Moderation Analysis

Load the data

```
# Load necessary packages
library(lme4)
```

```
Loading required package: Matrix
```

```
library(lmerTest)
```

```

Attaching package: 'lmerTest'

The following object is masked from 'package:lme4':

    lmer

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

    step
```

```
library(sjPlot)
library(effects)
```

```
Loading required package: carData

lattice theme set by effectsTheme()
See ?effectsTheme for details.
```

```
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(ggplot2)
library(readxl)
library(texreg)
```

```
Version:  1.39.4
Date:     2024-07-23
Author:   Philip Leifeld (University of Manchester)

Consider submitting praise using the praise or praise_interactive functions.
Please cite the JSS article in your publications -- see citation("texreg").
```

```
library(patchwork) # For combining plots
library(scales)    # For formatting


file_path <- "/Users/daryani/Desktop/data.xlsx"

data <- read_excel(file_path)
```

Process the data

```
# Calculate binding values composite for each participant
data <- data %>%
  mutate(binding_score = (loyalty_1 + loyalty_2 +
                          authority_1 + authority_2 +
```

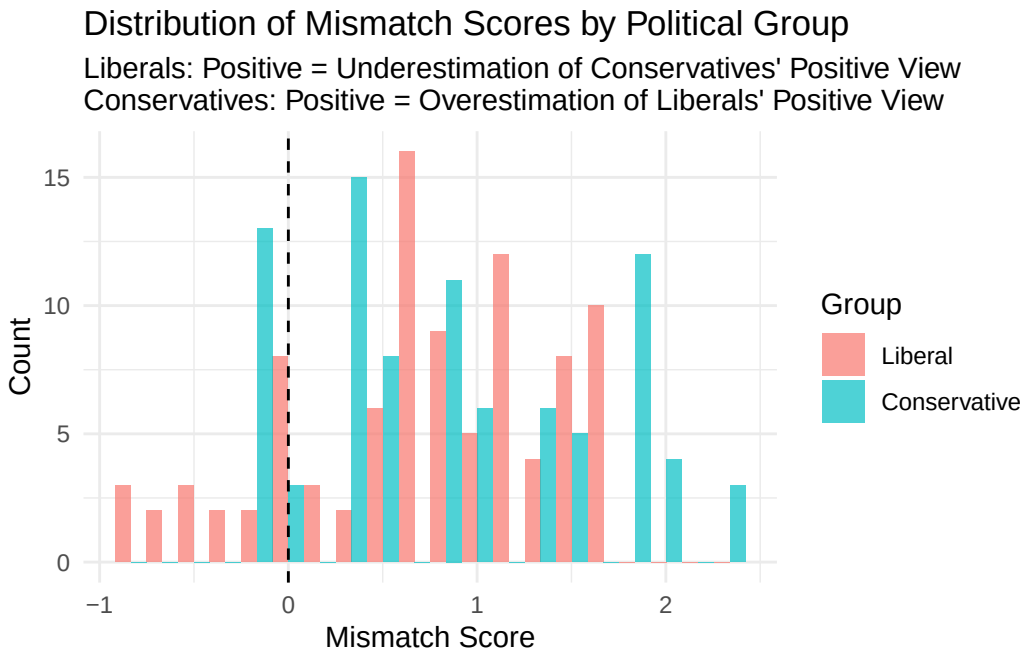
```
                          purity_1 + purity_2 + proportionality_1 +
                            proportionality_2) / 8)

# Calculate individualizing values composite for each participant
data <- data %>%
  mutate(individualizing_score = (care_1 + care_2 +
                                  equality_1 + equality_2) / 4)

# Calculate trust composite
data <- data %>%
  mutate(trust_score = (trust_1 + trust_2 + trust_3 +
                        trust_4 + trust_5 + trust_6) / 6)

# Calculate threat composite
data <- data %>%
  mutate(threat_score = (threat_1 + threat_2 + threat_3 +
                         threat_4 + threat_5 + threat_6) / 6)

# Calculate empathy composite
empathy_cols <- grep("^em_", names(data), value = TRUE)
data$empathy_score <- rowMeans(data[, empathy_cols], na.rm = TRUE)
```

Create the mismatch scores

```
# Calculate reference values (the actual perceptions from the other group)
# These serve as "reality" benchmarks to measure misperception against

# Reference value for binding morality: How conservatives ACTUALLY rate liberals' binding val
cons_binding_ref <- data %>%
  filter(Group == 2, Condition == 1) %>% # Conservatives in outgroup perception condition
  summarise(mean_binding = mean(binding_score, na.rm = TRUE)) %>%
  pull(mean_binding)

# Reference value for individualizing morality: How liberals ACTUALLY rate conservatives' ind
lib_indiv_ref <- data %>%
  filter(Group == 1, Condition == 1) %>% # Liberals in outgroup perception condition
  summarise(mean_indiv = mean(individualizing_score, na.rm = TRUE)) %>%
  pull(mean_indiv)

# Calculate mismatch scores for participants in metaperception condition
```

```r
data <- data %>%
  mutate(
    # LIBERAL MISMATCH: Difference between reality and liberals' meta-perception
    # Formula: (How conservatives actually rate liberals) - (How liberals think conservatives
    # POSITIVE values: Liberals UNDERESTIMATE conservatives' view (conservatives see liberals
    # NEGATIVE values: Liberals OVERESTIMATE conservatives' view (conservatives see liberals
    liberal_binding_mismatch = case_when(
      Group == 1 & Condition == 2 ~ cons_binding_ref - binding_score,
      TRUE ~ NA_real_
    ),

    # CONSERVATIVE MISMATCH: Difference between conservatives' meta-perception and reality
    # Formula: (How conservatives think liberals rate them) - (How liberals actually rate co
    # POSITIVE values: Conservatives OVERESTIMATE liberals' view (conservatives think liberal
    # NEGATIVE values: Conservatives UNDERESTIMATE liberals' view (conservatives think libera
    conservative_indiv_mismatch = case_when(
      Group == 2 & Condition == 2 ~ individualizing_score - lib_indiv_ref,
      TRUE ~ NA_real_
    )
  )

# Create a unified mismatch variable for multilevel modeling
# Combines both types of mismatch into a single variable
data <- data %>%
  mutate(
    mismatch_score = case_when(
      Group == 1 & Condition == 2 ~ liberal_binding_mismatch,     # For liberals
      Group == 2 & Condition == 2 ~ conservative_indiv_mismatch,  # For conservatives
      TRUE ~ NA_real_
    )
  )

# Filter to include only metaperception condition participants for analysis
mlm_data <- data %>%
  filter(Condition == 2) %>%
  # Convert Group to a factor with descriptive labels
  mutate(Group = factor(Group, levels = c(1, 2),
                        labels = c("Liberal", "Conservative")))

# Create direction indicators and ideology strength variables
mlm_data <- mlm_data %>%
  mutate(
```

```r
    # Binary indicator: Do liberals underestimate conservatives' positive view?
    # 1 = Yes (positive mismatch), 0 = No (negative mismatch)
    liberal_underestimation = if_else(Group == "Liberal" & mismatch_score > 0, 1, 0),

    # Binary indicator: Do conservatives overestimate liberals' positive view?
    # 1 = Yes (positive mismatch), 0 = No (negative mismatch)
    conservative_overestimation = if_else(Group == "Conservative" & mismatch_score > 0, 1, 0)

    # Ideology strength measured as distance from moderate (4)
    # For liberals: Higher values indicate stronger liberal ideology
    liberal_ideology_strength = if_else(Group == "Liberal", 4 - ideology, 0),

    # For conservatives: Higher values indicate stronger conservative ideology
    conservative_ideology_strength = if_else(Group == "Conservative", ideology - 4, 0)
  )

# Visualize the distribution of mismatch scores by political group
ggplot(mlm_data, aes(x = mismatch_score, fill = Group)) +
  geom_histogram(alpha = 0.7, position = "dodge", bins = 20) +
  labs(title = "Distribution of Mismatch Scores by Political Group",
       subtitle = "Liberals: Positive = Underestimation of Conservatives' Positive View\nCons
       x = "Mismatch Score", y = "Count") +
  theme_minimal() +
  geom_vline(xintercept = 0, linetype = "dashed", color = "black")
```



Fit the model

```
# ---- Create indicator variables ----
mlm_data <- mlm_data %>%
  mutate(
    # For liberals: is the mismatch positive (underestimation)?
    liberal_underestimation     = if_else(Group ==
                                         "Liberal" & mismatch_score > 0, 1, 0),

    # For conservatives: is the mismatch positive (overestimation)?
    conservative_overestimation = if_else(Group ==
                                       "Conservative" & mismatch_score > 0, 1, 0),

    # Alternative version using absolute distance from midpoint
    liberal_ideology_strength   = if_else(Group == "Liberal",      abs(ideology - 4), 0),
    conservative_ideology_strength = if_else(Group == "Conservative", abs(ideology - 4), 0)
  )

# ---- Split the data by political group ----
liberal_data       <- mlm_data %>% filter(Group == "Liberal")
conservative_data  <- mlm_data %>% filter(Group == "Conservative")
```

```r
# ============================================================
# ANALYSIS FOR LIBERALS (CONTROLLING FOR IDEOLOGY)
# ============================================================

# 1) Basic effect of mismatch on trust (controls ideology)
lib_trust_model <- lm(trust_score ~ mismatch_score + ideology,
                      data = liberal_data)
summary(lib_trust_model)
```

```
Call:
lm(formula = trust_score ~ mismatch_score + ideology, data = liberal_data)

Residuals:
    Min      1Q  Median      3Q     Max
-3.9792 -1.0287 -0.0235  0.9644  2.8898

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)      3.6457     0.3688   9.885 3.99e-16 ***
mismatch_score  -1.0521     0.2245  -4.686 9.59e-06 ***
ideology         0.2000     0.1122   1.782   0.0781 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.352 on 92 degrees of freedom
Multiple R-squared:  0.2875,    Adjusted R-squared:  0.272
F-statistic: 18.56 on 2 and 92 DF,  p-value: 1.689e-07
```

```r
# 2) Effect of mismatch on threat (controls ideology)
lib_threat_model <- lm(threat_score ~ mismatch_score + ideology,
                       data = liberal_data)
summary(lib_threat_model)
```

```
Call:
lm(formula = threat_score ~ mismatch_score + ideology, data = liberal_data)

Residuals:
    Min      1Q  Median      3Q     Max
-5.0679 -0.8079  0.2605  0.9488  3.8960
```

```
Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)      5.0531     0.4148  12.181  < 2e-16 ***
mismatch_score   0.9467     0.2525   3.749  0.00031 ***
ideology        -0.2326     0.1262  -1.843  0.06857 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.521 on 92 degrees of freedom
Multiple R-squared:  0.2255,    Adjusted R-squared:  0.2087
F-statistic: 13.39 on 2 and 92 DF,  p-value: 7.855e-06
```

```r
# 3) Direction-specific (controls ideology)
lib_trust_dir_model <- lm(trust_score ~ mismatch_score *
                            liberal_underestimation + ideology,
                          data = liberal_data)
summary(lib_trust_dir_model)
```

```
Call:
lm(formula = trust_score ~ mismatch_score * liberal_underestimation +
    ideology, data = liberal_data)

Residuals:
    Min      1Q  Median      3Q     Max
-3.4215 -1.0101 -0.0747  1.0017  2.9268

Coefficients:
                                        Estimate Std. Error t value Pr(>|t|)
(Intercept)                               4.1515     0.5617   7.391  7.2e-11 ***
mismatch_score                            0.2364     0.9948   0.238    0.813
liberal_underestimation                  -0.4495     0.5988  -0.751    0.455
ideology                                  0.1861     0.1140   1.632    0.106
mismatch_score:liberal_underestimation   -1.3365     1.0621  -1.258    0.212
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.354 on 90 degrees of freedom
Multiple R-squared:  0.3013,    Adjusted R-squared:  0.2702
F-statistic: 9.702 on 4 and 90 DF,  p-value: 1.435e-06
```

```r
lib_threat_dir_model <- lm(threat_score ~ mismatch_score *
                             liberal_underestimation + ideology,
                           data = liberal_data)
summary(lib_threat_dir_model)
```

```
Call:
lm(formula = threat_score ~ mismatch_score * liberal_underestimation +
    ideology, data = liberal_data)

Residuals:
    Min      1Q  Median      3Q     Max
-4.7325 -0.7602  0.1714  0.8995  3.3877

Coefficients:
                                      Estimate Std. Error t value Pr(>|t|)
(Intercept)                             3.8634     0.6110   6.323 9.69e-09 ***
mismatch_score                         -0.8117     1.0821  -0.750   0.4551
liberal_underestimation                 1.8493     0.6514   2.839   0.0056 **
ideology                               -0.1725     0.1241  -1.391   0.1678
mismatch_score:liberal_underestimation  1.1174     1.1554   0.967   0.3361
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.473 on 90 degrees of freedom
Multiple R-squared:  0.2895,    Adjusted R-squared:  0.258
F-statistic: 9.169 on 4 and 90 DF,  p-value: 2.928e-06
```

```r
# ============================================================
# ANALYSIS FOR CONSERVATIVES (CONTROLLING FOR IDEOLOGY)
# ============================================================

# 1) Basic effect of mismatch on trust (controls ideology)
con_trust_model <- lm(trust_score ~ mismatch_score + ideology,
                      data = conservative_data)
summary(con_trust_model)
```

```
Call:
lm(formula = trust_score ~ mismatch_score + ideology, data = conservative_data)
```

```
Residuals:
     Min       1Q   Median       3Q      Max
-2.88979 -0.82571  0.00813  0.85805  2.55435

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)     3.42793    0.51136   6.704 2.29e-09 ***
mismatch_score  1.25187    0.17106   7.318 1.45e-10 ***
ideology       -0.10919    0.08069  -1.353     0.18
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.181 on 83 degrees of freedom
Multiple R-squared:  0.4136,    Adjusted R-squared:  0.3994
F-statistic: 29.27 on 2 and 83 DF,  p-value: 2.404e-10
```

```r
# 2) Effect of mismatch on threat (controls ideology)
con_threat_model <- lm(threat_score ~ mismatch_score + ideology,
                       data = conservative_data)
summary(con_threat_model)
```

```
Call:
lm(formula = threat_score ~ mismatch_score + ideology, data = conservative_data)

Residuals:
    Min      1Q  Median      3Q     Max
-4.7309 -0.7658  0.3237  1.0371  2.3479

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)     5.53116    0.62126   8.903 1.02e-13 ***
mismatch_score -0.77575    0.20782  -3.733 0.000346 ***
ideology        0.03813    0.09803   0.389 0.698298
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.435 on 83 degrees of freedom
Multiple R-squared:  0.1498,    Adjusted R-squared:  0.1294
F-statistic: 7.315 on 2 and 83 DF,  p-value: 0.001186
```

```r
# 3) Direction-specific (controls ideology)
con_trust_dir_model <- lm(trust_score ~ mismatch_score *
                            conservative_overestimation + ideology,
                          data = conservative_data)
summary(con_trust_dir_model)
```

```
Call:
lm(formula = trust_score ~ mismatch_score * conservative_overestimation +
    ideology, data = conservative_data)

Residuals:
     Min       1Q   Median       3Q      Max
-2.89024 -0.78859  0.07335  0.76622  2.54421

Coefficients: (1 not defined because of singularities)
                                          Estimate Std. Error t value Pr(>|t|)
(Intercept)                                2.91755    0.58211   5.012 3.05e-06
mismatch_score                             1.03409    0.20929   4.941 4.04e-06
conservative_overestimation                0.77137    0.43762   1.763   0.0817
ideology                                  -0.10217    0.07978  -1.281   0.2039
mismatch_score:conservative_overestimation       NA         NA      NA       NA

(Intercept)                               ***
mismatch_score                            ***
conservative_overestimation               .
ideology
mismatch_score:conservative_overestimation
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.166 on 82 degrees of freedom
Multiple R-squared:  0.435, Adjusted R-squared:  0.4143
F-statistic: 21.04 on 3 and 82 DF,  p-value: 3.336e-10
```

```r
con_threat_dir_model <- lm(threat_score ~ mismatch_score *
                             conservative_overestimation + ideology,
                           data = conservative_data)
summary(con_threat_dir_model)
```

```
Call:
lm(formula = threat_score ~ mismatch_score * conservative_overestimation +
    ideology, data = conservative_data)

Residuals:
    Min      1Q  Median      3Q     Max
-4.4380 -0.8327  0.2914  1.0029  2.1543

Coefficients: (1 not defined because of singularities)
                                          Estimate Std. Error t value Pr(>|t|)
(Intercept)                                6.03791    0.71166   8.484 7.64e-13
mismatch_score                            -0.55952    0.25586  -2.187   0.0316
conservative_overestimation               -0.76588    0.53501  -1.432   0.1561
ideology                                   0.03116    0.09754   0.319   0.7502
mismatch_score:conservative_overestimation      NA         NA      NA       NA

(Intercept)                               ***
mismatch_score                            *
conservative_overestimation
ideology
mismatch_score:conservative_overestimation
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.426 on 82 degrees of freedom
Multiple R-squared:  0.1706,    Adjusted R-squared:  0.1402
F-statistic: 5.621 on 3 and 82 DF,  p-value: 0.001485
```

```r
# ============================================================
# VISUALIZATION HELPER (IDELOGY HELD CONSTANT)
# ============================================================

get_adjusted_predictions <- function(model, data, x_var = "mismatch_score") {
  # Hold ideology at its mean
  mean_ideology <- mean(data$ideology, na.rm = TRUE)

  # Base grid
  new_data <- data.frame(
    mismatch_score = seq(min(data$mismatch_score, na.rm = TRUE),
                         max(data$mismatch_score, na.rm = TRUE),
                         length.out = 100),
    ideology = mean_ideology
```

```
  )

  # If model includes liberal_underestimation, make two grids (0/1)
  if ("liberal_underestimation" %in% names(data) &&
      any(grepl("liberal_underestimation", names(coef(model))))) {
    new0 <- new_data; new0$liberal_underestimation <- 0
    new1 <- new_data; new1$liberal_underestimation <- 1
    new_data <- rbind(new0, new1)
  }

  # If model includes conservative_overestimation, make two grids (0/1)
  if ("conservative_overestimation" %in% names(data) &&
      any(grepl("conservative_overestimation", names(coef(model))))) {
    new0 <- new_data; new0$conservative_overestimation <- 0
    new1 <- new_data; new1$conservative_overestimation <- 1
    new_data <- rbind(new0, new1)
  }

  # Predict
  new_data$predicted <- predict(model, newdata = new_data)
  new_data
}

# ================================================================
# ADDITIONAL: IDEOLOGY STRENGTH AS MODERATOR
# ================================================================

lib_trust_ideology_mod <- lm(trust_score ~ mismatch_score * liberal_ideology_strength,
                             data = liberal_data)
summary(lib_trust_ideology_mod)
```

```
Call:
lm(formula = trust_score ~ mismatch_score * liberal_ideology_strength,
    data = liberal_data)

Residuals:
    Min      1Q  Median      3Q     Max
-3.4884 -1.1383 -0.0331  1.0468  2.9786

Coefficients:
                                          Estimate Std. Error t value Pr(>|t|)
```

```
(Intercept)                                   4.5253     0.5941   7.617 2.36e-11
mismatch_score                               -1.5576     0.6350  -2.453   0.0161
liberal_ideology_strength                    -0.1565     0.2626  -0.596   0.5526
mismatch_score:liberal_ideology_strength      0.1591     0.2685   0.593   0.5549

(Intercept)                                  ***
mismatch_score                               *
liberal_ideology_strength
mismatch_score:liberal_ideology_strength
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.38 on 91 degrees of freedom
Multiple R-squared:  0.2661,    Adjusted R-squared:  0.242
F-statistic:    11 on 3 and 91 DF,  p-value: 3.128e-06
```

```r
con_trust_ideology_mod <- lm(trust_score ~ mismatch_score * conservative_ideology_strength,
                             data = conservative_data)
summary(con_trust_ideology_mod)
```

```
Call:
lm(formula = trust_score ~ mismatch_score * conservative_ideology_strength,
    data = conservative_data)

Residuals:
     Min       1Q   Median       3Q      Max
-2.81249 -0.87940 -0.04576  0.90277  2.50412

Coefficients:
                                             Estimate Std. Error t value
(Intercept)                                   3.20487    0.55491   5.775
mismatch_score                                1.16759    0.40852   2.858
conservative_ideology_strength               -0.19484    0.24448  -0.797
mismatch_score:conservative_ideology_strength 0.04942    0.17937   0.275
                                             Pr(>|t|)
(Intercept)                                  1.33e-07 ***
mismatch_score                                 0.0054 **
conservative_ideology_strength                 0.4278
mismatch_score:conservative_ideology_strength  0.7836
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 1.193 on 82 degrees of freedom
Multiple R-squared:  0.4084,    Adjusted R-squared:  0.3868
F-statistic: 18.87 on 3 and 82 DF,  p-value: 2.125e-09
```

```r
# ================================================================
# MODEL COMPARISON TABLES (Console)
# ================================================================

# Liberal models
screenreg(list(
  "Liberal Trust"                 = lib_trust_model,
  "Liberal Trust (Direction)"     = lib_trust_dir_model,
  "Liberal Trust (Ideology Mod)"  = lib_trust_ideology_mod,
  "Liberal Threat"                = lib_threat_model,
  "Liberal Threat (Direction)"    = lib_threat_dir_model
), stars = c(0.05, 0.01, 0.001))
```

```
=============================================================================================
                                          Liberal Trust  Liberal Trust (Direction)  Liberal T
---------------------------------------------------------------------------------------------
(Intercept)                                3.65 ***       4.15 ***                  4.53 ***
                                          (0.37)         (0.56)                    (0.59)
mismatch_score                            -1.05 ***       0.24                     -1.56 *
                                          (0.22)         (0.99)                    (0.64)
ideology                                   0.20           0.19
                                          (0.11)         (0.11)
liberal_underestimation                                  -0.45
                                                         (0.60)
mismatch_score:liberal_underestimation                   -1.34
                                                         (1.06)
liberal_ideology_strength                                                          -0.16
                                                                                   (0.26)
mismatch_score:liberal_ideology_strength                                            0.16
                                                                                   (0.27)
---------------------------------------------------------------------------------------------
R^2                                        0.29           0.30                      0.27
Adj. R^2                                   0.27           0.27                      0.24
Num. obs.                                 95             95                        95
=============================================================================================
*** p < 0.001; ** p < 0.01; * p < 0.05
```

```
# Conservative models
screenreg(list(
  "Conservative Trust"                = con_trust_model,
  "Conservative Trust (Direction)"    = con_trust_dir_model,
  "Conservative Trust (Ideology Mod)" = con_trust_ideology_mod,
  "Conservative Threat"               = con_threat_model,
  "Conservative Threat (Direction)"   = con_threat_dir_model
), stars = c(0.05, 0.01, 0.001))
```

```
=============================================================================================
                                                Conservative Trust  Conservative Trust (Direct
---------------------------------------------------------------------------------------------
(Intercept)                                      3.43 ***            2.92 ***
                                                (0.51)              (0.58)
mismatch_score                                   1.25 ***            1.03 ***
                                                (0.17)              (0.21)
ideology                                        -0.11               -0.10
                                                (0.08)              (0.08)
conservative_overestimation                                          0.77
                                                                    (0.44)
conservative_ideology_strength

mismatch_score:conservative_ideology_strength

---------------------------------------------------------------------------------------------
R^2                                              0.41                0.43
Adj. R^2                                         0.40                0.41
Num. obs.                                       86                  86
=============================================================================================
*** p < 0.001; ** p < 0.01; * p < 0.05
```

Moderation of empathy on Trust

```
# EMPATHY AS MODERATOR ANALYSIS
# ============================

# Split data by political group
liberal_data <- data %>%
  filter(Group == 1, Condition == 2)  # Liberals in metaperception condition
```

```r
conservative_data <- data %>%
  filter(Group == 2, Condition == 2)  # Conservatives in metaperception condition

# Center empathy scores to reduce multicollinearity
liberal_data <- liberal_data %>%
  mutate(empathy_centered = empathy_score - mean(empathy_score, na.rm = TRUE))

conservative_data <- conservative_data %>%
  mutate(empathy_centered = empathy_score - mean(empathy_score, na.rm = TRUE))

# MODERATION ANALYSIS FOR LIBERALS
# ================================

# Test moderation: does empathy moderate the mismatch-trust relationship?
lib_mod_model <- lm(trust_score ~ liberal_binding_mismatch * empathy_centered
                    + ideology,
                    data = liberal_data)

# Print results
cat("\nLIBERAL MODERATION RESULTS:\n")
```

```
LIBERAL MODERATION RESULTS:
```

```r
summary(lib_mod_model)
```

```
Call:
lm(formula = trust_score ~ liberal_binding_mismatch * empathy_centered +
    ideology, data = liberal_data)

Residuals:
    Min      1Q  Median      3Q     Max
-3.2249 -1.0027 -0.0198  0.8692  2.9177

Coefficients:
                                      Estimate Std. Error t value Pr(>|t|)
(Intercept)                             3.4853     0.3547   9.826 6.57e-16
liberal_binding_mismatch               -0.9785     0.2165  -4.519 1.88e-05
empathy_centered                       -2.1436     0.6175  -3.472 0.000797
```

```
ideology                                    0.2695     0.1086   2.481 0.014948
liberal_binding_mismatch:empathy_centered   1.8607     0.6006   3.098 0.002600

(Intercept)                                ***
liberal_binding_mismatch                   ***
empathy_centered                           ***
ideology                                   *
liberal_binding_mismatch:empathy_centered **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.281 on 90 degrees of freedom
Multiple R-squared:  0.3747,    Adjusted R-squared:  0.3469
F-statistic: 13.48 on 4 and 90 DF,  p-value: 1.194e-08
```

```r
# Simple slopes analysis for liberals
# Define low, medium, and high empathy values (Mean ± 1SD)
lib_empathy_mean <- mean(liberal_data$empathy_centered, na.rm = TRUE)
lib_empathy_sd <- sd(liberal_data$empathy_centered, na.rm = TRUE)
lib_empathy_low <- lib_empathy_mean - lib_empathy_sd
lib_empathy_high <- lib_empathy_mean + lib_empathy_sd

# Calculate simple slopes
lib_slope_low <- coef(lib_mod_model)["liberal_binding_mismatch"] +
  coef(lib_mod_model)["liberal_binding_mismatch:empathy_centered"] * lib_empathy_low

lib_slope_med <- coef(lib_mod_model)["liberal_binding_mismatch"]

lib_slope_high <- coef(lib_mod_model)["liberal_binding_mismatch"] +
  coef(lib_mod_model)["liberal_binding_mismatch:empathy_centered"] * lib_empathy_high

# Print simple slopes results
cat("\nSimple Slopes Analysis for Liberals:\n")
```

```
Simple Slopes Analysis for Liberals:
```

```r
cat("Effect of mismatch on trust at low empathy (-1 SD):", round(lib_slope_low, 3), "\n")
```

```
Effect of mismatch on trust at low empathy (-1 SD): -1.596
```

```r
cat("Effect of mismatch on trust at mean empathy:", round(lib_slope_med, 3), "\n")
```

```
Effect of mismatch on trust at mean empathy: -0.978
```

```r
cat("Effect of mismatch on trust at high empathy (+1 SD):", round(lib_slope_high, 3), "\n\n")
```

```
Effect of mismatch on trust at high empathy (+1 SD): -0.361
```

```r
# MODERATION ANALYSIS FOR CONSERVATIVES
# ==================================

# Test moderation: does empathy moderate the mismatch-trust relationship?
con_mod_model <- lm(trust_score ~ conservative_indiv_mismatch * empathy_centered
                    + ideology,
                    data = conservative_data)

# Print results
cat("\nCONSERVATIVE MODERATION RESULTS:\n")
```

```
CONSERVATIVE MODERATION RESULTS:
```

```r
summary(con_mod_model)
```

```
Call:
lm(formula = trust_score ~ conservative_indiv_mismatch * empathy_centered +
    ideology, data = conservative_data)

Residuals:
     Min       1Q   Median       3Q      Max
-2.85385 -0.81532  0.06691  0.88508  2.59450

Coefficients:
                                          Estimate Std. Error t value
(Intercept)                                3.41122    0.51995   6.561
conservative_indiv_mismatch                1.24132    0.17464   7.108
empathy_centered                          -0.01025    0.26508  -0.039
ideology                                  -0.10605    0.08179  -1.297
```

```
conservative_indiv_mismatch:empathy_centered -0.11290    0.25614  -0.441
                                                Pr(>|t|)
(Intercept)                                     4.69e-09 ***
conservative_indiv_mismatch                     4.17e-10 ***
empathy_centered                                   0.969
ideology                                           0.198
conservative_indiv_mismatch:empathy_centered       0.661
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.193 on 81 degrees of freedom
Multiple R-squared:  0.4161,    Adjusted R-squared:  0.3873
F-statistic: 14.43 on 4 and 81 DF,  p-value: 6.126e-09
```

```r
# Simple slopes analysis for conservatives
# Define low, medium, and high empathy values (Mean ± 1SD)
con_empathy_mean <- mean(conservative_data$empathy_centered, na.rm = TRUE)
con_empathy_sd <- sd(conservative_data$empathy_centered, na.rm = TRUE)
con_empathy_low <- con_empathy_mean - con_empathy_sd
con_empathy_high <- con_empathy_mean + con_empathy_sd

# Calculate simple slopes
con_slope_low <- coef(con_mod_model)["conservative_indiv_mismatch"] +
  coef(con_mod_model)["conservative_indiv_mismatch:empathy_centered"] * con_empathy_low

con_slope_med <- coef(con_mod_model)["conservative_indiv_mismatch"]

con_slope_high <- coef(con_mod_model)["conservative_indiv_mismatch"] +
  coef(con_mod_model)["conservative_indiv_mismatch:empathy_centered"] * con_empathy_high

# Print simple slopes results
cat("\nSimple Slopes Analysis for Conservatives:\n")
```

```
Simple Slopes Analysis for Conservatives:
```

```r
cat("Effect of mismatch on trust at low empathy (-1 SD):", round(con_slope_low, 3), "\n")
```

```
Effect of mismatch on trust at low empathy (-1 SD): 1.313
```

```r
cat("Effect of mismatch on trust at mean empathy:", round(con_slope_med, 3), "\n")
```

```
Effect of mismatch on trust at mean empathy: 1.241
```

```r
cat("Effect of mismatch on trust at high empathy (+1 SD):", round(con_slope_high, 3), "\n\n")
```

```
Effect of mismatch on trust at high empathy (+1 SD): 1.17
```

```r
# ADDITIONAL ANALYSIS: Compare moderation model to base model
# ============================================================

# For liberals
lib_base_model <- lm(trust_score ~ liberal_binding_mismatch + empathy_centered + ideology,
                     data = liberal_data)
lib_anova <- anova(lib_base_model, lib_mod_model)
cat("\nModel Comparison for Liberals:\n")
```

```
Model Comparison for Liberals:
```

```r
print(lib_anova)
```

```
Analysis of Variance Table

Model 1: trust_score ~ liberal_binding_mismatch + empathy_centered + ideology
Model 2: trust_score ~ liberal_binding_mismatch * empathy_centered + ideology
  Res.Df    RSS Df Sum of Sq      F Pr(>F)
1     91 163.39
2     90 147.65  1    15.745 9.5972 0.0026 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# For conservatives
con_base_model <- lm(trust_score ~ conservative_indiv_mismatch + empathy_centered + ideology
                     data = conservative_data)
con_anova <- anova(con_base_model, con_mod_model)
cat("\nModel Comparison for Conservatives:\n")
```

Model Comparison for Conservatives:

```
print(con_anova)
```

```
Analysis of Variance Table

Model 1: trust_score ~ conservative_indiv_mismatch + empathy_centered +
    ideology
Model 2: trust_score ~ conservative_indiv_mismatch * empathy_centered +
    ideology
  Res.Df    RSS Df Sum of Sq      F Pr(>F)
1     82 115.53
2     81 115.25  1   0.27645 0.1943 0.6605
```

Moderation of empathy on Threat

```
# EMPATHY AS MODERATOR ANALYSIS FOR THREAT
# ========================================

# Split data by political group
liberal_data <- data %>%
  filter(Group == 1, Condition == 2)  # Liberals in metaperception condition

conservative_data <- data %>%
  filter(Group == 2, Condition == 2)  # Conservatives in metaperception condition

# Center empathy scores to reduce multicollinearity
liberal_data <- liberal_data %>%
  mutate(empathy_centered = empathy_score - mean(empathy_score, na.rm = TRUE))

conservative_data <- conservative_data %>%
  mutate(empathy_centered = empathy_score - mean(empathy_score, na.rm = TRUE))

# MODERATION ANALYSIS FOR LIBERALS
# ================================

# Test moderation: does empathy moderate the mismatch-threat relationship?
lib_mod_model <- lm(threat_score ~ liberal_binding_mismatch * empathy_centered
                    + ideology,
```

```
                    data = liberal_data)

# Print results
cat("\nLIBERAL MODERATION RESULTS (THREAT):\n")
```

```
LIBERAL MODERATION RESULTS (THREAT):
```

```
summary(lib_mod_model)
```

```
Call:
lm(formula = threat_score ~ liberal_binding_mismatch * empathy_centered +
    ideology, data = liberal_data)

Residuals:
    Min      1Q  Median      3Q     Max
-4.9434 -0.8326  0.1376  0.9668  3.2818

Coefficients:
                                          Estimate Std. Error t value Pr(>|t|)
(Intercept)                                5.0699     0.4216  12.026  < 2e-16
liberal_binding_mismatch                   0.9548     0.2573   3.710 0.000358
empathy_centered                           0.8895     0.7339   1.212 0.228661
ideology                                  -0.2473     0.1291  -1.916 0.058537
liberal_binding_mismatch:empathy_centered -0.3812     0.7139  -0.534 0.594679

(Intercept)                               ***
liberal_binding_mismatch                  ***
empathy_centered
ideology                                  .
liberal_binding_mismatch:empathy_centered
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.522 on 90 degrees of freedom
Multiple R-squared:  0.2409,    Adjusted R-squared:  0.2072
F-statistic: 7.141 on 4 and 90 DF,  p-value: 4.857e-05
```

```r
# Simple slopes analysis for liberals
# Define low, medium, and high empathy values (Mean ± 1SD)
lib_empathy_mean <- mean(liberal_data$empathy_centered, na.rm = TRUE)
lib_empathy_sd <- sd(liberal_data$empathy_centered, na.rm = TRUE)
lib_empathy_low <- lib_empathy_mean - lib_empathy_sd
lib_empathy_high <- lib_empathy_mean + lib_empathy_sd

# Calculate simple slopes
lib_slope_low <- coef(lib_mod_model)["liberal_binding_mismatch"] +
  coef(lib_mod_model)["liberal_binding_mismatch:empathy_centered"] *
  lib_empathy_low

lib_slope_med <- coef(lib_mod_model)["liberal_binding_mismatch"]

lib_slope_high <- coef(lib_mod_model)["liberal_binding_mismatch"] +
  coef(lib_mod_model)["liberal_binding_mismatch:empathy_centered"] *
  lib_empathy_high

# Print simple slopes results
cat("\nSimple Slopes Analysis for Liberals (Threat):\n")
```

```
Simple Slopes Analysis for Liberals (Threat):
```

```r
cat("Effect of mismatch on threat at low empathy (-1 SD):", round(lib_slope_low, 3), "\n")
```

```
Effect of mismatch on threat at low empathy (-1 SD): 1.081
```

```r
cat("Effect of mismatch on threat at mean empathy:", round(lib_slope_med, 3), "\n")
```

```
Effect of mismatch on threat at mean empathy: 0.955
```

```r
cat("Effect of mismatch on threat at high empathy (+1 SD):", round(lib_slope_high, 3), "\n\n
```

```
Effect of mismatch on threat at high empathy (+1 SD): 0.828
```

```r
# MODERATION ANALYSIS FOR CONSERVATIVES
# ====================================

# Test moderation: does empathy moderate the mismatch-threat relationship?
con_mod_model <- lm(threat_score ~ conservative_indiv_mismatch * empathy_centered
                    + ideology,
                   data = conservative_data)

# Print results
cat("\nCONSERVATIVE MODERATION RESULTS (THREAT):\n")
```

```
CONSERVATIVE MODERATION RESULTS (THREAT):
```

```r
summary(con_mod_model)
```

```
Call:
lm(formula = threat_score ~ conservative_indiv_mismatch * empathy_centered +
    ideology, data = conservative_data)

Residuals:
    Min      1Q  Median      3Q     Max
-4.7458 -0.7866  0.3232  0.9478  2.3987

Coefficients:
                                           Estimate Std. Error t value
(Intercept)                                 5.50283    0.63180   8.710
conservative_indiv_mismatch                -0.78442    0.21220  -3.697
empathy_centered                            0.03557    0.32210   0.110
ideology                                    0.04249    0.09939   0.428
conservative_indiv_mismatch:empathy_centered -0.15856    0.31124  -0.509
                                           Pr(>|t|)
(Intercept)                                2.98e-13 ***
conservative_indiv_mismatch                0.000396 ***
empathy_centered                           0.912338
ideology                                   0.670135
conservative_indiv_mismatch:empathy_centered 0.611836
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 1.449 on 81 degrees of freedom
Multiple R-squared:  0.1533,    Adjusted R-squared:  0.1115
F-statistic: 3.667 on 4 and 81 DF,  p-value: 0.008527
```

```r
# Simple slopes analysis for conservatives
# Define low, medium, and high empathy values (Mean ± 1SD)
con_empathy_mean <- mean(conservative_data$empathy_centered, na.rm = TRUE)
con_empathy_sd <- sd(conservative_data$empathy_centered, na.rm = TRUE)
con_empathy_low <- con_empathy_mean - con_empathy_sd
con_empathy_high <- con_empathy_mean + con_empathy_sd

# Calculate simple slopes
con_slope_low <- coef(con_mod_model)["conservative_indiv_mismatch"] +
  coef(con_mod_model)["conservative_indiv_mismatch:empathy_centered"] * con_empathy_low

con_slope_med <- coef(con_mod_model)["conservative_indiv_mismatch"]

con_slope_high <- coef(con_mod_model)["conservative_indiv_mismatch"] +
  coef(con_mod_model)["conservative_indiv_mismatch:empathy_centered"] * con_empathy_high

# Print simple slopes results
cat("\nSimple Slopes Analysis for Conservatives (Threat):\n")
```

```
Simple Slopes Analysis for Conservatives (Threat):
```

```r
cat("Effect of mismatch on threat at low empathy (-1 SD):", round(con_slope_low, 3), "\n")
```

```
Effect of mismatch on threat at low empathy (-1 SD): -0.684
```

```r
cat("Effect of mismatch on threat at mean empathy:", round(con_slope_med, 3), "\n")
```

```
Effect of mismatch on threat at mean empathy: -0.784
```

```r
cat("Effect of mismatch on threat at high empathy (+1 SD):", round(con_slope_high, 3), "\n\n
```

```
Effect of mismatch on threat at high empathy (+1 SD): -0.885
```

```r
# ADDITIONAL ANALYSIS: Compare moderation model to base model
# ============================================================

# For liberals
lib_base_model <- lm(threat_score ~ liberal_binding_mismatch + empathy_centered + ideology,
                     data = liberal_data)
lib_anova <- anova(lib_base_model, lib_mod_model)
cat("\nModel Comparison for Liberals (Threat):\n")
```

```
Model Comparison for Liberals (Threat):
```

```r
print(lib_anova)
```

```
Analysis of Variance Table

Model 1: threat_score ~ liberal_binding_mismatch + empathy_centered +
    ideology
Model 2: threat_score ~ liberal_binding_mismatch * empathy_centered +
    ideology
  Res.Df    RSS Df Sum of Sq      F Pr(>F)
1     91 209.23
2     90 208.57  1   0.66077 0.2851 0.5947
```

```r
# For conservatives
con_base_model <- lm(threat_score ~ conservative_indiv_mismatch + empathy_centered + ideology
                     data = conservative_data)
con_anova <- anova(con_base_model, con_mod_model)
cat("\nModel Comparison for Conservatives (Threat):\n")
```

```
Model Comparison for Conservatives (Threat):
```

```r
print(con_anova)
```

```
Analysis of Variance Table

Model 1: threat_score ~ conservative_indiv_mismatch + empathy_centered +
    ideology
```

```
Model 2: threat_score ~ conservative_indiv_mismatch * empathy_centered +
    ideology
  Res.Df    RSS Df Sum of Sq      F Pr(>F)
1     82 170.72
2     81 170.17  1   0.54521 0.2595 0.6118
```

Graph

```r
# 1. For liberals (trust and threat)
lib_trust_pred <- data.frame(
  mismatch_score = seq(min(liberal_data$mismatch_score, na.rm = TRUE),
                       max(liberal_data$mismatch_score, na.rm = TRUE),
                       length.out = 100),
  ideology = mean(liberal_data$ideology, na.rm = TRUE)
)
lib_trust_pred$predicted <- predict(lib_trust_model, newdata = lib_trust_pred)

lib_threat_pred <- data.frame(
  mismatch_score = seq(min(liberal_data$mismatch_score, na.rm = TRUE),
                       max(liberal_data$mismatch_score, na.rm = TRUE),
                       length.out = 100),
  ideology = mean(liberal_data$ideology, na.rm = TRUE)
)
lib_threat_pred$predicted <- predict(lib_threat_model, newdata = lib_threat_pred)

# 2. For conservatives (trust and threat)
con_trust_pred <- data.frame(
  mismatch_score = seq(min(conservative_data$mismatch_score, na.rm = TRUE),
                       max(conservative_data$mismatch_score, na.rm = TRUE),
                       length.out = 100),
  ideology = mean(conservative_data$ideology, na.rm = TRUE)
)
con_trust_pred$predicted <- predict(con_trust_model, newdata = con_trust_pred)

con_threat_pred <- data.frame(
  mismatch_score = seq(min(conservative_data$mismatch_score, na.rm = TRUE),
                       max(conservative_data$mismatch_score, na.rm = TRUE),
                       length.out = 100),
  ideology = mean(conservative_data$ideology, na.rm = TRUE)
)
con_threat_pred$predicted <- predict(con_threat_model, newdata = con_threat_pred)
```

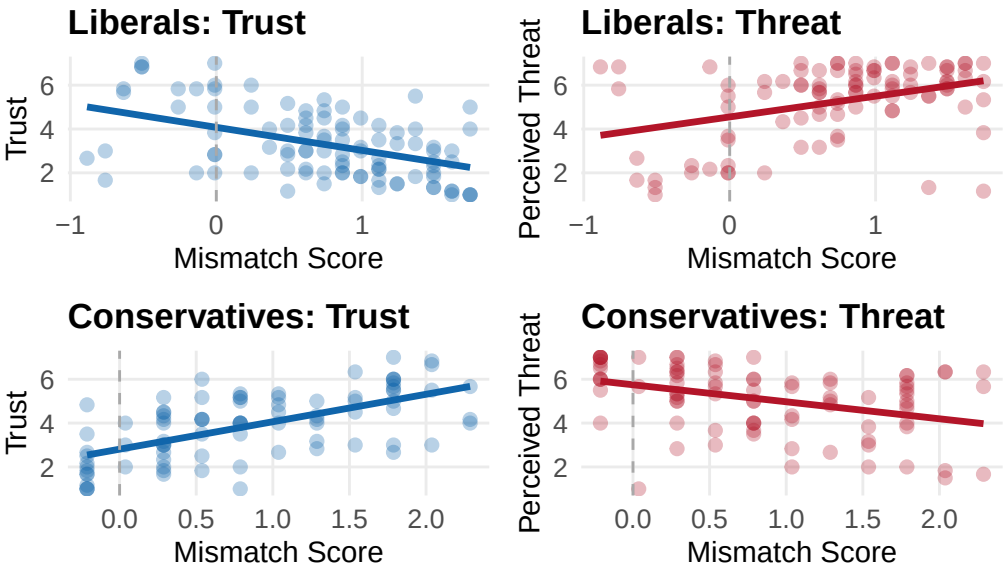
```r
# Create a function for formatting R² values
format_r2 <- function(model, digits = 2) {
  r2 <- summary(model)$r.squared
  return(paste0("R² = ", round(r2, digits)))
}

# Create a function for formatting p-values
format_p <- function(p_value) {
  if (p_value < 0.001) return("p < .001")
  if (p_value < 0.01) return("p < .01")
  if (p_value < 0.05) return("p < .05")
  if (p_value < 0.10) return("p < .10")
  return(paste0("p = ", round(p_value, 2)))
}

# Create labels for plots
lib_trust_label <- paste0("  = ", round(coef(lib_trust_model)[2], 2),
                          ", ", format_p(summary(lib_trust_model)$coefficients[2,4]))
lib_threat_label <- paste0("  = ", round(coef(lib_threat_model)[2], 2),
                           ", ", format_p(summary(lib_threat_model)$coefficients[2,4]))
con_trust_label <- paste0("  = ", round(coef(con_trust_model)[2], 2),
                          ", ", format_p(summary(con_trust_model)$coefficients[2,4]))
con_threat_label <- paste0("  = ", round(coef(con_threat_model)[2], 2),
                           ", ", format_p(summary(con_threat_model)$coefficients[2,4]))

# Common theme elements
theme_elements <- theme_minimal() +
  theme(
    panel.grid.minor = element_blank(),
    plot.title = element_text(size = 13, face = "bold"),
    plot.subtitle = element_text(size = 11),
    axis.title = element_text(size = 11),
    axis.text = element_text(size = 10),
    legend.position = "none",
    plot.caption = element_text(hjust = 0, size = 9, face = "italic")
  )

# Create individual plots
# ========================

# 1. Liberal Trust Plot
lib_trust_plot <- ggplot() +
```

```
  geom_point(data = liberal_data, aes(x = mismatch_score, y = trust_score),
             alpha = 0.3, size = 2, color = "#1065AB") +
  geom_line(data = lib_trust_pred, aes(x = mismatch_score, y = predicted),
            color = "#1065AB", size = 1.2) +
  geom_vline(xintercept = 0, linetype = "dashed", color = "darkgray") +
  labs(
    title = "Liberals: Trust",
    x = "Mismatch Score",
    y = "Trust"
  ) +
  scale_y_continuous(limits = c(1, 7)) +
  theme_elements
```

```
Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
i Please use `linewidth` instead.
```

```
# 2. Liberal Threat Plot
lib_threat_plot <- ggplot() +
  geom_point(data = liberal_data, aes(x = mismatch_score, y = threat_score),
             alpha = 0.3, size = 2, color = "#B31529") +
  geom_line(data = lib_threat_pred, aes(x = mismatch_score, y = predicted),
            color = "#B31529", size = 1.2) +
  geom_vline(xintercept = 0, linetype = "dashed", color = "darkgray") +
  labs(
    title = "Liberals: Threat",
    x = "Mismatch Score",
    y = "Perceived Threat"
  ) +
  scale_y_continuous(limits = c(1, 7)) +
  theme_elements

# 3. Conservative Trust Plot
con_trust_plot <- ggplot() +
  geom_point(data = conservative_data, aes(x = mismatch_score, y = trust_score),
             alpha = 0.3, size = 2, color = "#1065AB") +
  geom_line(data = con_trust_pred, aes(x = mismatch_score, y = predicted),
            color = "#1065AB", size = 1.2) +
  geom_vline(xintercept = 0, linetype = "dashed", color = "darkgray") +
  labs(
    title = "Conservatives: Trust",
    x = "Mismatch Score",
```

```
    y = "Trust"
  ) +
  scale_y_continuous(limits = c(1, 7)) +
  theme_elements

# 4. Conservative Threat Plot
con_threat_plot <- ggplot() +
  geom_point(data = conservative_data, aes(x = mismatch_score, y = threat_score),
             alpha = 0.3, size = 2, color = "#B31529") +
  geom_line(data = con_threat_pred, aes(x = mismatch_score, y = predicted),
            color = "#B31529", size = 1.2) +
  geom_vline(xintercept = 0, linetype = "dashed", color = "darkgray") +
  labs(
    title = "Conservatives: Threat",
    x = "Mismatch Score",
    y = "Perceived Threat"
  ) +
  scale_y_continuous(limits = c(1, 7)) +
  theme_elements

# Combine all plots
# =================
combined_plot <- (lib_trust_plot + lib_threat_plot) /
                 (con_trust_plot + con_threat_plot) +
  plot_annotation(
    title = "Moral Foundation Perception Mismatches and Intergroup Attitudes",
    theme = theme(
      plot.title = element_text(size = 16, face = "bold"),
      plot.subtitle = element_text(size = 12)
    )
  )

# Display the combined plot
combined_plot
```




```
# Save the plot as high-resolution PNG
ggsave("/Users/daryani/Desktop/moral_foundation_mismatch_results.png", combined_plot,
       width = 10, height = 8, dpi = 300)
```