Morality Analysis

Load the data

```
## Load the data
library(readxl)

file_path <- "/Users/yaldadaryani/Desktop/dataset_clean.xlsx"
data <- read_excel(file_path)

Sys.setenv(RGL_USE_NULL = "TRUE")
options(rgl.useNULL = TRUE)
# Packages
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(car)         # Levene tests, Type-III ANCOVA tables
```

```
Warning: package 'car' was built under R version 4.4.1

Loading required package: carData
```

```
Attaching package: 'car'

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

    recode
```

```
library(heplots)     # Box's M, multivariate SSPE/HE utilities
```

```
Warning: package 'heplots' was built under R version 4.4.1

Loading required package: broom

Warning: package 'broom' was built under R version 4.4.1
```

```
library(MVN)         # Multivariate normality + Mahalanobis outliers
```

```
Warning: package 'MVN' was built under R version 4.4.1
```

```
library(emmeans)     # Estimated marginal means + contrasts
```

```
Warning: package 'emmeans' was built under R version 4.4.1

Welcome to emmeans.
Caution: You lose important information if you filter this package's results.
See '? untidy'
```

```
library(effectsize)  # Effect sizes (partial eta^2, CI)
```

```
Warning: package 'effectsize' was built under R version 4.4.1
```

Ensure factors are factors

```r
# Robust recode to canonical labels
data <- data %>%
  mutate(
    group_clean = case_when(
      Group %in% c(1, "1", "Liberals", "liberals")      ~ "Liberals",
      Group %in% c(2, "2", "Conservatives", "conservatives")  ~ "Conservatives",
      TRUE ~ NA_character_
    ),
    condition_clean = case_when(
      Condition %in% c(1, "1", "Outgroup", "outgroup", "Actual", "Actual Perception") ~ "Outg
      Condition %in% c(2, "2", "Metaperception", "metaperception", "Meta")            ~ "Meta
      Condition %in% c(3, "3", "Ingroup", "ingroup")                                   ~ "Ing
      TRUE ~ NA_character_
    ),
    group     = factor(group_clean, levels = c("Liberals", "Conservatives")),
    condition = factor(condition_clean, levels = c("Outgroup", "Metaperception", "Ingroup"))
  ) %>%
  select(-group_clean, -condition_clean)

# Sanity check: you should now see real levels, not NA
print(with(data, table(group, condition, useNA = "ifany")))
```

```
               condition
group           Outgroup Metaperception Ingroup
  Liberals           100             95      99
  Conservatives       94             86      92
```

Create Composite Scores

```r
item_cols <- c(
  "care_1","care_2","equality_1","equality_2","proportionality_1","proportionality_2",
  "loyalty_1","loyalty_2","authority_1","authority_2","purity_1","purity_2"
)
missing <- setdiff(item_cols, names(data))
if (length(missing)) stop("Missing columns: ", paste(missing, collapse = ", "))

data <- data %>%
  mutate(across(all_of(item_cols), ~ suppressWarnings(as.numeric(.)))) %>%
  mutate(
    care_mean            = rowMeans(pick(care_1, care_2), na.rm = TRUE),
```

```
    equality_mean        = rowMeans(pick(equality_1, equality_2), na.rm = TRUE),
    proportionality_mean = rowMeans(pick(proportionality_1, proportionality_2), na.rm = TRUE)
    individualizing      = rowMeans(cbind(care_mean, equality_mean), na.rm = TRUE),
    loyalty_mean   = rowMeans(pick(loyalty_1, loyalty_2), na.rm = TRUE),
    authority_mean = rowMeans(pick(authority_1, authority_2), na.rm = TRUE),
    purity_mean    = rowMeans(pick(purity_1, purity_2), na.rm = TRUE),
    binding        = rowMeans(cbind(loyalty_mean, authority_mean, purity_mean,proportionality
  )
```

Simple Descriptives

```
desc <- data %>%
  group_by(group, condition) %>%
  summarise(
    n         = dplyr::n(),
    mean_ind  = mean(individualizing, na.rm = TRUE),
    sd_ind    = sd(individualizing, na.rm = TRUE),
    mean_bind = mean(binding, na.rm = TRUE),
    sd_bind   = sd(binding, na.rm = TRUE),
    .groups   = "drop"
  )

# Print PDF-friendly
print(as.data.frame(desc), row.names = FALSE)
```

```
        group      condition   n mean_ind    sd_ind mean_bind   sd_bind
      Liberals       Outgroup 100 2.212500 0.9746632  3.287500 0.9608005
      Liberals Metaperception  95 3.042105 1.0116690  2.003947 0.6735042
      Liberals        Ingroup  99 3.790404 0.7229008  2.657828 1.0689832
 Conservatives       Outgroup  94 3.308511 0.7780814  2.739362 1.0890553
 Conservatives Metaperception  86 3.058140 0.7540815  3.565407 0.7823247
 Conservatives        Ingroup  92 3.032609 0.7846548  3.408967 0.7914601
```

```
# Quick wide views
ind_wide <- tidyr::pivot_wider(desc |> select(group, condition, mean_ind),
                               names_from = condition, values_from = mean_ind)
bind_wide <- tidyr::pivot_wider(desc |> select(group, condition, mean_bind),
                                names_from = condition, values_from = mean_bind)
cat("\nIndividualizing (means):\n"); print(as.data.frame(ind_wide), row.names = FALSE)
```

```
Individualizing (means):
```

```
         group Outgroup Metaperception  Ingroup
      Liberals 2.212500       3.042105 3.790404
 Conservatives 3.308511       3.058140 3.032609
```

```
cat("\nBinding (means):\n");        print(as.data.frame(bind_wide), row.names = FALSE)
```

```
Binding (means):
```

```
         group Outgroup Metaperception  Ingroup
      Liberals 3.287500       2.003947 2.657828
 Conservatives 2.739362       3.565407 3.408967
```

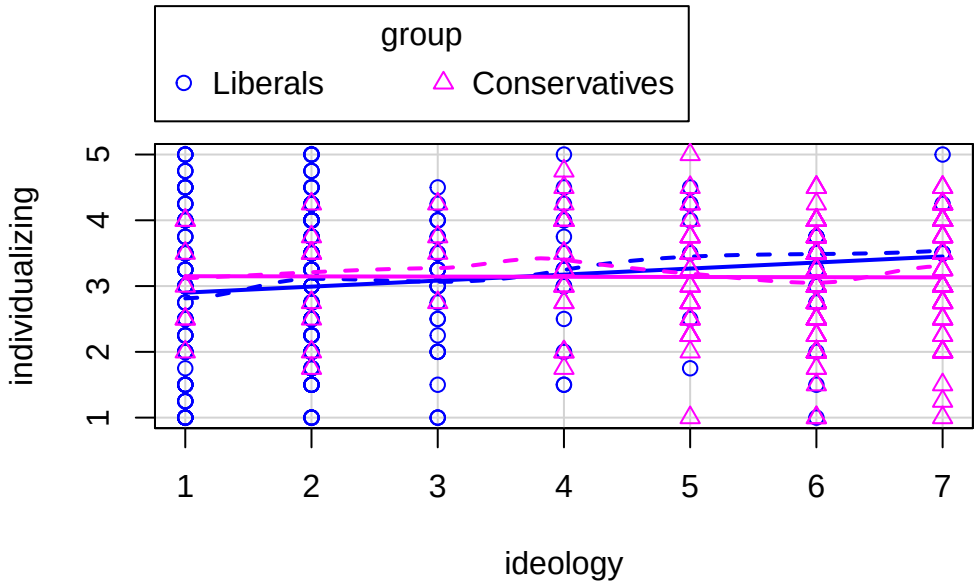
Equality of covariance matrices

```
# Note: Box's M is sensitive to non-normality; interpret alongside Pillai later
boxM(cbind(individualizing, binding) ~ group * condition, data = data)
```

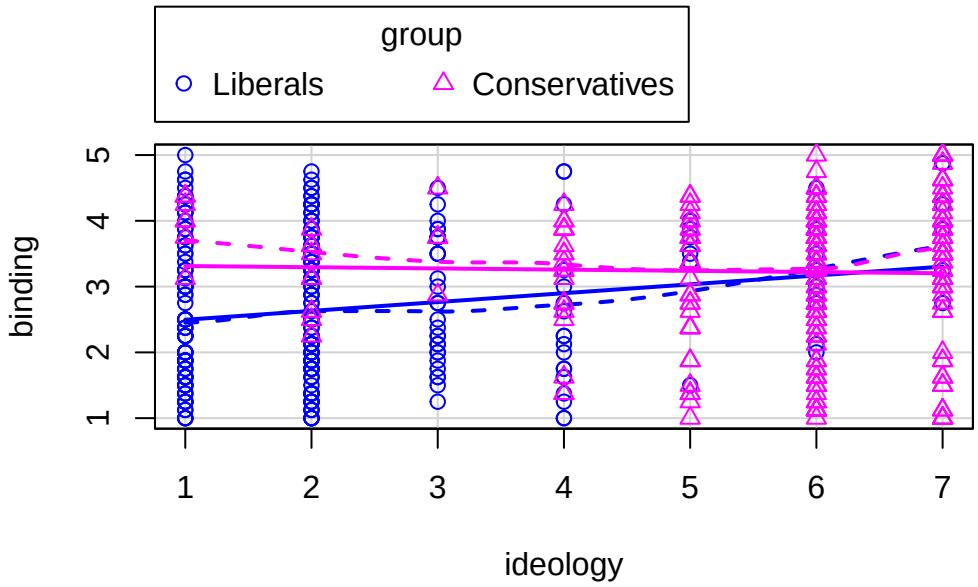
```
    Box's M-test for Homogeneity of Covariance Matrices

data:  Y
Chi-Sq (approx.) = 71.778, df = 15, p-value = 2.151e-09
```

Linearity of DV–covariate relations (quick visual check)

```
# Scatterplots of DV vs ideology, stratified by factors (optional visual check)
car::scatterplot(individualizing ~ ideology | group*condition, data = data)
```




```
car::scatterplot(binding ~ ideology | group*condition, data = data)
```



Homogeneity of regression slopes (covariate × factors)

```r
# For each DV, check whether ideology interacts with group/condition
m_ind <- lm(individualizing ~ ideology * group * condition, data = data)
m_bin <- lm(binding        ~ ideology * group * condition, data = data)

anova(m_ind)  # Look at ideology:group and ideology:condition (and 3-way)
```

```
Analysis of Variance Table

Response: individualizing
                          Df Sum Sq Mean Sq F value    Pr(>F)
ideology                   1   4.31  4.3129  6.1351  0.013550 *
group                      1   0.06  0.0584  0.0831  0.773194
condition                  2  44.03 22.0131 31.3134 1.306e-13 ***
ideology:group             1   1.83  1.8327  2.6071  0.106959
ideology:condition         2  60.91 30.4525 43.3183 < 2.2e-16 ***
group:condition            2  22.95 11.4753 16.3235 1.294e-07 ***
ideology:group:condition   2   9.06  4.5289  6.4422  0.001715 **
Residuals                554 389.46  0.7030
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
anova(m_bin)
```

```
Analysis of Variance Table

Response: binding
                          Df Sum Sq Mean Sq F value    Pr(>F)
ideology                   1  42.05  42.045 52.4745 1.468e-12 ***
group                      1   7.08   7.076  8.8311  0.003090 **
condition                  2   8.76   4.378  5.4640  0.004468 **
ideology:group             1   6.09   6.090  7.6005  0.006028 **
ideology:condition         2  95.23  47.616 59.4265 < 2.2e-16 ***
group:condition            2  22.13  11.067 13.8116 1.401e-06 ***
ideology:group:condition   2   0.94   0.470  0.5866  0.556569
Residuals                554 443.90   0.801
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Fit the MANCOVA (report both Pillai and Wilks)

```
# Multivariate model
mancova_model <- manova(cbind(individualizing, binding) ~ group * condition + ideology,
                        data = data)

summary(mancova_model, test = "Pillai")  # robust
```

```
                 Df  Pillai approx F num Df den Df    Pr(>F)
group             1 0.08948   27.420      2    558 4.378e-12 ***
condition         2 0.12367   18.422      4   1118 1.134e-14 ***
ideology          1 0.00923    2.599      2    558   0.07527 .
group:condition   2 0.37097   63.649      4   1118 < 2.2e-16 ***
Residuals       559
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
summary(mancova_model, test = "Wilks")   # conventional
```

```
                 Df   Wilks approx F num Df den Df    Pr(>F)
group             1 0.91052   27.420      2    558 4.378e-12 ***
condition         2 0.87832   18.698      4   1116 6.866e-15 ***
ideology          1 0.99077    2.599      2    558   0.07527 .
group:condition   2 0.64566   68.218      4   1116 < 2.2e-16 ***
Residuals       559
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Univariate ANCOVAs with Type-III tests + effect sizes

```
# Fit per-DV models with Type-III SS
fit_ind <- lm(individualizing ~ group * condition + ideology, data = data)
fit_bin <- lm(binding         ~ group * condition + ideology, data = data)

Anova(fit_ind, type = 3)
```

```
Anova Table (Type III tests)
```

```
Response: individualizing
                Sum Sq  Df  F value    Pr(>F)
(Intercept)     325.13   1 452.8765 < 2.2e-16 ***
group            30.81   1  42.9162 1.298e-10 ***
condition       122.55   2  85.3506 < 2.2e-16 ***
ideology          0.81   1   1.1351    0.2872
group:condition  82.89   2  57.7279 < 2.2e-16 ***
Residuals       401.32 559
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
Anova(fit_bin, type = 3)
```

```
Anova Table (Type III tests)

Response: binding
                Sum Sq  Df  F value    Pr(>F)
(Intercept)     699.43   1 847.2905 < 2.2e-16 ***
group            17.93   1  21.7253 3.938e-06 ***
condition        80.49   2  48.7550 < 2.2e-16 ***
ideology          3.89   1   4.7167   0.03029 *
group:condition 106.84   2  64.7121 < 2.2e-16 ***
Residuals       461.45 559
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# Partial eta-squared + 95% CI for key effects
eta_squared(Anova(fit_ind, type = 3), partial = TRUE, ci = 0.95)
```

```
Type 3 ANOVAs only give sensible and informative results when covariates
  are mean-centered and factors are coded with orthogonal contrasts (such
  as those produced by `contr.sum`, `contr.poly`, or `contr.helmert`, but
  *not* by the default `contr.treatment`).

# Effect Size for ANOVA (Type III)

Parameter       | Eta2 (partial) |       95% CI
-------------------------------------------------
group           |           0.07 | [0.04, 1.00]
condition       |           0.23 | [0.18, 1.00]
ideology        |       2.03e-03 | [0.00, 1.00]
```

```
group:condition |           0.17 | [0.13, 1.00]

- One-sided CIs: upper bound fixed at [1.00].
```

```
eta_squared(Anova(fit_bin, type = 3), partial = TRUE, ci = 0.95)
```

```
Type 3 ANOVAs only give sensible and informative results when covariates
  are mean-centered and factors are coded with orthogonal contrasts (such
  as those produced by `contr.sum`, `contr.poly`, or `contr.helmert`, but
  *not* by the default `contr.treatment`).

# Effect Size for ANOVA (Type III)

Parameter       | Eta2 (partial) |       95% CI
-------------------------------------------------
group           |           0.04 | [0.02, 1.00]
condition       |           0.15 | [0.11, 1.00]
ideology        |       8.37e-03 | [0.00, 1.00]
group:condition |           0.19 | [0.14, 1.00]

- One-sided CIs: upper bound fixed at [1.00].
```

Planned Contrasts for Ingroup Perception and Outgroup Perception

```
# EMMs for each DV, adjusted for ideology
emm_ind <- emmeans(fit_ind, ~ group * condition)
emm_bin <- emmeans(fit_bin, ~ group * condition)

# Inspect order (for sanity)
emm_ind
```

```
 group         condition      emmean     SE  df lower.CL upper.CL
 Liberals      Outgroup         2.26 0.0962 559     2.07     2.45
 Conservatives Outgroup         3.26 0.0988 559     3.07     3.45
 Liberals      Metaperception   3.09 0.0978 559     2.90     3.28
 Conservatives Metaperception   3.01 0.1020 559     2.81     3.21
 Liberals      Ingroup          3.83 0.0937 559     3.65     4.02
 Conservatives Ingroup          2.98 0.1000 559     2.78     3.18

Confidence level used: 0.95
```

```
emm_bin
```

```
 group         condition      emmean    SE  df lower.CL upper.CL
 Liberals      Outgroup         3.39 0.103 559     3.19     3.60
 Conservatives Outgroup         2.63 0.106 559     2.42     2.84
 Liberals      Metaperception   2.11 0.105 559     1.90     2.31
 Conservatives Metaperception   3.46 0.110 559     3.24     3.67
 Liberals      Ingroup          2.75 0.100 559     2.55     2.95
 Conservatives Ingroup          3.30 0.108 559     3.09     3.51

Confidence level used: 0.95
```

```
# EMMs (already fit)
emm_ind <- emmeans(fit_ind, ~ group * condition)

# Get the row labels in emm_ind's order (e.g., "Liberals.Ingroup", etc.)
labs <- with(as.data.frame(emm_ind),
             paste(group, condition, sep = "."))

# Helper to create a full-length contrast weight vector safely
make_w <- function(pos_names, neg_names, labels = labs) {
  w <- setNames(rep(0, length(labels)), labels)
  w[pos_names] <- w[pos_names] + 1
  w[neg_names] <- w[neg_names] - 1
  w
}

# H1: Ingroup (one group) vs Outgroup (other group)
w1 <- make_w("Liberals.Ingroup",  "Conservatives.Outgroup")
w2 <- make_w("Conservatives.Ingroup","Liberals.Outgroup")

h1_ind <- contrast(
  emm_ind,
  method = list(
    "Liberals Ingroup vs Conservatives Outgroup"  = w1,
    "Conservatives Ingroup vs Liberals Outgroup"  = w2
  ),
  adjust = "none"
)

summary(h1_ind, infer = c(TRUE, TRUE))
```

```
 contrast                                       estimate    SE  df lower.CL
 Liberals Ingroup vs Conservatives Outgroup     0.573 0.149 559    0.280
 Conservatives Ingroup vs Liberals Outgroup     0.721 0.154 559    0.418
 upper.CL t.ratio p.value
    0.865   3.849  0.0001
    1.023   4.678  <.0001

Confidence level used: 0.95
```

```r
eff_size(h1_ind, sigma = sigma(fit_ind), edf = df.residual(fit_ind))
```

```
 contrast
 Liberals Ingroup vs Conservatives Outgroup - Conservatives Ingroup vs Liberals Outgroup
 effect.size    SE  df lower.CL upper.CL
      -0.175 0.293 559   -0.751    0.402

sigma used for effect sizes: 0.8473
Confidence level used: 0.95
```

```r
emm_bin <- emmeans(fit_bin, ~ group * condition)
labs_b  <- with(as.data.frame(emm_bin), paste(group, condition, sep = "."))
make_wb <- function(pos_names, neg_names, labels = labs_b) {
  w <- setNames(rep(0, length(labels)), labels)
  w[pos_names] <- w[pos_names] + 1
  w[neg_names] <- w[neg_names] - 1
  w
}

h1_bin <- contrast(
  emm_bin,
  method = list(
    "Liberals Ingroup vs Conservatives Outgroup"  = make_wb("Liberals.Ingroup",  "Conservati
    "Conservatives Ingroup vs Liberals Outgroup"  = make_wb("Conservatives.Ingroup","Liberals
  ),
  adjust = "none"
)
summary(h1_bin, infer = c(TRUE, TRUE))
```

```
 contrast                                       estimate    SE  df lower.CL
 Liberals Ingroup vs Conservatives Outgroup     0.1166 0.160 559   -0.197
 Conservatives Ingroup vs Liberals Outgroup    -0.0962 0.165 559   -0.421
```

```
 upper.CL t.ratio p.value
    0.430   0.731  0.4650
    0.228  -0.583  0.5604

Confidence level used: 0.95
```

```r
eff_size(h1_bin, sigma = sigma(fit_bin), edf = df.residual(fit_bin))
```

```
 contrast
 Liberals Ingroup vs Conservatives Outgroup - Conservatives Ingroup vs Liberals Outgroup
 effect.size    SE  df lower.CL upper.CL
       0.234 0.293 559   -0.342     0.81

sigma used for effect sizes: 0.9086
Confidence level used: 0.95
```

Planned contrast for Outgroup Perception and Metaperception

```r
# EMMs for each DV, adjusted for ideology
emm_ind <- emmeans(fit_ind, ~ group * condition)
emm_bin <- emmeans(fit_bin, ~ group * condition)

# Inspect order (sanity check)
emm_ind
```

```
 group         condition      emmean     SE  df lower.CL upper.CL
 Liberals      Outgroup         2.26 0.0962 559     2.07     2.45
 Conservatives Outgroup         3.26 0.0988 559     3.07     3.45
 Liberals      Metaperception   3.09 0.0978 559     2.90     3.28
 Conservatives Metaperception   3.01 0.1020 559     2.81     3.21
 Liberals      Ingroup          3.83 0.0937 559     3.65     4.02
 Conservatives Ingroup          2.98 0.1000 559     2.78     3.18

Confidence level used: 0.95
```

```r
emm_bin
```

```
 group         condition      emmean    SE  df lower.CL upper.CL
 Liberals      Outgroup         3.39 0.103 559     3.19     3.60
```

```
 Conservatives Outgroup         2.63 0.106 559     2.42     2.84
 Liberals      Metaperception   2.11 0.105 559     1.90     2.31
 Conservatives Metaperception   3.46 0.110 559     3.24     3.67
 Liberals      Ingroup          2.75 0.100 559     2.55     2.95
 Conservatives Ingroup          3.30 0.108 559     3.09     3.51

Confidence level used: 0.95
```

```r
# ----- Helper (same as before) -----
labs <- with(as.data.frame(emm_ind), paste(group, condition, sep = "."))
make_w <- function(pos_names, neg_names, labels = labs) {
  w <- setNames(rep(0, length(labels)), labels)
  w[pos_names] <- w[pos_names] + 1
  w[neg_names] <- w[neg_names] - 1
  w
}

# ========================
# H2: Outgroup (one group) vs Metaperception (other group)
# ========================
# Individualizing
w3_ind <- make_w("Liberals.Outgroup",   "Conservatives.Metaperception")
w4_ind <- make_w("Conservatives.Outgroup", "Liberals.Metaperception")

h2_ind <- contrast(
  emm_ind,
  method = list(
    "Liberals Outgroup vs Conservatives Metaperception"   = w3_ind,
    "Conservatives Outgroup vs Liberals Metaperception"   = w4_ind
  ),
  adjust = "none"
)

summary(h2_ind, infer = c(TRUE, TRUE))                    # estimates, SEs, CIs, p
```

```
 contrast                                          estimate    SE  df lower.CL
 Liberals Outgroup vs Conservatives Metaperception   -0.748 0.155 559   -1.052
 Conservatives Outgroup vs Liberals Metaperception    0.169 0.153 559   -0.131
 upper.CL t.ratio p.value
   -0.444  -4.833  <.0001
    0.470   1.106  0.2690
```

```
Confidence level used: 0.95
```

```r
eff_size(h2_ind, sigma = sigma(fit_ind), edf = df.residual(fit_ind))  # standardized effects
```

```
 contrast
 Liberals Outgroup vs Conservatives Metaperception - Conservatives Outgroup vs Liberals Metap
 effect.size  SE  df lower.CL upper.CL
       -1.08 0.3 559    -1.67   -0.494

sigma used for effect sizes: 0.8473
Confidence level used: 0.95
```

```r
# ----- Binding -----
labs_b <- with(as.data.frame(emm_bin), paste(group, condition, sep = "."))
make_wb <- function(pos_names, neg_names, labels = labs_b) {
  w <- setNames(rep(0, length(labels)), labels)
  w[pos_names] <- w[pos_names] + 1
  w[neg_names] <- w[neg_names] - 1
  w
}

w3_bin <- make_wb("Liberals.Outgroup",    "Conservatives.Metaperception")
w4_bin <- make_wb("Conservatives.Outgroup", "Liberals.Metaperception")

h2_bin <- contrast(
  emm_bin,
  method = list(
    "Liberals Outgroup vs Conservatives Metaperception"    = w3_bin,
    "Conservatives Outgroup vs Liberals Metaperception"    = w4_bin
  ),
  adjust = "none"
)

summary(h2_bin, infer = c(TRUE, TRUE))
```

```
 contrast                                           estimate    SE  df lower.CL
 Liberals Outgroup vs Conservatives Metaperception  -0.0642 0.166 559   -0.390
 Conservatives Outgroup vs Liberals Metaperception   0.5236 0.164 559    0.201
 upper.CL t.ratio p.value
    0.262  -0.387  0.6991
    0.846   3.187  0.0015
```

```
Confidence level used: 0.95
```

```r
eff_size(h2_bin, sigma = sigma(fit_bin), edf = df.residual(fit_bin))
```

```
 contrast
 Liberals Outgroup vs Conservatives Metaperception - Conservatives Outgroup vs Liberals Metap
 effect.size    SE  df lower.CL upper.CL
      -0.647 0.299 559    -1.23  -0.0592

sigma used for effect sizes: 0.9086
Confidence level used: 0.95
```

Graph

```r
# ========================================
# Ideology-adjusted scores + violin plots
# ========================================
library(dplyr)
library(tidyr)
library(ggplot2)
library(forcats)

# 0) Ensure ideology is numeric
if (!is.numeric(data$ideology)) {
  data <- data %>% mutate(ideology = suppressWarnings(as.numeric(ideology)))
}

# 1) Fit ANCOVA-style models to get a single slope for ideology (no interactions)
#    This mirrors your main analysis specification.
fit_ind  <- lm(individualizing ~ ideology + group * condition, data = data)
fit_bind <- lm(binding         ~ ideology + group * condition, data = data)

b_ind  <- coef(fit_ind)[["ideology"]]
b_bind <- coef(fit_bind)[["ideology"]]
xbar   <- mean(data$ideology, na.rm = TRUE)

# 2) Compute ideology-adjusted scores (unit-preserving adjustment to the covariate mean)
#    y_adj = y - b_hat * (x - xbar)
data <- data %>%
```

```
  mutate(
    individualizing_adj = individualizing - b_ind  * (ideology - xbar),
    binding_adj         = binding        - b_bind * (ideology - xbar)
  )

# 3) Tidy to long format for plotting
plot_df_adj <- data %>%
  filter(!is.na(group), !is.na(condition)) %>%
  mutate(
    # Pretty labels (optional)
    group_label = fct_recode(group, "Pro-life" = "Prolife", "Pro-choice" = "Prochoice"),
    condition_label = fct_recode(
      condition,
      "Outgroup Perception" = "Outgroup",
      "Metaperception"      = "Metaperception",
      "Ingroup Perception"  = "Ingroup"
    ),
    condition_label = factor(condition_label,
                             levels = c("Ingroup Perception","Outgroup Perception","Metaperce
  ) %>%
  select(group_label, condition_label, individualizing_adj, binding_adj) %>%
  pivot_longer(
    cols = c(individualizing_adj, binding_adj),
    names_to = "moral_foundation",
    values_to = "value_adj"
  ) %>%
  mutate(
    foundation_label = if_else(
      moral_foundation == "individualizing_adj",
      "Individualizing Foundations",
      "Binding Foundations"
    )
  )
```

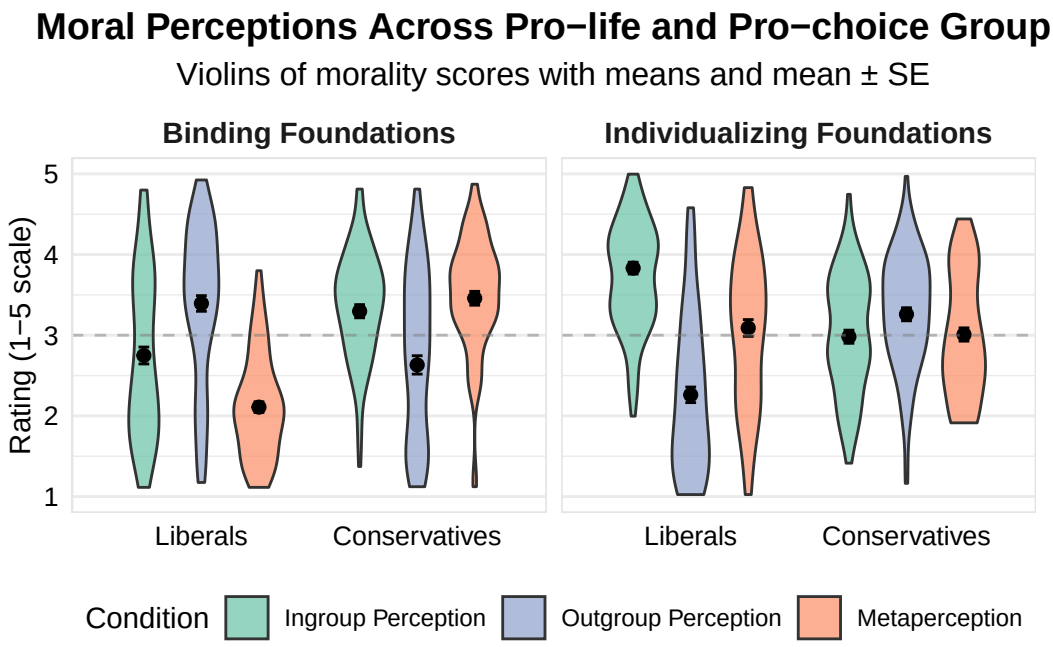
```
Warning: There was 1 warning in `mutate()`.
i In argument: `group_label = fct_recode(group, `Pro-life` = "Prolife",
  `Pro-choice` = "Prochoice")`.
Caused by warning:
! Unknown levels in `f`: Prolife, Prochoice
```

```r
# 4) Summary stats (means and SEs) on adjusted scores
sum_df_adj <- plot_df_adj %>%
  group_by(group_label, condition_label, foundation_label) %>%
  summarise(
    mean = mean(value_adj, na.rm = TRUE),
    sd   = sd(value_adj, na.rm = TRUE),
    n    = sum(!is.na(value_adj)),
    se   = sd / sqrt(n),
    .groups = "drop"
  )

# Optional: inspect adjusted cell means
print(sum_df_adj %>% arrange(foundation_label, group_label, condition_label))
```

```
# A tibble: 12 x 7
   group_label   condition_label     foundation_label    mean    sd     n     se
   <fct>         <fct>               <chr>              <dbl> <dbl> <int>  <dbl>
 1 Liberals      Ingroup Perception  Binding Foundatio~  2.75 1.04     99 0.105
 2 Liberals      Outgroup Perception Binding Foundatio~  3.39 0.968   100 0.0968
 3 Liberals      Metaperception      Binding Foundatio~  2.11 0.646    95 0.0663
 4 Conservatives Ingroup Perception  Binding Foundatio~  3.30 0.783    92 0.0817
 5 Conservatives Outgroup Perception Binding Foundatio~  2.63 1.10     94 0.114
 6 Conservatives Metaperception      Binding Foundatio~  3.46 0.795    86 0.0858
 7 Liberals      Ingroup Perception  Individualizing F~  3.83 0.728    99 0.0732
 8 Liberals      Outgroup Perception Individualizing F~  2.26 0.965   100 0.0965
 9 Liberals      Metaperception      Individualizing F~  3.09 1.01     95 0.104
10 Conservatives Ingroup Perception  Individualizing F~  2.98 0.778    92 0.0811
11 Conservatives Outgroup Perception Individualizing F~  3.26 0.782    94 0.0807
12 Conservatives Metaperception      Individualizing F~  3.01 0.761    86 0.0820
```

```r
# 5) Plot: violins of ideology-adjusted scores
ggplot(plot_df_adj, aes(x = group_label, y = value_adj, fill = condition_label)) +
  geom_violin(position = position_dodge(width = 0.8), alpha = 0.7, width = 0.7, trim = TRUE)

  # mean points (adjusted)
  geom_point(
    data = sum_df_adj,
    aes(x = group_label, y = mean, group = condition_label),
    position = position_dodge(width = 0.8),
    size = 2, color = "black", inherit.aes = FALSE
  ) +
```

```r
# mean ± SE error bars (adjusted)
geom_errorbar(
  data = sum_df_adj,
  aes(x = group_label, ymin = mean - se, ymax = mean + se, group = condition_label),
  width = 0.15,
  position = position_dodge(width = 0.8),
  inherit.aes = FALSE
) +

facet_wrap(~ foundation_label, ncol = 2) +
scale_fill_manual(
  values = c(
    "Ingroup Perception"  = "#66c2a5",
    "Outgroup Perception" = "#8da0cb",
    "Metaperception"      = "#fc8d62"
  ),
  name = "Condition"
) +
labs(
  title = "Moral Perceptions Across Pro-life and Pro-choice Groups",
  subtitle = "Violins of morality scores with means and mean ± SE",
  x = NULL, y = "Rating (1-5 scale)"
) +
theme_minimal() +
theme(
  legend.position = "bottom",
  plot.title = element_text(hjust = 0.5, face = "bold", size = 14),
  plot.subtitle = element_text(hjust = 0.5, size = 12),
  strip.text = element_text(face = "bold", size = 11),
  panel.grid.major.x = element_blank(),
  panel.border = element_rect(fill = NA, color = "gray90"),
  axis.text = element_text(color = "black", size = 10)
) +
geom_hline(yintercept = 3, linetype = "dashed", color = "gray50", alpha = 0.5) +
scale_y_continuous(limits = c(1, 5), breaks = 1:5)
```




```r
# 6) Save
ggsave(
  filename = "/Users/yaldadaryani/Desktop/moral_perception_plot_adjusted.jpg",
  width = 8, height = 6, dpi = 300
)
```