

Avg+SD+Reactivity

Contents

```
library(dplyr)
```

```
##  
## Attaching package: 'dplyr'  
  
## The following objects are masked from 'package:stats':  
##  
##   filter, lag  
  
## The following objects are masked from 'package:base':  
##  
##   intersect, setdiff, setequal, union
```

```
library(tidyr)  
library(car)      # for Type III ANOVA (Anova)
```

```
## Loading required package: carData  
  
##  
## Attaching package: 'car'  
  
## The following object is masked from 'package:dplyr':  
##  
##   recode
```

```
library(lme4)      # only if you prefer mixed-models
```

```
## Loading required package: Matrix  
  
##  
## Attaching package: 'Matrix'  
  
## The following objects are masked from 'package:tidyr':  
##  
##   expand, pack, unpack
```

```
# assume `dat` is already loaded and has columns: subj, trial.num, trial.val, sex, age, ethn, Ipos, Ineg, Iaro, feelings_initial
feelings_initial <- load("feelings_initial.RData")
```

```
# 1. Compute within-subject mean & SD for each emotion
```

```
subject_metrics <- dat %>%
  group_by(subj) %>%
  summarise(
    Ipos_mean = mean(Ipos, na.rm=TRUE), # average positive affect per subject
    Ineg_mean = mean(Ineg, na.rm=TRUE),
    Iaro_mean = mean(Iaro, na.rm=TRUE),
    Ipos_sd = sd(Ipos, na.rm=TRUE), # within-subject dispersion of positive affect
    Ineg_sd = sd(Ineg, na.rm=TRUE),
    Iaro_sd = sd(Iaro, na.rm=TRUE),
    .groups = "drop"
  )
```

```
# 2. Compute per-subject emotion reactivity: change from neutral
```

```
condition_means <- dat %>%
  group_by(subj, trial.val) %>%
  summarise(
    Ipos_m = mean(Ipos, na.rm=TRUE), # mean positive affect under each stimulus
    Ineg_m = mean(Ineg, na.rm=TRUE), # mean negative affect under each stimulus
    Iaro_m = mean(Iaro, na.rm=TRUE), # mean arousal under each stimulus
    .groups = "drop"
  ) %>%
  pivot_wider(
    id_cols = subj,
    names_from = trial.val,
    values_from = c(Ipos_m, Ineg_m, Iaro_m)
  ) %>%
  mutate(
    Ipos_reac_pos = Ipos_m_pos - Ipos_m_neu, # increase in Ipos following a positive stimulus vs. neutral
    Ipos_reac_neg = Ipos_m_neg - Ipos_m_neu, # increase in Ipos following a negative stimulus vs. neutral
    Ineg_reac_pos = Ineg_m_pos - Ineg_m_neu, # increase in Ineg following a positive stimulus vs. neutral
    Ineg_reac_neg = Ineg_m_neg - Ineg_m_neu, # increase in Ineg following a negative stimulus vs. neutral
    Iaro_reac_pos = Iaro_m_pos - Iaro_m_neu, # increase in Iaro following a positive stimulus vs. neutral
    Iaro_reac_neg = Iaro_m_neg - Iaro_m_neu # increase in Iaro following a negative stimulus vs. neutral
  )
```

```
# 3. Merge computed metrics with demographics
```

```
demo <- dat %>%
  select(subj, sex, age, ethn) %>%
  distinct() # one row per subject

metrics_full <- subject_metrics %>%
  left_join(condition_means, by="subj") %>% # add reactivity scores
  left_join(demo, by="subj") # add sex, age, ethnicity
```

```
# 4. Multivariate tests to assess joint differences
```

```
# MANOVA for emotion means
```

```
manova_means <- manova(cbind(Ipos_mean, Ineg_mean, Iaro_mean) ~ sex + age + ethn,
  data=metrics_full)
```

```
summary(manova_means, test="Wilks")
```

```
##           Df    Wilks approx F num Df den Df  Pr(>F)
## sex       2 0.89512   2.7343      6 288.00 0.01341 *
## age      1 0.97029   1.4697      3 144.00 0.22531
## ethn     6 0.88011   1.0463     18 407.78 0.40614
## Residuals 146
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# MANOVA for emotion SDs
```

```
manova_sds <- manova(cbind(Ipos_sd, Ineg_sd, Iaro_sd) ~ sex + age + ethn,
                     data=metrics_full)
summary(manova_sds, test="Wilks")
```

```
##           Df    Wilks approx F num Df den Df  Pr(>F)
## sex       2 0.92784   1.83169      6 288.00 0.0928 .
## age      1 0.98273   0.84342      3 144.00 0.4722
## ethn     6 0.87783   1.06803     18 407.78 0.3826
## Residuals 146
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# MANOVA for reactivity measures
```

```
react_vars <- grep("reac", names(metrics_full), value=TRUE)
manova_reac <- manova(as.matrix(metrics_full[react_vars]) ~ sex + age + ethn,
                     data=metrics_full)
summary(manova_reac, test="Wilks")
```

```
##           Df    Wilks approx F num Df den Df  Pr(>F)
## sex       2 0.89679   1.31542     12 282.00 0.2088
## age      1 0.96736   0.79286      6 141.00 0.5770
## ethn     6 0.74322   1.20789     36 621.94 0.1916
## Residuals 146
```

- sex (p = 0.01341): multivariate sex differences in overall means of Ipos, Ineg, Iaro

```
# 5. Test group differences for each metric with Type III ANOVA
```

```
# vector of metric names in metrics_full
```

```
metrics <- c(
  "Ipos_mean", "Ipos_sd", "Ipos_reac_pos", "Ipos_reac_neg",
  "Ineg_mean", "Ineg_sd", "Ineg_reac_pos", "Ineg_reac_neg",
  "Iaro_mean", "Iaro_sd", "Iaro_reac_pos", "Iaro_reac_neg"
)
```

```
# for each metric, fit lm(metric ~ sex + age + ethn), print ANOVA and coefficients
```

```
for (m in metrics) {
  cat("\n=== Metric:", m, "===\n")
  # build the formula dynamically
  f <- as.formula(paste(m, "~ sex + age + ethn"))
```

```

fit <- lm(f, data = metrics_full)
# Type III omnibus tests
print(Anova(fit, type = "III"))
# parameter estimates
print(coef(summary(fit)))
}

```

```

##
## === Metric: Ipos_mean ===
## Anova Table (Type III tests)
##
## Response: Ipos_mean
##           Sum Sq Df F value    Pr(>F)
## (Intercept) 17.256  1 29.2586 2.531e-07 ***
## sex          2.972  2  2.5193  0.08401 .
## age          0.601  1  1.0194  0.31434
## ethn         7.005  6  1.9796  0.07218 .
## Residuals   86.107 146
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##               Estimate Std. Error
## (Intercept)      2.49475857 0.46121346
## sexfemale         0.20020188 0.12668955
## sexother        -1.13134905 0.77692713
## age              0.02213294 0.02192181
## ethnBlack/African American 0.08730840 0.24732381
## ethnLatino/Hispanic -0.33717616 0.24120604
## ethnOther        -0.01740202 0.30227718
## ethnWhite/Caucasian 0.13375179 0.16151319
## ethnAmerican Indian/Native American or Alaskan Native -0.93996799 0.40921334
## ethnDecline to state -0.33288505 0.56495722
##
##               t value    Pr(>|t|)
## (Intercept)      5.40911914 2.531141e-07
## sexfemale         1.58025564 1.162124e-01
## sexother        -1.45618426 1.474888e-01
## age              1.00963105 3.143424e-01
## ethnBlack/African American 0.35301250 7.245882e-01
## ethnLatino/Hispanic -1.39787614 1.642705e-01
## ethnOther        -0.05756974 9.541701e-01
## ethnWhite/Caucasian 0.82811681 4.089560e-01
## ethnAmerican Indian/Native American or Alaskan Native -2.29701208 2.303990e-02
## ethnDecline to state -0.58922170 5.566232e-01
##
## === Metric: Ipos_sd ===
## Anova Table (Type III tests)
##
## Response: Ipos_sd
##           Sum Sq Df F value    Pr(>F)
## (Intercept)  7.052  1 12.7653 0.0004789 ***
## sex          3.424  2  3.0983 0.0481041 *
## age          1.064  1  1.9263 0.1672777
## ethn         4.932  6  1.4878 0.1862018
## Residuals   80.661 146

```

```

## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##               Estimate Std. Error
## (Intercept)      1.59489036 0.44639123
## sexfemale         0.25832908 0.12261807
## sexother        -0.86083862 0.75195865
## age              0.02944778 0.02121729
## ethnBlack/African American 0.09640195 0.23937545
## ethnLatino/Hispanic -0.19799003 0.23345429
## ethnOther        -0.25338838 0.29256275
## ethnWhite/Caucasian 0.10974663 0.15632256
## ethnAmerican Indian/Native American or Alaskan Native -0.80512139 0.39606226
## ethnDecline to state -0.28691642 0.54680093
##
##               t value      Pr(>|t|)
## (Intercept)      3.5728532 0.0004788662
## sexfemale         2.1067783 0.0368469128
## sexother        -1.1447952 0.2541672556
## age              1.3879140 0.1672776521
## ethnBlack/African American 0.4027228 0.6877412442
## ethnLatino/Hispanic -0.8480891 0.3977766113
## ethnOther        -0.8660992 0.3878567849
## ethnWhite/Caucasian 0.7020524 0.4837642097
## ethnAmerican Indian/Native American or Alaskan Native -2.0328152 0.0438834848
## ethnDecline to state -0.5247182 0.6005748914
##
## === Metric: Ipos_reac_pos ===
## Anova Table (Type III tests)
##
## Response: Ipos_reac_pos
##           Sum Sq Df F value    Pr(>F)
## (Intercept)  17.87  1  7.2960 0.007729 **
## sex          11.90  2  2.4295 0.091632 .
## age           2.46  1  1.0052 0.317711
## ethn         25.75  6  1.7523 0.112948
## Residuals    357.60 146
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##               Estimate Std. Error
## (Intercept)      2.538781791 0.93990270
## sexfemale         0.457631627 0.25817948
## sexother        -1.832362125 1.58329269
## age              0.044790543 0.04467425
## ethnBlack/African American 0.008696724 0.50401894
## ethnLatino/Hispanic -0.303910471 0.49155158
## ethnOther        -0.897118410 0.61600790
## ethnWhite/Caucasian 0.248909216 0.32914625
## ethnAmerican Indian/Native American or Alaskan Native -1.755609123 0.83393213
## ethnDecline to state -0.653935427 1.15132116
##
##               t value      Pr(>|t|)
## (Intercept)      2.70111128 0.007728569
## sexfemale         1.77253294 0.078391636
## sexother        -1.15731105 0.249035195
## age              1.00260321 0.317711133
## ethnBlack/African American 0.01725476 0.986256937

```

```

## ethnLatino/Hispanic -0.61826772 0.537362191
## ethnOther -1.45634238 0.147445148
## ethnWhite/Caucasian 0.75622680 0.450731702
## ethnAmerican Indian/Native American or Alaskan Native -2.10521823 0.036984656
## ethnDecline to state -0.56798698 0.570916279
##
## === Metric: Ipos_reac_neg ===
## Anova Table (Type III tests)
##
## Response: Ipos_reac_neg
## Sum Sq Df F value Pr(>F)
## (Intercept) 0.156 1 0.3626 0.5480
## sex 0.494 2 0.5736 0.5647
## age 0.005 1 0.0124 0.9114
## ethn 3.119 6 1.2069 0.3060
## Residuals 62.892 146
##
## Estimate Std. Error
## (Intercept) -0.237346994 0.39416752
## sexfemale -0.110962173 0.10827287
## sexother 0.149012656 0.66398634
## age 0.002088132 0.01873506
## ethnBlack/African American -0.338111173 0.21137071
## ethnLatino/Hispanic 0.076499873 0.20614226
## ethnOther -0.490931555 0.25833558
## ethnWhite/Caucasian -0.083086201 0.13803425
## ethnAmerican Indian/Native American or Alaskan Native 0.092748140 0.34972658
## ethnDecline to state 0.172329167 0.48283020
## t value Pr(>|t|)
## (Intercept) -0.6021475 0.54800995
## sexfemale -1.0248382 0.30713456
## sexother 0.2244213 0.82274329
## age 0.1114558 0.91140798
## ethnBlack/African American -1.5996123 0.11184640
## ethnLatino/Hispanic 0.3711023 0.71109925
## ethnOther -1.9003637 0.05935668
## ethnWhite/Caucasian -0.6019245 0.54815797
## ethnAmerican Indian/Native American or Alaskan Native 0.2652019 0.79122804
## ethnDecline to state 0.3569146 0.72167104
##
## === Metric: Ineg_mean ===
## Anova Table (Type III tests)
##
## Response: Ineg_mean
## Sum Sq Df F value Pr(>F)
## (Intercept) 23.083 1 42.3028 1.166e-09 ***
## sex 3.743 2 3.4294 0.03504 *
## age 0.004 1 0.0074 0.93176
## ethn 4.163 6 1.2715 0.27397
## Residuals 79.665 146
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Estimate Std. Error
## (Intercept) 2.885368148 0.44362547
## sexfemale 0.317542821 0.12185835

```

```

## sexother -0.031652136 0.74729965
## age 0.001808829 0.02108584
## ethnBlack/African American -0.060942721 0.23789233
## ethnLatino/Hispanic -0.317651535 0.23200784
## ethnOther 0.138570433 0.29075009
## ethnWhite/Caucasian 0.070419633 0.15535402
## ethnAmerican Indian/Native American or Alaskan Native -0.692260892 0.39360833
## ethnDecline to state -0.275510373 0.54341304
## t value Pr(>|t|)
## (Intercept) 6.50406335 1.166454e-09
## sexfemale 2.60583558 1.011462e-02
## sexother -0.04235535 9.662733e-01
## age 0.08578409 9.317556e-01
## ethnBlack/African American -0.25617775 7.981742e-01
## ethnLatino/Hispanic -1.36914136 1.730576e-01
## ethnOther 0.47659636 6.343621e-01
## ethnWhite/Caucasian 0.45328492 6.510166e-01
## ethnAmerican Indian/Native American or Alaskan Native -1.75875571 8.071409e-02
## ethnDecline to state -0.50699992 6.129198e-01
##
## === Metric: Ineg_sd ===
## Anova Table (Type III tests)
##
## Response: Ineg_sd
## Sum Sq Df F value Pr(>F)
## (Intercept) 8.110 1 15.8956 0.0001054 ***
## sex 3.103 2 3.0406 0.0508451 .
## age 0.915 1 1.7929 0.1826560
## ethn 2.738 6 0.8945 0.5006953
## Residuals 74.490 146
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## Estimate Std. Error
## (Intercept) 1.71029359 0.42897579
## sexfemale 0.27849521 0.11783427
## sexother -0.36369134 0.72262186
## age 0.02730130 0.02038953
## ethnBlack/African American 0.01190580 0.23003650
## ethnLatino/Hispanic -0.24898389 0.22434634
## ethnOther -0.26754490 0.28114876
## ethnWhite/Caucasian 0.02726528 0.15022382
## ethnAmerican Indian/Native American or Alaskan Native -0.56327925 0.38061035
## ethnDecline to state -0.26267361 0.52546812
## t value Pr(>|t|)
## (Intercept) 3.98692332 0.0001054126
## sexfemale 2.36344842 0.0194232770
## sexother -0.50329414 0.6155159567
## age 1.33898662 0.1826560311
## ethnBlack/African American 0.05175615 0.9587937437
## ethnLatino/Hispanic -1.10981926 0.2689015120
## ethnOther -0.95161332 0.3428658436
## ethnWhite/Caucasian 0.18149773 0.8562286440
## ethnAmerican Indian/Native American or Alaskan Native -1.47993676 0.1410447192
## ethnDecline to state -0.49988495 0.6179086530

```

```

##
## === Metric: Ineg_reac_pos ===
## Anova Table (Type III tests)
##
## Response: Ineg_reac_pos
##           Sum Sq Df F value Pr(>F)
## (Intercept)  0.0600  1  0.3762 0.5406
## sex          0.3323  2  1.0420 0.3553
## age          0.0019  1  0.0120 0.9128
## ethn         1.2574  6  1.3145 0.2542
## Residuals    23.2773 146
##
##                                     Estimate Std. Error
## (Intercept)                    -0.147074475 0.23980029
## sexfemale                      -0.031034098 0.06587013
## sexother                        0.533341251 0.40395037
## age                             0.001250222 0.01139788
## ethnBlack/African American      0.255494060 0.12859191
## ethnLatino/Hispanic             0.290139186 0.12541108
## ethnOther                       0.024001308 0.15716400
## ethnWhite/Caucasian             0.123312341 0.08397610
## ethnAmerican Indian/Native American or Alaskan Native 0.236718608 0.21276369
## ethnDecline to state            0.215095719 0.29374013
##
##                                     t value   Pr(>|t|)
## (Intercept)                    -0.6133207 0.54061862
## sexfemale                      -0.4711407 0.63824348
## sexother                        1.3203138 0.18879638
## age                             0.1096890 0.91280665
## ethnBlack/African American      1.9868595 0.04880936
## ethnLatino/Hispanic            2.3135053 0.02209083
## ethnOther                       0.1527151 0.87883384
## ethnWhite/Caucasian            1.4684218 0.14414089
## ethnAmerican Indian/Native American or Alaskan Native 1.1125893 0.26771340
## ethnDecline to state            0.7322653 0.46518051
##
## === Metric: Ineg_reac_neg ===
## Anova Table (Type III tests)
##
## Response: Ineg_reac_neg
##           Sum Sq Df F value   Pr(>F)
## (Intercept)  23.13  1 10.2672 0.001663 **
## sex          17.03  2  3.7795 0.025100 *
## age           1.80  1  0.7979 0.373204
## ethn         15.36  6  1.1363 0.344181
## Residuals    328.88 146
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##                                     Estimate Std. Error
## (Intercept)                    2.88819985 0.90136564
## sexfemale                      0.67300130 0.24759383
## sexother                      -0.27910825 1.51837591
## age                             0.03826824 0.04284255
## ethnBlack/African American      0.28204499 0.48335360
## ethnLatino/Hispanic            -0.46797793 0.47139741
## ethnOther                      -0.53038266 0.59075088

```



```

## ethnWhite/Caucasian                0.23365314 0.31565089
## ethnAmerican Indian/Native American or Alaskan Native -1.00422488 0.79973997
## ethnDecline to state                -0.46793684 1.10411570
##                                     t value    Pr(>|t|)
## (Intercept)                        3.2042489 0.001663105
## sexfemale                          2.7181667 0.007359674
## sexother                           -0.1838203 0.854409516
## age                                0.8932297 0.373204165
## ethnBlack/African American          0.5835169 0.560445732
## ethnLatino/Hispanic                 -0.9927461 0.322476175
## ethnOther                           -0.8978110 0.370764466
## ethnWhite/Caucasian                 0.7402265 0.460351286
## ethnAmerican Indian/Native American or Alaskan Native -1.2556892 0.211234511
## ethnDecline to state                -0.4238114 0.672327094
##
## === Metric: Iaro_mean ===
## Anova Table (Type III tests)
##
## Response: Iaro_mean
##               Sum Sq Df F value    Pr(>F)
## (Intercept)  17.004   1 10.5346 0.001453 **
## sex           4.562   2  1.4133 0.246652
## age          1.035   1  0.6412 0.424594
## ethn         5.502   6  0.5682 0.755157
## Residuals    235.657 146
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##               Estimate Std. Error
## (Intercept)    2.47646991 0.76299810
## sexfemale      0.22641929 0.20958600
## sexother      -1.53357829 1.28529188
## age            0.02903882 0.03626584
## ethnBlack/African American 0.22313333 0.40915458
## ethnLatino/Hispanic      0.12384592 0.39903377
## ethnOther         0.52839215 0.50006544
## ethnWhite/Caucasian      0.06931642 0.26719570
## ethnAmerican Indian/Native American or Alaskan Native -0.85244612 0.67697287
## ethnDecline to state     0.07313229 0.93462425
##
##               t value    Pr(>|t|)
## (Intercept)    3.2457091 0.001452958
## sexfemale      1.0803169 0.281782439
## sexother      -1.1931751 0.234736140
## age            0.8007208 0.424594356
## ethnBlack/African American 0.5453521 0.586343531
## ethnLatino/Hispanic      0.3103645 0.756726386
## ethnOther        1.0566460 0.292418433
## ethnWhite/Caucasian      0.2594219 0.795675160
## ethnAmerican Indian/Native American or Alaskan Native -1.2592028 0.209966560
## ethnDecline to state     0.0782478 0.937738082
##
## === Metric: Iaro_sd ===
## Anova Table (Type III tests)
##
## Response: Iaro_sd

```

```

##          Sum Sq Df F value    Pr(>F)
## (Intercept)  4.283  1 11.1343 0.001075 **
## sex          0.299  2  0.3880 0.679107
## age          0.135  1  0.3505 0.554763
## ethn         0.518  6  0.2243 0.968370
## Residuals    56.161 146
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##              Estimate Std. Error
## (Intercept)    1.242883965  0.3724770
## sexfemale      0.069180678  0.1023148
## sexother      -0.317497006  0.6274481
## age            0.010480918  0.0177041
## ethnBlack/African American 0.102759943  0.1997393
## ethnLatino/Hispanic 0.123642672  0.1947985
## ethnOther      -0.001755194  0.2441197
## ethnWhite/Caucasian 0.036049288  0.1304384
## ethnAmerican Indian/Native American or Alaskan Native -0.053897908  0.3304816
## ethnDecline to state 0.409199350  0.4562607
##
##              t value    Pr(>|t|)
## (Intercept)    3.336806972 0.001075021
## sexfemale      0.676155356 0.500011709
## sexother      -0.506013175 0.613610585
## age            0.592005163 0.554762778
## ethnBlack/African American 0.514470401 0.607701051
## ethnLatino/Hispanic 0.634720734 0.526603951
## ethnOther      -0.007189889 0.994273163
## ethnWhite/Caucasian 0.276370178 0.782654601
## ethnAmerican Indian/Native American or Alaskan Native -0.163088975 0.870673905
## ethnDecline to state 0.896854198 0.371273175
##
## === Metric: Iaro_reac_pos ===
## Anova Table (Type III tests)
##
## Response: Iaro_reac_pos
##          Sum Sq Df F value    Pr(>F)
## (Intercept)  6.869  1  3.8030 0.05308 .
## sex          4.104  2  1.1362 0.32387
## age          0.028  1  0.0155 0.90110
## ethn         8.563  6  0.7902 0.57901
## Residuals    263.695 146
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##              Estimate Std. Error
## (Intercept)    1.573971690  0.80711253
## sexfemale      0.196821627  0.22170368
## sexother      -1.549421624  1.35960389
## age            0.004775647  0.03836263
## ethnBlack/African American 0.427571573  0.43281076
## ethnLatino/Hispanic 0.645676725  0.42210480
## ethnOther      0.085871897  0.52897783
## ethnWhite/Caucasian 0.195823744  0.28264422
## ethnAmerican Indian/Native American or Alaskan Native -0.772647992  0.71611356
## ethnDecline to state 0.254318015  0.98866163

```

```

##                                t value  Pr(>|t|)
## (Intercept)                   1.9501267 0.05307677
## sexfemale                     0.8877689 0.37612527
## sexother                      -1.1396125 0.25631398
## age                           0.1244869 0.90110097
## ethnBlack/African American    0.9878950 0.32483846
## ethnLatino/Hispanic           1.5296598 0.12826473
## ethnOther                     0.1623355 0.87126609
## ethnWhite/Caucasian           0.6928277 0.48951827
## ethnAmerican Indian/Native American or Alaskan Native -1.0789462 0.28239100
## ethnDecline to state          0.2572346 0.79735982
##
## === Metric: Iaro_reac_neg ===
## Anova Table (Type III tests)
##
## Response: Iaro_reac_neg
##              Sum Sq  Df F value Pr(>F)
## (Intercept)    3.666   1  1.7220 0.1915
## sex             7.134   2  1.6753 0.1908
## age            1.609   1  0.7556 0.3861
## ethn           3.341   6  0.2615 0.9539
## Residuals    310.851 146
##
##                                Estimate Std. Error
## (Intercept)                   1.14994023 0.87631220
## sexfemale                     0.39576145 0.24071197
## sexother                      -0.98029036 1.47617270
## age                           0.03620484 0.04165174
## ethnBlack/African American    0.33646479 0.46991880
## ethnLatino/Hispanic           0.29315619 0.45829493
## ethnOther                     0.32892000 0.57433098
## ethnWhite/Caucasian           0.14722004 0.30687738
## ethnAmerican Indian/Native American or Alaskan Native -0.34582380 0.77751122
## ethnDecline to state          0.71976528 1.07342684
##
##                                t value  Pr(>|t|)
## (Intercept)                   1.3122495 0.1914953
## sexfemale                     1.6441287 0.1023012
## sexother                      -0.6640757 0.5076893
## age                           0.8692275 0.3861494
## ethnBlack/African American    0.7160062 0.4751311
## ethnLatino/Hispanic           0.6396671 0.5233915
## ethnOther                     0.5727011 0.5677280
## ethnWhite/Caucasian           0.4797357 0.6321332
## ethnAmerican Indian/Native American or Alaskan Native -0.4447830 0.6571352
## ethnDecline to state          0.6705304 0.5035791

```

Based on the Type III ANOVA results in the provided PDF :contentReferenceoaicite:0:contentReferenceoaicite:1, the following group-difference summary emerges:

Metric	Sex p	Age p	Ethnicity p	Significant Effect
Ipos__mean	0.084	0.314	0.072	—
Ipos__sd	0.048	0.167	0.186	Females > Males ($\beta=+0.26$, $p=.037$)
Ipos__reac__pos	0.092	0.318	0.113	—
Ipos__reac__neg	0.565	0.911	0.306	—

Metric	Sex p	Age p	Ethnicity p	Significant Effect
Ineg_mean	0.035	0.932	0.274	Females > Males ($\beta=+0.32$, $p=.010$)
Ineg_sd	0.051 ·	0.183	0.501	Females > Males ($\beta=+0.28$, $p=.019$) ¹
Ineg_reac_pos	0.355	0.913	0.254	—
Ineg_reac_neg	0.025	0.373	0.344	Females > Males ($\beta=+0.67$, $p=.007$)
Iaro_mean	0.247	0.425	0.755	—
Iaro_sd	0.679	0.555	0.968	—
Iaro_reac_pos	0.324	0.901	0.579	—
Iaro_reac_neg	0.191	0.386	0.954	—

Signif. codes: **bold** = $p < .05$; · = $p < .10$ (trend)

¹ Although the omnibus Sex test for Ineg_sd was $p = .051$, the female vs. male contrast was significant at $p = .019$

- Sex differences
 - Emotion dispersion: Females show greater within-person dispersion SD in positive affect (Ipos_sd: $\beta = 0.26$, $p = .037$) and slightly greater negative affect (Ineg_sd: $\beta = 0.28$, $p = .019$)
 - Emotion level: Females have higher average negative affect (Ineg_mean: $\beta = 0.32$, $p = .010$)
 - Reactivity: Females show stronger negative-stimulus reactivity in negative affect (Ineg_reac_neg: $\beta = 0.67$, $p = .007$)
 - * Compared to males, females have bigger increase in Ineg (negative emotion) following a negative stimulus (than the baseline–neutral stimulus)

```
# robust regression + FDR correction
```

```
library(MASS)
```

```
##
```

```
## Attaching package: 'MASS'
```

```
## The following object is masked from 'package:dplyr':
```

```
##
```

```
##      select
```

```
library(boot)
```

```
##
```

```
## Attaching package: 'boot'
```

```
## The following object is masked from 'package:car':
```

```
##
```

```
##      logit
```

```
# original p-values
```

```
sex_effect_est <- numeric(length(metrics))
```

```
sex_p_vals <- numeric(length(metrics))
```

```
names(sex_effect_est) <- names(sex_p_vals) <- metrics
```

```
for (i in seq_along(metrics)) {
```

```

m <- metrics[i]
cat("\n=== Robust Check: ", m, " ===\n")

f <- as.formula(paste(m, "~ sex + age + ethn"))
fit_robust <- rlm(f, data = metrics_full)
summ <- summary(fit_robust)

# sexfemale estimate & t value
est <- summ$coefficients["sexfemale", "Value"]
tval <- summ$coefficients["sexfemale", "t value"]
df <- nrow(metrics_full) - length(coef(fit_robust))
pval <- 2 * pt(-abs(tval), df)

sex_effect_est[i] <- est
sex_p_vals[i] <- pval
}

```

```

##
## === Robust Check: Ipos_mean ===
##
## === Robust Check: Ipos_sd ===
##
## === Robust Check: Ipos_reac_pos ===
##
## === Robust Check: Ipos_reac_neg ===
##
## === Robust Check: Ineg_mean ===
##
## === Robust Check: Ineg_sd ===
##
## === Robust Check: Ineg_reac_pos ===
##
## === Robust Check: Ineg_reac_neg ===
##
## === Robust Check: Iaro_mean ===
##
## === Robust Check: Iaro_sd ===
##
## === Robust Check: Iaro_reac_pos ===
##
## === Robust Check: Iaro_reac_neg ===

```

```

# FDR correction
sex_p_fdr <- p.adjust(sex_p_vals, method = "fdr")

robust_summary <- data.frame(
  Metric = metrics,
  Estimate_sexfemale = round(sex_effect_est, 3),
  P_unadj = signif(sex_p_vals, 3),
  P_FDR = signif(sex_p_fdr, 3),
  Significant = sex_p_fdr < 0.05
)

```

```
# View table
print(robust_summary)
```

	Metric	Estimate_sexfemale	P_unadj	P_FDR	Significant
## Ipos_mean	Ipos_mean	0.191	0.13700	0.2740	FALSE
## Ipos_sd	Ipos_sd	0.261	0.04470	0.1340	FALSE
## Ipos_reac_pos	Ipos_reac_pos	0.498	0.07010	0.1680	FALSE
## Ipos_reac_neg	Ipos_reac_neg	-0.083	0.26700	0.4000	FALSE
## Ineg_mean	Ineg_mean	0.335	0.01170	0.0702	FALSE
## Ineg_sd	Ineg_sd	0.279	0.02320	0.0926	FALSE
## Ineg_reac_pos	Ineg_reac_pos	-0.036	0.40200	0.5120	FALSE
## Ineg_reac_neg	Ineg_reac_neg	0.675	0.00894	0.0702	FALSE
## Iaro_mean	Iaro_mean	0.170	0.45700	0.5120	FALSE
## Iaro_sd	Iaro_sd	0.081	0.46900	0.5120	FALSE
## Iaro_reac_pos	Iaro_reac_pos	0.129	0.56800	0.5680	FALSE
## Iaro_reac_neg	Iaro_reac_neg	0.322	0.22200	0.3800	FALSE

Interpretation

- **Estimate_sexfemale** (robust regression estimate): how much higher or lower females scored compared to males
- **P_unadj**: p-value from robust regression (unadjusted for multiple comparisons)
- **P_FDR**: p-value after False Discovery Rate correction. Controls for multiple testing

Result:

- Unadjusted significance ($p < 0.05$)
 - Ipos_sd ($P_{\text{unadj}} = 0.0447$, $\beta = 0.261$)
 - Ineg_mean ($P_{\text{unadj}} = 0.0117$, $\beta = 0.335$)
 - Ineg_sd ($P_{\text{unadj}} = 0.0232$, $\beta = 0.279$)
 - Ineg_reac_neg ($P_{\text{unadj}} = 0.00894$, $\beta = 0.675$)
 - These suggest that, compared to males:
 - * Females show higher dispersion (SD) in both positive and negative emotion
 - * Females have higher average negative emotion
 - * Females respond more strongly to negative stimuli (higher negative-stimulus reactivity in negative emotion)
- None of the 12 metrics reached statistical significance after FDR correction ($P_{\text{FDR}} < 0.05$)