussian fit (tau)
- (RT median and RT variance will be included for comparison, but not for principle analysis)

Accuracy

- hit rates
- false alarm rates
- distractor effects*

*Distractor effects are calculated in the following way:

$$\frac{HR_{distractors\ absent} - HR_{distractors\ present}}{HR_{distractors\ absent} + HR_{distractors\ present}}$$

```
## `summarise()` regrouping output by 'Group', 'dom_resp', 'ID', 'Task' (override with `.groups` argumen
```

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```

MU

Ex-Gaussian stats of Reaction time - mu (gaussian central estimate)

```
##
##  Two-sample Kolmogorov-Smirnov test
##
## data:  exgauss[Group == "Control" & dom_resp == FALSE, ]$mu and exgauss[Group == "Control" & dom_resp
## D = 0.23333, p-value = 0.254
```

```
## alternative hypothesis: two-sided
```

Statistics for RT ex-gauss mu

Constrasts for exgauss mu

MU by LMM - joint tests and facet line plot of interactions

```
##  model term             df1 df2 F.ratio p.value
##  Group                    1  27   2.949 0.0974
##  Distractors              1  27  54.749 <.0001
##  Task                     2  54   0.890 0.4167
##  Group:Distractors        1  27   0.000 0.9989
##  Group:Task               2  54   0.244 0.7842
##  Distractors:Task         2  54   8.470 0.0006
##  Group:Distractors:Task   2  54   1.473 0.2384
```

```
## Group = Control:
##  model term       df1 df2 F.ratio p.value
##  Distractors        1  27  26.452 <.0001
##  Task               2  54   0.711 0.4955
##  Distractors:Task   2  54   8.220 0.0008
##
## Group = ADHD:
##  model term       df1 df2 F.ratio p.value
##  Distractors        1  27  28.363 <.0001
##  Task               2  54   0.412 0.6643
##  Distractors:Task   2  54   1.491 0.2343
```

```
## Distractors = Absent, Task = AttendFull:
##  model term df1   df2 F.ratio p.value
##  Group        1 38.69   1.054 0.3111
##
## Distractors = Present, Task = AttendFull:
##  model term df1   df2 F.ratio p.value
##  Group        1 38.69   3.224 0.0804
##
## Distractors = Absent, Task = AttendLeft:
##  model term df1   df2 F.ratio p.value
##  Group        1 38.69   2.976 0.0925
##
## Distractors = Present, Task = AttendLeft:
##  model term df1   df2 F.ratio p.value
##  Group        1 38.69   1.838 0.1831
##
## Distractors = Absent, Task = AttendRight:
##  model term df1   df2 F.ratio p.value
##  Group        1 38.69   3.795 0.0587
##
## Distractors = Present, Task = AttendRight:
##  model term df1   df2 F.ratio p.value
##  Group        1 38.69   2.392 0.1301
```

```
## Distractors = Absent:
##  model term df1    df2 F.ratio p.value
```

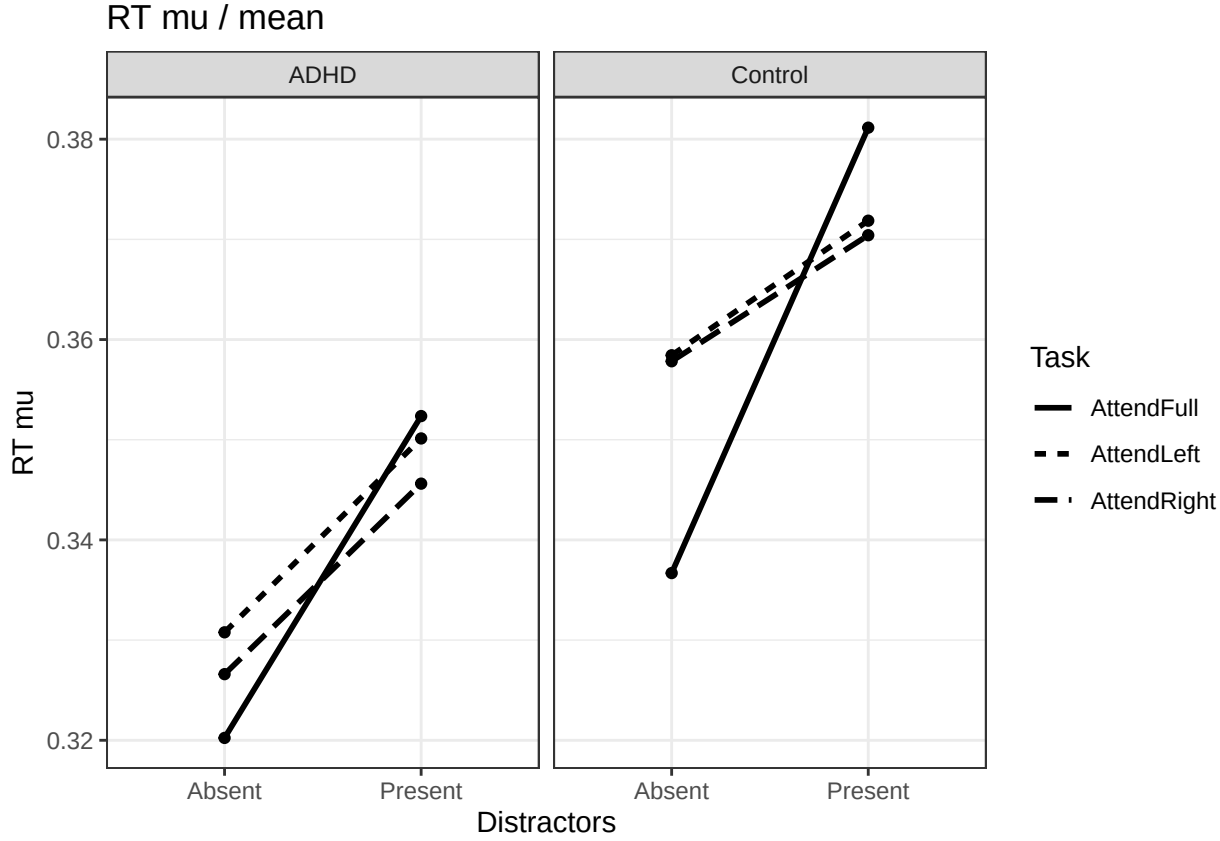
```
##  Group        1  29.54   2.817 0.1038
##  Task         2 103.05   6.109 0.0031
##  Group:Task   2 103.05   1.196 0.3066
##
## Distractors = Present:
##  model term df1    df2 F.ratio p.value
##  Group        1  29.54   2.815 0.1039
##  Task         2 103.05   1.589 0.2090
##  Group:Task   2 103.05   0.252 0.7779
```

```
## Task = AttendFull, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 77.19  41.507 <.0001
##
## Task = AttendLeft, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 77.19   3.787 0.0553
##
## Task = AttendRight, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 77.19   3.324 0.0722
##
## Task = AttendFull, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 77.19  23.222 <.0001
##
## Task = AttendLeft, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 77.19   8.426 0.0048
##
## Task = AttendRight, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 77.19   8.137 0.0056
```

```
## Task = AttendFull:
##  model term        df1   df2 F.ratio p.value
##  Group               1 32.20   2.187 0.1489
##  Distractors         1 77.19  63.708 <.0001
##  Group:Distractors   1 77.19   1.652 0.2025
##
## Task = AttendLeft:
##  model term        df1   df2 F.ratio p.value
##  Group               1 32.20   2.606 0.1162
##  Distractors         1 77.19  11.672 0.0010
##  Group:Distractors   1 77.19   0.381 0.5389
##
## Task = AttendRight:
##  model term        df1   df2 F.ratio p.value
##  Group               1 32.20   3.353 0.0763
##  Distractors         1 77.19  10.845 0.0015
##  Group:Distractors   1 77.19   0.450 0.5043
```

```
## Distractors = Absent, Group = Control:
##  model term df1    df2 F.ratio p.value
##  Task         2 103.05   5.965 0.0035
```

```
##
## Distractors = Present, Group = Control:
##  model term df1    df2 F.ratio p.value
##  Task         2 103.05   1.320 0.2715
##
## Distractors = Absent, Group = ADHD:
##  model term df1    df2 F.ratio p.value
##  Task         2 103.05   1.175 0.3130
##
## Distractors = Present, Group = ADHD:
##  model term df1    df2 F.ratio p.value
##  Task         2 103.05   0.492 0.6128
```



Contrasts performed on the LMM of spread levels (all x all interaction)

```
##  [1] "Control.Absent.AttendFull"   "ADHD.Absent.AttendFull"
##  [3] "Control.Present.AttendFull"  "ADHD.Present.AttendFull"
##  [5] "Control.Absent.AttendLeft"   "ADHD.Absent.AttendLeft"
##  [7] "Control.Present.AttendLeft"  "ADHD.Present.AttendLeft"
##  [9] "Control.Absent.AttendRight"  "ADHD.Absent.AttendRight"
## [11] "Control.Present.AttendRight" "ADHD.Present.AttendRight"
```

```
## TEST CONTRAST: FvLR_adhd 0 0.5 0 0.5 0 -0.25 0 -0.25 0 -0.25 0 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
```

```
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.001982   0.004333  -0.457    0.647
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: LvFR_adhd 0 -0.25 0 -0.25 0 0.5 0 0.5 0 -0.25 0 -0.25

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.004249   0.004333   0.981    0.327
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: RvFL_adhd 0 -0.25 0 -0.25 0 -0.25 0 -0.25 0 0.5 0 0.5

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.002267   0.004333  -0.523    0.601
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: dstr_adhd 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.023498   0.004085  -5.752 8.82e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAF_adhd 0 0.5 0 -0.5 0 -0.25 0 0.25 0 -0.25 0 0.25

##
```

```
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.006471   0.004333  -1.493    0.135
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAL_adhd 0 -0.25 0 0.25 0 0.5 0 -0.5 0 -0.25 0 0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.003110   0.004333   0.718    0.473
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAR_adhd 0 -0.25 0 0.25 0 -0.25 0 0.25 0 0.5 0 -0.5
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.003361   0.004333   0.776    0.438
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: FvLR_ctrl 0.5 0 0.5 0 -0.25 0 -0.25 0 -0.25 0 -0.25 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.005715   0.004485  -1.274    0.203
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: LvFR_ctrl -0.25 0 -0.25 0 0.5 0 0.5 0 -0.25 0 -0.25 0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.003626   0.004485   0.809    0.419
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: RvFL_ctrl -0.25 0 -0.25 0 -0.25 0 -0.25 0 0.5 0 0.5 0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.002088   0.004485   0.466    0.642
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: dstr_ctrl 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.023489   0.004228  -5.555 2.78e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: drAF_ctrl 0.5 0 -0.5 0 -0.25 0 0.25 0 -0.25 0 0.25 0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
```

```
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.015726   0.004485  -3.506 0.000454 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAL_ctrl -0.25 0 0.25 0 0.5 0 -0.5 0 -0.25 0 0.25 0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.007545   0.004485   1.682   0.0925 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAR_ctrl -0.25 0 0.25 0 -0.25 0 0.25 0 0.5 0 -0.5 0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.008181   0.004485   1.824   0.0681 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAF_ctrl V ADHD 0.25 -0.25 -0.25 0.25 -0.125 0.125 0.125 -0.125 -0.125 0.125 0.125 -0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.004628   0.003118  -1.484    0.138
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAL_ctrl V ADHD -0.125 0.125 0.125 -0.125 0.25 -0.25 -0.25 0.25 -0.125 0.125 0.125 -0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.002217   0.003118   0.711    0.477
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAR_ctrl V ADHD -0.125 0.125 0.125 -0.125 -0.125 0.125 0.125 -0.125 0.25 -0.25 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = mu ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.002410   0.003118   0.773     0.44
## (Adjusted p values reported -- single-step method)
```

SIGMA

Ex-Gaussian stats of Reaction time - sigma (gaussian dispersion)

```
##
##  Two-sample Kolmogorov-Smirnov test
##
## data:  exgauss[Group == "Control" & dom_resp == FALSE, ]$sigma and exgauss[Group == "Control" & dom_
## D = 0.2381, p-value = 0.2342
## alternative hypothesis: two-sided
```

Statistics for RTV - exgauss sigma:

Constrasts for exgauss sigma

SIGMA by LMM - joint tests and facet line plot of interactions

```
##  model term             df1 df2 F.ratio p.value
##  Group                    1  27   4.373 0.0461
##  Distractors              1  27   5.796 0.0232
##  Task                     2  54   1.249 0.2949
##  Group:Distractors        1  27   0.001 0.9743
##  Group:Task               2  54   0.139 0.8709
##  Distractors:Task         2  54   2.065 0.1367
##  Group:Distractors:Task   2  54   1.098 0.3410
```

```
## Group = Control:
##  model term       df1 df2 F.ratio p.value
##  Distractors        1  27   2.878 0.1013
##  Task               2  54   0.740 0.4819
##  Distractors:Task   2  54   2.967 0.0599
##
## Group = ADHD:
##  model term       df1 df2 F.ratio p.value
##  Distractors        1  27   2.921 0.0989
##  Task               2  54   0.645 0.5289
##  Distractors:Task   2  54   0.096 0.9083
```

```
## Distractors = Absent, Task = AttendFull:
##  model term df1   df2 F.ratio p.value
##  Group        1 63.87   1.248 0.2682
##
## Distractors = Present, Task = AttendFull:
##  model term df1   df2 F.ratio p.value
##  Group        1 63.87   3.749 0.0573
##
## Distractors = Absent, Task = AttendLeft:
##  model term df1   df2 F.ratio p.value
##  Group        1 63.87   3.754 0.0571
##
## Distractors = Present, Task = AttendLeft:
##  model term df1   df2 F.ratio p.value
##  Group        1 63.87   3.293 0.0743
##
## Distractors = Absent, Task = AttendRight:
##  model term df1   df2 F.ratio p.value
##  Group        1 63.87   3.503 0.0658
##
## Distractors = Present, Task = AttendRight:
##  model term df1   df2 F.ratio p.value
##  Group        1 63.87   1.539 0.2193
```

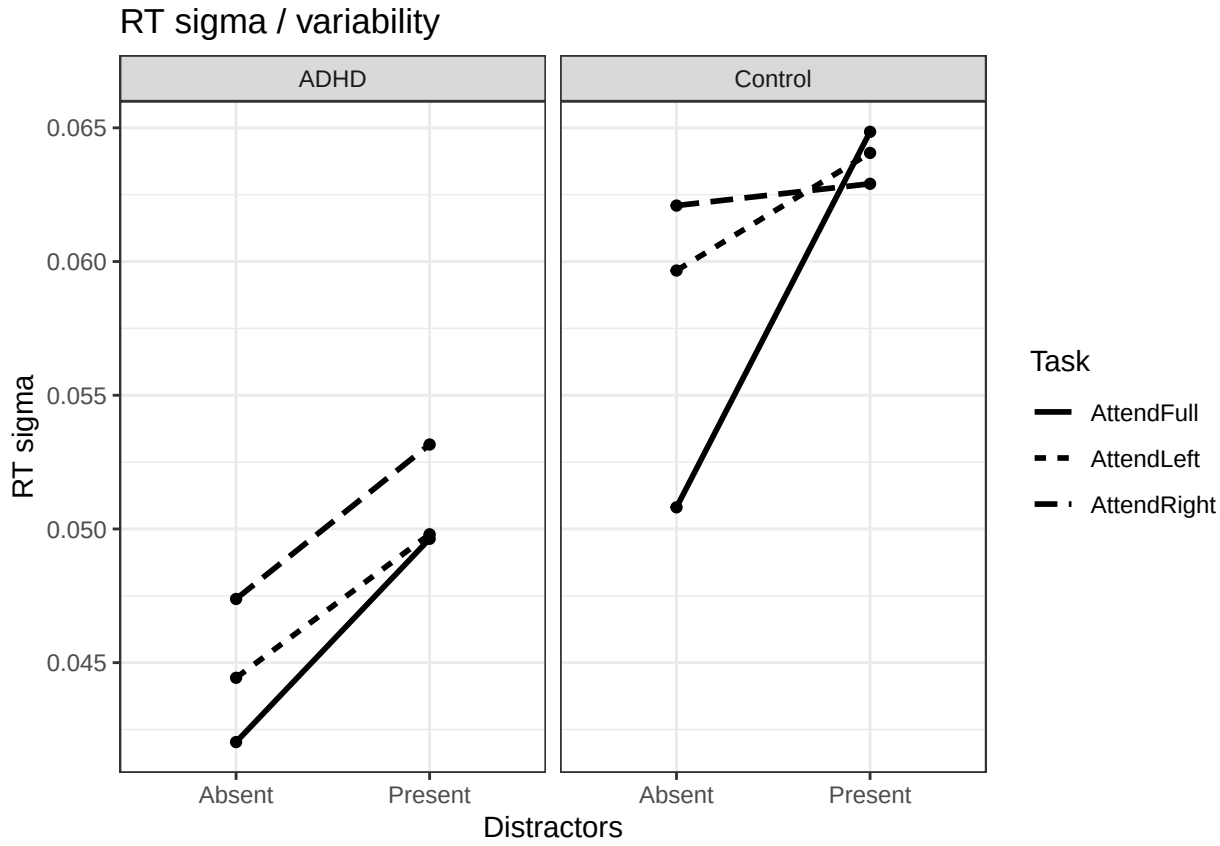
```
## Distractors = Absent:
##  model term df1   df2 F.ratio p.value
##  Group        1 36.38   3.659 0.0637
##  Task         2 94.70   2.956 0.0569
##  Group:Task   2 94.70   0.527 0.5922
##
## Distractors = Present:
##  model term df1   df2 F.ratio p.value
##  Group        1 36.38   3.757 0.0604
##  Task         2 94.70   0.053 0.9485
##  Group:Task   2 94.70   0.350 0.7057
```

```
## Task = AttendFull, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 63.97   7.941 0.0064
##
## Task = AttendLeft, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 63.97   0.779 0.3806
```

```
##
## Task = AttendRight, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 63.97   0.027 0.8707
##
## Task = AttendFull, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 63.97   2.494 0.1192
##
## Task = AttendLeft, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 63.97   1.242 0.2693
##
## Task = AttendRight, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 63.97   1.439 0.2346

## Task = AttendFull:
##  model term        df1   df2 F.ratio p.value
##  Group               1 43.09   2.892 0.0962
##  Distractors         1 63.97   9.758 0.0027
##  Group:Distractors   1 63.97   0.864 0.3561
##
## Task = AttendLeft:
##  model term        df1   df2 F.ratio p.value
##  Group               1 43.09   4.369 0.0425
##  Distractors         1 63.97   1.986 0.1636
##  Group:Distractors   1 63.97   0.019 0.8896
##
## Task = AttendRight:
##  model term        df1   df2 F.ratio p.value
##  Group               1 43.09   3.005 0.0901
##  Distractors         1 63.97   0.905 0.3451
##  Group:Distractors   1 63.97   0.513 0.4766

## Distractors = Absent, Group = Control:
##  model term df1  df2 F.ratio p.value
##  Task         2 94.7   2.797 0.0660
##
## Distractors = Present, Group = Control:
##  model term df1  df2 F.ratio p.value
##  Task         2 94.7   0.076 0.9271
##
## Distractors = Absent, Group = ADHD:
##  model term df1  df2 F.ratio p.value
##  Task         2 94.7   0.610 0.5453
##
## Distractors = Present, Group = ADHD:
##  model term df1  df2 F.ratio p.value
##  Task         2 94.7   0.336 0.7154
```



Contrasts performed on the LMM of spread levels (all x all interaction)

```
##  [1] "Control.Absent.AttendFull"   "ADHD.Absent.AttendFull"
##  [3] "Control.Present.AttendFull"  "ADHD.Present.AttendFull"
##  [5] "Control.Absent.AttendLeft"   "ADHD.Absent.AttendLeft"
##  [7] "Control.Present.AttendLeft"  "ADHD.Present.AttendLeft"
##  [9] "Control.Absent.AttendRight"  "ADHD.Absent.AttendRight"
## [11] "Control.Present.AttendRight" "ADHD.Present.AttendRight"
```

```
## TEST CONTRAST: FvLR_adhd 0 0.5 0 0.5 0 -0.25 0 -0.25 0 -0.25 0 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.002862   0.003173  -0.902    0.367
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: LvFR_adhd 0 -0.25 0 -0.25 0 0.5 0 0.5 0 -0.25 0 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
```

```
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                 Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.0009336  0.0031731  -0.294    0.769
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: RvFL_adhd 0 -0.25 0 -0.25 0 -0.25 0 -0.25 0 0.5 0 0.5

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.003795   0.003173   1.196    0.232
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: dstr_adhd 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.006248   0.002992  -2.088   0.0368 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAF_adhd 0 0.5 0 -0.5 0 -0.25 0 0.25 0 -0.25 0 0.25

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.001016   0.003173   -0.32    0.749
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAL_adhd 0 -0.25 0 0.25 0 0.5 0 -0.5 0 -0.25 0 0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.0006619  0.0031731   0.209    0.835
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAR_adhd 0 -0.25 0 0.25 0 -0.25 0 0.25 0 0.5 0 -0.5
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.0003538  0.0031731   0.112    0.911
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: FvLR_ctrl 0.5 0 0.5 0 -0.25 0 -0.25 0 -0.25 0 -0.25 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.004352   0.003284  -1.325    0.185
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: LvFR_ctrl -0.25 0 -0.25 0 0.5 0 0.5 0 -0.25 0 -0.25 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.001698   0.003284   0.517    0.605
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: RvFL_ctrl -0.25 0 -0.25 0 -0.25 0 -0.25 0 0.5 0 0.5 0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.002654   0.003284   0.808    0.419
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: dstr_ctrl 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.006419   0.003097  -2.073   0.0382 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAF_ctrl 0.5 0 -0.5 0 -0.25 0 0.25 0 -0.25 0 0.25 0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.005718   0.003284  -1.741   0.0817 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAL_ctrl -0.25 0 0.25 0 0.5 0 -0.5 0 -0.25 0 0.25 0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
```

```
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.001515   0.003284   0.461    0.645
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAR_ctrl -0.25 0 0.25 0 -0.25 0 0.25 0 0.5 0 -0.5 0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.004203   0.003284    1.28    0.201
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAF_ctrl V ADHD 0.25 -0.25 -0.25 0.25 -0.125 0.125 0.125 -0.125 -0.125 0.125 0.125 -0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.002351   0.002283   -1.03    0.303
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAL_ctrl V ADHD -0.125 0.125 0.125 -0.125 0.25 -0.25 -0.25 0.25 -0.125 0.125 0.125 -0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.0004263  0.0022834   0.187    0.852
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAR_ctrl V ADHD -0.125 0.125 0.125 -0.125 -0.125 0.125 0.125 -0.125 0.25 -0.25 -0.25

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
```

```
##
##
## Fit: lmer(formula = sigma ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.001925   0.002283   0.843    0.399
## (Adjusted p values reported -- single-step method)
```

TAU

Ex-Gaussian stats of Reaction time - tau (exponential tail)

```
##
##  Two-sample Kolmogorov-Smirnov test
##
## data:  exgauss[Group == "Control" & dom_resp == FALSE, ]$tau and exgauss[Group == "Control" & dom_res
## D = 0.1619, p-value = 0.6877
## alternative hypothesis: two-sided
```

Statistics for RT ex-gauss tau:

```
## boundary (singular) fit: see ?isSingular
```

Constrasts for exgauss tau

TAU by LMM - joint tests and facet line plot of interactions

```
##  model term             df1 df2 F.ratio p.value
##  Group                    1  27   0.076 0.7845
##  Distractors              1  27   0.077 0.7833
##  Task                     2  54   1.052 0.3561
##  Group:Distractors        1  27   0.486 0.4915
##  Group:Task               2  54   0.473 0.6259
##  Distractors:Task         2  54   1.005 0.3729
##  Group:Distractors:Task   2  54   0.467 0.6294
```

```
## Group = Control:
##  model term       df1 df2 F.ratio p.value
##  Distractors        1  27   0.460 0.5036
##  Task               2  54   0.308 0.7364
##  Distractors:Task   2  54   0.050 0.9512
##
## Group = ADHD:
##  model term       df1 df2 F.ratio p.value
##  Distractors        1  27   0.091 0.7650
##  Task               2  54   1.250 0.2947
##  Distractors:Task   2  54   1.470 0.2389
```

```
## Distractors = Absent, Task = AttendFull:
##  model term df1    df2 F.ratio p.value
##  Group        1 120.42   0.780 0.3788
##
## Distractors = Present, Task = AttendFull:
```

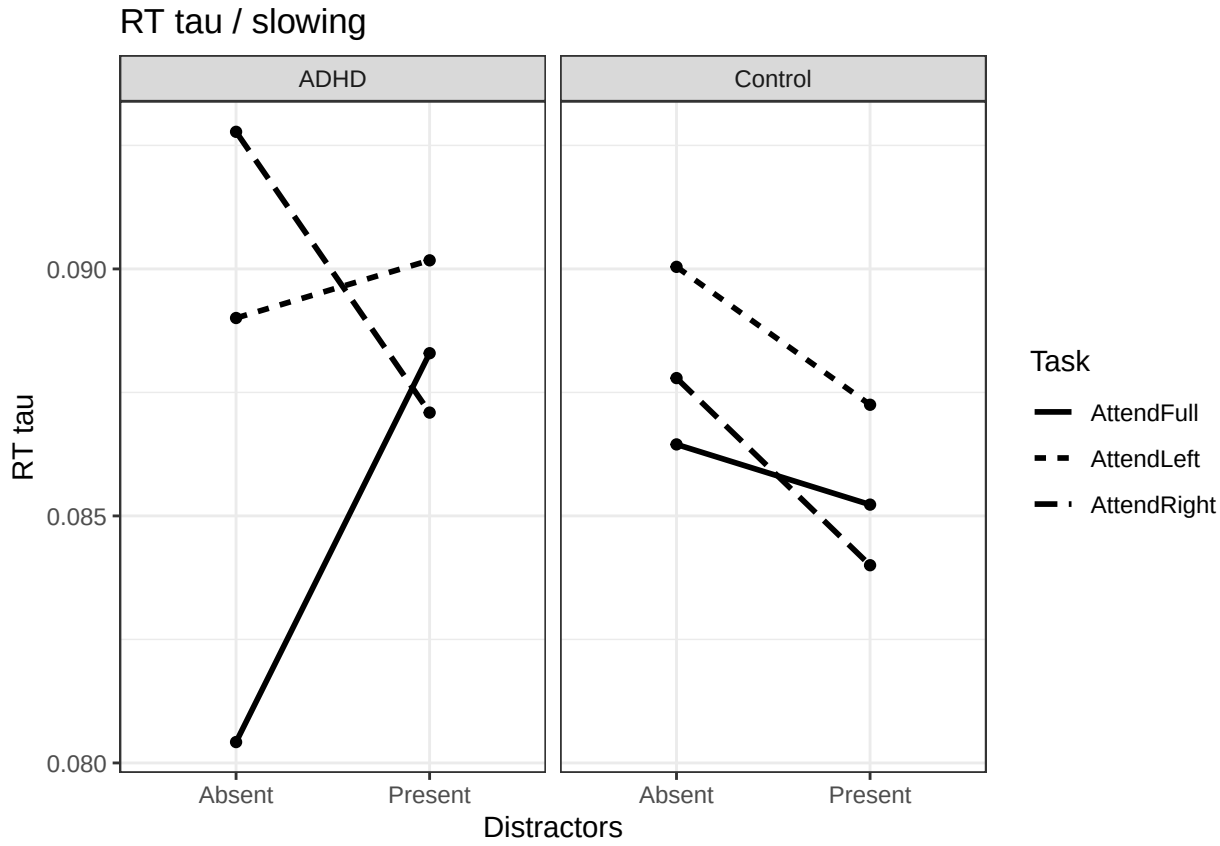
```
##  model term df1    df2 F.ratio p.value
##  Group        1 120.42   0.202 0.6540
##
## Distractors = Absent, Task = AttendLeft:
##  model term df1    df2 F.ratio p.value
##  Group        1 120.42   0.023 0.8796
##
## Distractors = Present, Task = AttendLeft:
##  model term df1    df2 F.ratio p.value
##  Group        1 120.42   0.184 0.6690
##
## Distractors = Absent, Task = AttendRight:
##  model term df1    df2 F.ratio p.value
##  Group        1 120.42   0.534 0.4663
##
## Distractors = Present, Task = AttendRight:
##  model term df1    df2 F.ratio p.value
##  Group        1 120.42   0.205 0.6514

## Distractors = Absent:
##  model term df1    df2 F.ratio p.value
##  Group        1  45.56   0.019 0.8905
##  Task         2 108.00   1.742 0.1801
##  Group:Task   2 108.00   0.939 0.3941
##
## Distractors = Present:
##  model term df1    df2 F.ratio p.value
##  Group        1  45.56   0.367 0.5477
##  Task         2 108.00   0.315 0.7303
##  Group:Task   2 108.00   0.000 0.9998

## Task = AttendFull, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 79.54   0.040 0.8417
##
## Task = AttendLeft, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 79.54   0.211 0.6476
##
## Task = AttendRight, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 79.54   0.388 0.5354
##
## Task = AttendFull, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 79.54   1.793 0.1843
##
## Task = AttendLeft, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 79.54   0.039 0.8431
##
## Task = AttendRight, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 79.54   0.935 0.3365
```

```
## Task = AttendFull:
##  model term        df1   df2 F.ratio p.value
##  Group               1 58.77   0.077 0.7831
##  Distractors         1 79.54   0.618 0.4340
##  Group:Distractors   1 79.54   1.155 0.2858
##
## Task = AttendLeft:
##  model term        df1   df2 F.ratio p.value
##  Group               1 58.77   0.031 0.8606
##  Distractors         1 79.54   0.037 0.8482
##  Group:Distractors   1 79.54   0.219 0.6411
##
## Task = AttendRight:
##  model term        df1   df2 F.ratio p.value
##  Group               1 58.77   0.569 0.4536
##  Distractors         1 79.54   1.254 0.2663
##  Group:Distractors   1 79.54   0.050 0.8232
```

```
## Distractors = Absent, Group = Control:
##  model term df1 df2 F.ratio p.value
##  Task         2 108   0.197 0.8214
##
## Distractors = Present, Group = Control:
##  model term df1 df2 F.ratio p.value
##  Task         2 108   0.161 0.8517
##
## Distractors = Absent, Group = ADHD:
##  model term df1 df2 F.ratio p.value
##  Task         2 108   2.566 0.0815
##
## Distractors = Present, Group = ADHD:
##  model term df1 df2 F.ratio p.value
##  Task         2 108   0.154 0.8570
```



Contrasts performed on the LMM of spread levels (all x all interaction)

```
##  [1] "Control.Absent.AttendFull"   "ADHD.Absent.AttendFull"
##  [3] "Control.Present.AttendFull"  "ADHD.Present.AttendFull"
##  [5] "Control.Absent.AttendLeft"   "ADHD.Absent.AttendLeft"
##  [7] "Control.Present.AttendLeft"  "ADHD.Present.AttendLeft"
##  [9] "Control.Absent.AttendRight"  "ADHD.Absent.AttendRight"
## [11] "Control.Present.AttendRight" "ADHD.Present.AttendRight"
```

```
## TEST CONTRAST: FvLR_adhd 0 0.5 0 0.5 0 -0.25 0 -0.25 0 -0.25 0 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.005404   0.003530  -1.531    0.126
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: LvFR_adhd 0 -0.25 0 -0.25 0 0.5 0 0.5 0 -0.25 0 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
```

```
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.002444   0.003530   0.692    0.489
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: RvFL_adhd 0 -0.25 0 -0.25 0 -0.25 0 -0.25 0 0.5 0 0.5

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.002959   0.003530   0.838    0.402
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: dstr_adhd 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.001118   0.003328  -0.336    0.737
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAF_adhd 0 0.5 0 -0.5 0 -0.25 0 0.25 0 -0.25 0 0.25

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.005065   0.003530  -1.435    0.151
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAL_adhd 0 -0.25 0 0.25 0 0.5 0 -0.5 0 -0.25 0 0.25

##
##   Simultaneous Tests for General Linear Hypotheses
```

```
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                  Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -3.676e-05  3.530e-03   -0.01    0.992
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAR_adhd 0 -0.25 0 0.25 0 -0.25 0 0.25 0 0.5 0 -0.5

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.005102   0.003530   1.445    0.148
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: FvLR_ctrl 0.5 0 0.5 0 -0.25 0 -0.25 0 -0.25 0 -0.25 0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                  Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.001433   0.003654  -0.392    0.695
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: LvFR_ctrl -0.25 0 -0.25 0 0.5 0 0.5 0 -0.25 0 -0.25 0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.002779   0.003654   0.761    0.447
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: RvFL_ctrl -0.25 0 -0.25 0 -0.25 0 -0.25 0 0.5 0 0.5 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.001346   0.003654  -0.368    0.713
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: dstr_ctrl 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.002599   0.003445   0.755    0.451
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAF_ctrl 0.5 0 -0.5 0 -0.25 0 0.25 0 -0.25 0 0.25 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.001035   0.003654  -0.283    0.777
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAL_ctrl -0.25 0 0.25 0 0.5 0 -0.5 0 -0.25 0 0.25 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.0001441  0.0036538   0.039    0.969
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAR_ctrl -0.25 0 0.25 0 -0.25 0 0.25 0 0.5 0 -0.5 0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.0008913  0.0036538   0.244    0.807
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: drAF_ctrl V ADHD 0.25 -0.25 -0.25 0.25 -0.125 0.125 0.125 -0.125 -0.125 0.125 0.125 -0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.002015   0.002540   0.793    0.428
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: drAL_ctrl V ADHD -0.125 0.125 0.125 -0.125 0.25 -0.25 -0.25 0.25 -0.125 0.125 0.125 -0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 9.045e-05  2.540e-03   0.036    0.972
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: drAR_ctrl V ADHD -0.125 0.125 0.125 -0.125 -0.125 0.125 0.125 -0.125 0.25 -0.25 -0.25
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = tau ~ all_groups + (1 | ID), data = exgauss)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
```

```
## contrast == 0 -0.002105   0.002540  -0.829    0.407
## (Adjusted p values reported -- single-step method)
```

Hit rates

```
##
##  Two-sample Kolmogorov-Smirnov test
##
## data:  hit_rates[Group == "Control" & dom_resp == FALSE, ]$hit_rate and hit_rates[Group == "Control"
## D = 0.48095, p-value = 0.0006095
## alternative hypothesis: two-sided
```

Statistics for hit rates

Constrasts for Hit Rates

Hit rate by LMM - joint tests and facet line plot of interactions

```
##  model term             df1 df2 F.ratio p.value
##  Group                    1  27   0.000 0.9914
##  Distractors              1  27  71.837 <.0001
##  Task                     2  54   0.416 0.6620
##  Group:Distractors        1  27   0.002 0.9636
##  Group:Task               2  54   0.048 0.9536
##  Distractors:Task         2  54   3.910 0.0259
##  Group:Distractors:Task   2  54   2.195 0.1212
```

```
## Group = Control:
##  model term       df1 df2 F.ratio p.value
##  Distractors        1  27  35.100 <.0001
##  Task               2  54   0.152 0.8595
##  Distractors:Task   2  54   5.612 0.0061
##
## Group = ADHD:
##  model term       df1 df2 F.ratio p.value
##  Distractors        1  27  36.797 <.0001
##  Task               2  54   0.317 0.7296
##  Distractors:Task   2  54   0.311 0.7342
```

```
## Distractors = Absent, Task = AttendFull:
##  model term df1   df2 F.ratio p.value
##  Group        1 41.74   0.215 0.6454
##
## Distractors = Present, Task = AttendFull:
##  model term df1   df2 F.ratio p.value
##  Group        1 41.74   0.393 0.5344
##
## Distractors = Absent, Task = AttendLeft:
##  model term df1   df2 F.ratio p.value
##  Group        1 41.74   0.019 0.8913
##
## Distractors = Present, Task = AttendLeft:
##  model term df1   df2 F.ratio p.value
##  Group        1 41.74   0.015 0.9022
```

```
##
## Distractors = Absent, Task = AttendRight:
##  model term df1   df2 F.ratio p.value
##  Group        1 41.74   0.103 0.7500
##
## Distractors = Present, Task = AttendRight:
##  model term df1   df2 F.ratio p.value
##  Group        1 41.74   0.193 0.6627

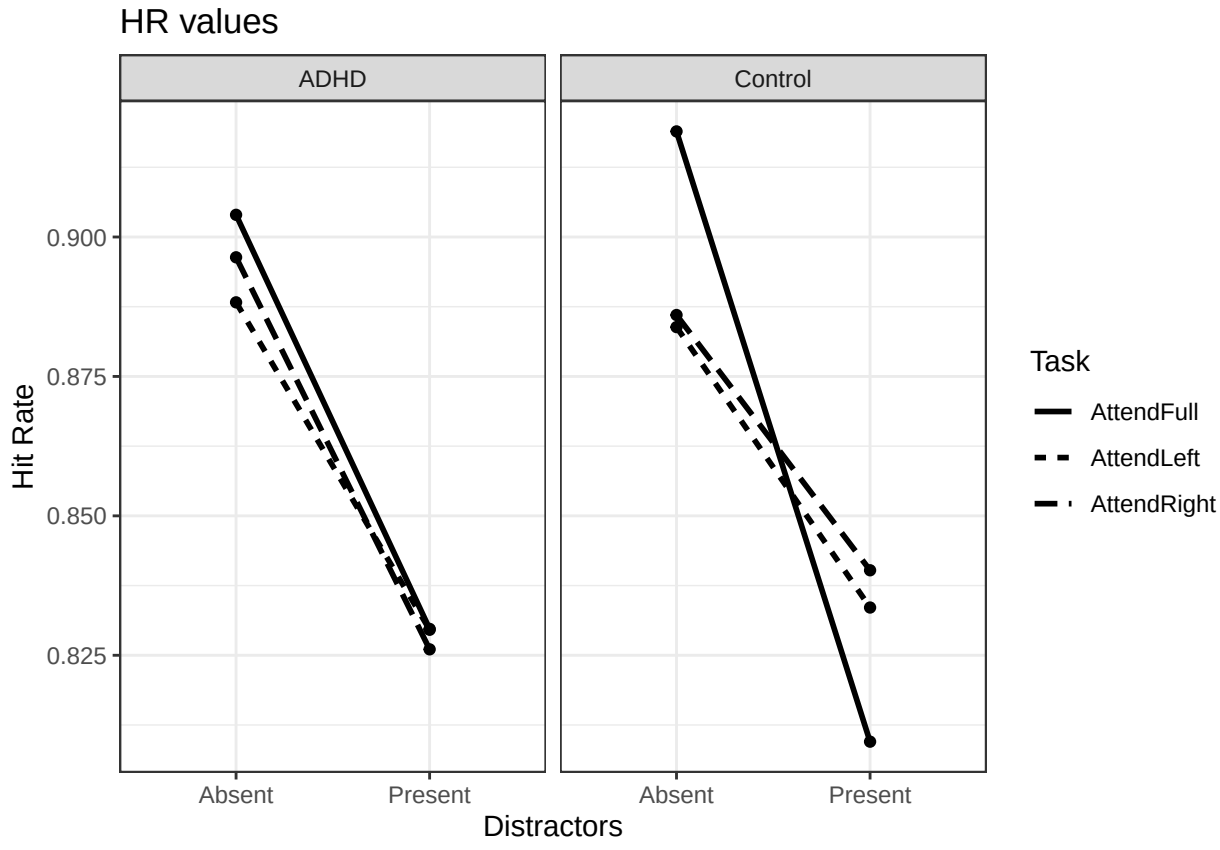
## Distractors = Absent:
##  model term df1    df2 F.ratio p.value
##  Group        1  31.17   0.000 0.9985
##  Task         2 108.00   3.318 0.0399
##  Group:Task   2 108.00   0.806 0.4492
##
## Distractors = Present:
##  model term df1    df2 F.ratio p.value
##  Group        1  31.17   0.001 0.9819
##  Task         2 108.00   1.008 0.3684
##  Group:Task   2 108.00   1.436 0.2424

## Task = AttendFull, Group = Control:
##  model term  df1  df2 F.ratio p.value
##  Distractors   1 74.6  42.230 <.0001
##
## Task = AttendLeft, Group = Control:
##  model term  df1  df2 F.ratio p.value
##  Distractors   1 74.6   8.918 0.0038
##
## Task = AttendRight, Group = Control:
##  model term  df1  df2 F.ratio p.value
##  Distractors   1 74.6   7.388 0.0082
##
## Task = AttendFull, Group = ADHD:
##  model term  df1  df2 F.ratio p.value
##  Distractors   1 74.6  20.833 <.0001
##
## Task = AttendLeft, Group = ADHD:
##  model term  df1  df2 F.ratio p.value
##  Distractors   1 74.6  13.026 0.0006
##
## Task = AttendRight, Group = ADHD:
##  model term  df1  df2 F.ratio p.value
##  Distractors   1 74.6  18.672 <.0001

## Task = AttendFull:
##  model term        df1   df2 F.ratio p.value
##  Group               1 31.79   0.008 0.9308
##  Distractors         1 74.60  61.543 <.0001
##  Group:Distractors   1 74.60   2.257 0.1372
##
## Task = AttendLeft:
##  model term        df1   df2 F.ratio p.value
##  Group               1 31.79   0.000 0.9941
##  Distractors         1 74.60  21.672 <.0001
```

```
##  Group:Distractors   1 74.60   0.130 0.7199
##
## Task = AttendRight:
##  model term        df1   df2 F.ratio p.value
##  Group               1 31.79   0.004 0.9497
##  Distractors         1 74.60  24.575 <.0001
##  Group:Distractors   1 74.60   1.097 0.2983

## Distractors = Absent, Group = Control:
##  model term df1 df2 F.ratio p.value
##  Task         2 108   3.439 0.0356
##
## Distractors = Present, Group = Control:
##  model term df1 df2 F.ratio p.value
##  Task         2 108   2.324 0.1027
##
## Distractors = Absent, Group = ADHD:
##  model term df1 df2 F.ratio p.value
##  Task         2 108   0.587 0.5578
##
## Distractors = Present, Group = ADHD:
##  model term df1 df2 F.ratio p.value
##  Task         2 108   0.041 0.9600
```



Contrasts performed on the LMM of spread levels (all x all interaction)

```
##  [1] "Control.Absent.AttendFull"   "ADHD.Absent.AttendFull"
##  [3] "Control.Present.AttendFull"  "ADHD.Present.AttendFull"
##  [5] "Control.Absent.AttendLeft"   "ADHD.Absent.AttendLeft"
```

```
##  [7] "Control.Present.AttendLeft"  "ADHD.Present.AttendLeft"
##  [9] "Control.Absent.AttendRight"  "ADHD.Absent.AttendRight"
## [11] "Control.Present.AttendRight" "ADHD.Present.AttendRight"
```

```
## TEST CONTRAST: FvLR_adhd 0 0.5 0 0.5 0 -0.25 0 -0.25 0 -0.25 0 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.006781   0.009540   0.711    0.477
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: LvFR_adhd 0 -0.25 0 -0.25 0 0.5 0 0.5 0 -0.25 0 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.005105   0.009540  -0.535    0.593
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: RvFL_adhd 0 -0.25 0 -0.25 0 -0.25 0 -0.25 0 0.5 0 0.5
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.001676   0.009540  -0.176    0.861
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: dstr_adhd 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
```

```
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.067752   0.008995   7.532 4.97e-14 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAF_adhd 0 0.5 0 -0.5 0 -0.25 0 0.25 0 -0.25 0 0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.004873   0.009540   0.511    0.609
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAL_adhd 0 -0.25 0 0.25 0 0.5 0 -0.5 0 -0.25 0 0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.00678    0.00954  -0.711    0.477
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAR_adhd 0 -0.25 0 0.25 0 -0.25 0 0.25 0 0.5 0 -0.5
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.001907   0.009540     0.2    0.842
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: FvLR_ctrl 0.5 0 0.5 0 -0.25 0 -0.25 0 -0.25 0 -0.25 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
```

```
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.003306   0.009875   0.335    0.738
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: LvFR_ctrl -0.25 0 -0.25 0 0.5 0 0.5 0 -0.25 0 -0.25 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.004971   0.009875  -0.503    0.615
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: RvFL_ctrl -0.25 0 -0.25 0 -0.25 0 -0.25 0 0.5 0 0.5 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.001665   0.009875   0.169    0.866
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: dstr_ctrl 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0  0.06849    0.00931   7.357 1.89e-13 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAF_ctrl 0.5 0 -0.5 0 -0.25 0 0.25 0 -0.25 0 0.25 0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.030699   0.009875   3.109  0.00188 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: drAL_ctrl -0.25 0 0.25 0 0.5 0 -0.5 0 -0.25 0 0.25 0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.013656   0.009875  -1.383    0.167
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: drAR_ctrl -0.25 0 0.25 0 -0.25 0 0.25 0 0.5 0 -0.5 0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.017042   0.009875  -1.726   0.0844 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: drAF_ctrl V ADHD 0.25 -0.25 -0.25 0.25 -0.125 0.125 0.125 -0.125 -0.125 0.125 0.125 -0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
```

```
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.012913   0.006865   1.881     0.06 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAL_ctrl V ADHD -0.125 0.125 0.125 -0.125 0.25 -0.25 -0.25 0.25 -0.125 0.125 0.125 -0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.003438   0.006865  -0.501    0.617
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAR_ctrl V ADHD -0.125 0.125 0.125 -0.125 -0.125 0.125 0.125 -0.125 0.25 -0.25 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = hit_rate ~ all_groups + (1 | ID), data = hit_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.009475   0.006865   -1.38    0.168
## (Adjusted p values reported -- single-step method)
```

False alarms

```
##
##  Two-sample Kolmogorov-Smirnov test
##
## data:  fa_rates[Group == "Control" & dom_resp == FALSE, ]$fa_rate and fa_rates[Group == "Control" & d
## D = 0.16667, p-value = 0.7159
## alternative hypothesis: two-sided
```

Statistics for false alarm rates:

Constrasts for False Alarms

False Alarm by LMM - joint tests and facet line plot of interactions

```
##  model term             df1 df2 F.ratio p.value
##  Group                    1  27   0.996 0.3271
##  Distractors              1  27  15.438 0.0005
##  Task                     2  54   1.477 0.2374
##  Group:Distractors        1  27   0.038 0.8474
##  Group:Task               2  54   0.726 0.4887
##  Distractors:Task         2  54   9.374 0.0003
##  Group:Distractors:Task   2  54   0.044 0.9571
```

```
## Group = Control:
##  model term       df1 df2 F.ratio p.value
##  Distractors        1  27   8.218 0.0079
##  Task               2  54   2.013 0.1435
##  Distractors:Task   2  54   4.949 0.0106
##
## Group = ADHD:
##  model term       df1 df2 F.ratio p.value
##  Distractors        1  27   7.224 0.0122
##  Task               2  54   0.125 0.8831
##  Distractors:Task   2  54   4.452 0.0162
```

```
## Distractors = Absent, Task = AttendLeft:
##  model term df1   df2 F.ratio p.value
##  Group        1 59.52   0.587 0.4467
##
## Distractors = Present, Task = AttendLeft:
##  model term df1   df2 F.ratio p.value
##  Group        1 59.52   0.218 0.6425
##
## Distractors = Absent, Task = AttendNone:
##  model term df1   df2 F.ratio p.value
##  Group        1 59.52   1.615 0.2087
##
## Distractors = Present, Task = AttendNone:
##  model term df1   df2 F.ratio p.value
##  Group        1 59.52   1.632 0.2063
##
## Distractors = Absent, Task = AttendRight:
##  model term df1   df2 F.ratio p.value
##  Group        1 59.52   0.322 0.5727
##
## Distractors = Present, Task = AttendRight:
##  model term df1   df2 F.ratio p.value
##  Group        1 59.52   0.245 0.6222
```

```
## Distractors = Absent:
##  model term df1    df2 F.ratio p.value
##  Group        1  34.90   1.002 0.3237
##  Task         2 102.81   1.133 0.3260
##  Group:Task   2 102.81   0.354 0.7030
##
## Distractors = Present:
##  model term df1    df2 F.ratio p.value
##  Group        1  34.90   0.741 0.3952
##  Task         2 102.81   7.943 0.0006
```

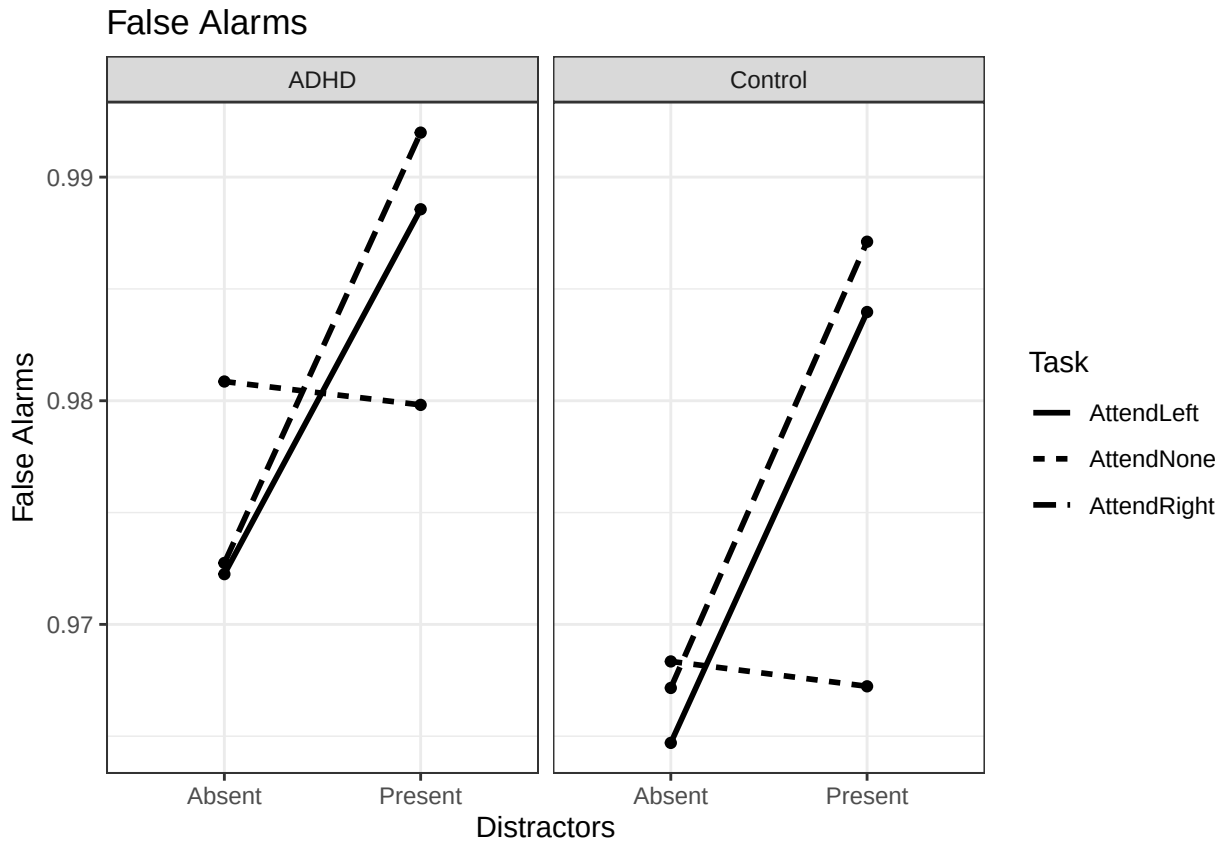
```
##  Group:Task   2 102.81   0.569 0.5677

## Task = AttendLeft, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 71.58   9.535 0.0029
##
## Task = AttendNone, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 71.58   0.032 0.8590
##
## Task = AttendRight, Group = Control:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 71.58  10.227 0.0021
##
## Task = AttendLeft, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 71.58   7.327 0.0085
##
## Task = AttendNone, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 71.58   0.030 0.8628
##
## Task = AttendRight, Group = ADHD:
##  model term  df1   df2 F.ratio p.value
##  Distractors   1 71.58  10.193 0.0021

## Task = AttendLeft:
##  model term        df1   df2 F.ratio p.value
##  Group               1 39.92   0.471 0.4964
##  Distractors         1 71.58  16.822 0.0001
##  Group:Distractors   1 71.58   0.116 0.7348
##
## Task = AttendNone:
##  model term        df1   df2 F.ratio p.value
##  Group               1 39.92   2.014 0.1636
##  Distractors         1 71.58   0.062 0.8043
##  Group:Distractors   1 71.58   0.000 0.9938
##
## Task = AttendRight:
##  model term        df1   df2 F.ratio p.value
##  Group               1 39.92   0.350 0.5573
##  Distractors         1 71.58  20.414 <.0001
##  Group:Distractors   1 71.58   0.007 0.9351

## Distractors = Absent, Group = Control:
##  model term df1    df2 F.ratio p.value
##  Task         2 102.81   0.185 0.8315
##
## Distractors = Present, Group = Control:
##  model term df1    df2 F.ratio p.value
##  Task         2 102.81   6.117 0.0031
##
## Distractors = Absent, Group = ADHD:
##  model term df1    df2 F.ratio p.value
##  Task         2 102.81   1.342 0.2659
```

```
##
## Distractors = Present, Group = ADHD:
##  model term df1    df2 F.ratio p.value
##  Task         2 102.81   2.262 0.1093
```



Contrasts performed on the LMM of spread levels (all x all interaction)

```
##  [1] "Control.Absent.AttendLeft"   "ADHD.Absent.AttendLeft"
##  [3] "Control.Present.AttendLeft"  "ADHD.Present.AttendLeft"
##  [5] "Control.Absent.AttendNone"   "ADHD.Absent.AttendNone"
##  [7] "Control.Present.AttendNone"  "ADHD.Present.AttendNone"
##  [9] "Control.Absent.AttendRight"  "ADHD.Absent.AttendRight"
## [11] "Control.Present.AttendRight" "ADHD.Present.AttendRight"
```

```
## TEST CONTRAST: NvLR_adhd 0 -0.25 0 -0.25 0 0.5 0 0.5 0 -0.25 0 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.001049   0.003818  -0.275    0.784
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: LvNR_adhd 0 0.5 0 0.5 0 -0.25 0 -0.25 0 -0.25 0 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##                  Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.0009479  0.0038181  -0.248    0.804
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: RvNL_adhd 0 -0.25 0 -0.25 0 -0.25 0 -0.25 0 0.5 0 0.5
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.001997   0.003818   0.523    0.601
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: dstr_adhd 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0  -0.0115     0.0036  -3.196  0.00139 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAN_adhd 0 -0.25 0 0.25 0 0.5 0 -0.5 0 -0.25 0 0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
```

```
## contrast == 0 0.009413   0.003818   2.465   0.0137 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAL_adhd 0 0.5 0 -0.5 0 -0.25 0 0.25 0 -0.25 0 0.25

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.003608   0.003818  -0.945    0.345
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: drAR_adhd 0 -0.25 0 0.25 0 -0.25 0 0.25 0 0.5 0 -0.5

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.005805   0.003818   -1.52    0.128
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: NvLR_ctrl -0.25 0 -0.25 0 0.5 0 0.5 0 -0.25 0 -0.25 0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.007948   0.003952  -2.011   0.0443 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: LvNR_ctrl 0.5 0 0.5 0 -0.25 0 -0.25 0 -0.25 0 -0.25 0

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
```

```
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.001874   0.003952   0.474    0.635
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: RvNL_ctrl -0.25 0 -0.25 0 -0.25 0 -0.25 0 0.5 0 0.5 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.006074   0.003952   1.537    0.124
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: dstr_ctrl 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0 0.3333333 0 -0.3333333 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.012703   0.003726  -3.409 0.000652 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAN_ctrl -0.25 0 0.25 0 0.5 0 -0.5 0 -0.25 0 0.25 0
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.010361   0.003952   2.622  0.00875 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAL_ctrl 0.5 0 -0.5 0 -0.25 0 0.25 0 -0.25 0 0.25 0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.004923   0.003952  -1.246    0.213
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: drAR_ctrl -0.25 0 0.25 0 -0.25 0 0.25 0 0.5 0 -0.5 0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.005438   0.003952  -1.376    0.169
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: drAN_ctrl V ADHD -0.125 0.125 0.125 -0.125 0.25 -0.25 -0.25 0.25 -0.125 0.125 0.125 -0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.0004741  0.0027476   0.173    0.863
## (Adjusted p values reported -- single-step method)
## TEST CONTRAST: drAL_ctrl V ADHD 0.25 -0.25 -0.25 0.25 -0.125 0.125 0.125 -0.125 -0.125 0.125 0.125 -0
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##                 Estimate Std. Error z value Pr(>|z|)
```

```
## contrast == 0 -0.0006574  0.0027476  -0.239    0.811
## (Adjusted p values reported -- single-step method)
```

```
## TEST CONTRAST: drAR_ctrl V ADHD -0.125 0.125 0.125 -0.125 -0.125 0.125 0.125 -0.125 0.25 -0.25 -0.25
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = fa_rate ~ all_groups + (1 | ID), data = fa_rates)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.0001832  0.0027476   0.067    0.947
## (Adjusted p values reported -- single-step method)
```

Distractor effect

Statistics for distractor effect:

Contrasts for distractor effect:

```
## [1] "Control.AttendFull"  "ADHD.AttendFull"     "Control.AttendLeft"
## [4] "ADHD.AttendLeft"     "Control.AttendRight" "ADHD.AttendRight"
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = distractor_effect ~ all_groups + (1 | ID), data = distractor_effect)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.0004263  0.0316368   0.013    0.989
## (Adjusted p values reported -- single-step method)
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = distractor_effect ~ all_groups + (1 | ID), data = distractor_effect)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.005112   0.011073   0.462    0.644
## (Adjusted p values reported -- single-step method)
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
```

```
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = distractor_effect ~ all_groups + (1 | ID), data = distractor_effect)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.008169   0.011073   0.738    0.461
## (Adjusted p values reported -- single-step method)
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = distractor_effect ~ all_groups + (1 | ID), data = distractor_effect)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.003057   0.011073  -0.276    0.782
## (Adjusted p values reported -- single-step method)
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = distractor_effect ~ all_groups + (1 | ID), data = distractor_effect)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0  0.03795    0.01146   3.311  0.00093 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = distractor_effect ~ all_groups + (1 | ID), data = distractor_effect)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.01787    0.01146  -1.559    0.119
## (Adjusted p values reported -- single-step method)
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
```

```
##
##
## Fit: lmer(formula = distractor_effect ~ all_groups + (1 | ID), data = distractor_effect)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.02008    0.01146  -1.752   0.0798 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: FvLR ctrl V ADHD 0.5 -0.5 -0.25 0.25 -0.25 0.25

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = distractor_effect ~ all_groups + (1 | ID), data = distractor_effect)
##
## Linear Hypotheses:
##               Estimate Std. Error z value Pr(>|z|)
## contrast == 0 0.016418   0.007968    2.06   0.0394 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: LvFR ctrl V ADHD -0.25 -0.25 0.5 0.5 -0.25 -0.25

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = distractor_effect ~ all_groups + (1 | ID), data = distractor_effect)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.013020   0.007968  -1.634    0.102
## (Adjusted p values reported -- single-step method)

## TEST CONTRAST: RvFL ctrl V ADHD -0.25 -0.25 -0.25 -0.25 0.5 0.5

##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: User-defined Contrasts
##
##
## Fit: lmer(formula = distractor_effect ~ all_groups + (1 | ID), data = distractor_effect)
##
## Linear Hypotheses:
##                Estimate Std. Error z value Pr(>|z|)
## contrast == 0 -0.008510   0.007968  -1.068    0.286
## (Adjusted p values reported -- single-step method)
```