Supplemental Material. A data-driven test for cross-cultural differences in face-shape preferences (Zhang et al.)

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Housekeeping

Load libraries

```
library(tidyverse)
library(broom)
library(geomorph)
library(lme4)
library(lmerTest)
library(readxl)
library(caret)
```

Custom functions

```
# Select PCs according to Broken Stick Model (MacArthur 1957)
# Takes output from plotTangentSpace or prcomp as argument
# Returns selected PCs and saves number of selected PCs in variable called "n.P
Cs.[argument name]"

# Some of the following code has been adapted from function "evplot" (Francois
Gillet, http://adn.biol.umontreal.ca/~numericalecology/numecolR/)
selectPCs<-function(PCA.output){

  ev <- PCA.output$sdev^2
  n.ev <- length(ev)
  bsm <- data.frame(j=seq(1:n.ev), p=0)

  bsm$p[1] <- 1/n.ev
  for (i in 2:n.ev) bsm$p[i] <- bsm$p[i-1] + (1/(n.ev + 1 - i))
  bsm$p <- 100*bsm$p/n.ev

  test<-cbind(100*ev/sum(ev), bsm$p[n.ev:1])
  n.PCs<-sum(test[,1] >= test[,2])

  arg_name <- deparse(substitute(PCA.output)) # Get argument name
  var_name <- paste("n.PCs", arg_name, sep=".")
  assign(var_name, n.PCs, .GlobalEnv)

  if (!is.null(PCA.output$pc.summary$importance)) {

    return(PCA.output$pc.summary$importance[,1:n.PCs])

  } else {

    temp<-summary(PCA.output)
    return(temp$importance[,1:n.PCs])

  }

}
```

Face shape analysis

Data prep

Read shape data (N=200)

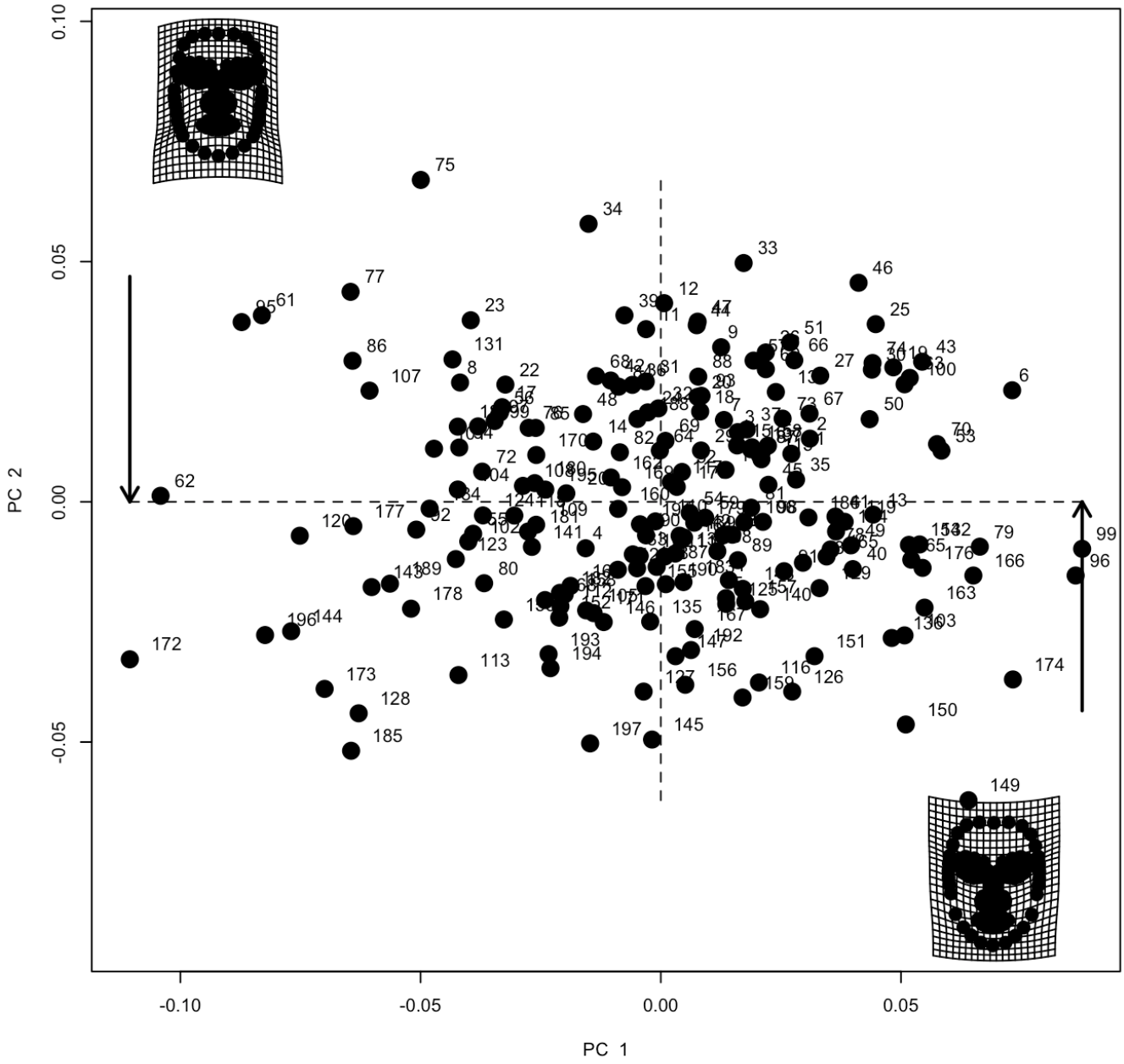
```
data<-readland.tps("EAsian_n200.tps", specID = "imageID",warnmsg = FALSE)
ids<-dimnames(data)[[3]]

# Defining dimensions of data
k<-dim(data)[1] # number of landmarks
d<-dim(data)[2] # number of dimensions
n<-dim(data)[3] # number of specimen
```

Generalized Procrustes analysis

```
gpa.data<-gpagen(data,print.progress=FALSE)

# geomorph flips templates: rotate
rotate<-gpa.data$coords
temp<-array(0,c(k,d,n))
data.aligned<-array(0,c(k,d,n))

for (i in 1:n){
  temp[,,i]<-rotate[,,i] %*% matrix(c(-1,0,0,1),2,2,byrow=T)
  data.aligned[,,i] <- temp[,c(2,1),i]
}

dimnames(data.aligned)[[3]]<-ids
```

Principal component analysis

```
PCA <- plotTangentSpace(data.aligned, verbose = T,label=T)
```



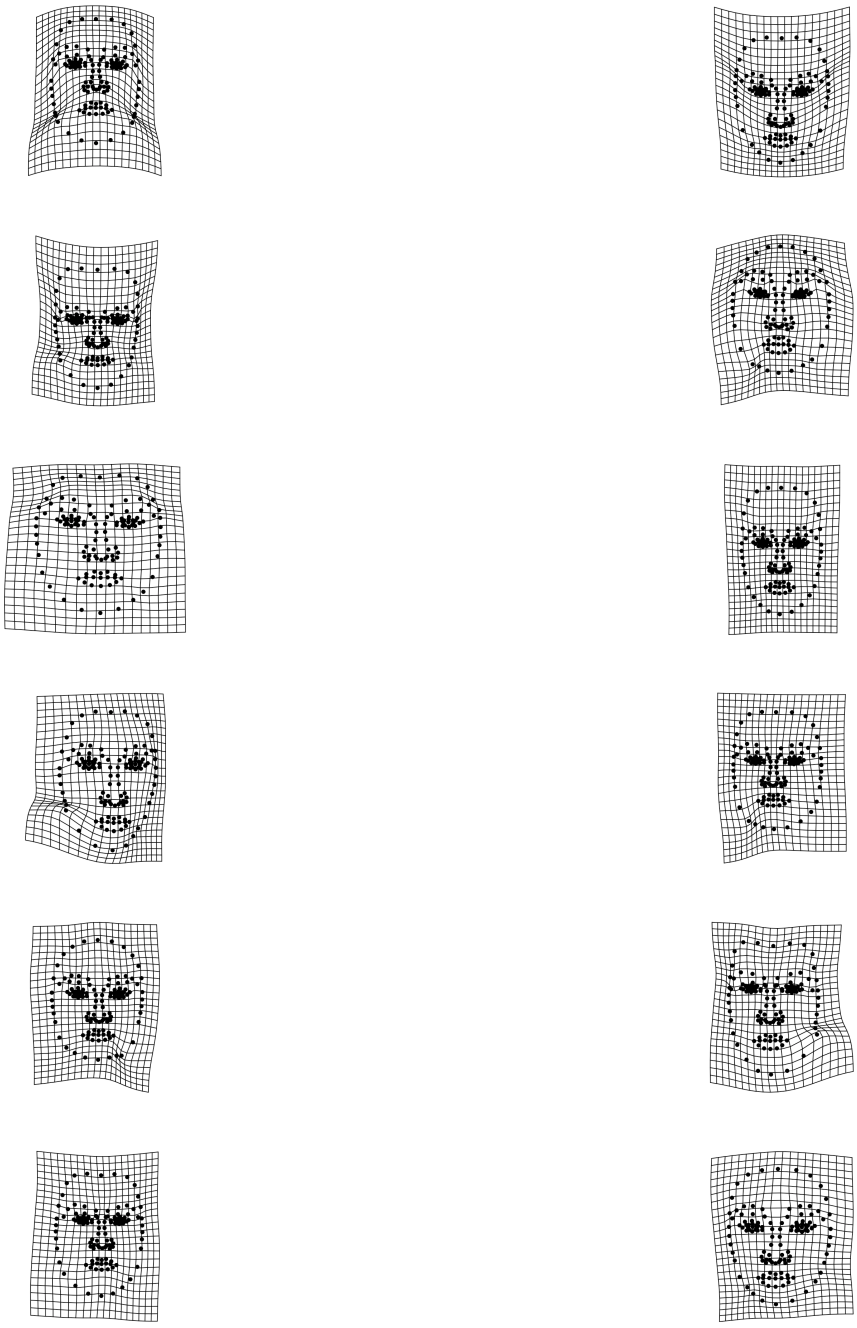

```
selectPCs(PCA)
```

```
##                                PC1         PC2         PC3         PC4
## Standard deviation     0.03674288 0.02329802 0.02172556 0.01976332
## Proportion of Variance 0.27543000 0.11074000 0.09630000 0.07969000
## Cumulative Proportion  0.27543000 0.38617000 0.48246000 0.56215000
##                                PC5         PC6         PC7         PC8
## Standard deviation     0.01852792 0.01550315 0.01232229 0.01191755
## Proportion of Variance 0.07004000 0.04903000 0.03098000 0.02898000
## Cumulative Proportion  0.63218000 0.68122000 0.71220000 0.74117000
##                                 PC9         PC10         PC11         PC12
## Standard deviation     0.009958666 0.009512661 0.009040295 0.008849775
## Proportion of Variance 0.020230000 0.018460000 0.016670000 0.015980000
## Cumulative Proportion  0.761410000 0.779870000 0.796540000 0.812520000
```

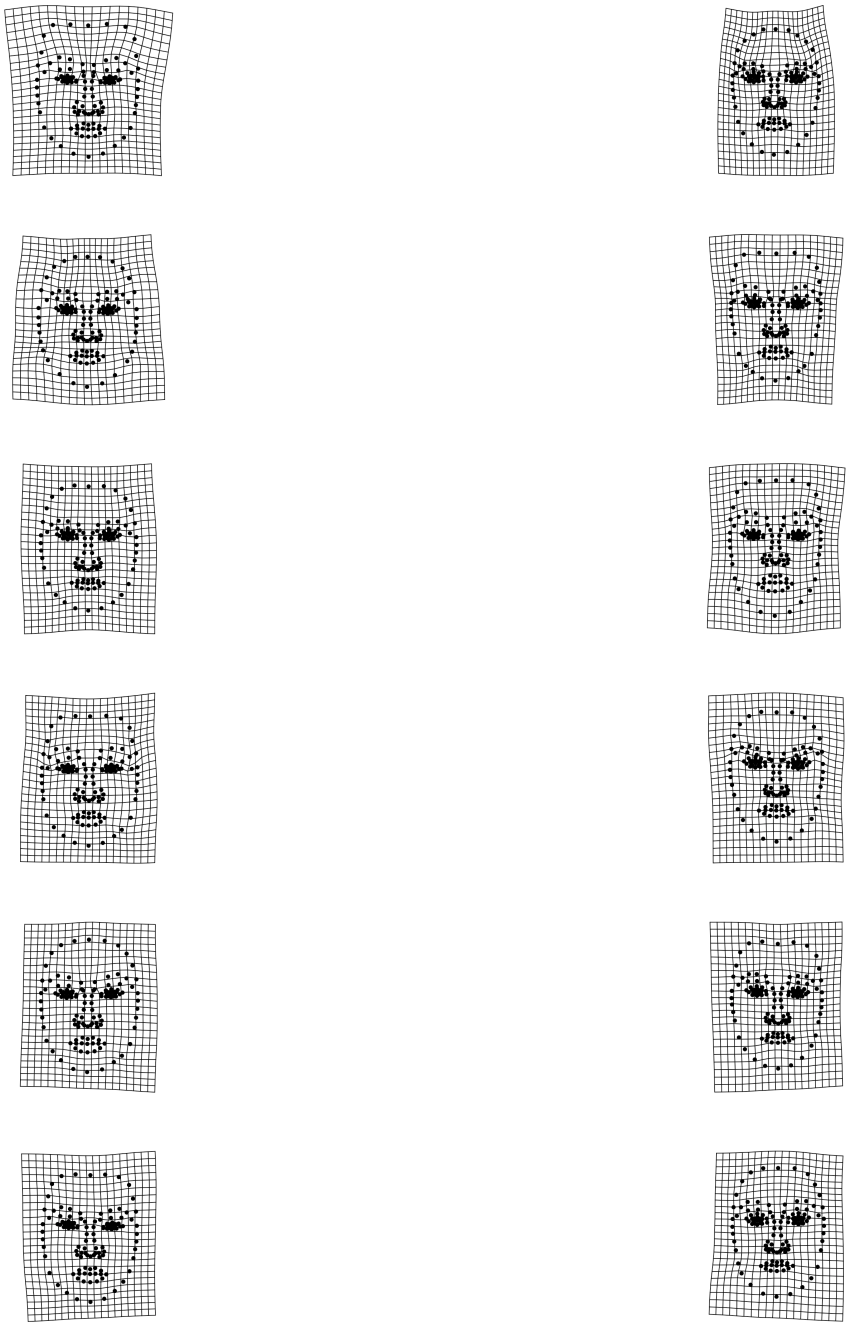
Hence retaining 12 principal components, explaining 81% of variance

Visualize PCs

PCs 1-6



PCs 7-12



Saving PC scores for subsequent analyses

```
scores<-PCA$pc.scores

col_names<-dimnames(scores)[[1]]
row_names<-dimnames(scores)[[2]]
PC.scores<-matrix(scores,ncol=n,byrow = TRUE, dimnames=list(row_names,col_name
s)) %>%
  t() %>%
  as.data.frame() %>%
  rownames_to_column(var="face_id") %>%
  dplyr::select(1:(n.PCs.PCA+1)) %>%
  mutate_at(vars(PC1:PC12),funs(as.numeric(scale(.))))
```

```
## Warning: funs() is soft deprecated as of dplyr 0.8.0
## please use list() instead
##
## # Before:
## funs(name = f(.)
##
## # After:
## list(name = ~f(.))
## This warning is displayed once per session.
```

Prepping data for analyses

Load rating data, effect-code face ethnicity (-.5 = Chinese, +.5 = White UK), standardize rating within each user, average rating per face ID

```
attr <- read_xls("Male_faces_Fall2017.xls") %>%
  gather(stimulus, rating, 8:107) %>%
  rbind(read_xls("Female_faces_Fall2017.xls") %>%
        gather(stimulus, rating, 8:107)
  ) %>%
  mutate(rater_group =  recode(country_of_birth,
                               "CN" = "Chinese UK-resident",
                               "HK" = "Chinese UK-resident",
                               "GB" = "White UK")
  ) %>%
  rbind(read_csv("Male_faces_Shanghai_data.csv") %>%
        gather(stimulus, rating, 8:107) %>%
        mutate(country_of_birth = "CN",
               rater_group = "Chinese China-resident")
  ) %>%
  rbind(read_csv("Female_faces_Shanghai_data.csv") %>%
        gather(stimulus, rating, 8:107) %>%
        mutate(country_of_birth = "CN",
               rater_group = "Chinese China-resident")
  ) %>%
  rename(rater_sex = sex) %>%
  mutate(stimulus = gsub("_r/", "/", stimulus, fixed = T)) %>%
  separate(stimulus, c("face_ethn", "face_sex", "fe", "face_id")) %>%
  unite("face_id", c(fe, face_id)) %>%
  mutate(face_ethn.e = recode(face_ethn, "ea" = -.5, "wh" = .5)) %>%
  group_by(user_id) %>%
  mutate(rating.c = (rating - mean(rating)) / sd(rating)) %>%
  ungroup() %>%
  group_by(face_id, face_sex, face_ethn, face_ethn.e, rater_group) %>%
  summarise(rating.m=mean(rating.c)) %>%
  ungroup() %>%
  left_join(PC.scores, by="face_id")
```

Average PC scores by face sex and ethnicity

```
attr %>%
  select(face_ethn, face_sex, face_id, starts_with("PC")) %>%
  distinct() %>%
  select(-face_id)%>%
  group_by(face_ethn, face_sex) %>%
  summarise_all(funs(mean)) %>%
  ungroup()
```

face_ethn <chr>	face_sex <chr>	PC1 <dbl>	PC2 <dbl>	PC3 <dbl>	PC4 <dbl>	PC5 <dbl>
ea	female	0.49583770	0.7619386	0.13630340	0.048207110	-0.5927631
ea	male	-0.08793491	0.5106452	-0.19655207	0.005931431	0.4700486
wh	female	-0.01282015	-0.2182166	-0.05068316	-0.052286097	-0.4229027
wh	male	-0.39508264	-1.0543672	0.11093182	-0.001852444	0.5456172

4 rows | 1-8 of 14 columns

Formula for first 3 PCs

```
formula.r <- rating.m  ~
  face_ethn.e*rater_group.e*PC1 +
  face_ethn.e*rater_group.e*PC2 +
  face_ethn.e*rater_group.e*PC3 +
  (1 + rater_group.e || face_id)
```

Formula for all 12 PCs

```
formula <- rating.m  ~
    face_ethn.e*rater_group.e*PC1 + face_ethn.e*rater_group.e*PC2 +
    face_ethn.e*rater_group.e*PC3 + face_ethn.e*rater_group.e*PC4 +
    face_ethn.e*rater_group.e*PC5 + face_ethn.e*rater_group.e*PC6 +
    face_ethn.e*rater_group.e*PC7 + face_ethn.e*rater_group.e*PC8 +
    face_ethn.e*rater_group.e*PC9 + face_ethn.e*rater_group.e*PC10 +
    face_ethn.e*rater_group.e*PC11 + face_ethn.e*rater_group.e*PC12 +
    (1 + rater_group.e || face_id)
```

Subsetting Data

Model 1 Data: Chinese-UK resident vs White UK

Our first model compared ratings by Chinese UK-resident raters (effect coded as 0.5) and White UK raters (effect coded as -0.5).

```
model1.data <- attr %>%
              filter(rater_group == "Chinese UK-resident" |
                       rater_group == "White UK") %>%
              mutate(rater_group.e = recode(rater_group,
                                            "Chinese UK-resident" = 0.5,
                                            "White UK" = -0.5)
              )
```

Model 2 Data: Chinese-China resident vs White UK

Our second model compared ratings by Chinese China-resident raters (effect coded as 0.5) and White UK raters (effect coded as -0.5).

```
model2.data <- attr %>%
              filter(rater_group == "Chinese China-resident" |
                       rater_group == "White UK") %>%
              mutate(rater_group.e = recode(rater_group,
                                            "Chinese China-resident" = 0.5,
                                            "White UK" = -0.5)
                     )
```

Model 3 Data: Chinese China-resident vs Chinese-UK resident

Our third model compared ratings by Chinese China-resident raters (effect coded as 0.5) and Chinese UK-resident raters (effect coded as -0.5).

```
model3.data <- attr %>%
              filter(rater_group == "Chinese China-resident" |
                       rater_group == "Chinese UK-resident") %>%
              mutate(rater_group.e = recode(rater_group,
                                            "Chinese China-resident" = 0.5,
                                            "Chinese UK-resident" = -0.5
                                            )
              )
```

Reviewer-requested models with only 3 PCs

Men’s judgments of women’s facial attractiveness

Model 1: Chinese UK-resident vs White UK

```
model1.female.r <- lmer(formula.r,
                        data = filter(model1.data, face_sex=="female"))
summary(model1.female.r)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula.r
##    Data: filter(model1.data, face_sex == "female")
##
## REML criterion at convergence: 295.7
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.65501 -0.49565 -0.06033  0.48859  2.14171
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.25919  0.5091
##  face_id.1 rater_group.e 0.01107  0.1052
##  Residual                0.07299  0.2702
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                Estimate Std. Error        df t value
## (Intercept)                    0.004984   0.081528 92.002921   0.061
## face_ethn.e                   -0.108915   0.163055 92.002921  -0.668
## rater_group.e                  0.074542   0.059417 91.998752   1.255
## PC1                            0.129792   0.077548 92.002921   1.674
## PC2                            0.049643   0.087292 92.002921   0.569
## PC3                           -0.063688   0.063599 92.002921  -1.001
## face_ethn.e:rater_group.e     -0.161535   0.118835 91.998752  -1.359
## face_ethn.e:PC1                0.128181   0.155096 92.002921   0.826
## rater_group.e:PC1             -0.195155   0.056517 91.998752  -3.453
## face_ethn.e:PC2                0.172955   0.174584 92.002921   0.991
## rater_group.e:PC2             -0.225672   0.063619 91.998752  -3.547
## face_ethn.e:PC3               -0.247745   0.127197 92.002921  -1.948
## rater_group.e:PC3              0.002367   0.046351 91.998752   0.051
## face_ethn.e:rater_group.e:PC1 -0.026378   0.113034 91.998752  -0.233
## face_ethn.e:rater_group.e:PC2 -0.114319   0.127237 91.998752  -0.898
## face_ethn.e:rater_group.e:PC3 -0.052906   0.092702 91.998752  -0.571
##                               Pr(>|t|)
## (Intercept)                   0.951383
## face_ethn.e                   0.505827
## rater_group.e                 0.212823
## PC1                           0.097586 .
## PC2                           0.570950
## PC3                           0.319255
## face_ethn.e:rater_group.e     0.177368
## face_ethn.e:PC1               0.410679
## rater_group.e:PC1             0.000840 ***
## face_ethn.e:PC2               0.324446
## rater_group.e:PC2             0.000615 ***
## face_ethn.e:PC3               0.054497 .
## rater_group.e:PC3             0.959377
## face_ethn.e:rater_group.e:PC1 0.815996
## face_ethn.e:rater_group.e:PC2 0.371281
## face_ethn.e:rater_group.e:PC3 0.569589
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 16 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

```
# AIC
extractAIC(model1.female.r)[2]
```

```
## [1] 281.9364
```

Model 2: Chinese China-resident vs White UK

```
model2.female.r <- lmer(formula.r,
                        data = filter(model2.data, face_sex=="female"))
summary(model2.female.r)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula.r
##    Data: filter(model2.data, face_sex == "female")
##
## REML criterion at convergence: 260.9
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.74487 -0.49510 -0.07727  0.50955  1.75269
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.201881 0.44931
##  face_id.1 rater_group.e 0.008618 0.09283
##  Residual                0.063717 0.25242
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                Estimate Std. Error        df t value
## (Intercept)                   -0.016440   0.072486 92.001568  -0.227
## face_ethn.e                   -0.008683   0.144973 92.001568  -0.060
## rater_group.e                  0.031693   0.055302 91.999323   0.573
## PC1                            0.146896   0.068948 92.001568   2.131
## PC2                            0.066569   0.077612 92.001568   0.858
## PC3                           -0.036961   0.056546 92.001568  -0.654
## face_ethn.e:rater_group.e      0.038930   0.110605 91.999323   0.352
## face_ethn.e:PC1                0.073890   0.137896 92.001568   0.536
## rater_group.e:PC1             -0.160947   0.052603 91.999323  -3.060
## face_ethn.e:PC2                0.144630   0.155223 92.001568   0.932
## rater_group.e:PC2             -0.191820   0.059213 91.999323  -3.240
## face_ethn.e:PC3               -0.198610   0.113091 92.001568  -1.756
## rater_group.e:PC3              0.055822   0.043141 91.999323   1.294
## face_ethn.e:rater_group.e:PC1 -0.134960   0.105205 91.999323  -1.283
## face_ethn.e:rater_group.e:PC2 -0.170970   0.118425 91.999323  -1.444
## face_ethn.e:rater_group.e:PC3  0.045364   0.086281 91.999323   0.526
##                               Pr(>|t|)
## (Intercept)                    0.82108
## face_ethn.e                    0.95237
## rater_group.e                  0.56798
## PC1                            0.03580 *
## PC2                            0.39328
## PC3                            0.51497
## face_ethn.e:rater_group.e      0.72566
## face_ethn.e:PC1                0.59336
## rater_group.e:PC1              0.00290 **
## face_ethn.e:PC2                0.35390
## rater_group.e:PC2              0.00167 **
## face_ethn.e:PC3                0.08238 .
## rater_group.e:PC3              0.19892
## face_ethn.e:rater_group.e:PC1  0.20277
## face_ethn.e:rater_group.e:PC2  0.15222
## face_ethn.e:rater_group.e:PC3  0.60031
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 16 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

```
# AIC
extractAIC(model2.female.r)[2]
```

```
## [1] 244.0731
```

Model 3: Chinese China-resident vs Chinese UK-resident

```
model3.female.r <- lmer(formula.r,
                        data = filter(model3.data, face_sex=="female"),
                        control=lmerControl(optimizer="Nelder_Mead",optCtrl=lis
t(maxfun=1e5)))
summary(model3.female.r)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula.r
##    Data: filter(model3.data, face_sex == "female")
## Control:
## lmerControl(optimizer = "Nelder_Mead", optCtrl = list(maxfun = 1e+05))
##
## REML criterion at convergence: 258.6
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.59142 -0.43566 -0.04533  0.43135  2.48801
##
## Random effects:
##  Groups    Name          Variance  Std.Dev.
##  face_id   (Intercept)   2.578e-01 0.5077849
##  face_id.1 rater_group.e 3.659e-08 0.0001913
##  Residual                5.443e-02 0.2333059
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                Estimate Std. Error       df t value
## (Intercept)                     0.02083    0.08005 92.00001   0.260
## face_ethn.e                    -0.08945    0.16010 92.00001  -0.559
## rater_group.e                  -0.04285    0.04947 92.00000  -0.866
## PC1                             0.04932    0.07614 92.00001   0.648
## PC2                            -0.04627    0.08571 92.00001  -0.540
## PC3                            -0.03578    0.06245 92.00001  -0.573
## face_ethn.e:rater_group.e       0.20046    0.09894 92.00000   2.026
## face_ethn.e:PC1                 0.06070    0.15228 92.00001   0.399
## rater_group.e:PC1               0.03421    0.04705 92.00000   0.727
## face_ethn.e:PC2                 0.08747    0.17142 92.00001   0.510
## rater_group.e:PC2               0.03385    0.05297 92.00000   0.639
## face_ethn.e:PC3                -0.22506    0.12489 92.00001  -1.802
## rater_group.e:PC3               0.05346    0.03859 92.00000   1.385
## face_ethn.e:rater_group.e:PC1 -0.10858    0.09411 92.00000  -1.154
## face_ethn.e:rater_group.e:PC2 -0.05665    0.10593 92.00000  -0.535
## face_ethn.e:rater_group.e:PC3  0.09827    0.07718 92.00000   1.273
##                                Pr(>|t|)
## (Intercept)                      0.7953
## face_ethn.e                      0.5777
## rater_group.e                    0.3886
## PC1                              0.5188
## PC2                              0.5906
## PC3                              0.5681
## face_ethn.e:rater_group.e        0.0456 *
## face_ethn.e:PC1                  0.6911
## rater_group.e:PC1                0.4691
## face_ethn.e:PC2                  0.6111
## rater_group.e:PC2                0.5243
## face_ethn.e:PC3                  0.0748 .
## rater_group.e:PC3                0.1693
## face_ethn.e:rater_group.e:PC1    0.2516
```

```
## face_ethn.e:rater_group.e:PC2   0.5941
## face_ethn.e:rater_group.e:PC3   0.2061
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 16 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

```
# AIC
extractAIC(model3.female.r)[2]
```

```
## [1] 241.6278
```

Women's judgments of men's facial attractiveness

Model 1: Chinese UK-resident vs White UK

```
model1.male.r <- lmer(formula.r,
                      data = filter(model1.data, face_sex=="male"))
summary(model1.male.r)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula.r
##    Data: filter(model1.data, face_sex == "male")
##
## REML criterion at convergence: 276.6
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.01601 -0.46775 -0.03797  0.46912  2.70558
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.20784  0.4559
##  face_id.1 rater_group.e 0.02037  0.1427
##  Residual                0.06462  0.2542
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                Estimate Std. Error        df t value
## (Intercept)                    0.035767   0.083101 92.000370   0.430
## face_ethn.e                    0.319719   0.166202 92.000370   1.924
## rater_group.e                 -0.070342   0.065589 91.999828  -1.072
## PC1                            0.128396   0.047170 92.000370   2.722
## PC2                           -0.062112   0.073477 92.000370  -0.845
## PC3                            0.035951   0.046004 92.000370   0.781
## face_ethn.e:rater_group.e      0.004320   0.131177 91.999828   0.033
## face_ethn.e:PC1                0.101457   0.094339 92.000370   1.075
## rater_group.e:PC1             -0.007442   0.037229 91.999828  -0.200
## face_ethn.e:PC2               -0.022785   0.146955 92.000370  -0.155
## rater_group.e:PC2             -0.105492   0.057993 91.999828  -1.819
## face_ethn.e:PC3               -0.276166   0.092007 92.000370  -3.002
## rater_group.e:PC3              0.061219   0.036309 91.999828   1.686
## face_ethn.e:rater_group.e:PC1  0.110201   0.074459 91.999828   1.480
## face_ethn.e:rater_group.e:PC2 -0.110092   0.115986 91.999828  -0.949
## face_ethn.e:rater_group.e:PC3  0.102438   0.072618 91.999828   1.411
##                               Pr(>|t|)
## (Intercept)                    0.66791
## face_ethn.e                    0.05749 .
## rater_group.e                  0.28632
## PC1                            0.00776 **
## PC2                            0.40012
## PC3                            0.43653
## face_ethn.e:rater_group.e      0.97380
## face_ethn.e:PC1                0.28499
## rater_group.e:PC1              0.84200
## face_ethn.e:PC2                0.87712
## rater_group.e:PC2              0.07216 .
## face_ethn.e:PC3                0.00346 **
## rater_group.e:PC3              0.09518 .
## face_ethn.e:rater_group.e:PC1  0.14228
## face_ethn.e:rater_group.e:PC2  0.34502
## face_ethn.e:rater_group.e:PC3  0.16172
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 16 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

```
# AIC
extractAIC(model1.male.r)[2]
```

```
## [1] 256.2662
```

Model 2: Chinese China-resident vs White UK

```
model2.male.r <- lmer(formula.r,
                      data = filter(model2.data, face_sex=="male"),
                      control=lmerControl(optimizer="bobyqa",optCtrl=list(maxfu
n=2e5)))
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv,
: Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
## Warning: Model failed to converge with 1 negative eigenvalue: -6.0e-07
```

```
summary(model2.male.r)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula.r
##    Data: filter(model2.data, face_sex == "male")
## Control: lmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 2e+05))
##
## REML criterion at convergence: 299.8
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.48132 -0.44380 -0.01985  0.52114  2.42801
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.185636 0.43085
##  face_id.1 rater_group.e 0.008764 0.09362
##  Residual                0.094741 0.30780
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                               Estimate Std. Error       df t value
## (Intercept)                    0.05136    0.08186 92.00000   0.627
## face_ethn.e                    0.43449    0.16371 92.00000   2.654
## rater_group.e                 -0.03916    0.07550 92.00000  -0.519
## PC1                            0.10597    0.04646 92.00000   2.281
## PC2                           -0.04787    0.07238 92.00000  -0.661
## PC3                            0.03699    0.04531 92.00000   0.816
## face_ethn.e:rater_group.e      0.23387    0.15101 92.00000   1.549
## face_ethn.e:PC1                0.08219    0.09293 92.00000   0.884
## rater_group.e:PC1             -0.05229    0.04286 92.00000  -1.220
## face_ethn.e:PC2                0.02082    0.14475 92.00000   0.144
## rater_group.e:PC2             -0.07701    0.06676 92.00000  -1.154
## face_ethn.e:PC3               -0.29579    0.09063 92.00000  -3.264
## rater_group.e:PC3              0.06330    0.04180 92.00000   1.514
## face_ethn.e:rater_group.e:PC1  0.07166    0.08572 92.00000   0.836
## face_ethn.e:rater_group.e:PC2 -0.02287    0.13352 92.00000  -0.171
## face_ethn.e:rater_group.e:PC3  0.06320    0.08360 92.00000   0.756
##                               Pr(>|t|)
## (Intercept)                    0.53194
## face_ethn.e                    0.00937 **
## rater_group.e                  0.60526
## PC1                            0.02487 *
## PC2                            0.50999
## PC3                            0.41640
## face_ethn.e:rater_group.e      0.12488
## face_ethn.e:PC1                0.37877
## rater_group.e:PC1              0.22557
## face_ethn.e:PC2                0.88593
## rater_group.e:PC2              0.25167
## face_ethn.e:PC3                0.00154 **
## rater_group.e:PC3              0.13333
## face_ethn.e:rater_group.e:PC1  0.40531
## face_ethn.e:rater_group.e:PC2  0.86435
```

```
## face_ethn.e:rater_group.e:PC3  0.45161
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 16 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

```
## convergence code: 0
## Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
# AIC
extractAIC(model2.male.r)[2]
```

```
## [1] 281.406
```

Model 2b: Chinese China-resident vs White UK

Removing all 3-way interactions to facilitate convergence.

```
model2.male.r.b <- lmer( rating.m  ~ face_ethn.e + rater_group.e + PC1 + PC2 +
PC3 +
                                     face_ethn.e:rater_group.e +
                                     face_ethn.e:PC1 + rater_group.e:PC1 +
                                     face_ethn.e:PC2 + rater_group.e:PC2 +
                                     face_ethn.e:PC3 + rater_group.e:PC3 +
                                     (1 + rater_group.e || face_id),
                        data = filter(model2.data, face_sex=="male"),
                        control=lmerControl(optimizer="bobyqa",optCtrl=list(maxfu
n=2e5)))

summary(model2.male.r.b)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula:
## rating.m ~ face_ethn.e + rater_group.e + PC1 + PC2 + PC3 + face_ethn.e:rater
_group.e +
##     face_ethn.e:PC1 + rater_group.e:PC1 + face_ethn.e:PC2 + rater_group.e:PC
2 +
##     face_ethn.e:PC3 + rater_group.e:PC3 + (1 + rater_group.e ||
##     face_id)
##    Data: filter(model2.data, face_sex == "male")
## Control: lmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 2e+05))
##
## REML criterion at convergence: 292.7
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.55146 -0.45668 -0.02051  0.48993  2.47613
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.18782  0.4334
##  face_id.1 rater_group.e 0.01416  0.1190
##  Residual                0.09038  0.3006
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                            Estimate Std. Error       df t value Pr(>|t|)
## (Intercept)                 0.05136    0.08186 92.00000   0.627  0.53194
## face_ethn.e                 0.43449    0.16371 92.00000   2.654  0.00937 **
## rater_group.e              -0.02703    0.04937 95.00000  -0.547  0.58534
## PC1                         0.10597    0.04646 92.00000   2.281  0.02487 *
## PC2                        -0.04787    0.07238 92.00000  -0.661  0.50999
## PC3                         0.03699    0.04531 92.00000   0.816  0.41640
## face_ethn.e:rater_group.e   0.23316    0.13814 95.00000   1.688  0.09472 .
## face_ethn.e:PC1             0.08219    0.09293 92.00000   0.884  0.37877
## rater_group.e:PC1          -0.04816    0.04206 95.00000  -1.145  0.25501
## face_ethn.e:PC2             0.02082    0.14475 92.00000   0.144  0.88593
## rater_group.e:PC2          -0.06788    0.06506 95.00000  -1.043  0.29946
## face_ethn.e:PC3            -0.29579    0.09063 92.00000  -3.264  0.00154 **
## rater_group.e:PC3           0.07136    0.04079 95.00000   1.750  0.08340 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 13 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

```
# AIC
extractAIC(model2.male.r.b)[2]
```

```
## [1] 276.9253
```

Model 2b1: Chinese China-resident vs White UK (PC1 only)

```
model2.male.r.b1 <- lmer( rating.m  ~ face_ethn.e * rater_group.e * PC1 +
                                     (1 + rater_group.e || face_id),
                      data = filter(model2.data, face_sex=="male"))
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl =
## control$checkConv, : Model failed to converge with max|grad| = 0.00237397
## (tol = 0.002, component 1)
```

```
summary(model2.male.r.b1)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula:
## rating.m ~ face_ethn.e * rater_group.e * PC1 + (1 + rater_group.e ||
##     face_id)
##    Data: filter(model2.data, face_sex == "male")
##
## REML criterion at convergence: 289.2
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.37927 -0.46386 -0.04605  0.48860  2.37338
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.20836  0.4565
##  face_id.1 rater_group.e 0.02683  0.1638
##  Residual                0.08608  0.2934
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                Estimate Std. Error        df t value
## (Intercept)                    0.028414   0.051908 96.002999   0.547
## face_ethn.e                    0.522010   0.103817 96.002999   5.028
## rater_group.e                 -0.002241   0.046182 95.998543  -0.049
## PC1                            0.094488   0.046762 96.002999   2.021
## face_ethn.e:rater_group.e      0.385555   0.092364 95.998543   4.174
## face_ethn.e:PC1                0.072852   0.093525 96.002999   0.779
## rater_group.e:PC1             -0.036414   0.041604 95.998543  -0.875
## face_ethn.e:rater_group.e:PC1  0.085342   0.083208 95.998543   1.026
##                               Pr(>|t|)
## (Intercept)                     0.5854
## face_ethn.e                   2.30e-06 ***
## rater_group.e                   0.9614
## PC1                             0.0461 *
## face_ethn.e:rater_group.e     6.57e-05 ***
## face_ethn.e:PC1                 0.4379
## rater_group.e:PC1               0.3836
## face_ethn.e:rater_group.e:PC1   0.3076
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) fc_th. rtr_g. PC1   fc_.:_. f_.:PC r_.:PC
## face_ethn.e 0.061
## rater_grop. 0.000  0.000
## PC1         0.219  0.140  0.000
## fc_thn.:r_. 0.000  0.000  0.061  0.000
## fc_thn.:PC1 0.140  0.219  0.000  0.008 0.000
## rtr_gr.:PC1 0.000  0.000  0.219  0.000 0.140   0.000
## fc_.:_.:PC1 0.000  0.000  0.140  0.000 0.219   0.000  0.008
## convergence code: 0
## Model failed to converge with max|grad| = 0.00237397 (tol = 0.002, component
```

```
1)
```

```
# AIC
extractAIC(model2.male.r.b1)[2]
```

```
## [1] 281.8919
```

Model 2b2: Chinese China-resident vs White UK (PC2 only)

Removed 3-way intereaction for convergence.

```
model2.male.r.b2 <- lmer( rating.m  ~ face_ethn.e + PC2 + rater_group.e + face_
ethn.e : PC2 + rater_group.e : PC2 +
                                      (1 + rater_group.e || face_id),
                      data = filter(model2.data, face_sex=="male"))
summary(model2.male.r.b2)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: rating.m ~ face_ethn.e + PC2 + rater_group.e + face_ethn.e:PC2 +
##     rater_group.e:PC2 + (1 + rater_group.e || face_id)
##    Data: filter(model2.data, face_sex == "male")
##
## REML criterion at convergence: 290.5
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.45803 -0.44824 -0.03875  0.42241  2.14920
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.22308  0.4723
##  face_id.1 rater_group.e 0.05832  0.2415
##  Residual                0.07441  0.2728
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                     Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)       -0.018759   0.083033 96.000982  -0.226 0.821741
## face_ethn.e        0.351198   0.166067 96.000982   2.115 0.037037 *
## PC2               -0.080779   0.074926 96.000982  -1.078 0.283683
## rater_group.e     -0.042781   0.047028 97.999437  -0.910 0.365209
## face_ethn.e:PC2    0.008183   0.149853 96.000982   0.055 0.956566
## PC2:rater_group.e -0.157365   0.043550 97.999437  -3.613 0.000479 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) fc_th. PC2   rtr_g. f_.:PC
## face_ethn.e 0.449
## PC2         0.375  0.751
## rater_grop. 0.000  0.000  0.000
## fc_thn.:PC2 0.751  0.375  0.184 0.000
## PC2:rtr_gr. 0.000  0.000  0.000 0.252  0.000
```

```
# AIC
extractAIC(model2.male.r.b2)[2]
```

```
## [1] 287.4411
```

Model 2b3: Chinese China-resident vs White UK (PC3 only)

```
model2.male.r.b3 <- lmer( rating.m  ~ face_ethn.e * rater_group.e * PC3 +
                                    (1 + rater_group.e || face_id),
                      data = filter(model2.data, face_sex=="male"))
summary(model2.male.r.b3)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula:
## rating.m ~ face_ethn.e * rater_group.e * PC3 + (1 + rater_group.e ||
##     face_id)
##    Data: filter(model2.data, face_sex == "male")
##
## REML criterion at convergence: 283.8
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.35738 -0.39252 -0.01673  0.39143  2.10379
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.20858  0.4567
##  face_id.1 rater_group.e 0.06666  0.2582
##  Residual                0.06479  0.2545
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                  Estimate Std. Error         df t value
## (Intercept)                     0.0225181  0.0496596 96.0002209   0.453
## face_ethn.e                     0.4503085  0.0993192 96.0002209   4.534
## rater_group.e                  -0.0009472  0.0448131 95.9998597  -0.021
## PC3                             0.0442282  0.0456417 96.0002208   0.969
## face_ethn.e:rater_group.e       0.3579095  0.0896262 95.9998597   3.993
## face_ethn.e:PC3                -0.2683028  0.0912834 96.0002208  -2.939
## rater_group.e:PC3               0.0660912  0.0411873 95.9998597   1.605
## face_ethn.e:rater_group.e:PC3   0.0491290  0.0823746 95.9998597   0.596
##                                Pr(>|t|)
## (Intercept)                    0.651249
## face_ethn.e                    1.67e-05 ***
## rater_group.e                  0.983180
## PC3                            0.334965
## face_ethn.e:rater_group.e      0.000128 ***
## face_ethn.e:PC3                0.004121 **
## rater_group.e:PC3              0.111856
## face_ethn.e:rater_group.e:PC3 0.552305
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) fc_th. rtr_g. PC3    fc_.:_. f_.:PC r_.:PC
## face_ethn.e -0.014
## rater_grop.  0.000  0.000
## PC3          0.056 -0.146  0.000
## fc_thn.:r_.  0.000  0.000 -0.014  0.000
## fc_thn.:PC3 -0.146  0.056  0.000 -0.121  0.000
## rtr_gr.:PC3  0.000  0.000  0.056  0.000 -0.146   0.000
## fc_.:_.:PC3  0.000  0.000 -0.146  0.000  0.056   0.000 -0.121
```

```
# AIC
extractAIC(model2.male.r.b3)[2]
```

```
## [1] 276.2573
```

Model 3: Chinese China-resident vs Chinese UK-resident

```
model3.male.r <- lmer(formula.r, data = filter(model3.data, face_sex=="male"))
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv,
: Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
## Warning: Model failed to converge with 1 negative eigenvalue: -4.0e-05
```

```
summary(model3.male.r)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula.r
##    Data: filter(model3.data, face_sex == "male")
##
## REML criterion at convergence: 228.8
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.95640 -0.45571 -0.09033  0.42671  2.70800
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.198799 0.44587
##  face_id.1 rater_group.e 0.005993 0.07741
##  Residual                0.045213 0.21263
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                Estimate Std. Error        df t value
## (Intercept)                    0.016187   0.079793 91.999921   0.203
## face_ethn.e                    0.436655   0.159585 91.999921   2.736
## rater_group.e                  0.031182   0.052656 92.000029   0.592
## PC1                            0.102252   0.045292 91.999921   2.258
## PC2                           -0.100618   0.070552 91.999921  -1.426
## PC3                            0.067602   0.044172 91.999921   1.530
## face_ethn.e:rater_group.e      0.229553   0.105312 92.000029   2.180
## face_ethn.e:PC1                0.137287   0.090584 91.999921   1.516
## rater_group.e:PC1             -0.044846   0.029889 92.000029  -1.500
## face_ethn.e:PC2               -0.034222   0.141104 91.999921  -0.243
## rater_group.e:PC2              0.028480   0.046558 92.000029   0.612
## face_ethn.e:PC3               -0.244569   0.088344 91.999921  -2.768
## rater_group.e:PC3              0.002084   0.029150 92.000029   0.072
## face_ethn.e:rater_group.e:PC1 -0.038541   0.059777 92.000029  -0.645
## face_ethn.e:rater_group.e:PC2  0.087217   0.093116 92.000029   0.937
## face_ethn.e:rater_group.e:PC3 -0.039243   0.058299 92.000029  -0.673
##                               Pr(>|t|)
## (Intercept)                    0.83969
## face_ethn.e                    0.00746 **
## rater_group.e                  0.55518
## PC1                            0.02633 *
## PC2                            0.15721
## PC3                            0.12934
## face_ethn.e:rater_group.e      0.03183 *
## face_ethn.e:PC1                0.13305
## rater_group.e:PC1              0.13693
## face_ethn.e:PC2                0.80891
## rater_group.e:PC2              0.54224
## face_ethn.e:PC3                0.00681 **
## rater_group.e:PC3              0.94315
## face_ethn.e:rater_group.e:PC1  0.52070
## face_ethn.e:rater_group.e:PC2  0.35139
## face_ethn.e:rater_group.e:PC3  0.50256
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 16 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

```
## convergence code: 0
## Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
# AIC
extractAIC(model3.male.r)[2]
```

```
## [1] 204.217
```

Preregistered analyses

Men's judgments of women's facial attractiveness

Model 1: Chinese UK-resident vs White UK

```
model1.female <- lmer(formula,
                      data = filter(model1.data, face_sex=="female"),
                      control=lmerControl(optimizer="Nelder_Mead",optCtrl=list
(maxfun=1e5)))
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv,
: Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
## Warning: Model failed to converge with 1 negative eigenvalue: -9.7e-07
```

```
summary(model1.female)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula
##    Data: filter(model1.data, face_sex == "female")
## Control:
## lmerControl(optimizer = "Nelder_Mead", optCtrl = list(maxfun = 1e+05))
##
## REML criterion at convergence: 335.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.4397 -0.4657 -0.0323  0.4206  1.6304
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.18751  0.43303
##  face_id.1 rater_group.e 0.00299  0.05468
##  Residual                0.06390  0.25278
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                Estimate Std. Error        df t value
## (Intercept)                   -0.146242   0.121546 73.999998  -1.203
## face_ethn.e                   -0.326933   0.243093 73.999998  -1.345
## rater_group.e                  0.071271   0.093830 74.000001   0.760
## PC1                            0.180659   0.079597 73.999998   2.270
## PC2                            0.042950   0.096707 73.999998   0.444
## PC3                            0.020313   0.065428 73.999998   0.310
## PC4                           -0.099076   0.058438 73.999998  -1.695
## PC5                           -0.141864   0.099321 73.999998  -1.428
## PC6                            0.124900   0.060592 73.999998   2.061
## PC7                            0.121802   0.071102 73.999998   1.713
## PC8                            0.199181   0.068069 73.999998   2.926
## PC9                           -0.071142   0.058728 73.999998  -1.211
## PC10                           0.251373   0.064896 73.999998   3.873
## PC11                          -0.080734   0.056833 73.999998  -1.421
## PC12                          -0.033065   0.069200 73.999998  -0.478
## face_ethn.e:rater_group.e     -0.096727   0.187659 74.000001  -0.515
## face_ethn.e:PC1               -0.019043   0.159194 73.999998  -0.120
## rater_group.e:PC1             -0.159953   0.061446 74.000001  -2.603
## face_ethn.e:PC2                0.266659   0.193414 73.999998   1.379
## rater_group.e:PC2             -0.242535   0.074655 74.000001  -3.249
## face_ethn.e:PC3               -0.243938   0.130856 73.999998  -1.864
## rater_group.e:PC3             -0.021444   0.050508 74.000001  -0.425
## face_ethn.e:PC4                0.171821   0.116875 73.999998   1.470
## rater_group.e:PC4             -0.096223   0.045112 74.000001  -2.133
## face_ethn.e:PC5               -0.096535   0.198642 73.999998  -0.486
## rater_group.e:PC5              0.104701   0.076672 74.000001   1.366
## face_ethn.e:PC6                0.097204   0.121184 73.999998   0.802
## rater_group.e:PC6              0.100997   0.046775 74.000001   2.159
## face_ethn.e:PC7               -0.037958   0.142205 73.999998  -0.267
## rater_group.e:PC7             -0.084536   0.054889 74.000001  -1.540
## face_ethn.e:PC8               -0.069780   0.136138 73.999998  -0.513
```

```
## rater_group.e:PC8               -0.014832   0.052547 74.000001  -0.282
## face_ethn.e:PC9                  0.022170   0.117455 73.999998   0.189
## rater_group.e:PC9                0.037716   0.045336 74.000001   0.832
## face_ethn.e:PC10                -0.049727   0.129793 73.999998  -0.383
## rater_group.e:PC10               0.088611   0.050098 74.000001   1.769
## face_ethn.e:PC11                -0.209036   0.113665 73.999998  -1.839
## rater_group.e:PC11               0.064112   0.043873 74.000001   1.461
## face_ethn.e:PC12                -0.090167   0.138399 73.999998  -0.651
## rater_group.e:PC12               0.004524   0.053420 74.000001   0.085
## face_ethn.e:rater_group.e:PC1   -0.209302   0.122892 74.000001  -1.703
## face_ethn.e:rater_group.e:PC2   -0.184291   0.149309 74.000001  -1.234
## face_ethn.e:rater_group.e:PC3   -0.012250   0.101016 74.000001  -0.121
## face_ethn.e:rater_group.e:PC4   -0.002851   0.090224 74.000001  -0.032
## face_ethn.e:rater_group.e:PC5   -0.002694   0.153345 74.000001  -0.018
## face_ethn.e:rater_group.e:PC6   -0.170224   0.093550 74.000001  -1.820
## face_ethn.e:rater_group.e:PC7    0.003848   0.109778 74.000001   0.035
## face_ethn.e:rater_group.e:PC8    0.032384   0.105094 74.000001   0.308
## face_ethn.e:rater_group.e:PC9    0.092621   0.090672 74.000001   1.022
## face_ethn.e:rater_group.e:PC10 -0.148769   0.100196 74.000001  -1.485
## face_ethn.e:rater_group.e:PC11   0.026157   0.087746 74.000001   0.298
## face_ethn.e:rater_group.e:PC12   0.080894   0.106840 74.000001   0.757
##                                Pr(>|t|)
## (Intercept)                     0.23274
## face_ethn.e                     0.18277
## rater_group.e                   0.44992
## PC1                             0.02614 *
## PC2                             0.65825
## PC3                             0.75708
## PC4                             0.09420 .
## PC5                             0.15740
## PC6                             0.04279 *
## PC7                             0.09089 .
## PC8                             0.00455 **
## PC9                             0.22960
## PC10                            0.00023 ***
## PC11                            0.15965
## PC12                            0.63419
## face_ethn.e:rater_group.e       0.60778
## face_ethn.e:PC1                 0.90511
## rater_group.e:PC1               0.01115 *
## face_ethn.e:PC2                 0.17214
## rater_group.e:PC2               0.00174 **
## face_ethn.e:PC3                 0.06626 .
## rater_group.e:PC3               0.67239
## face_ethn.e:PC4                 0.14577
## rater_group.e:PC4               0.03624 *
## face_ethn.e:PC5                 0.62842
## rater_group.e:PC5               0.17621
## face_ethn.e:PC6                 0.42505
## rater_group.e:PC6               0.03408 *
## face_ethn.e:PC7                 0.79027
## rater_group.e:PC7               0.12779
## face_ethn.e:PC8                 0.60978
## rater_group.e:PC8               0.77853
```

```
## face_ethn.e:PC9                  0.85081
## rater_group.e:PC9                0.40813
## face_ethn.e:PC10                 0.70272
## rater_group.e:PC10               0.08106 .
## face_ethn.e:PC11                 0.06992 .
## rater_group.e:PC11               0.14816
## face_ethn.e:PC12                 0.51674
## rater_group.e:PC12               0.93274
## face_ethn.e:rater_group.e:PC1    0.09274 .
## face_ethn.e:rater_group.e:PC2    0.22100
## face_ethn.e:rater_group.e:PC3    0.90381
## face_ethn.e:rater_group.e:PC4    0.97488
## face_ethn.e:rater_group.e:PC5    0.98603
## face_ethn.e:rater_group.e:PC6    0.07286 .
## face_ethn.e:rater_group.e:PC7    0.97214
## face_ethn.e:rater_group.e:PC8    0.75884
## face_ethn.e:rater_group.e:PC9    0.31034
## face_ethn.e:rater_group.e:PC10   0.14185
## face_ethn.e:rater_group.e:PC11   0.76646
## face_ethn.e:rater_group.e:PC12   0.45136
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 52 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

```
## convergence code: 0
## Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

Model 2: Chinese China-resident vs White UK

```
model2.female <- lmer(formula,
                      data = filter(model2.data, face_sex=="female"),
                      control=lmerControl(optimizer="Nelder_Mead",optCtrl=list
(maxfun=1e5)))
```

```
## Warning: Model failed to converge with 1 negative eigenvalue: -4.2e-08
```

```
summary(model2.female)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula
##    Data: filter(model2.data, face_sex == "female")
## Control:
## lmerControl(optimizer = "Nelder_Mead", optCtrl = list(maxfun = 1e+05))
##
## REML criterion at convergence: 326.1
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.5844 -0.4685 -0.0337  0.4410  1.5271
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.153920 0.39233
##  face_id.1 rater_group.e 0.008553 0.09248
##  Residual                0.064038 0.25306
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                 Estimate Std. Error        df t value
## (Intercept)                    -0.127803   0.111879 74.000000  -1.142
## face_ethn.e                    -0.295446   0.223758 74.000000  -1.320
## rater_group.e                   0.108149   0.095903 74.000000   1.128
## PC1                             0.190112   0.073266 74.000000   2.595
## PC2                             0.052875   0.089015 74.000000   0.594
## PC3                             0.052648   0.060224 74.000000   0.874
## PC4                            -0.058537   0.053790 74.000000  -1.088
## PC5                            -0.124995   0.091421 74.000000  -1.367
## PC6                             0.082601   0.055773 74.000000   1.481
## PC7                             0.139491   0.065447 74.000000   2.131
## PC8                             0.171964   0.062655 74.000000   2.745
## PC9                            -0.066560   0.054057 74.000000  -1.231
## PC10                            0.212028   0.059735 74.000000   3.549
## PC11                           -0.066600   0.052312 74.000000  -1.273
## PC12                           -0.001749   0.063696 74.000000  -0.027
## face_ethn.e:rater_group.e      -0.033753   0.191807 74.000000  -0.176
## face_ethn.e:PC1                -0.013328   0.146532 74.000000  -0.091
## rater_group.e:PC1              -0.141047   0.062804 74.000000  -2.246
## face_ethn.e:PC2                 0.288788   0.178031 74.000000   1.622
## rater_group.e:PC2              -0.222684   0.076305 74.000000  -2.918
## face_ethn.e:PC3                -0.241171   0.120448 74.000000  -2.002
## rater_group.e:PC3               0.043227   0.051625 74.000000   0.837
## face_ethn.e:PC4                 0.188833   0.107580 74.000000   1.755
## rater_group.e:PC4              -0.015144   0.046109 74.000000  -0.328
## face_ethn.e:PC5                -0.119299   0.182843 74.000000  -0.652
## rater_group.e:PC5               0.138440   0.078367 74.000000   1.767
## face_ethn.e:PC6                 0.130103   0.111546 74.000000   1.166
## rater_group.e:PC6               0.016400   0.047809 74.000000   0.343
## face_ethn.e:PC7                -0.059963   0.130894 74.000000  -0.458
## rater_group.e:PC7              -0.049157   0.056102 74.000000  -0.876
## face_ethn.e:PC8                -0.167233   0.125310 74.000000  -1.335
```

```
## rater_group.e:PC8              -0.069266   0.053708 74.000000  -1.290
## face_ethn.e:PC9                -0.018359   0.108113 74.000000  -0.170
## rater_group.e:PC9               0.046879   0.046338 74.000000   1.012
## face_ethn.e:PC10                0.016967   0.119470 74.000000   0.142
## rater_group.e:PC10              0.009922   0.051205 74.000000   0.194
## face_ethn.e:PC11               -0.161027   0.104625 74.000000  -1.539
## rater_group.e:PC11              0.092380   0.044843 74.000000   2.060
## face_ethn.e:PC12               -0.092271   0.127392 74.000000  -0.724
## rater_group.e:PC12              0.067155   0.054601 74.000000   1.230
## face_ethn.e:rater_group.e:PC1  -0.197873   0.125608 74.000000  -1.575
## face_ethn.e:rater_group.e:PC2  -0.140033   0.152609 74.000000  -0.918
## face_ethn.e:rater_group.e:PC3  -0.006716   0.103249 74.000000  -0.065
## face_ethn.e:rater_group.e:PC4   0.031174   0.092218 74.000000   0.338
## face_ethn.e:rater_group.e:PC5  -0.048222   0.156734 74.000000  -0.308
## face_ethn.e:rater_group.e:PC6  -0.104426   0.095618 74.000000  -1.092
## face_ethn.e:rater_group.e:PC7  -0.040162   0.112204 74.000000  -0.358
## face_ethn.e:rater_group.e:PC8  -0.162520   0.107417 74.000000  -1.513
## face_ethn.e:rater_group.e:PC9   0.011564   0.092676 74.000000   0.125
## face_ethn.e:rater_group.e:PC10 -0.015382   0.102410 74.000000  -0.150
## face_ethn.e:rater_group.e:PC11  0.122175   0.089685 74.000000   1.362
## face_ethn.e:rater_group.e:PC12  0.076686   0.109201 74.000000   0.702
##                               Pr(>|t|)
## (Intercept)                   0.257000
## face_ethn.e                   0.190777
## rater_group.e                 0.263094
## PC1                           0.011405 *
## PC2                           0.554322
## PC3                           0.384835
## PC4                           0.280014
## PC5                           0.175690
## PC6                           0.142845
## PC7                           0.036381 *
## PC8                           0.007598 **
## PC9                           0.222106
## PC10                          0.000675 ***
## PC11                          0.206959
## PC12                          0.978167
## face_ethn.e:rater_group.e     0.860796
## face_ethn.e:PC1               0.927772
## rater_group.e:PC1             0.027701 *
## face_ethn.e:PC2               0.109030
## rater_group.e:PC2             0.004658 **
## face_ethn.e:PC3               0.048919 *
## rater_group.e:PC3             0.405102
## face_ethn.e:PC4               0.083348 .
## rater_group.e:PC4             0.743508
## face_ethn.e:PC5               0.516121
## rater_group.e:PC5             0.081427 .
## face_ethn.e:PC6               0.247211
## rater_group.e:PC6             0.732552
## face_ethn.e:PC7               0.648221
## rater_group.e:PC7             0.383756
## face_ethn.e:PC8               0.186115
## rater_group.e:PC8             0.201179
```

```
## face_ethn.e:PC9                 0.865622
## rater_group.e:PC9               0.314988
## face_ethn.e:PC10                0.887453
## rater_group.e:PC10              0.846887
## face_ethn.e:PC11                0.128047
## rater_group.e:PC11              0.042907 *
## face_ethn.e:PC12                0.471159
## rater_group.e:PC12              0.222617
## face_ethn.e:rater_group.e:PC1  0.119449
## face_ethn.e:rater_group.e:PC2  0.361813
## face_ethn.e:rater_group.e:PC3  0.948309
## face_ethn.e:rater_group.e:PC4  0.736289
## face_ethn.e:rater_group.e:PC5  0.759199
## face_ethn.e:rater_group.e:PC6  0.278325
## face_ethn.e:rater_group.e:PC7  0.721411
## face_ethn.e:rater_group.e:PC8  0.134542
## face_ethn.e:rater_group.e:PC9  0.901033
## face_ethn.e:rater_group.e:PC10 0.881017
## face_ethn.e:rater_group.e:PC11 0.177247
## face_ethn.e:rater_group.e:PC12 0.484732
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 52 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

Model 3: Chinese China-resident vs Chinese UK-resident

```
model3.female <- lmer(formula,
                      data = filter(model3.data, face_sex=="female"),
                      control=lmerControl(optimizer="Nelder_Mead",optCtrl=list
(maxfun=1e5)))
summary(model3.female)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula
##    Data: filter(model3.data, face_sex == "female")
## Control:
## lmerControl(optimizer = "Nelder_Mead", optCtrl = list(maxfun = 1e+05))
##
## REML criterion at convergence: 304.4
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.87338 -0.41712 -0.00539  0.39609  2.00709
##
## Random effects:
##  Groups    Name          Variance  Std.Dev.
##  face_id   (Intercept)   1.830e-01 0.427772
##  face_id.1 rater_group.e 9.857e-05 0.009928
##  Residual                4.591e-02 0.214261
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                 Estimate Std. Error         df t value
## (Intercept)                   -0.0921670  0.1177435 74.0000004  -0.783
## face_ethn.e                   -0.3438095  0.2354870 74.0000004  -1.460
## rater_group.e                  0.0368782  0.0786600 73.9999997   0.469
## PC1                            0.1101359  0.0771064 74.0000007   1.428
## PC2                           -0.0683923  0.0936814 74.0000005  -0.730
## PC3                            0.0419263  0.0633809 74.0000008   0.661
## PC4                           -0.1066485  0.0566094 74.0000008  -1.884
## PC5                           -0.0726441  0.0962135 74.0000007  -0.755
## PC6                            0.1330995  0.0586964 74.0000007   2.268
## PC7                            0.0972233  0.0688779 74.0000007   1.412
## PC8                            0.1645478  0.0659393 74.0000007   2.495
## PC9                           -0.0477025  0.0568903 74.0000008  -0.838
## PC10                           0.2563336  0.0628660 74.0000007   4.077
## PC11                          -0.0345441  0.0550545 74.0000008  -0.627
## PC12                           0.0005131  0.0670347 74.0000007   0.008
## face_ethn.e:rater_group.e      0.0629741  0.1573200 73.9999997   0.400
## face_ethn.e:PC1               -0.1179793  0.1542129 74.0000008  -0.765
## rater_group.e:PC1              0.0189062  0.0515119 73.9999997   0.367
## face_ethn.e:PC2                0.1966426  0.1873628 74.0000005   1.050
## rater_group.e:PC2              0.0198514  0.0625850 73.9999997   0.317
## face_ethn.e:PC3               -0.2472963  0.1267618 74.0000008  -1.951
## rater_group.e:PC3              0.0646706  0.0423424 73.9999997   1.527
## face_ethn.e:PC4                0.1874082  0.1132188 74.0000008   1.655
## rater_group.e:PC4              0.0810790  0.0378186 73.9999997   2.144
## face_ethn.e:PC5               -0.1206457  0.1924270 74.0000007  -0.627
## rater_group.e:PC5              0.0337387  0.0642766 73.9999997   0.525
## face_ethn.e:PC6                0.0449912  0.1173928 74.0000007   0.383
## rater_group.e:PC6             -0.0845973  0.0392128 73.9999997  -2.157
## face_ethn.e:PC7               -0.0580393  0.1377558 74.0000007  -0.421
## rater_group.e:PC7              0.0353796  0.0460147 73.9999997   0.769
## face_ethn.e:PC8               -0.1510406  0.1318785 74.0000007  -1.145
```

```
## rater_group.e:PC8               -0.0544344  0.0440515 73.9999997  -1.236
## face_ethn.e:PC9                  0.0279518  0.1137805 74.0000008   0.246
## rater_group.e:PC9                0.0091630  0.0380062 73.9999997   0.241
## face_ethn.e:PC10                -0.0574180  0.1257321 74.0000007  -0.457
## rater_group.e:PC10              -0.0786891  0.0419984 73.9999997  -1.874
## face_ethn.e:PC11                -0.1479486  0.1101090 74.0000008  -1.344
## rater_group.e:PC11               0.0282677  0.0367798 73.9999997   0.769
## face_ethn.e:PC12                -0.0518241  0.1340693 74.0000007  -0.387
## rater_group.e:PC12               0.0626309  0.0447833 73.9999997   1.399
## face_ethn.e:rater_group.e:PC1    0.0114297  0.1030238 73.9999997   0.111
## face_ethn.e:rater_group.e:PC2    0.0442581  0.1251700 73.9999997   0.354
## face_ethn.e:rater_group.e:PC3    0.0055338  0.0846848 73.9999997   0.065
## face_ethn.e:rater_group.e:PC4    0.0340241  0.0756372 73.9999997   0.450
## face_ethn.e:rater_group.e:PC5   -0.0455285  0.1285532 73.9999997  -0.354
## face_ethn.e:rater_group.e:PC6    0.0657983  0.0784257 73.9999997   0.839
## face_ethn.e:rater_group.e:PC7   -0.0440092  0.0920294 73.9999997  -0.478
## face_ethn.e:rater_group.e:PC8   -0.1949046  0.0881031 73.9999997  -2.212
## face_ethn.e:rater_group.e:PC9   -0.0810570  0.0760125 73.9999997  -1.066
## face_ethn.e:rater_group.e:PC10   0.1333875  0.0839968 73.9999997   1.588
## face_ethn.e:rater_group.e:PC11   0.0960178  0.0735597 73.9999997   1.305
## face_ethn.e:rater_group.e:PC12 -0.0042084  0.0895666 73.9999997  -0.047
##                                Pr(>|t|)
## (Intercept)                    0.436255
## face_ethn.e                    0.148524
## rater_group.e                  0.640569
## PC1                            0.157395
## PC2                            0.467663
## PC3                            0.510348
## PC4                            0.063502 .
## PC5                            0.452627
## PC6                            0.026274 *
## PC7                            0.162279
## PC8                            0.014809 *
## PC9                            0.404450
## PC10                           0.000113 ***
## PC11                           0.532293
## PC12                           0.993914
## face_ethn.e:rater_group.e      0.690094
## face_ethn.e:PC1                0.446680
## rater_group.e:PC1              0.714647
## face_ethn.e:PC2                0.297351
## rater_group.e:PC2              0.751992
## face_ethn.e:PC3                0.054858 .
## rater_group.e:PC3              0.130943
## face_ethn.e:PC4                0.102104
## rater_group.e:PC4              0.035327 *
## face_ethn.e:PC5                0.532610
## rater_group.e:PC5              0.601223
## face_ethn.e:PC6                0.702630
## rater_group.e:PC6              0.034222 *
## face_ethn.e:PC7                0.674743
## rater_group.e:PC7              0.444414
## face_ethn.e:PC8                0.255775
## rater_group.e:PC8              0.220479
```

```
## face_ethn.e:PC9                 0.806622
## rater_group.e:PC9               0.810150
## face_ethn.e:PC10                0.649246
## rater_group.e:PC10              0.064931 .
## face_ethn.e:PC11                0.183165
## rater_group.e:PC11              0.444598
## face_ethn.e:PC12                0.700201
## rater_group.e:PC12              0.166130
## face_ethn.e:rater_group.e:PC1   0.911962
## face_ethn.e:rater_group.e:PC2   0.724656
## face_ethn.e:rater_group.e:PC3   0.948075
## face_ethn.e:rater_group.e:PC4   0.654146
## face_ethn.e:rater_group.e:PC5   0.724226
## face_ethn.e:rater_group.e:PC6   0.404177
## face_ethn.e:rater_group.e:PC7   0.633912
## face_ethn.e:rater_group.e:PC8   0.030036 *
## face_ethn.e:rater_group.e:PC9   0.289726
## face_ethn.e:rater_group.e:PC10 0.116549
## face_ethn.e:rater_group.e:PC11 0.195833
## face_ethn.e:rater_group.e:PC12 0.962651
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 52 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

Women's judgments of men's facial attractiveness

Model 1: Chinese UK-resident vs White UK

```
model1.male <- lmer(formula,
                    data = filter(model1.data, face_sex=="male"),
                    control=lmerControl(optimizer="Nelder_Mead",optCtrl=list(ma
xfun=1e5)))
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv,
: Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
summary(model1.male)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula
##    Data: filter(model1.data, face_sex == "male")
## Control:
## lmerControl(optimizer = "Nelder_Mead", optCtrl = list(maxfun = 1e+05))
##
## REML criterion at convergence: 356.9
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.5337 -0.4345  0.0343  0.3941  2.3389
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.213349 0.46190
##  face_id.1 rater_group.e 0.001691 0.04112
##  Residual                0.062682 0.25036
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                Estimate Std. Error        df t value
## (Intercept)                    0.114291   0.127450 74.000001   0.897
## face_ethn.e                    0.150388   0.254900 74.000001   0.590
## rater_group.e                  0.037257   0.091839 74.000000   0.406
## PC1                            0.134469   0.057682 74.000001   2.331
## PC2                           -0.076340   0.091595 74.000001  -0.833
## PC3                           -0.006738   0.052529 74.000001  -0.128
## PC4                           -0.008411   0.053872 74.000001  -0.156
## PC5                           -0.019904   0.065424 74.000001  -0.304
## PC6                            0.016865   0.070862 74.000001   0.238
## PC7                            0.066652   0.064380 74.000001   1.035
## PC8                            0.032218   0.059641 74.000001   0.540
## PC9                            0.048608   0.057300 74.000001   0.848
## PC10                           0.027924   0.057306 74.000001   0.487
## PC11                          -0.017439   0.052317 74.000001  -0.333
## PC12                           0.065764   0.059480 74.000001   1.106
## face_ethn.e:rater_group.e     -0.363609   0.183679 74.000000  -1.980
## face_ethn.e:PC1                0.079780   0.115364 74.000001   0.692
## rater_group.e:PC1             -0.038289   0.041565 74.000000  -0.921
## face_ethn.e:PC2                0.048861   0.183190 74.000001   0.267
## rater_group.e:PC2             -0.229391   0.066003 74.000000  -3.475
## face_ethn.e:PC3               -0.272132   0.105058 74.000001  -2.590
## rater_group.e:PC3              0.080710   0.037852 74.000000   2.132
## face_ethn.e:PC4                0.181262   0.107744 74.000001   1.682
## rater_group.e:PC4             -0.038732   0.038820 74.000000  -0.998
## face_ethn.e:PC5                0.018437   0.130849 74.000001   0.141
## rater_group.e:PC5              0.080580   0.047144 74.000000   1.709
## face_ethn.e:PC6               -0.132929   0.141725 74.000001  -0.938
## rater_group.e:PC6             -0.027865   0.051063 74.000000  -0.546
## face_ethn.e:PC7               -0.009866   0.128760 74.000001  -0.077
## rater_group.e:PC7              0.025634   0.046392 74.000000   0.553
## face_ethn.e:PC8               -0.083460   0.119282 74.000001  -0.700
```

```
## rater_group.e:PC8                0.026290   0.042977 74.000000   0.612
## face_ethn.e:PC9                  0.242761   0.114600 74.000001   2.118
## rater_group.e:PC9               -0.014830   0.041290 74.000000  -0.359
## face_ethn.e:PC10                -0.182116   0.114612 74.000001  -1.589
## rater_group.e:PC10               0.110668   0.041294 74.000000   2.680
## face_ethn.e:PC11                -0.112181   0.104634 74.000001  -1.072
## rater_group.e:PC11               0.008916   0.037699 74.000000   0.236
## face_ethn.e:PC12                 0.063305   0.118959 74.000001   0.532
## rater_group.e:PC12               0.098409   0.042861 74.000000   2.296
## face_ethn.e:rater_group.e:PC1    0.077115   0.083131 74.000000   0.928
## face_ethn.e:rater_group.e:PC2    0.086893   0.132005 74.000000   0.658
## face_ethn.e:rater_group.e:PC3    0.106797   0.075704 74.000000   1.411
## face_ethn.e:rater_group.e:PC4   -0.052467   0.077639 74.000000  -0.676
## face_ethn.e:rater_group.e:PC5    0.028548   0.094289 74.000000   0.303
## face_ethn.e:rater_group.e:PC6    0.132633   0.102126 74.000000   1.299
## face_ethn.e:rater_group.e:PC7   -0.143512   0.092783 74.000000  -1.547
## face_ethn.e:rater_group.e:PC8    0.041744   0.085954 74.000000   0.486
## face_ethn.e:rater_group.e:PC9    0.149136   0.082580 74.000000   1.806
## face_ethn.e:rater_group.e:PC10  -0.141905   0.082589 74.000000  -1.718
## face_ethn.e:rater_group.e:PC11   0.025626   0.075398 74.000000   0.340
## face_ethn.e:rater_group.e:PC12  -0.239438   0.085721 74.000000  -2.793
##                                 Pr(>|t|)
## (Intercept)                     0.372759
## face_ethn.e                     0.556995
## rater_group.e                   0.686153
## PC1                             0.022469 *
## PC2                             0.407273
## PC3                             0.898280
## PC4                             0.876357
## PC5                             0.761805
## PC6                             0.812539
## PC7                             0.303904
## PC8                             0.590680
## PC9                             0.399005
## PC10                            0.627504
## PC11                            0.739829
## PC12                            0.272461
## face_ethn.e:rater_group.e       0.051469 .
## face_ethn.e:PC1                 0.491387
## rater_group.e:PC1               0.359957
## face_ethn.e:PC2                 0.790423
## rater_group.e:PC2               0.000857 ***
## face_ethn.e:PC3                 0.011543 *
## rater_group.e:PC3               0.036303 *
## face_ethn.e:PC4                 0.096717 .
## rater_group.e:PC4               0.321651
## face_ethn.e:PC5                 0.888329
## rater_group.e:PC5               0.091599 .
## face_ethn.e:PC6                 0.351325
## rater_group.e:PC6               0.586908
## face_ethn.e:PC7                 0.939133
## rater_group.e:PC7               0.582233
## face_ethn.e:PC8                 0.486320
## rater_group.e:PC8               0.542598
```

```
## face_ethn.e:PC9                 0.037505 *
## rater_group.e:PC9               0.720488
## face_ethn.e:PC10                0.116328
## rater_group.e:PC10              0.009070 **
## face_ethn.e:PC11                0.287146
## rater_group.e:PC11              0.813701
## face_ethn.e:PC12                0.596214
## rater_group.e:PC12              0.024508 *
## face_ethn.e:rater_group.e:PC1   0.356612
## face_ethn.e:rater_group.e:PC2   0.512418
## face_ethn.e:rater_group.e:PC3   0.162514
## face_ethn.e:rater_group.e:PC4   0.501290
## face_ethn.e:rater_group.e:PC5   0.762909
## face_ethn.e:rater_group.e:PC6   0.198071
## face_ethn.e:rater_group.e:PC7   0.126191
## face_ethn.e:rater_group.e:PC8   0.628649
## face_ethn.e:rater_group.e:PC9   0.074992 .
## face_ethn.e:rater_group.e:PC10 0.089939 .
## face_ethn.e:rater_group.e:PC11 0.734918
## face_ethn.e:rater_group.e:PC12 0.006639 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 52 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

```
## convergence code: 0
## Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

Model 2: Chinese China-resident vs White UK

```
model2.male <- lmer(formula,
                    data = filter(model2.data, face_sex=="male"),
                    control=lmerControl(optimizer="Nelder_Mead",optCtrl=list(ma
xfun=1e5)))
```

```
## Warning: Model failed to converge with 1 negative eigenvalue: -7.2e-07
```

```
summary(model2.male)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula
##    Data: filter(model2.data, face_sex == "male")
## Control:
## lmerControl(optimizer = "Nelder_Mead", optCtrl = list(maxfun = 1e+05))
##
## REML criterion at convergence: 387.5
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.41237 -0.42265 -0.03423  0.47084  2.01438
##
## Random effects:
##  Groups    Name          Variance Std.Dev.
##  face_id   (Intercept)   0.20480  0.4525
##  face_id.1 rater_group.e 0.01336  0.1156
##  Residual                0.08785  0.2964
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                 Estimate Std. Error         df t value
## (Intercept)                    0.1195230  0.1284956 73.9999990   0.930
## face_ethn.e                    0.3147681  0.2569911 73.9999990   1.225
## rater_group.e                  0.0477206  0.1120279 74.0000006   0.426
## PC1                            0.1167775  0.0581553 73.9999987   2.008
## PC2                           -0.0452842  0.0923466 73.9999989  -0.490
## PC3                            0.0004075  0.0529598 73.9999987   0.008
## PC4                           -0.0205129  0.0543139 73.9999987  -0.378
## PC5                           -0.0450704  0.0659611 73.9999988  -0.683
## PC6                            0.0043433  0.0714437 73.9999987   0.061
## PC7                            0.0532738  0.0649083 73.9999988   0.821
## PC8                            0.0338644  0.0601305 73.9999986   0.563
## PC9                            0.0405021  0.0577702 73.9999987   0.701
## PC10                           0.0073668  0.0577762 73.9999987   0.128
## PC11                          -0.0091879  0.0527461 73.9999987  -0.174
## PC12                           0.0410850  0.0599677 73.9999987   0.685
## face_ethn.e:rater_group.e     -0.0348485  0.2240558 74.0000006  -0.156
## face_ethn.e:PC1                0.0753903  0.1163107 73.9999987   0.648
## rater_group.e:PC1             -0.0736708  0.0507023 74.0000006  -1.453
## face_ethn.e:PC2                0.0613300  0.1846932 73.9999989   0.332
## rater_group.e:PC2             -0.1672793  0.0805117 74.0000006  -2.078
## face_ethn.e:PC3               -0.2990312  0.1059196 73.9999987  -2.823
## rater_group.e:PC3              0.0950016  0.0461726 74.0000006   2.058
## face_ethn.e:PC4                0.1217699  0.1086277 73.9999987   1.121
## rater_group.e:PC4             -0.0629364  0.0473531 74.0000006  -1.329
## face_ethn.e:PC5                0.0210455  0.1319223 73.9999988   0.160
## rater_group.e:PC5              0.0302481  0.0575077 74.0000006   0.526
## face_ethn.e:PC6               -0.1344761  0.1428873 73.9999987  -0.941
## rater_group.e:PC6             -0.0529092  0.0622876 74.0000006  -0.849
## face_ethn.e:PC7               -0.0216010  0.1298165 73.9999988  -0.166
## rater_group.e:PC7             -0.0011229  0.0565898 74.0000006  -0.020
## face_ethn.e:PC8               -0.0423252  0.1202609 73.9999986  -0.352
```

```
## rater_group.e:PC8                0.0295822  0.0524243 74.0000006   0.564
## face_ethn.e:PC9                  0.1773849  0.1155403 73.9999986   1.535
## rater_group.e:PC9               -0.0310417  0.0503665 74.0000006  -0.616
## face_ethn.e:PC10                -0.1583027  0.1155524 73.9999987  -1.370
## rater_group.e:PC10               0.0695543  0.0503717 74.0000006   1.381
## face_ethn.e:PC11                -0.1074964  0.1054921 73.9999987  -1.019
## rater_group.e:PC11               0.0254172  0.0459863 74.0000006   0.553
## face_ethn.e:PC12                 0.0779317  0.1199354 73.9999987   0.650
## rater_group.e:PC12               0.0490518  0.0522824 74.0000006   0.938
## face_ethn.e:rater_group.e:PC1    0.0683362  0.1014046 74.0000006   0.674
## face_ethn.e:rater_group.e:PC2    0.1118301  0.1610234 74.0000006   0.694
## face_ethn.e:rater_group.e:PC3    0.0529992  0.0923452 74.0000006   0.574
## face_ethn.e:rater_group.e:PC4   -0.1714515  0.0947063 74.0000006  -1.810
## face_ethn.e:rater_group.e:PC5    0.0337653  0.1150155 74.0000006   0.294
## face_ethn.e:rater_group.e:PC6    0.1295397  0.1245752 74.0000006   1.040
## face_ethn.e:rater_group.e:PC7   -0.1669833  0.1131796 74.0000006  -1.475
## face_ethn.e:rater_group.e:PC8    0.1240124  0.1048486 74.0000006   1.183
## face_ethn.e:rater_group.e:PC9    0.0183831  0.1007330 74.0000006   0.182
## face_ethn.e:rater_group.e:PC10  -0.0942773  0.1007435 74.0000006  -0.936
## face_ethn.e:rater_group.e:PC11   0.0349944  0.0919725 74.0000006   0.380
## face_ethn.e:rater_group.e:PC12  -0.2101842  0.1045648 74.0000006  -2.010
##                                 Pr(>|t|)
## (Intercept)                       0.3553
## face_ethn.e                       0.2245
## rater_group.e                     0.6714
## PC1                               0.0483 *
## PC2                               0.6253
## PC3                               0.9939
## PC4                               0.7068
## PC5                               0.4966
## PC6                               0.9517
## PC7                               0.4144
## PC8                               0.5750
## PC9                               0.4854
## PC10                              0.8989
## PC11                              0.8622
## PC12                              0.4954
## face_ethn.e:rater_group.e         0.8768
## face_ethn.e:PC1                   0.5189
## rater_group.e:PC1                 0.1504
## face_ethn.e:PC2                   0.7408
## rater_group.e:PC2                 0.0412 *
## face_ethn.e:PC3                   0.0061 **
## rater_group.e:PC3                 0.0432 *
## face_ethn.e:PC4                   0.2659
## rater_group.e:PC4                 0.1879
## face_ethn.e:PC5                   0.8737
## rater_group.e:PC5                 0.6005
## face_ethn.e:PC6                   0.3497
## rater_group.e:PC6                 0.3984
## face_ethn.e:PC7                   0.8683
## rater_group.e:PC7                 0.9842
## face_ethn.e:PC8                   0.7259
## rater_group.e:PC8                 0.5743
```

```
## face_ethn.e:PC9                   0.1290
## rater_group.e:PC9                 0.5396
## face_ethn.e:PC10                  0.1748
## rater_group.e:PC10                0.1715
## face_ethn.e:PC11                  0.3115
## rater_group.e:PC11                0.5821
## face_ethn.e:PC12                  0.5178
## rater_group.e:PC12                0.3512
## face_ethn.e:rater_group.e:PC1     0.5025
## face_ethn.e:rater_group.e:PC2     0.4895
## face_ethn.e:rater_group.e:PC3     0.5678
## face_ethn.e:rater_group.e:PC4     0.0743 .
## face_ethn.e:rater_group.e:PC5     0.7699
## face_ethn.e:rater_group.e:PC6     0.3018
## face_ethn.e:rater_group.e:PC7     0.1444
## face_ethn.e:rater_group.e:PC8     0.2407
## face_ethn.e:rater_group.e:PC9     0.8557
## face_ethn.e:rater_group.e:PC10    0.3524
## face_ethn.e:rater_group.e:PC11    0.7047
## face_ethn.e:rater_group.e:PC12    0.0481 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 52 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

Model 3: Chinese China-resident vs Chinese UK-resident

```
model3.male <- lmer(formula,
                    data = filter(model3.data, face_sex=="male"),
                    control=lmerControl(optimizer="Nelder_Mead",optCtrl=list(ma
xfun=1e5)))
summary(model3.male)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: formula
##    Data: filter(model3.data, face_sex == "male")
## Control:
## lmerControl(optimizer = "Nelder_Mead", optCtrl = list(maxfun = 1e+05))
##
## REML criterion at convergence: 330.7
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.90037 -0.45966 -0.01636  0.42203  2.51679
##
## Random effects:
##  Groups    Name          Variance  Std.Dev.
##  face_id   (Intercept)   1.933e-01 0.43963
##  face_id.1 rater_group.e 6.692e-05 0.00818
##  Residual                4.996e-02 0.22352
## Number of obs: 200, groups:  face_id, 100
##
## Fixed effects:
##                                 Estimate Std. Error        df t value
## (Intercept)                     0.138151   0.120369 74.000000   1.148
## face_ethn.e                     0.132964   0.240737 74.000000   0.552
## rater_group.e                   0.010464   0.081473 74.000000   0.128
## PC1                             0.097633   0.054477 74.000000   1.792
## PC2                            -0.159980   0.086506 74.000000  -1.849
## PC3                             0.040763   0.049610 74.000000   0.822
## PC4                            -0.039879   0.050879 74.000000  -0.784
## PC5                            -0.004780   0.061789 74.000000  -0.077
## PC6                            -0.009589   0.066925 74.000000  -0.143
## PC7                             0.066091   0.060803 74.000000   1.087
## PC8                             0.047009   0.056327 74.000000   0.835
## PC9                             0.033087   0.054116 74.000000   0.611
## PC10                            0.062701   0.054122 74.000000   1.159
## PC11                           -0.004730   0.049410 74.000000  -0.096
## PC12                            0.090289   0.056175 74.000000   1.607
## face_ethn.e:rater_group.e       0.328760   0.162946 74.000000   2.018
## face_ethn.e:PC1                 0.113948   0.108954 74.000000   1.046
## rater_group.e:PC1              -0.035382   0.036874 74.000000  -0.960
## face_ethn.e:PC2                 0.104776   0.173012 74.000000   0.606
## rater_group.e:PC2               0.062111   0.058553 74.000000   1.061
## face_ethn.e:PC3                -0.245633   0.099221 74.000000  -2.476
## rater_group.e:PC3               0.014291   0.033579 74.000000   0.426
## face_ethn.e:PC4                 0.095537   0.101757 74.000000   0.939
## rater_group.e:PC4              -0.024204   0.034438 74.000000  -0.703
## face_ethn.e:PC5                 0.035320   0.123579 74.000000   0.286
## rater_group.e:PC5              -0.050332   0.041823 74.000000  -1.203
## face_ethn.e:PC6                -0.068160   0.133850 74.000000  -0.509
## rater_group.e:PC6              -0.025044   0.045299 74.000000  -0.553
## face_ethn.e:PC7                -0.093357   0.121606 74.000000  -0.768
## rater_group.e:PC7              -0.026757   0.041155 74.000000  -0.650
## face_ethn.e:PC8                -0.021453   0.112655 74.000000  -0.190
```

```
## rater_group.e:PC8                0.003292   0.038126 74.000000   0.086
## face_ethn.e:PC9                  0.251953   0.108233 74.000000   2.328
## rater_group.e:PC9               -0.016211   0.036629 74.000000  -0.443
## face_ethn.e:PC10                -0.229255   0.108244 74.000000  -2.118
## rater_group.e:PC10              -0.041114   0.036633 74.000000  -1.122
## face_ethn.e:PC11                -0.094684   0.098820 74.000000  -0.958
## rater_group.e:PC11               0.016502   0.033444 74.000000   0.493
## face_ethn.e:PC12                -0.041787   0.112350 74.000000  -0.372
## rater_group.e:PC12              -0.049357   0.038023 74.000000  -1.298
## face_ethn.e:rater_group.e:PC1   -0.008779   0.073747 74.000000  -0.119
## face_ethn.e:rater_group.e:PC2    0.024937   0.117105 74.000000   0.213
## face_ethn.e:rater_group.e:PC3   -0.053798   0.067159 74.000000  -0.801
## face_ethn.e:rater_group.e:PC4   -0.118985   0.068876 74.000000  -1.728
## face_ethn.e:rater_group.e:PC5    0.005217   0.083646 74.000000   0.062
## face_ethn.e:rater_group.e:PC6   -0.003093   0.090598 74.000000  -0.034
## face_ethn.e:rater_group.e:PC7   -0.023471   0.082311 74.000000  -0.285
## face_ethn.e:rater_group.e:PC8    0.082269   0.076252 74.000000   1.079
## face_ethn.e:rater_group.e:PC9   -0.130752   0.073259 74.000000  -1.785
## face_ethn.e:rater_group.e:PC10   0.047627   0.073266 74.000000   0.650
## face_ethn.e:rater_group.e:PC11   0.009369   0.066888 74.000000   0.140
## face_ethn.e:rater_group.e:PC12   0.029254   0.076046 74.000000   0.385
##                                 Pr(>|t|)
## (Intercept)                       0.2548
## face_ethn.e                       0.5824
## rater_group.e                     0.8982
## PC1                               0.0772 .
## PC2                               0.0684 .
## PC3                               0.4139
## PC4                               0.4357
## PC5                               0.9385
## PC6                               0.8865
## PC7                               0.2806
## PC8                               0.4066
## PC9                               0.5428
## PC10                              0.2504
## PC11                              0.9240
## PC12                              0.1122
## face_ethn.e:rater_group.e         0.0473 *
## face_ethn.e:PC1                   0.2990
## rater_group.e:PC1                 0.3404
## face_ethn.e:PC2                   0.5466
## rater_group.e:PC2                 0.2922
## face_ethn.e:PC3                   0.0156 *
## rater_group.e:PC3                 0.6716
## face_ethn.e:PC4                   0.3509
## rater_group.e:PC4                 0.4844
## face_ethn.e:PC5                   0.7758
## rater_group.e:PC5                 0.2326
## face_ethn.e:PC6                   0.6121
## rater_group.e:PC6                 0.5820
## face_ethn.e:PC7                   0.4451
## rater_group.e:PC7                 0.5176
## face_ethn.e:PC8                   0.8495
## rater_group.e:PC8                 0.9314
```

```
## face_ethn.e:PC9                    0.0227 *
## rater_group.e:PC9                  0.6594
## face_ethn.e:PC10                   0.0375 *
## rater_group.e:PC10                 0.2654
## face_ethn.e:PC11                   0.3411
## rater_group.e:PC11                 0.6232
## face_ethn.e:PC12                   0.7110
## rater_group.e:PC12                 0.1983
## face_ethn.e:rater_group.e:PC1      0.9056
## face_ethn.e:rater_group.e:PC2      0.8320
## face_ethn.e:rater_group.e:PC3      0.4257
## face_ethn.e:rater_group.e:PC4      0.0882 .
## face_ethn.e:rater_group.e:PC5      0.9504
## face_ethn.e:rater_group.e:PC6      0.9729
## face_ethn.e:rater_group.e:PC7      0.7763
## face_ethn.e:rater_group.e:PC8      0.2841
## face_ethn.e:rater_group.e:PC9      0.0784 .
## face_ethn.e:rater_group.e:PC10     0.5177
## face_ethn.e:rater_group.e:PC11     0.8890
## face_ethn.e:rater_group.e:PC12     0.7016
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation matrix not shown by default, as p = 52 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

Comparing AIC of full and reduced models

```
## Warning: `data_frame()` is deprecated, use `tibble()`.
## This warning is displayed once per session.
```

SexOfFace <chr>	Model <chr>	AIC_full.model <dbl>	AIC_reduced.model <dbl>	difference <dbl>
Female	1	262.2750	281.9364	-19.661377
Female	2	250.0716	244.0731	5.998492
Female	3	220.6482	241.6278	-20.979574
Male	1	270.2652	256.2662	13.998974
Male	2	311.6408	281.4060	30.234794
Male	3	234.8788	204.2170	30.661855

6 rows