Experiment 3 Supplement

Excluding trials exceeding initiation time limit in initmax condition

General preparations

Load libraries

```
library(mousetrap)
library(ggplot2)
library(dplyr)
library(tidyr)
library(afex)
library(MBESS)
library(ordinal)
```

Custom ggplot2 theme

```
theme_set(theme_classic()+
  theme(
    axis.line = element_line(colour = "black"),
    axis.ticks = element_line(colour = "black"),
    axis.text = element_text(colour = "black"),
    panel.border = element_rect(colour = "black", fill=NA)
  ))
```

Custom functions

```
# Function to compute confidence interval for partial eta-squared
get_partial_etas <- function(anova_table, conf.level=.90){
  partial_etas <- sapply(row.names(anova_table),function(i){
    F <- anova_table[i,"F"]
    df1 <- anova_table[i,"num Df"]
    df2 <- anova_table[i,"den Df"]
    ci <- conf.limits.ncf(F.value=F,conf.level=conf.level,df.1=df1,df.2=df2)
    return(
      c(pes=((F*df1)/(F*df1+df2)),
        lower=ci$Lower.Limit/(ci$Lower.Limit+df1+df2+1),
        upper=ci$Upper.Limit/(ci$Upper.Limit+df1+df2+1)))
  })
  return(t(partial_etas))
}
```

Data import

```
raw_data <- read.csv("../data/exp3.csv")
raw_data$Typicality <- factor(raw_data$Condition,levels=c("Typical","Atypical"))
raw_data$group <- factor(raw_data$group,levels=c("static","rtmax","initmax","dynamic"))
```

Filter trials in initmax condition above initiation time limit

```
# Count eligible and non-eligible trials
n_eligible <- sum(with(raw_data,group=="initmax" & response_time_initial_phase<=600))
n_noneligible <- sum(with(raw_data,group=="initmax" & response_time_initial_phase>600))

# Percent trials in initmax condition above initiation time limit
n_noneligible/(n_eligible+n_noneligible)
```

```
## [1] 0.1236045
```

```
# Check number of participants
length(unique(raw_data$subject_nr))
```

```
## [1] 245
```

```
# Exclude non-eligible trials
raw_data <- subset(raw_data, !(group=="initmax" & response_time_initial_phase>600))

# Check number of participants again
length(unique(raw_data$subject_nr))
```

```
## [1] 244
```

```
# --> this completely removes 1 participant in initmax condition
```

Correctness - analysis including all remaining trials

Percent of correct trials per condition

```
with(raw_data,table(group, correct)/c(table(group)))
```

```
##          correct
## group              0          1
##   static  0.05887600 0.94112400
##   rtmax   0.10877193 0.89122807
##   initmax 0.09281165 0.90718835
##   dynamic 0.06403509 0.93596491
```

Chi-squared test

```
chisq.test(with(raw_data,table(group, correct)),correct = FALSE)
```

```
##
##  Pearson's Chi-squared test
##
```

```
## data:  with(raw_data, table(group, correct))
## X-squared = 25.618, df = 3, p-value = 1.147e-05
```

Generalized linear mixed model

```
# use default contrasts (dummy coding with static as baseline)
contrasts(raw_data$group)
```

```
##         rtmax initmax dynamic
## static      0       0       0
## rtmax       1       0       0
## initmax     0       1       0
## dynamic     0       0       1
```

```
summary(glmer(correct~(1|subject_nr)+group,family="binomial",data=raw_data))
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: correct ~ (1 | subject_nr) + group
##    Data: raw_data
##
##      AIC      BIC   logLik deviance df.resid
##   2493.9   2526.0  -1242.0   2483.9     4495
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.3315  0.2059  0.2585  0.3110  0.5707
##
## Random effects:
##  Groups     Name        Variance Std.Dev.
##  subject_nr (Intercept) 0.3932   0.6271
## Number of obs: 4500, groups:  subject_nr, 244
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    2.9470     0.1615  18.249  < 2e-16 ***
## grouprtmax    -0.7094     0.2017  -3.517 0.000437 ***
## groupinitmax  -0.5220     0.2051  -2.545 0.010939 *
## groupdynamic  -0.0906     0.2155  -0.420 0.674225
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) grprtm grpntm
## grouprtmax  -0.759
## groupinitmx -0.736  0.584
## groupdynamc -0.692  0.553  0.544
```

Correctness - analysis excluding trials in rtmax condition > limit

Exclude trials in rtmax condition above time limit

```
raw_data <- subset(raw_data, response!="None")
```

Percent of correct trials per condition

```
with(raw_data,table(group, correct)/c(table(group)))
```

```
##          correct
## group              0         1
##   static  0.05887600 0.94112400
##   rtmax   0.07383774 0.92616226
##   initmax 0.09281165 0.90718835
##   dynamic 0.06403509 0.93596491
```

Chi-squared test

```
chisq.test(with(raw_data,table(group, correct)),correct = FALSE)
```

```
##
##  Pearson's Chi-squared test
##
## data:  with(raw_data, table(group, correct))
## X-squared = 11.113, df = 3, p-value = 0.01113
```

Generalized linear mixed model

```
summary(glmer(correct~(1|subject_nr)+group,family="binomial",data=raw_data))
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: correct ~ (1 | subject_nr) + group
##    Data: raw_data
##
##      AIC      BIC   logLik deviance df.resid
##   2282.1   2314.1  -1136.0   2272.1     4452
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.3862  0.1972  0.2353  0.2774  0.6079
##
## Random effects:
##  Groups     Name        Variance Std.Dev.
##  subject_nr (Intercept) 0.4952   0.7037
## Number of obs: 4457, groups:  subject_nr, 244
##
```

```
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)   2.98726    0.16961  17.612   <2e-16 ***
## grouprtmax   -0.26148    0.22224  -1.177   0.2394
## groupinitmax -0.52941    0.21514  -2.461   0.0139 *
## groupdynamic -0.09172    0.22553  -0.407   0.6842
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) grprtm grpntm
## grouprtmax  -0.705
## groupinitmx -0.733  0.551
## groupdynamc -0.689  0.524  0.542
```

Exclude incorrect trials

```
raw_data <- subset(raw_data, correct==1)
```

Only keep participants with > 0 trials in either typicality condition

```
# Detect participants with 0 trials left in one of the typicality conditions
# (they all are in the initmax condition)
sort(rowSums(with(raw_data,table(subject_nr,Typicality)==0)),decreasing=TRUE)[1:10]
```

```
## 3102 3202 3206 3230 3001 3002 3003 3004 3005 3006
##    1    1    1    1    0    0    0    0    0    0
```

```
# Remove these participants
raw_data <- subset(raw_data,
  !subject_nr%in%c(3102,3202,3206,3230))
```

Trajectory preprocessing

```
mt_data <- mt_import_mousetrap(raw_data,
  xpos_label = c("xpos_initial_phase","xpos_get_response"),
  ypos_label = c("ypos_initial_phase","ypos_get_response"),
  timestamps_label = c("timestamps_initial_phase","timestamps_get_response"))
mt_data <- mt_remap_symmetric(mt_data)
mt_data <- mt_align_start(mt_data, start=c(0,0))
mt_data <- mt_derivatives(mt_data)
mt_data <- mt_measures(mt_data)
mt_data <- mt_time_normalize(mt_data)
```

Manipulation check using per participant mean of time variables

Aggregate data per participant and condition

```
mt_data$measures$RT_initial <- mt_data$data$response_time_initial_phase
mt_data$measures$IT <- mt_data$measures$initiation_time

agg_times <- mt_aggregate_per_subject(mt_data,
  use_variables = c("RT_initial","IT","RT"),
  use2_variables = "group",subject_id="subject_nr")
```

Descriptives

```
mean_times <- agg_times %>%
  group_by(group) %>%
  summarize(
    N = n(),
    M_RT_inital = mean(RT_initial),
    SD_RT_initial = sd(RT_initial),
    M_IT = mean(IT),
    SD_IT = sd(IT),
    M_RT = mean(RT),
    SD_RT = sd(RT)
    ) %>%
  as.data.frame()

print(mean_times, digits=5)
```

```
##     group  N M_RT_inital SD_RT_initial   M_IT  SD_IT   M_RT   SD_RT
## 1  static 59      808.47        324.06 508.69 215.60 2110.4  654.06
## 2   rtmax 60      650.12        176.61 437.25 159.98 1521.6  183.42
## 3 initmax 61      328.25        114.28 206.89 101.94 1441.7  259.18
## 4 dynamic 60      773.38        752.17 348.67 233.25 2805.4 1199.82
```

Specify contrasts (used in contrast analyses later)

```
contrast_matrix_separate <- list(
  rtmax_vs_static = c(-1,1,0,0),
  initmax_vs_static = c(-1,0,1,0),
  dynamic_vs_static= c(-1,0,0,1))
```

Compare RT initial

```
# ANOVA
anova_RT_initial <- aov_ez(data=agg_times,dv = "RT_initial", between = "group", id = "subject_nr")
```

```
## Contrasts set to contr.sum for the following variables: group
```

```r
nice(anova_RT_initial,es = c("pes","ges"))
```

```
## Anova Table (Type 3 tests)
##
## Response: RT_initial
##   Effect     df       MSE         F ges pes p.value
## 1  group 3, 236 178365.75 16.21 *** .17 .17  <.0001
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1 ' ' 1
```

```r
# Contrast analysis
anova_RT_initial_grid <- lsmeans(anova_RT_initial,~group)
contrast(anova_RT_initial_grid,contrast_matrix_separate)
```

```
##  contrast            estimate       SE  df t.ratio p.value
##  rtmax_vs_static   -158.35691 77.43327 236  -2.045  0.0420
##  initmax_vs_static -480.21922 77.11794 236  -6.227  <.0001
##  dynamic_vs_static  -35.09692 77.43327 236  -0.453  0.6508
```

Compare initiation time

```r
# ANOVA
anova_IT <- aov_ez(data=agg_times,dv = "IT", between = "group", id = "subject_nr")
```

```
## Contrasts set to contr.sum for the following variables: group
```

```r
nice(anova_IT,es = c("pes","ges"))
```

```
## Anova Table (Type 3 tests)
##
## Response: IT
##   Effect     df      MSE         F ges pes p.value
## 1  group 3, 236 34065.62 29.87 *** .28 .28  <.0001
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1 ' ' 1
```

```r
# Contrast analysis
anova_IT_grid <- lsmeans(anova_IT,~group)
contrast(anova_IT_grid,contrast_matrix_separate)
```

```
##  contrast           estimate       SE  df t.ratio p.value
##  rtmax_vs_static    -71.4404 33.83997 236  -2.111  0.0358
##  initmax_vs_static -301.7988 33.70217 236  -8.955  <.0001
##  dynamic_vs_static -160.0251 33.83997 236  -4.729  <.0001
```

Compare total RT

```r
# ANOVA
anova_RT <- aov_ez(data=agg_times,dv = "RT", between = "group", id = "subject_nr")
```

```
## Contrasts set to contr.sum for the following variables: group
```

```r
nice(anova_RT,es = c("pes","ges"))
```

```
## Anova Table (Type 3 tests)
##
## Response: RT
##   Effect     df       MSE         F ges pes p.value
## 1  group 3, 236 490516.97 49.01 *** .38 .38  <.0001
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1 ' ' 1
```

```
# Contrast analysis
anova_RT_grid <- lsmeans(anova_RT,~group)
contrast(anova_RT_grid,contrast_matrix_separate)
```

```
##  contrast           estimate       SE  df t.ratio p.value
##  rtmax_vs_static   -588.8280 128.4100 236  -4.586  <.0001
##  initmax_vs_static -668.7459 127.8871 236  -5.229  <.0001
##  dynamic_vs_static  694.9442 128.4100 236   5.412  <.0001
```

Manipulation check using per participant median of time variables

Aggregate data per participant and condition

```
agg_times <- mt_aggregate_per_subject(mt_data,
  use_variables = c("IT","RT_initial","RT"),
  use2_variables = "group",subject_id="subject_nr",
  .funs="median")
```

Descriptives

```
mean_times <- agg_times %>%
  group_by(group) %>%
  summarize(
    N = n(),
    M_RT_inital = mean(RT_initial),
    SD_RT_initial = sd(RT_initial),
    M_IT = mean(IT),
    SD_IT = sd(IT),
    M_RT = mean(RT),
    SD_RT = sd(RT)
    ) %>%
  as.data.frame()

print(mean_times, digits=5)
```

```
##     group  N M_RT_inital SD_RT_initial   M_IT  SD_IT   M_RT  SD_RT
## 1  static 59      760.84        297.31 497.36 207.87 1934.0 588.13
## 2   rtmax 60      630.30        178.20 437.12 163.29 1476.9 206.95
## 3 initmax 61      317.30        122.40 202.30 114.20 1360.3 251.48
## 4 dynamic 60      516.82        329.58 267.10 164.41 2461.7 859.45
```

Compare RT initial

```
# ANOVA
anova_RT_initial <- aov_ez(data=agg_times,dv = "RT_initial", between = "group", id = "subject_nr")
```

```
## Contrasts set to contr.sum for the following variables: group
```

```
nice(anova_RT_initial,es = c("pes","ges"))
```

```
## Anova Table (Type 3 tests)
##
## Response: RT_initial
##   Effect     df      MSE         F ges pes p.value
## 1  group 3, 236 60627.62 35.05 *** .31 .31  <.0001
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1 ' ' 1
```

```
# Contrast analysis
anova_RT_initial_grid <- lsmeans(anova_RT_initial,~group)
contrast(anova_RT_initial_grid,contrast_matrix_separate)
```

```
##  contrast           estimate       SE  df t.ratio p.value
##  rtmax_vs_static   -130.5390 45.14473 236  -2.892  0.0042
##  initmax_vs_static -443.5439 44.96090 236  -9.865  <.0001
##  dynamic_vs_static -244.0223 45.14473 236  -5.405  <.0001
```

Compare initiation time

```
# ANOVA
anova_IT <- aov_ez(data=agg_times,dv = "IT", between = "group", id = "subject_nr")
```

```
## Contrasts set to contr.sum for the following variables: group
```

```
nice(anova_IT,es = c("pes","ges"))
```

```
## Anova Table (Type 3 tests)
##
## Response: IT
##   Effect     df      MSE         F ges pes p.value
## 1  group 3, 236 27358.94 42.40 *** .35 .35  <.0001
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1 ' ' 1
```

```
# Contrast analysis
anova_IT_grid <- lsmeans(anova_IT,~group)
contrast(anova_IT_grid,contrast_matrix_separate)
```

```
##  contrast            estimate       SE  df t.ratio p.value
##  rtmax_vs_static    -60.24774 30.32645 236  -1.987  0.0481
##  initmax_vs_static -295.06932 30.20295 236  -9.770  <.0001
##  dynamic_vs_static -230.26441 30.32645 236  -7.593  <.0001
```

Compare total RT

```
# ANOVA
anova_RT <- aov_ez(data=agg_times,dv = "RT", between = "group", id = "subject_nr")
```

```
## Contrasts set to contr.sum for the following variables: group
```

```
nice(anova_RT,es = c("pes","ges"))
```

```
## Anova Table (Type 3 tests)
##
## Response: RT
##   Effect     df       MSE         F ges pes p.value
## 1  group 3, 236 296459.00 51.02 *** .39 .39  <.0001
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1 ' ' 1
```

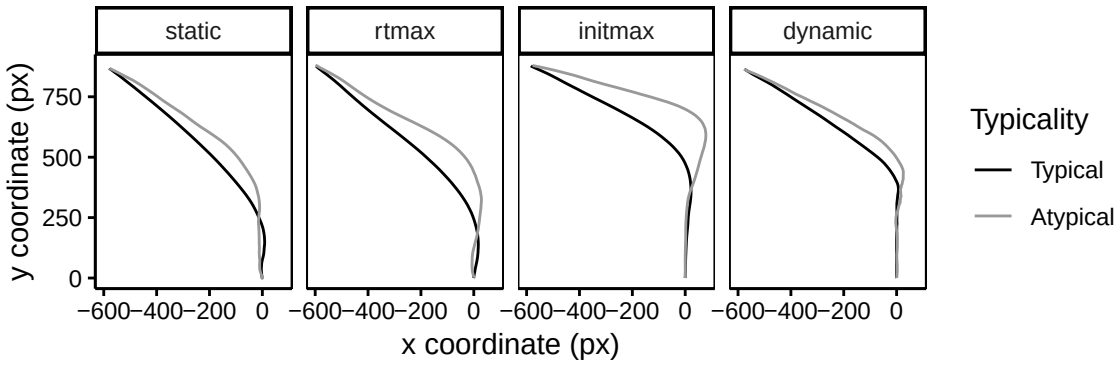
```
# Contrast analysis
anova_RT_grid <- lsmeans(anova_RT,~group)
contrast(anova_RT_grid,contrast_matrix_separate)
```

```
##  contrast           estimate       SE  df t.ratio p.value
##  rtmax_vs_static   -457.0743 99.82841 236  -4.579  <.0001
##  initmax_vs_static -573.6134 99.42189 236  -5.769  <.0001
##  dynamic_vs_static  527.6924 99.82841 236   5.286  <.0001
```

Aggregate trajectory curvature

Average time-normalized tajectories

```
mt_plot_aggregate(mt_data, use = "tn_trajectories", facet_col = "group",
  x = "xpos", y = "ypos", color = "Typicality", subject_id = "subject_nr")+
  xlab("x coordinate (px)") + ylab("y coordinate (px)")+
  scale_color_manual(values = c("black","grey60"))
```



Comparison of MAD aggregated per participant

Aggregate data per participant and condition

```
agg_mad <- mt_aggregate_per_subject(mt_data, subject_id = "subject_nr",
  use_variables = "MAD", use2_variables = c("Typicality","group"))
```

Descriptives and paired t-tests

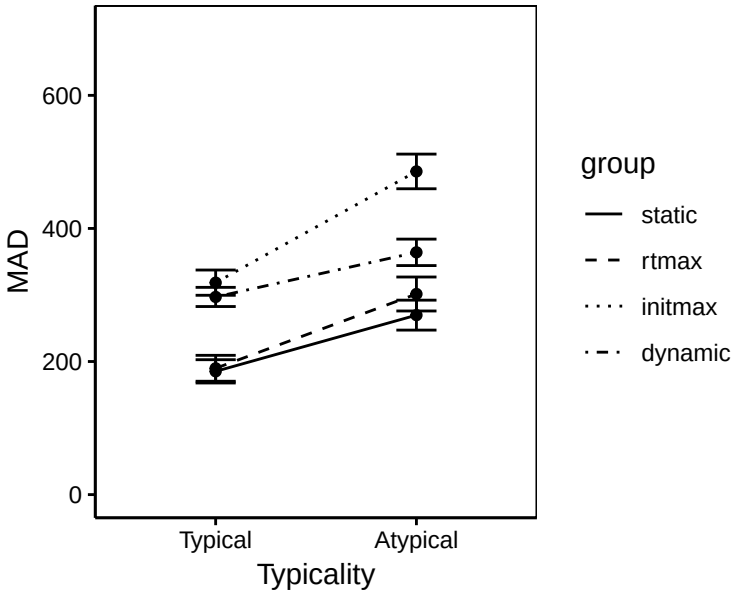
```
mad_table <- agg_mad %>%
  group_by(group) %>%
  select(MAD,group,Typicality) %>%
  summarize(
    N =  length(MAD[Typicality=="Typical"]),
    M_t = mean(MAD[Typicality=="Typical"]),
    SD_t = sd(MAD[Typicality=="Typical"]),
    M_a = mean(MAD[Typicality=="Atypical"]),
    SD_a = sd(MAD[Typicality=="Atypical"]),
    t = t.test(MAD[Typicality=="Atypical"],MAD[Typicality=="Typical"],paired=TRUE)$statistic,
    p = t.test(MAD[Typicality=="Atypical"],MAD[Typicality=="Typical"],paired=TRUE)$p.value,
    d = (M_a-M_t)/sd(MAD[Typicality=="Atypical"]-MAD[Typicality=="Typical"])
    )

mad_table %>%
  as.data.frame() %>%
  print(digits=3)
```

```
##     group  N M_t SD_t M_a SD_a    t        p     d
## 1  static 59 185  134 270  173 4.18 1.01e-04 0.544
## 2   rtmax 60 190  151 301  198 4.32 6.00e-05 0.558
## 3 initmax 61 319  148 486  203 6.91 3.54e-09 0.885
## 4 dynamic 60 297  112 364  154 3.95 2.09e-04 0.510
```

Figure

```
ggplot(agg_mad,aes(x=Typicality,y=MAD,linetype=group,group=group))+
  geom_line(stat="summary",fun.y="mean")+
  geom_point(stat="summary",fun.y="mean")+
  geom_errorbar(stat="summary",fun.data="mean_se",width=.2,linetype=1)+
  scale_linetype_manual(values=c(1,2,3,4))+
  coord_cartesian(ylim=c(0,700))
```



ANOVA

```
anova_mad <- aov_ez(data=agg_mad, dv = "MAD", between = "group", within = "Typicality",
                    id = "subject_nr")
```

```
## Contrasts set to contr.sum for the following variables: group
```

```
nice(anova_mad,es = c("pes","ges"))
```

```
## Anova Table (Type 3 tests)
##
## Response: MAD
##              Effect     df      MSE         F ges pes p.value
## 1             group 3, 236 37713.48 20.83 *** .16 .21  <.0001
## 2       Typicality 1, 236 14664.36 94.71 *** .10 .29  <.0001
## 3 group:Typicality 3, 236 14664.36   3.95 ** .01 .05    .009
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1 ' ' 1
```

```
# 90 % confidence interval for partial eta-squared
round(get_partial_etas(anova_mad$anova_table, conf.level=.90),2)
```

```
##                   pes lower upper
## group            0.21  0.13  0.27
## Typicality       0.29  0.21  0.36
## group:Typicality 0.05  0.01  0.09
```

Contrast analyses

```
# Retrieve grid
anova_mad_grid <- lsmeans(anova_mad,~Typicality:group)

# Specify contrasts
```

```r
contrast_matrix_complete <- list(
  typicality_static = c(-1,1,0,0,0,0,0,0),
  rtmax_static_main=  c(-1,-1,1,1,0,0,0,0)/2,
  initmax_static_main = c(-1,-1,0,0,1,1,0,0)/2,
  dynamic_static_main = c(-1,-1,0,0,0,0,1,1)/2,
  rtmax_static_int = c(1,-1,-1,1,0,0,0,0),
  initmax_static_int = c(1,-1,0,0,-1,1,0,0),
  dynamic_static_int = c(1,-1,0,0,0,0,-1,1))

# Test contrasts
contrast(anova_mad_grid,contrast_matrix_complete)
```

```
##  contrast             estimate       SE  df t.ratio p.value
##  typicality_static    84.48112 22.29567 236   3.789  0.0002
##  rtmax_static_main    18.18135 25.17707 236   0.722  0.4709
##  initmax_static_main 174.62636 25.07454 236   6.964  <.0001
##  dynamic_static_main 103.08993 25.17707 236   4.095  0.0001
##  rtmax_static_int     27.18582 31.39918 236   0.866  0.3875
##  initmax_static_int   82.67111 31.27132 236   2.644  0.0088
##  dynamic_static_int  -17.42019 31.39918 236  -0.555  0.5796
```

Distribution of trajectory shapes

Bimodality coefficient

```r
# Standardize MAD per participant
mt_data <- mt_standardize(mt_data, use_variables = "MAD", within = "subject_nr")

# Calculate bimodality coefficient
mt_check_bimodality(mt_data, use_variables = "z_MAD",
  grouping_variables = c("group","Typicality"), methods = "BC")
```

```
## $BC
##     group Typicality     z_MAD
## 1  static    Typical 0.5202425
## 2  static   Atypical 0.5479891
## 3   rtmax    Typical 0.5356378
## 4   rtmax   Atypical 0.5014132
## 5 initmax    Typical 0.4830443
## 6 initmax   Atypical 0.4700964
## 7 dynamic    Typical 0.5596031
## 8 dynamic   Atypical 0.5080918
```

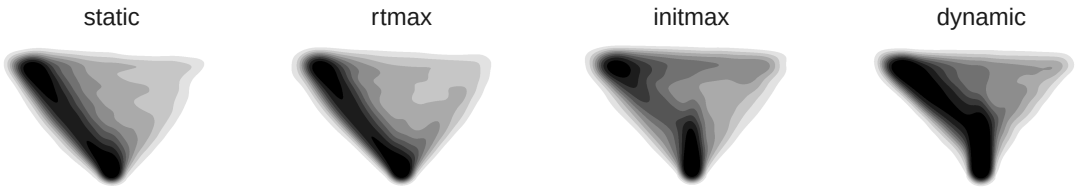
Smoothed heatmaps

```r
heatmap_smoothed <- mt_heatmap_ggplot(mt_data,
  xres = 1000,
  smooth_radius = 20,
  n_shades = 10,
  mean_image = 0.2,
```

```
  colors=c("white","black"),
  facet_col="group")
```

```
## spatializing trajectories
## calculate image
## smooth image
## enhance image by 4
## spatializing trajectories
## calculate image
## smooth image
## enhance image by 3.8
## spatializing trajectories
## calculate image
## smooth image
## enhance image by 3.8
## spatializing trajectories
## calculate image
## smooth image
## enhance image by 6.1
```

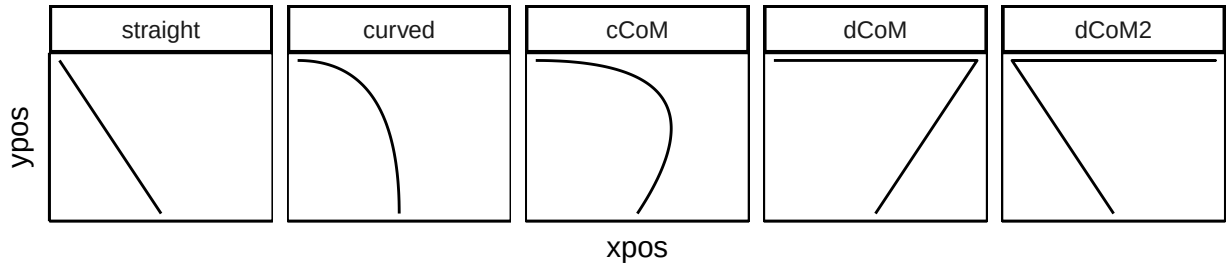
```
heatmap_smoothed+
  theme(strip.background = element_rect(colour = NA))
```



Prototype classification

Plot prototypes

```
mt_plot(mt_prototypes,facet_col="mt_id",only_ggplot = TRUE)+
  geom_path()+
  facet_grid(cols = vars(factor(mt_id,levels=rownames(mt_prototypes))))+
  theme(axis.text=ggplot2::element_blank(),axis.ticks=ggplot2::element_blank())
```



Map trajectories onto prototypes

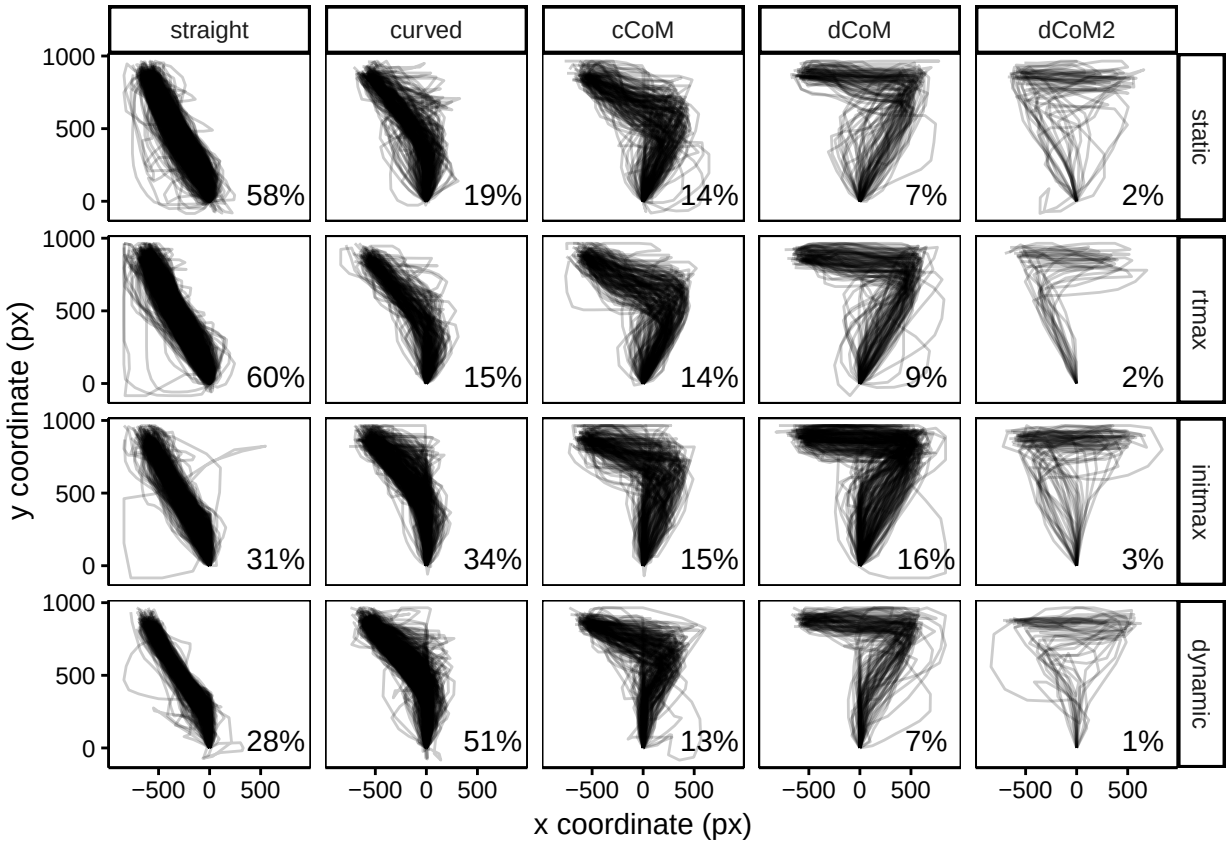
```
mt_data <- mt_spatialize(mt_data)
mt_data <- mt_map(mt_data,prototypes = mt_prototypes,
  save_as = "measures", grouping_variables = "group")
mt_data$data$prototype_label <- mt_data$measures$prototype_label
```

Classified trajectories per group

Relative frequencies

```
prototype_percentages <- mt_data$data %>%
  group_by(group,prototype_label) %>%
  summarise(n=n()) %>%
  mutate(Percent=paste(round(100*n/sum(n)),"%",sep=""))

mt_plot(mt_data, use = "sp_trajectories",
  x = "xpos", y = "ypos", facet_col = "prototype_label", facet_row="group",alpha=.2)+
  xlab("x coordinate (px)") + ylab("y coordinate (px)")+
  geom_text(data=prototype_percentages,aes(label=Percent),x=650,y=50)+
  scale_y_continuous(breaks=c(0,500,1000))+
  coord_cartesian(xlim=c(-900,900))
```



Chi-squared test

```r
chisq.test(with(mt_data$data,table(group, prototype_label)))
```

```
##
##  Pearson's Chi-squared test
##
## data:  with(mt_data$data, table(group, prototype_label))
## X-squared = 552.8, df = 12, p-value < 2.2e-16
```

Classified trajectories per group X typicality condition

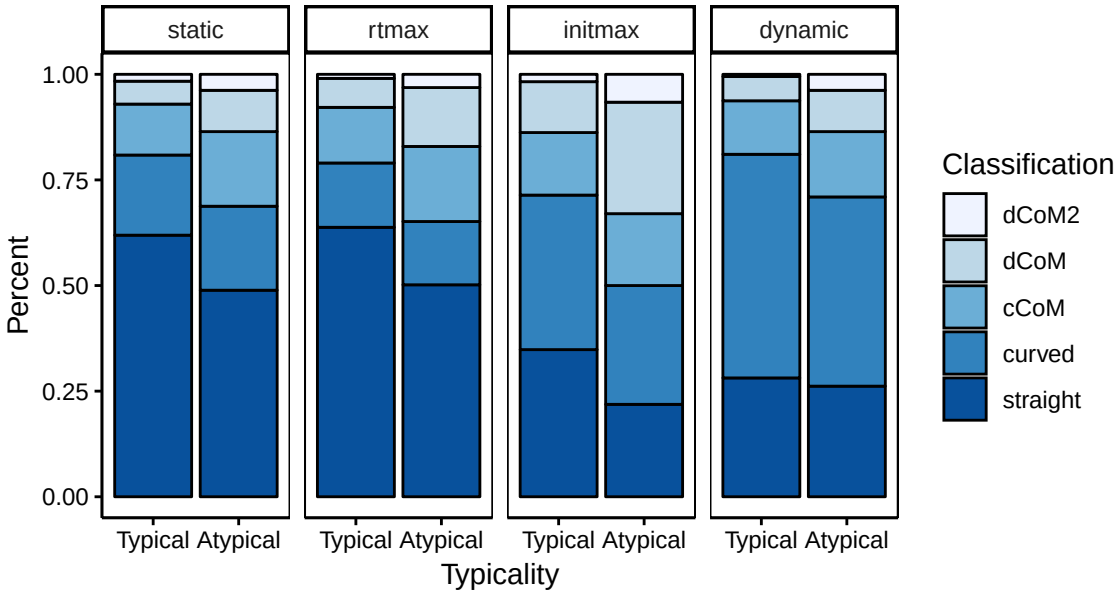
Relative frequencies

```r
rel_freq_agg <- mt_data$data %>%
  group_by(group,Typicality,prototype_label) %>%
  summarise(n=n()) %>%
  mutate(Percent=n/sum(n))

spread(rel_freq_agg[,-4],"prototype_label","Percent",fill = 0) %>%
  as.data.frame()%>%
  print(digits=2)
```

```
##     group Typicality straight curved cCoM  dCoM  dCoM2
## 1  static    Typical     0.62   0.19 0.12 0.054 0.0163
## 2  static   Atypical     0.49   0.20 0.18 0.098 0.0379
## 3   rtmax    Typical     0.64   0.15 0.13 0.069 0.0096
## 4   rtmax   Atypical     0.50   0.15 0.18 0.139 0.0314
## 5 initmax    Typical     0.35   0.37 0.15 0.120 0.0174
## 6 initmax   Atypical     0.22   0.28 0.17 0.264 0.0660
## 7 dynamic    Typical     0.28   0.53 0.13 0.057 0.0053
## 8 dynamic   Atypical     0.26   0.45 0.15 0.098 0.0379
```

```r
ggplot(rel_freq_agg,aes(x=Typicality,y=Percent,fill=forcats::fct_rev(prototype_label)))+
  geom_bar(stat="identity",color="black")+
  scale_fill_brewer(type="seq",name="Classification")+
  facet_grid(.~group)
```



Ordinal mixed regression

```
contrasts(mt_data$data$Typicality) <- c(-0.5,0.5)
# use default contrasts for group (dummy coding with static as baseline)
contrasts(mt_data$data$group)
```

```
##         rtmax initmax dynamic
## static      0       0       0
## rtmax       1       0       0
## initmax     0       1       0
## dynamic     0       0       1
```

```
summary(clmm(prototype_label~Typicality*group+(1|subject_nr),data=mt_data$data))
```

```
## Cumulative Link Mixed Model fitted with the Laplace approximation
##
## formula: prototype_label ~ Typicality * group + (1 | subject_nr)
## data:    mt_data$data
##
##  link  threshold nobs logLik   AIC      niter      max.grad cond.H
##  logit flexible  4115 -5045.75 10115.49 1304(5219) 6.00e-03 2.2e+02
##
## Random effects:
##  Groups     Name        Variance Std.Dev.
##  subject_nr (Intercept) 0.6799   0.8246
## Number of groups:  subject_nr 240
##
## Coefficients:
##                           Estimate Std. Error z value Pr(>|z|)
## Typicality1                0.69987    0.13744   5.092 3.54e-07 ***
## grouprtmax                 0.05651    0.18243   0.310   0.7568
## groupinitmax               1.16952    0.17952   6.515 7.28e-11 ***
## groupdynamic               0.78487    0.17738   4.425 9.65e-06 ***
## Typicality1:grouprtmax     0.15945    0.20120   0.792   0.4281
```

```
## Typicality1:groupinitmax  0.25940    0.18962   1.368   0.1713
## Typicality1:groupdynamic -0.39943    0.18156  -2.200   0.0278 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Threshold coefficients:
##                 Estimate Std. Error z value
## straight|curved   0.1105     0.1290   0.857
## curved|cCoM       1.6448     0.1318  12.481
## cCoM|dCoM         2.7325     0.1369  19.953
## dCoM|dCoM2        4.6551     0.1694  27.481
```