

# 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. 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

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```

## 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	<b>0.048</b>	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	—
Ineg_mean	<b>0.035</b>	0.932	0.274	Females > Males ( $\beta=+0.32$ , $p=.010$ )
Ineg_sd	0.051 ·	0.183	0.501	Females > Males ( $\beta=+0.28$ , $p=.019$ ) <sup>1</sup>
Ineg_reac_pos	0.355	0.913	0.254	—
Ineg_reac_neg	<b>0.025</b>	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)

<sup>1</sup> 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:  $\beta=+0.67$ ,  $p=.007$ )

#### # 5. 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