When and why people think beliefs are "debunked" by scientific explanations for their origins

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Contents

Setup

Load exact versions of packages used in reported analyses.

```
if (!require(checkpoint, quietly = TRUE))  {
  install.packages("checkpoint")
  require(checkpoint)
}
checkpoint("2018-09-21")
library(tidyverse)
library(magrittr)
library(broom)
library(car)
library(heplots)
library(WRS2)
library(dae)
library(ez)
library(knitr)

op <- options(contrasts = c("contr.sum", "contr.poly"))
```

These two plotting functions are used throughout.

```
vio_dot <- function(data, y, x, color = NULL, dotsize = 0.4) {
  data %>%
    ggplot(aes_string(y = y, x = x, color = color)) +
    geom_violin() +
    geom_dotplot(
      aes_string(fill = color),
      position="dodge",
      binaxis = "y", stackdir = "center", binwidth = 0.2,
      dotsize = dotsize
    )
}
paper_plot <- function(data, y, x, x_lab, color, color_lab, ylim, dodge) {
  data %>%
    ggplot(aes_string(x = x, y = y, color = color)) +
    geom_hline(yintercept = 0) +
    geom_pointrange(
      stat = "summary",
      fun.data = mean_se,
      position = position_dodge(dodge)
    ) +
    geom_errorbar(
      stat = "summary",
```

```
      fun.data = mean_se,
      position = position_dodge(dodge),
      width = 0.1,
      show.legend = FALSE
    ) +
    scale_color_grey(name = color_lab, labels = str_to_title) +
    scale_x_discrete(name = x_lab, labels = str_to_title) +
    coord_cartesian(ylim = ylim) +
    labs(y = "Suggested Change in Confidence") +
    theme_classic() +
    theme(
      legend.position = "top",
      axis.line.x = element_blank(),
      axis.ticks.x = element_blank()
    )
}
```

ANOVA with η^2

```
ANOVA <- function(lm) {
  lm %>%
    Anova(type = "III") %>%
    tidy() %>%
    slice(-1) %>%  # Drop intercept.
    bind_cols(etasq(lm))
}
```

Experiment 1

Load data.

```
exp1_raw <- read_csv("data/experiment1_data.csv")
exp1_data <-
  exp1_raw %>%
  select(
    participant_id = ResponseId,
    consent = Q1,
    michael_should = Q20, you_should = Q22,
    michael_would = Q100, you_would = Q14,
    germ_theory = Q101_1_1, evolution = Q101_3_1, god = Q101_5_1,
    soulmate = Q101_7_1, murder_wrong = Q101_9_1, vegetarianism = Q101_11_1,
    attention_check = Q13_9_TEXT, done_before = Q106,
    sex = Q81, age = Q82,
    valence = AcceptReject, domain = SciRelMor, prevalence = CommonRare,
    own_belief = TargetRating,
    condition = FalseNeutralTrue
  ) %>%
  # Drop extra header rows.
  slice(-1:-2) %>%
  type_convert() %>%
  # Center Likerts at 0.
  mutate_at(
    vars(contains("should"), contains("would"), own_belief),
```

```
    funs(. - 4)
  ) %>%
  mutate(
    agrees_with_michael = own_belief > 0,
    common_avg = (germ_theory + god + murder_wrong) / 3,
    rare_avg = (evolution + soulmate + vegetarianism) / 3,
    consent = consent %>%
      recode_factor("2" = "consent", "1" = "no_consent"),
    done_before = done_before %>%
      recode_factor("1" = "yes", "2" = "maybe", "3" = "no"),
    sex = sex %>%
      recode_factor("1" = "male", "2" = "female", "3" = "other"),
    domain = domain %>%
      recode_factor("1" = "scientific", "2" = "religious", "3" = "moral"),
    prevalence = prevalence %>%
      recode_factor("1" = "common", "2" = "rare"),
    condition = condition %>%
      recode_factor(
        "True" = "reliable",
        "Neutral" = "neutral",
        "False" = "unreliable"
      ),
    pass_check = grepl("dax", attention_check, ignore.case = TRUE)
  ) %>%
  mutate_at(
    vars(contains("you_")),
    funs(. * if_else(agrees_with_michael, 1, -1))
  )
```

Participants

10 participants didn't complete the experiment. Another 17 participants think they might have done a similar study before. 22 of the rest missed a catch question. Analyses will focus on data from the remaining 173 participants.

```
exp1_data %>%
  filter(consent == "consent") %>%
  # Don't count leaving attention check blank as not finishing, just as wrong.
  select(-attention_check) %>%
  count(complete.cases(.), done_before, pass_check)
exp1_included <-
  exp1_data %>%
  drop_na() %>%
  filter(done_before == "no", pass_check)
```

complete.cases(.)	done_before	pass_check	n
FALSE	no	TRUE	1
FALSE	NA	FALSE	8
FALSE	NA	TRUE	1
TRUE	yes	FALSE	1
TRUE	yes	TRUE	6
TRUE	maybe	FALSE	2

complete.cases(.)	done_before	pass_check	n
TRUE	maybe	TRUE	8
TRUE	no	FALSE	22
TRUE	no	TRUE	173

Demographics

```
exp1_included %>% select(sex, age) %>% summary() %>% kable()
```

sex	age
male :101	Min. :18.0
female: 72	1st Qu.:24.0
	Median :29.0
	Mean :32.4
	3rd Qu.:36.0
	Max. :67.0

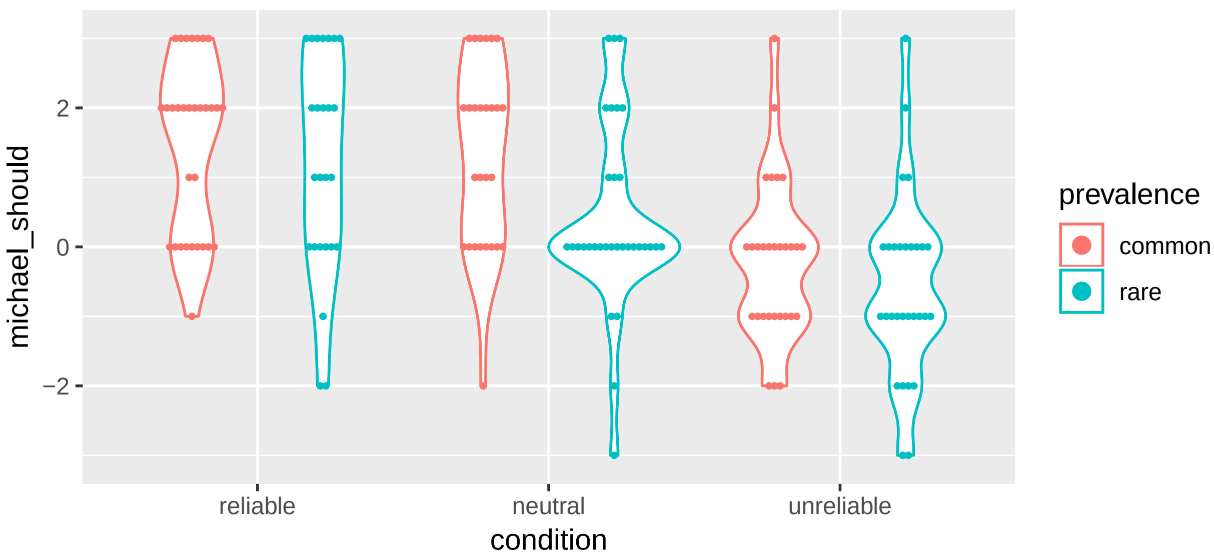
Inclusion/exclusion by conditions

```
exp1_included %>% count(condition, prevalence) %>% spread(prevalence, n)
```

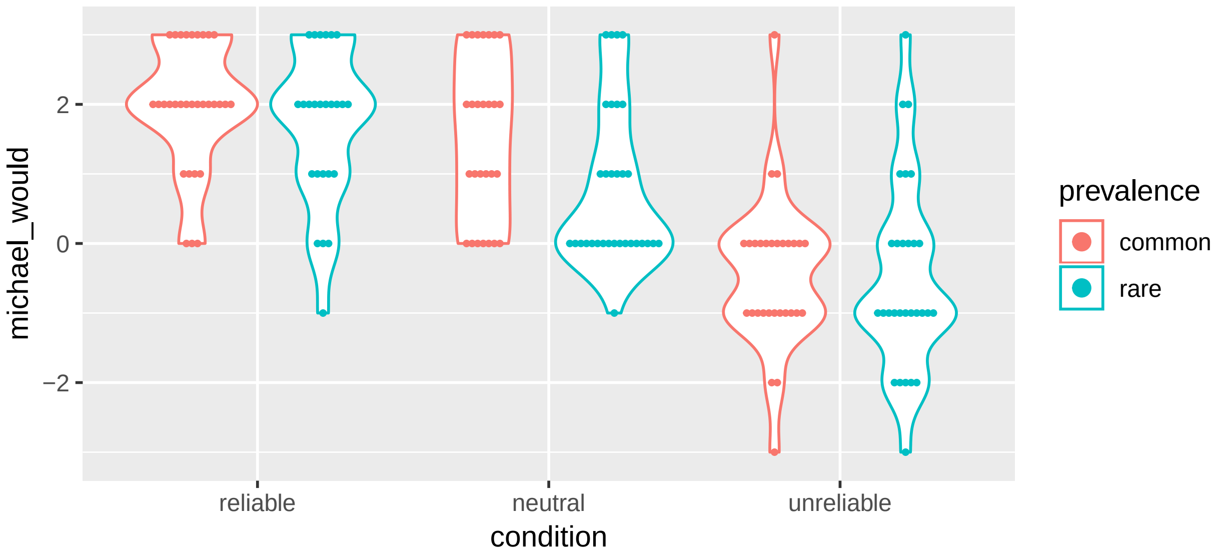
condition	common	rare
reliable	31	25
neutral	27	32
unreliable	29	29

Distribution and Means

```
exp1_included %>% vio_dot("michael_should", "condition", "prevalence")
```



```r
exp1_included %>% vio_dot("michael_would", "condition", "prevalence")
```



Group means

Reliable mechanisms are taken to support belief, as are neutral explanations (only somewhat less strongly), while unreliable mechanisms are taken to undermine belief. This is consistent across common and rare target beliefs, and also seen in predictive judgments (about what people would do). Values are overall higher for common target beliefs.

```r
exp1_included %$%
  tapply(michael_should, list(condition, prevalence), mean) %>%
  kable()
```

	common	rare
reliable	1.4839	1.2000
neutral	1.3333	0.4062
unreliable	-0.2069	-0.5862

```r
exp1_included %$%
  tapply(michael_would, list(condition, prevalence), mean) %>%
  kable()
```

	common	rare
reliable	1.9677	1.6800
neutral	1.5185	0.7812
unreliable	-0.4483	-0.4828

Things are qualitatively the same across domains, except that people don't say unreliable mechanisms should undermine moral beliefs (mean response lower than for neutral explanations, but still slightly positive).

```r
exp1_included %$%
  tapply(michael_should, list(condition, domain), mean) %>%
  kable()
```

	scientific	religious	moral
reliable	1.5714	1.0588	1.3889
neutral	1.1579	0.5263	0.8095
unreliable	-0.5789	-0.7895	0.1500

```r
exp1_included %$%
  tapply(michael_would, list(condition, domain), mean) %>%
  kable()
```

	scientific	religious	moral
reliable	1.6190	1.7647	2.167
neutral	1.0000	1.0526	1.286
unreliable	-0.6316	-0.4211	-0.350

The main effect of prevalence is also consistent across domains.

```r
exp1_included %$%
  tapply(michael_should, list(prevalence, domain), mean) %>%
  kable()
```

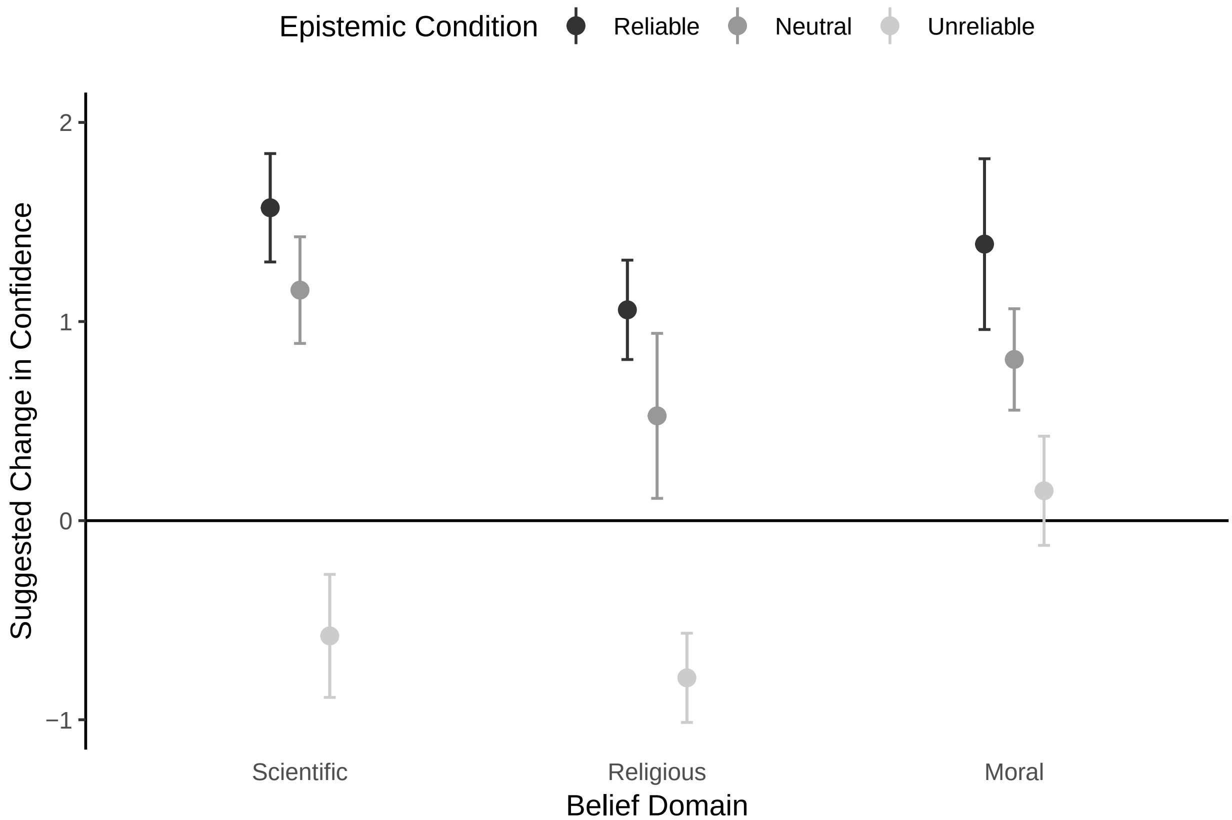
	scientific	religious	moral
common	0.8438	0.6923	1.0690
rare	0.6296	-0.1724	0.4667

```r
exp1_included %$%
  tapply(michael_would, list(prevalence, domain), mean) %>%
  kable()
```

	scientific	religious	moral
common	0.7188	1.2692	1.1379
rare	0.6667	0.3103	0.8667

Plot for Paper

```r
exp1_included %>%
  paper_plot(
    y = "michael_should",
    x = "domain", x_lab = "Belief Domain",
    color = "condition", color_lab = "Epistemic Condition",
    ylim = c(-1, 2), dodge = 0.25
  )
```



ANOVAs

Main effects of epistemic condition and claim prevalence, no interaction. All pairwise differences between epistemic conditions are significant.

```
exp1_should_lm <- exp1_included %$% lm(michael_should ~ condition * prevalence)
ANOVA(exp1_should_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	92.332	2	26.2902	0.0000	0.2369
prevalence	12.071	1	6.8739	0.0096	0.0403
condition:prevalence	3.475	2	0.9896	0.3739	0.0117
Residuals	293.254	167			

```
exp1_included %$% pairwise.t.test(michael_should, condition, "holm")
```

```
##
##  Pairwise comparisons using t tests with pooled SD
##
## data:  michael_should and condition
##
##            reliable neutral
## neutral    0.04     -
## unreliable 2e-10    4e-06
##
```

```
## P value adjustment method: holm
```

An analogous ANOVA analyzing the predictive judgments (about what the subject of the vignette *would* do, as opposed to what he *should* do) finds the same effects.

```r
exp1_would_lm <- exp1_included %$% lm(michael_would ~ condition * prevalence)
ANOVA(exp1_would_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	158.008	2	61.357	0.0000	0.4229
prevalence	5.358	1	4.161	0.0429	0.0246
condition:prevalence	3.692	2	1.434	0.2413	0.0169
Residuals	215.031	167			

```r
exp1_included %$% pairwise.t.test(michael_would, condition, "holm")
```

```
##
##  Pairwise comparisons using t tests with pooled SD
##
## data:  michael_would and condition
##
##            reliable neutral
## neutral    9e-04    -
## unreliable <2e-16   8e-12
##
## P value adjustment method: holm
```

Check assumptions for ANOVAs

Shapiro-Wilk test is significant, but the results are the same using a robust test, and previous visualization didn't suggest any issues with using the mean as a summary statistic.

```r
exp1_included %$% leveneTest(michael_should ~ condition * prevalence)
```

	Df	F value	Pr(>F)
group	5	1.021	0.407
	167		

```r
exp1_included %$% leveneTest(michael_would ~ condition * prevalence)
```

	Df	F value	Pr(>F)
group	5	0.7915	0.5572
	167		

```r
exp1_should_lm %>% residuals() %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
```

```
## W = 0.98, p-value = 0.02
```

```r
exp1_would_lm %>% residuals() %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
## W = 0.98, p-value = 0.005
```

```r
exp1_included %$% t2way(michael_should ~ condition * prevalence)
```

```
## Call:
## t2way(formula = michael_should ~ condition * prevalence)
##
##                        value p.value
## condition             45.685   0.001
## prevalence             4.368   0.040
## condition:prevalence   2.540   0.293
```

```r
exp1_included %$% t2way(michael_would ~ condition * prevalence)
```

```
## Call:
## t2way(formula = michael_would ~ condition * prevalence)
##
##                         value p.value
## condition             111.956   0.001
## prevalence              5.356   0.024
## condition:prevalence    2.703   0.272
```

Belief Reinforcement/Undermining

```r
exp1_included %>%
  group_by(condition) %>%
  summarise(
    michael_should = mean(michael_should),
    michael_would = mean(michael_would)
  )
```

condition	michael_should	michael_would
reliable	1.3571	1.8393
neutral	0.8305	1.1186
unreliable	-0.3966	-0.4655

Tests against the scale midpoint confirm reinforcement for reliable and neutral mechanisms, undermining for unreliable mechanisms.

```r
exp1_included %>%
  group_by(condition) %>%
  do(tidy(t.test(.$michael_should))) %>%
  select(-c(method, alternative))
```

condition	estimate	statistic	p.value	parameter	conf.low	conf.high
reliable	1.3571	7.286	0.0000	55	0.9839	1.7304

condition	estimate	statistic	p.value	parameter	conf.low	conf.high
neutral	0.8305	4.544	0.0000	58	0.4647	1.1964
unreliable	-0.3966	-2.432	0.0182	57	-0.7230	-0.0701

```
exp1_included %>%
  group_by(condition) %>%
  do(tidy(t.test(.$michael_would))) %>%
  select(-c(method, alternative))
```

condition	estimate	statistic	p.value	parameter	conf.low	conf.high
reliable	1.8393	13.695	0.0000	55	1.5701	2.1084
neutral	1.1186	7.219	0.0000	58	0.8085	1.4288
unreliable	-0.4655	-2.879	0.0056	57	-0.7893	-0.1417

Verify Perceived Prevalence

The "common" beliefs are indeed perceived to be more prevalent than the "rare" beliefs.

```
exp1_included %>%
  select(germ_theory:vegetarianism) %>%
  summarize_all(funs(mean))
```

germ_theory	evolution	god	soulmate	murder_wrong	vegetarianism
85.54	55.71	67.14	51.14	91.78	24.08

```
exp1_included %$% t.test(common_avg, rare_avg, paired = TRUE)
```

```
##
##  Paired t-test
##
## data:  common_avg and rare_avg
## t = 30, df = 170, p-value <2e-16
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  35.34 40.35
## sample estimates:
## mean of the differences
##                   37.85
```

Experiment 2

Load data.

```
exp2_raw <- read_csv("data/experiment2_data.csv")
exp2_data <-
  exp2_raw %>%
  select(
    participant_id = ResponseId,
```

```
    consent = Q1,
    michael_would = Q100, you_would = Q14,
    michael_should = Q14_1, you_should = Q17,
    attention_check = Q13_9_TEXT, done_before = Q106,
    sex = Q81, age = Q82,
    valence = AcceptReject, domain = SciRelMor, prevalence = CommonRare,
    condition = NormallyAbnormally
  ) %>%
  # Drop extra header rows.
  slice(-1:-2) %>%
  type_convert() %>%
  # Center Likerts at 0.
  mutate_at(
    vars(contains("should"), contains("would")),
    funs(. - 4)
  ) %>%
  mutate(
    consent = consent %>%
      recode_factor("2" = "consent", "1" = "no_consent"),
    done_before = done_before %>%
      recode_factor("1" = "yes", "2" = "maybe", "3" = "no"),
    sex = sex %>%
      recode_factor("1" = "male", "2" = "female", "3" = "other"),
    domain = domain %>%
      recode_factor("1" = "scientific", "2" = "religious", "3" = "moral"),
    prevalence = prevalence %>%
      recode_factor("1" = "common", "2" = "rare"),
    condition = condition %>%
      recode_factor("normally" = "normal", "abnormally" = "abnormal"),
    pass_check = grepl("dax", attention_check, ignore.case = TRUE)
  )
```

Participants

7 participants didn't complete the experiment. Another 7 participants think they might have done a similar study before. 4 of the rest missed a catch question. Analyses will focus on data from the remaining 107 participants.

```
exp2_data %>%
  filter(consent == "consent") %>%
  # Don't count leaving attention check blank as not finishing, just as wrong.
  select(-attention_check) %>%
  count(complete.cases(.), done_before, pass_check)
exp2_included <-
  exp2_data %>%
  drop_na() %>%
  filter(done_before == "no", pass_check)
```

complete.cases(.)	done_before	pass_check	n
FALSE	no	TRUE	2
FALSE		FALSE	5
TRUE	yes	TRUE	2
TRUE	maybe	TRUE	5

complete.cases(.)	done_before	pass_check	n
TRUE	no	FALSE	4
TRUE	no	TRUE	107

Demographics

```
exp2_included %>% select(sex, age) %>% summary() %>% kable()
```

sex	age
male :67	Min. :18
female:40	1st Qu.:24
	Median :28
	Mean :32
	3rd Qu.:36
	Max. :73

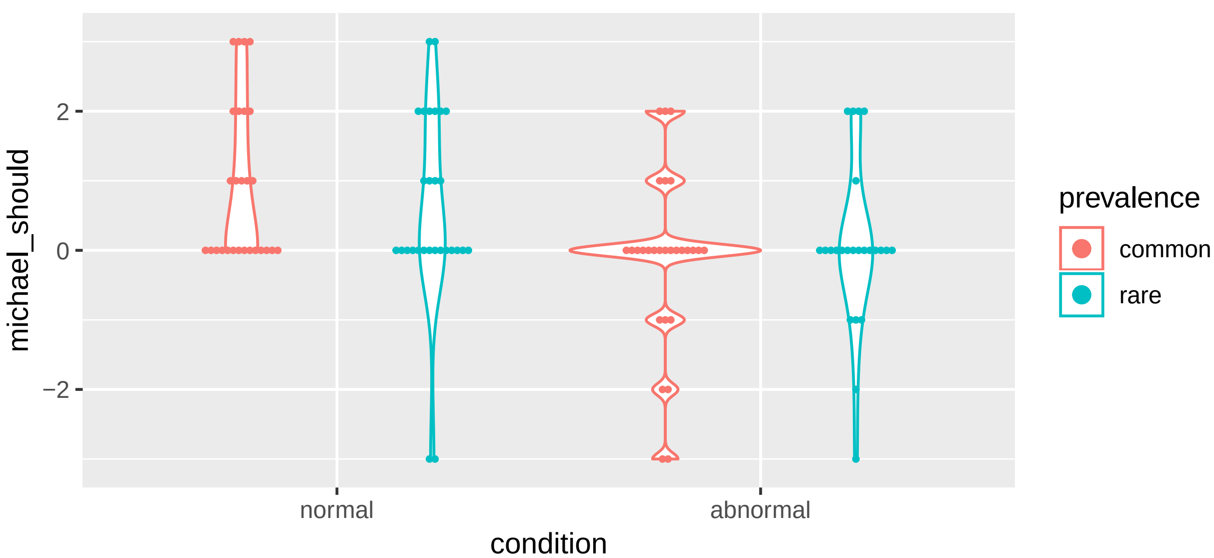
Inclusion/exclusion by conditions

```
exp2_included %>% count(condition, prevalence) %>% spread(prevalence, n)
```

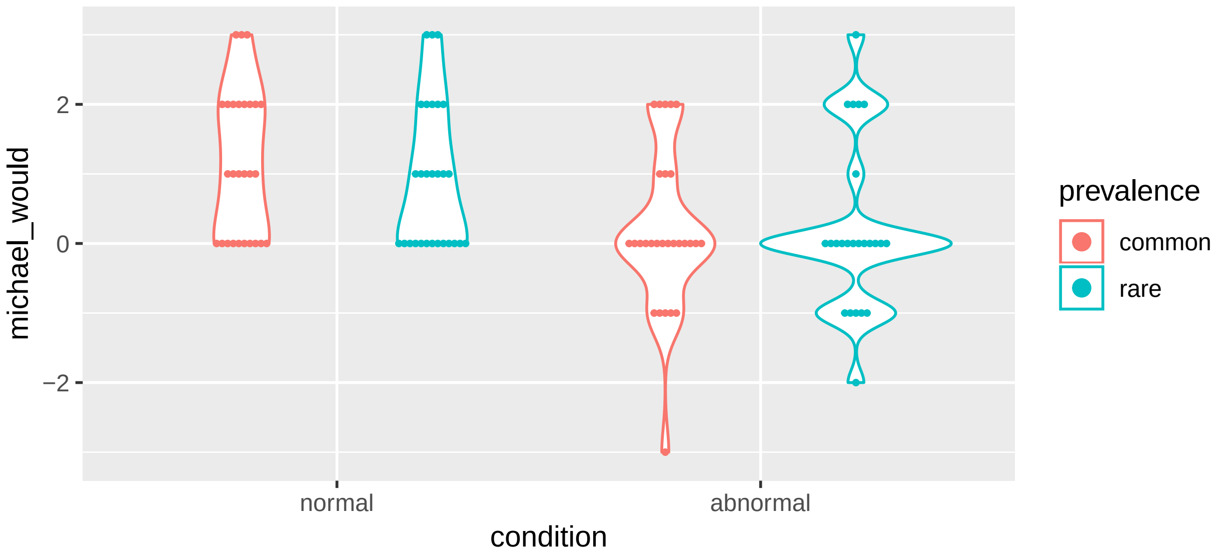
condition	common	rare
normal	27	28
abnormal	28	24

Distribution and Means

```
exp2_included %>% vio_dot("michael_should", "condition", "prevalence")
```



```r
exp2_included %>% vio_dot("michael_would", "condition", "prevalence")
```



Group means

Association with a normal mechanism, but not an abnormal mechanism, seems to be taken as support for a belief. This is consistent across common and rare beliefs. No evidence of a main effect of belief prevalence in this sample.

```r
exp2_included %$%
  tapply(michael_should, list(condition, prevalence), mean) %>%
  kable()
```

	common	rare
normal	0.9259	0.5714
abnormal	-0.1429	0.0417

```r
exp2_included %$%
  tapply(michael_would, list(condition, prevalence), mean) %>%
  kable()
```

	common	rare
normal	1.1481	0.9286
abnormal	0.1786	0.2083

The same qualitative pattern is seen across belief domains.

```r
exp2_included %$%
  tapply(michael_should, list(condition, domain), mean) %>%
  kable()
```

	scientific	religious	moral
normal	0.7917	0.5714	0.8235
abnormal	0.0000	-0.3500	0.2353

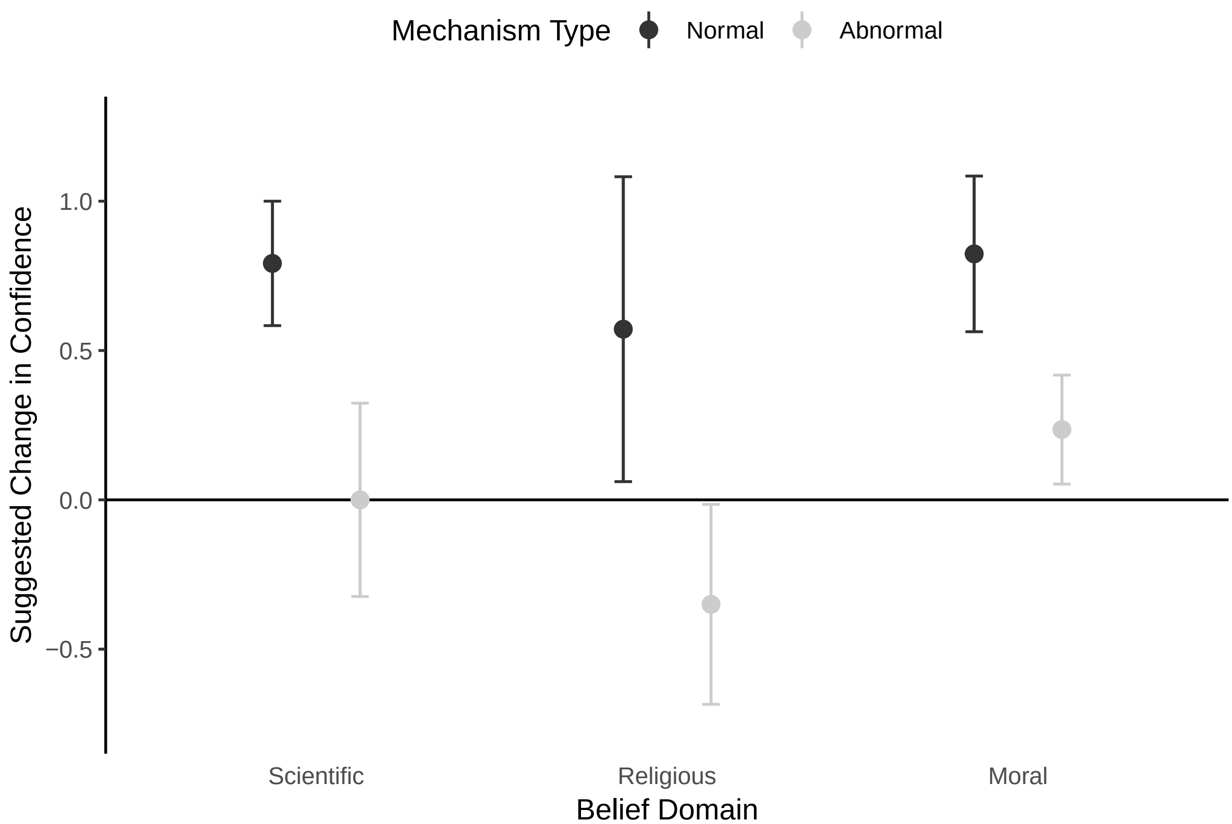
	scientific	religious	moral

```
exp2_included %$%
  tapply(michael_would, list(condition, domain), mean) %>%
  kable()
```

	scientific	religious	moral
normal	1.167	0.9286	0.9412
abnormal	0.200	0.3000	0.0588

Plot for Paper

```
exp2_included %>%
  paper_plot(
    y = "michael_should",
    x = "domain", x_lab = "Belief Domain",
    color = "condition", color_lab = "Mechanism Type",
    ylim = c(-0.75, 1.25), dodge = 0.5
  )
```



ANOVAs

Main effect of the type of mechanism associated with the target belief (normal/abnormal). No effect of prevalence of the target belief and no interaction.

```
exp2_should_lm <-
  exp2_included %$% lm(michael_should ~ condition * prevalence)
ANOVA(exp2_should_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	17.0206	1	10.6188	0.0015	0.0953
prevalence	0.1924	1	0.1201	0.7297	0.0014
condition:prevalence	1.9353	1	1.2074	0.2744	0.0116
Residuals	165.0959	103			

As in Experiment 1, the same effects are seen for predictive judgments.

```
exp2_would_lm <- exp2_included %$% lm(michael_would ~ condition * prevalence)
ANOVA(exp2_would_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	19.0197	1	15.1475	0.0002	0.1293
prevalence	0.2400	1	0.1911	0.6629	0.0020
condition:prevalence	0.4141	1	0.3298	0.5670	0.0032
Residuals	129.3300	103			

Check assumptions for ANOVAs

Shapiro-Wilk test is again significant, but the results are again the same using a robust test, and previous visualization again didn't suggest any issues with using the mean as a summary statistic.

```
exp2_included %$% leveneTest(michael_should ~ condition * prevalence)
```

	Df	F value	Pr(>F)
group	3	0.401	0.7526
	103		

```
exp2_included %$% leveneTest(michael_would ~ condition * prevalence)
```

	Df	F value	Pr(>F)
group	3	0.1868	0.9052
	103		

```
exp2_should_lm %>% residuals() %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
```

```
## W = 0.94, p-value = 2e-04
```

```r
exp2_included %$% t2way(michael_should ~ condition * prevalence)
```

```
## Call:
## t2way(formula = michael_should ~ condition * prevalence)
##
##                       value p.value
## condition            6.8535   0.012
## prevalence           0.0056   0.941
## condition:prevalence 0.0936   0.761
```

```r
exp2_included %$% t2way(michael_would ~ condition * prevalence)
```

```
## Call:
## t2way(formula = michael_would ~ condition * prevalence)
##
##                       value p.value
## condition            8.7226   0.005
## prevalence           0.5009   0.482
## condition:prevalence 0.2800   0.599
```

Belief Reinforcement/Undermining

```r
exp2_included %>%
  group_by(condition) %>%
  summarise(
    michael_should = mean(michael_should),
    michael_would = mean(michael_would)
  )
```

condition	michael_should	michael_would
normal	0.7455	1.0364
abnormal	-0.0577	0.1923

Testing against the scale midpoint confirms reinforcement for association with normal mechanisms, no evidence of reinforcement for abnormal mechanisms.

```r
exp2_included %>%
  group_by(condition) %>%
  do(tidy(t.test(.$michael_should))) %>%
  select(-c(method, alternative))
```

condition	estimate	statistic	p.value	parameter	conf.low	conf.high
normal	0.7455	4.272	0.0001	54	0.3956	1.095
abnormal	-0.0577	-0.339	0.7360	51	-0.3994	0.284

```r
exp2_included %>%
  group_by(condition) %>%
  do(tidy(t.test(.$michael_would))) %>%
  select(-c(method, alternative))
```

condition	estimate	statistic	p.value	parameter	conf.low	conf.high
normal	1.0364	7.296	0.0000	54	0.7516	1.3212
abnormal	0.1923	1.183	0.2423	51	-0.1340	0.5187

Experiment 3

Load data.

```
exp3_raw <- read_csv("data/experiment3_data.csv")
exp3_data <-
  exp3_raw %>%
  select(
    participant_id = ResponseId,
    consent = Q1,
    michael_would_1 = Q100, michael_should_1 = Q15,
    you_would.1 = Q14, you_should_1 = Q16,
    michael_would_2 = Q119, michael_should_2 = Q118,
    you_would_2 = Q122, you_should_2 = Q121,
    plausible = Q97,
    attention_check = Q13_9_TEXT, comp_check_1 = Q19, comp_check_2 = Q20,
    done_before = Q106,
    sex = Q81, age = Q82,
    valence = AcceptReject, domain = SciRelMor, prevalence = CommonRare,
    own_belief = TargetRating,
    discipline = ExplanationType,
    condition = NormalAbnormal
  ) %>%
  # Drop extra header rows.
  slice(-1:-2) %>%
  type_convert() %>%
  mutate(
    consent = consent %>%
      recode_factor("2" = "consent", "1" = "no_consent"),
    done_before = done_before %>%
      recode_factor("1" = "yes", "2" = "maybe", "3" = "no"),
    sex = sex %>%
      recode_factor("1" = "male", "2" = "female", "3" = "other"),
    domain = domain %>%
      recode_factor("1" = "scientific", "2" = "religious", "3" = "moral"),
    prevalence = prevalence %>%
      recode_factor("1" = "common", "2" = "rare"),
    condition = condition %>%
      recode_factor("Normal" = "normal", "Abnormal" = "abnormal"),
    valence = valence %>%
      recode_factor("1" = "accept", "2" = "reject"),
    discipline = discipline %>%
      recode_factor(
        "Neuro" = "neuroscience",
        "Genetic" = "genetic",
        "Psychological" = "psychological",
        "Developmental" = "developmental"
      ),
```

```
    michael_would = pmax(michael_would_1, michael_would_2, na.rm = TRUE),
    michael_should = pmax(michael_should_1, michael_should_2, na.rm = TRUE),
    you_would = pmax(you_would.1, you_would_2, na.rm = TRUE),
    you_should = pmax(you_should_1, you_should_2, na.rm = TRUE),
    pass_old_imc = grepl("dax", attention_check, ignore.case = TRUE),
    pass_check = pass_old_imc & comp_check_1 == 45 & comp_check_2 == 1
  ) %>%
  select(-(michael_would_1:you_should_2)) %>%
  # Center Likerts at 0.
  mutate_at(
    vars(contains("should"), contains("would"), own_belief),
    funs(. - 4)
  ) %>%
  mutate(
    agrees_with_michael = ((valence == "accept" & own_belief > 0)
                           | (valence == "reject" & own_belief < 0))
  ) %>%
  mutate_at(
    vars(contains("michael_")),
    funs(. * if_else(valence == "accept", 1, -1))
  ) %>%
  mutate_at(
    vars(contains("you_")),
    funs(. * if_else(own_belief > 0, 1, -1))
  )
```

Participants

32 participants didn't complete the experiment. Another 56 participants think they might have done a similar study before. 33 missed an easy catch question. 129 missed a specific reading comprehension question. Analyses will focus on data from the remaining 258 participants.

```
exp3_consented <-
  exp3_data %>%
  filter(consent == "consent") %>%
  # Don't count leaving attention check blank as not finishing, just as wrong.
  select(-attention_check)
exp3_consented %>% count(complete.cases(.))
```

complete.cases(.)	n
FALSE	32
TRUE	476

```
exp3_consented %>% drop_na() %>% count(done_before)
```

done_before	n
yes	11
maybe	45
no	420

```r
exp3_consented %>%
  drop_na() %>%
  filter(done_before == "no") %>%
  count(pass_old_imc, pass_check)
```

pass_old_imc	pass_check	n
FALSE	FALSE	33
TRUE	FALSE	129
TRUE	TRUE	258

```r
exp3_included <-
  exp3_data %>%
  drop_na() %>%
  filter(done_before == "no", pass_old_imc, pass_check)
```

Demographics

```r
exp3_included %>% select(sex, age) %>% summary() %>% kable()
```

sex	age
male :139	Min. :18.0
female:119	1st Qu.:24.0
other : 0	Median :29.0
	Mean :32.3
	3rd Qu.:37.0
	Max. :72.0

Inclusion/exclusion by conditions

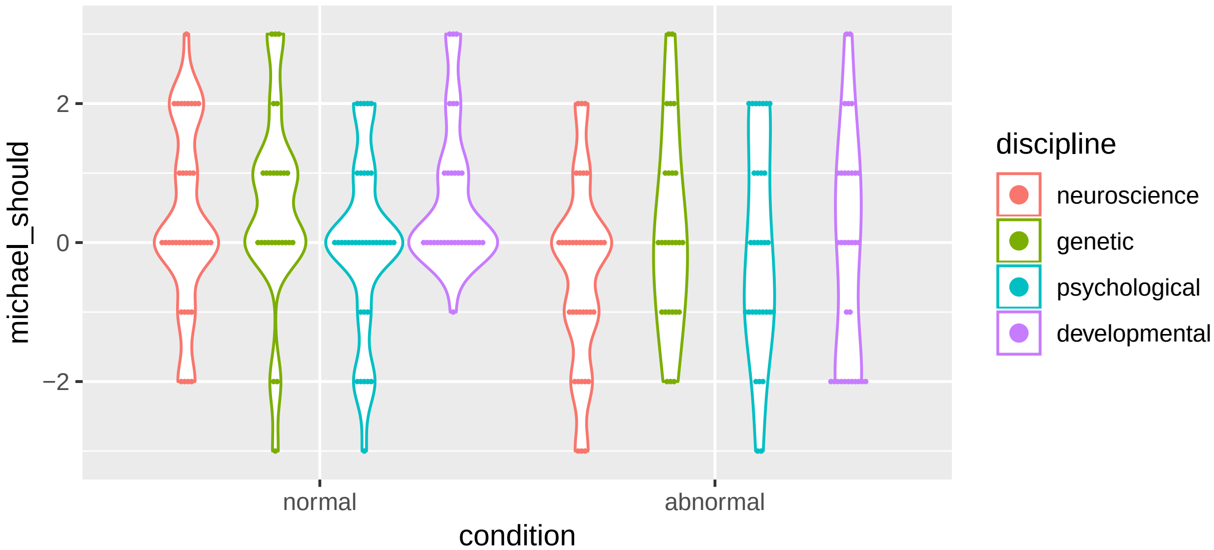
```r
exp3_included %>% count(condition, discipline, prevalence)
```

condition	discipline	prevalence	n
normal	neuroscience	common	14
normal	neuroscience	rare	23
normal	genetic	common	13
normal	genetic	rare	14
normal	psychological	common	19
normal	psychological	rare	18
normal	developmental	common	14
normal	developmental	rare	17
abnormal	neuroscience	common	19
abnormal	neuroscience	rare	18
abnormal	genetic	common	14
abnormal	genetic	rare	12
abnormal	psychological	common	18
abnormal	psychological	rare	13
abnormal	developmental	common	12
abnormal	developmental	rare	20

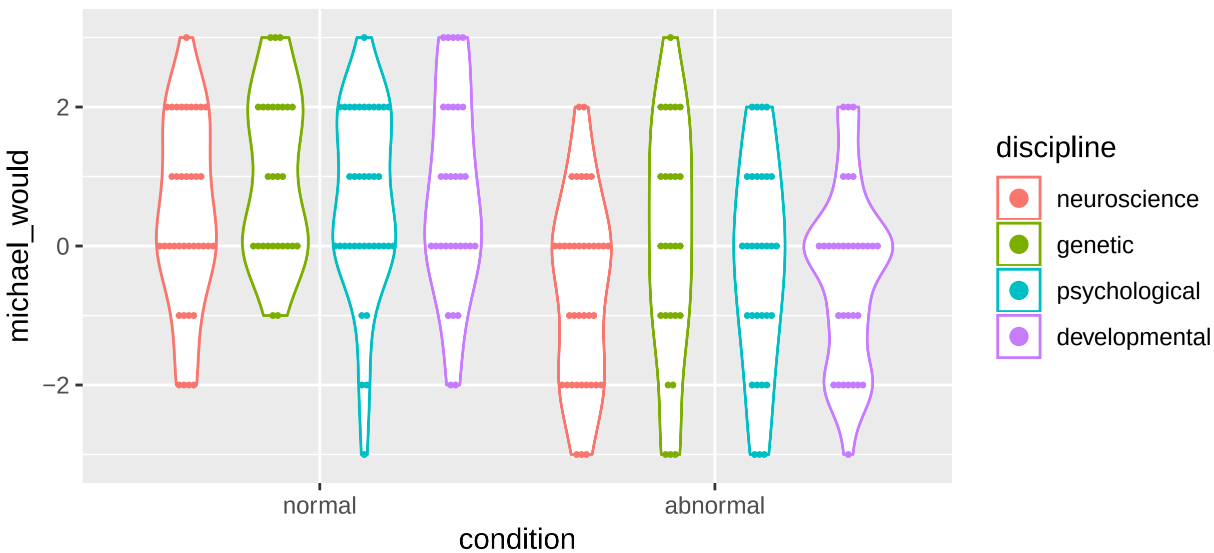
condition	discipline	prevalence	n

Distribution and Means

```
exp3_included %>%
  vio_dot("michael_should", "condition", "discipline", dotsize = 0.25)
```




```
exp3_included %>%
  vio_dot("michael_would", "condition",  "discipline", dotsize = 0.35)
```



Group means

Association with a normal mechanism is still consistently taken to support belief reinforcement, whereas association with an abnormal mechanism is not. Only exception is the cognitive explanation (and only absent there for the normative judgment, not the predictive one).

```r
exp3_included %$%
  tapply(michael_should, list(condition, discipline), mean) %>%
  kable()
```

	neuroscience	genetic	psychological	developmental
normal	0.3243	0.5185	-0.0270	0.6452
abnormal	-0.4595	0.1538	-0.0968	-0.1562

```r
exp3_included %$%
  tapply(michael_would, list(condition, discipline), mean) %>%
  kable()
```

	neuroscience	genetic	psychological	developmental
normal	0.4324	1	0.6216	0.7742
abnormal	-0.6486	0	-0.2903	-0.4062

Effect of normality is again qualitatively the same across domains.

```r
exp3_included %$%
  tapply(michael_should, list(condition, domain), mean) %>%
  kable()
```

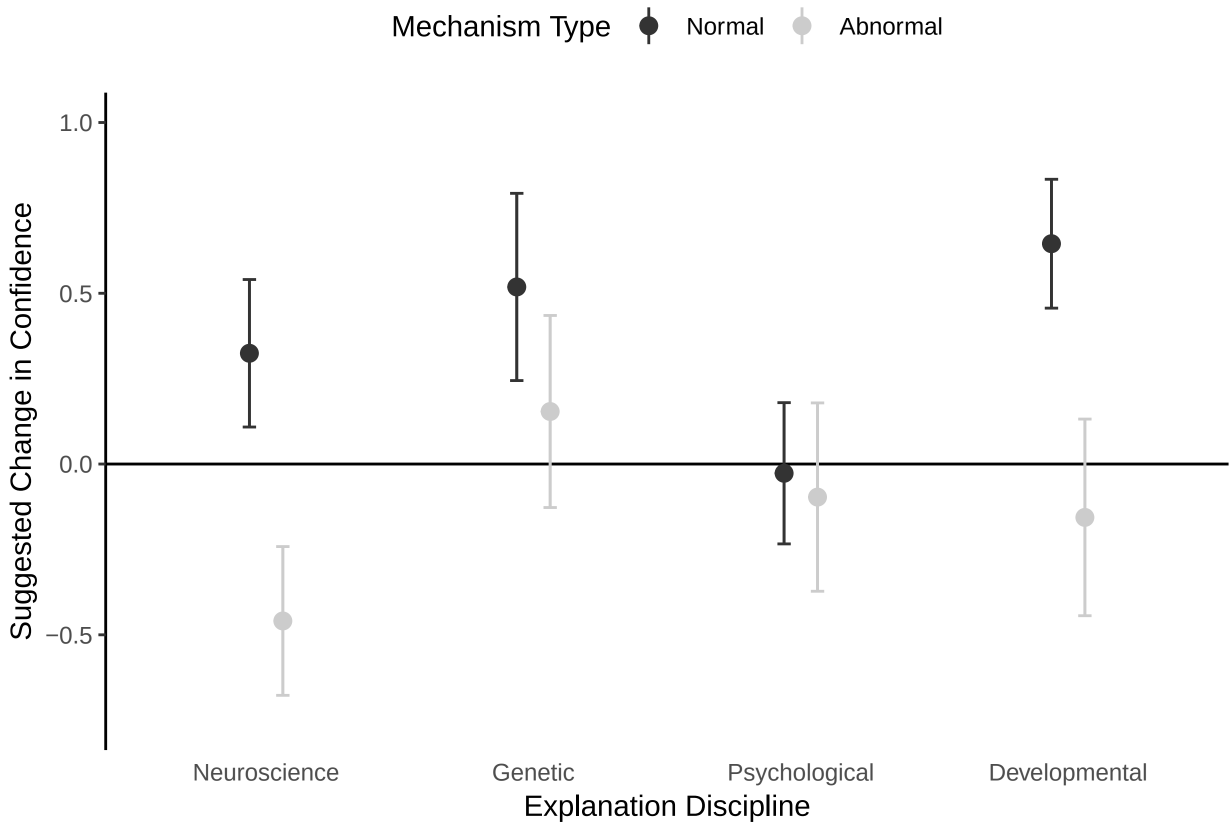
	scientific	religious	moral
normal	0.2909	0.3611	0.3902
abnormal	-0.2857	-0.0638	-0.1818

```r
exp3_included %$%
  tapply(michael_would, list(condition, domain), mean) %>%
  kable()
```

	scientific	religious	moral
normal	0.4909	0.8056	0.8293
abnormal	-0.3429	-0.4894	-0.2500

Plot for Paper

```r
exp3_included %>%
  paper_plot(
    y = "michael_should",
    x = "discipline", x_lab = "Explanation Discipline",
    color = "condition", color_lab = "Mechanism Type",
    ylim = c(-0.75, 1), dodge = 0.25
  )
```



ANOVAs

Main effect of mechanism type, no other significant effects or interactions.

```
exp3_should_lm <-
  exp3_included %$% lm(michael_should ~ condition * discipline * prevalence)
ANOVA(exp3_should_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	19.3442	1	10.2993	0.0015	0.0391
discipline	6.4015	3	1.1361	0.3351	0.0186
prevalence	0.2925	1	0.1557	0.6935	0.0007
condition:discipline	6.6471	3	1.1797	0.3181	0.0142
condition:prevalence	0.5876	1	0.3129	0.5764	0.0008
discipline:prevalence	9.4755	3	1.6817	0.1715	0.0195
condition:discipline:prevalence	8.1514	3	1.4467	0.2298	0.0176
Residuals	454.5237	242			

As in Experiments 1 and 2, the same effects are seen for predictive judgments.

```
exp3_would_lm <-
  exp3_included %$% lm(michael_would ~ condition * discipline * prevalence)
ANOVA(exp3_would_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	65.6746	1	33.7151	0.0000	0.1292

term	sumsq	df	statistic	p.value	Partial eta^2
discipline	9.3741	3	1.6041	0.1890	0.0241
prevalence	1.0520	1	0.5401	0.4631	0.0013
condition:discipline	0.7731	3	0.1323	0.9408	0.0017
condition:prevalence	0.0351	1	0.0180	0.8934	0.0000
discipline:prevalence	5.0891	3	0.8709	0.4568	0.0107
condition:discipline:prevalence	14.6153	3	2.5010	0.0601	0.0301
Residuals	471.3983	242			

Check assumptions for ANOVAs

```
exp3_included %$%
  leveneTest(michael_should ~ condition * discipline * prevalence)
```

	Df	F value	Pr(>F)
group	15	0.7926	0.6855
	242		

```
exp3_included %$%
  leveneTest(michael_would ~ condition * discipline * prevalence)
```

	Df	F value	Pr(>F)
group	15	0.624	0.8541
	242		

```
exp3_should_lm %>% residuals() %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
## W = 0.99, p-value = 0.07
```

```
exp3_would_lm %>% residuals() %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
## W = 0.99, p-value = 0.1
```

Verify results hold without strict exclusion criteria

Effect of mechanism type remains even including participants who answered one or more comprehension questions incorrectly.

```
exp3_finishers <- exp3_data %>% drop_na()
exp3_finishers.lm <-
```

```
  exp3_finishers %$% lm(michael_should ~ condition * discipline * prevalence)
ANOVA(exp3_finishers.lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	15.2001	1	7.6315	0.0060	0.0170
discipline	12.7790	3	2.1386	0.0947	0.0148
prevalence	0.2944	1	0.1478	0.7008	0.0004
condition:discipline	9.1609	3	1.5331	0.2053	0.0115
condition:prevalence	0.1725	1	0.0866	0.7687	0.0001
discipline:prevalence	2.6799	3	0.4485	0.7185	0.0031
condition:discipline:prevalence	4.8653	3	0.8142	0.4865	0.0058
Residuals	836.5363	420			

Belief Reinforcement/Undermining

```
exp3_included %>%
  group_by(condition) %>%
  summarise(
    michael_should = mean(michael_should),
    michael_would = mean(michael_would)
  )
```

condition	michael_should	michael_would
normal	0.3409	0.6818
abnormal	-0.1667	-0.3651

Testing against the scale midpoint again confirms reinforcement for association with normal mechanisms, no evidence of reinforcement for abnormal mechanisms.

```
exp3_included %>%
  group_by(condition) %>%
  do(tidy(t.test(.$michael_should))) %>%
  select(-c(method, alternative))
```

condition	estimate	statistic	p.value	parameter	conf.low	conf.high
normal	0.3409	3.067	0.0026	131	0.1210	0.5608
abnormal	-0.1667	-1.265	0.2083	125	-0.4275	0.0941

```
exp3_included %>%
  group_by(condition) %>%
  do(tidy(t.test(.$michael_would))) %>%
  select(-c(method, alternative))
```

condition	estimate	statistic	p.value	parameter	conf.low	conf.high
normal	0.6818	5.828	0.0000	131	0.4504	0.9132
abnormal	-0.3651	-2.803	0.0059	125	-0.6229	-0.1073

First-Person Judgments

Exclude participants who were neutral about explained belief in analyzing "you would"/"you should" data. Use the remaining 242 participants.

```
exp3_with_belief <-
  exp3_included %>%
  filter(own_belief != 0) %>%
  mutate(
    own_opposing = agrees_with_michael %>%
      parse_factor(levels = c("TRUE", "FALSE")) %>%
      recode_factor("TRUE" = "own", "FALSE" = "opposing")
  )
nrow(exp3_with_belief)
```

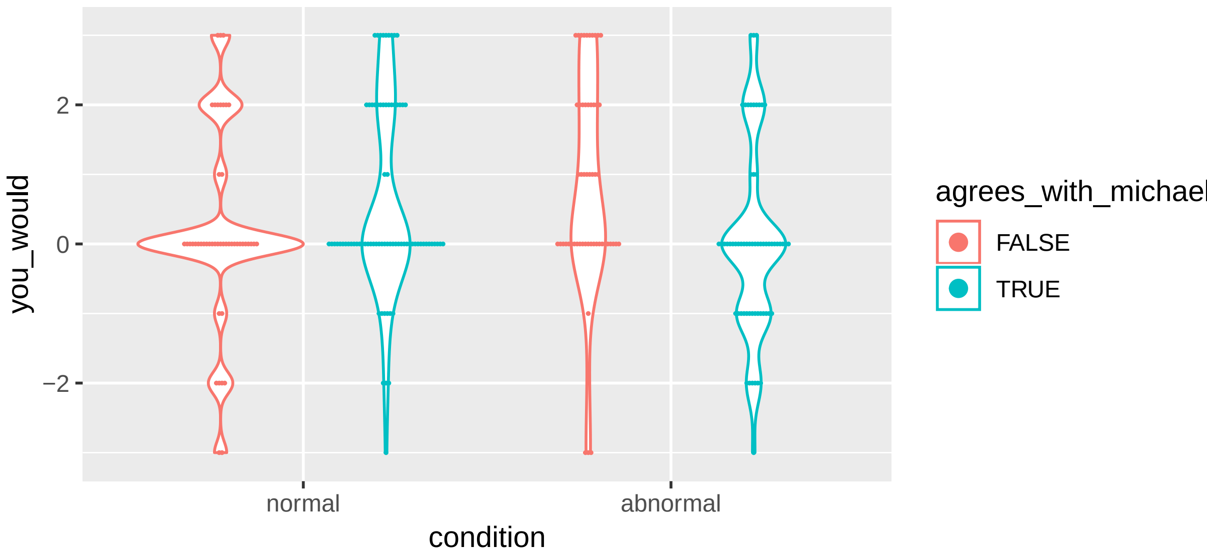
```
## [1] 242
```

```
exp3_with_belief %>% count(condition, discipline, agrees_with_michael)
```

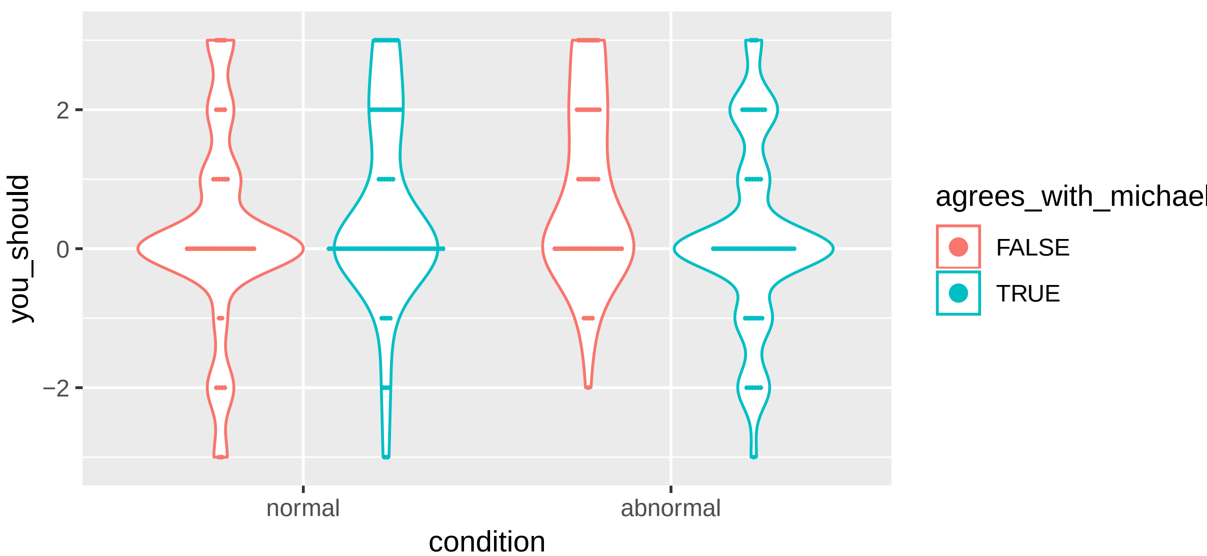
condition	discipline	agrees_with_michael	n
normal	neuroscience	FALSE	11
normal	neuroscience	TRUE	24
normal	genetic	FALSE	10
normal	genetic	TRUE	16
normal	psychological	FALSE	16
normal	psychological	TRUE	19
normal	developmental	FALSE	10
normal	developmental	TRUE	19
abnormal	neuroscience	FALSE	16
abnormal	neuroscience	TRUE	18
abnormal	genetic	FALSE	8
abnormal	genetic	TRUE	18
abnormal	psychological	FALSE	15
abnormal	psychological	TRUE	11
abnormal	developmental	FALSE	16
abnormal	developmental	TRUE	15

First-person distribution and means

```
exp3_with_belief %>%
  vio_dot("you_would", "condition", "agrees_with_michael", dotsize = 0.2)
```




```
exp3_with_belief %>%
  vio_dot("you_should", "condition", "agrees_with_michael", dotsize = 0.2)
```



When participants read an explanation for their own belief, their belief is is more reinforced by explanations that invoke a normal mechanism than an abnormal mechanism, but when they read an explanation for the opposing belief, their belief is more reinforced when the explanation invokes an *abnormal* mechanism.

```
exp3_belief_gathered <-
  exp3_with_belief %>%
  gather(you_would, you_should, key = "judgment", value = "value")

exp3_with_belief %$%
  tapply(you_would, list(condition, own_opposing), mean) %>%
  kable()
```

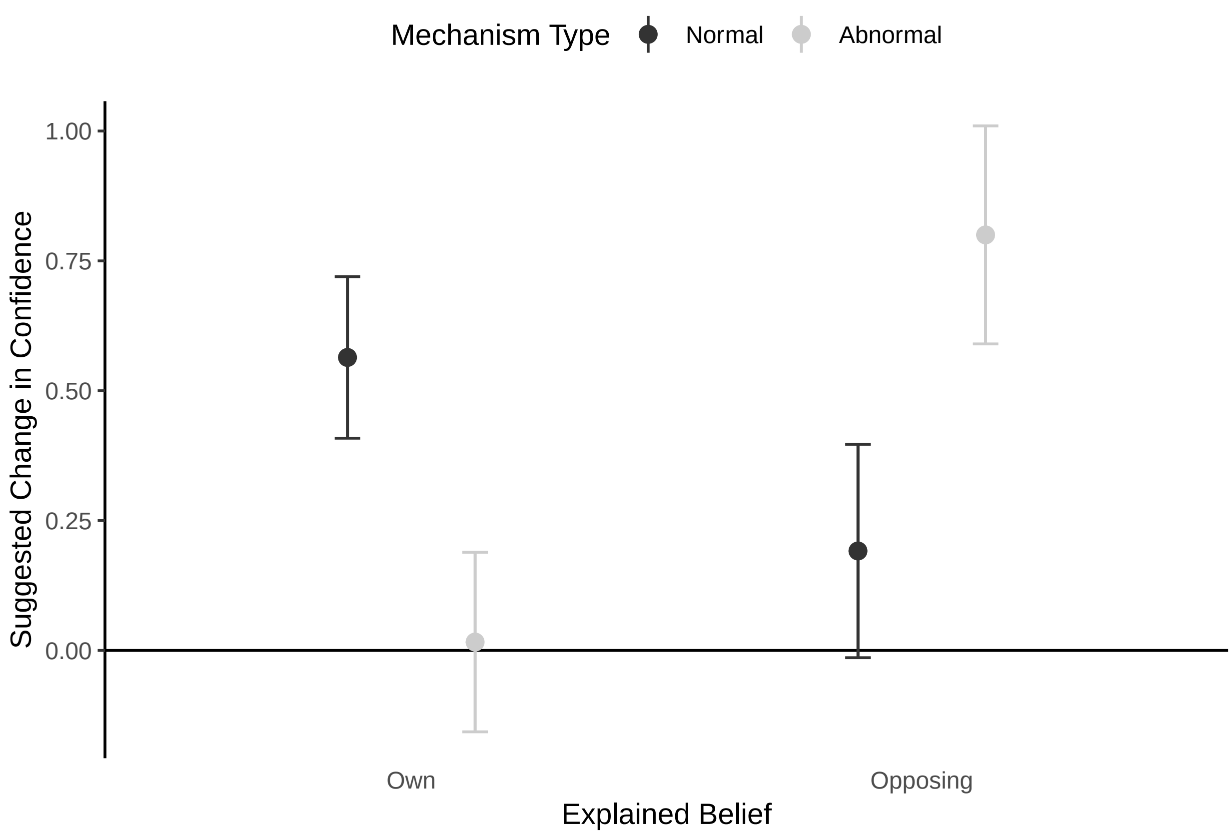
	own	opposing
normal	0.5641	0.1915
abnormal	0.0161	0.8000

```r
exp3_with_belief %$%
  tapply(you_should, list(condition, own_opposing), mean) %>%
  kable()
```

	own	opposing
normal	0.5256	0.2128
abnormal	0.1774	0.8000

First-person plot for paper

```r
exp3_with_belief %>%
  paper_plot(
    y = "you_would",
    x = "own_opposing", x_lab = "Explained Belief",
    color = "condition", color_lab = "Mechanism Type",
    ylim = c(-0.15, 1), dodge = 0.5
  )
```



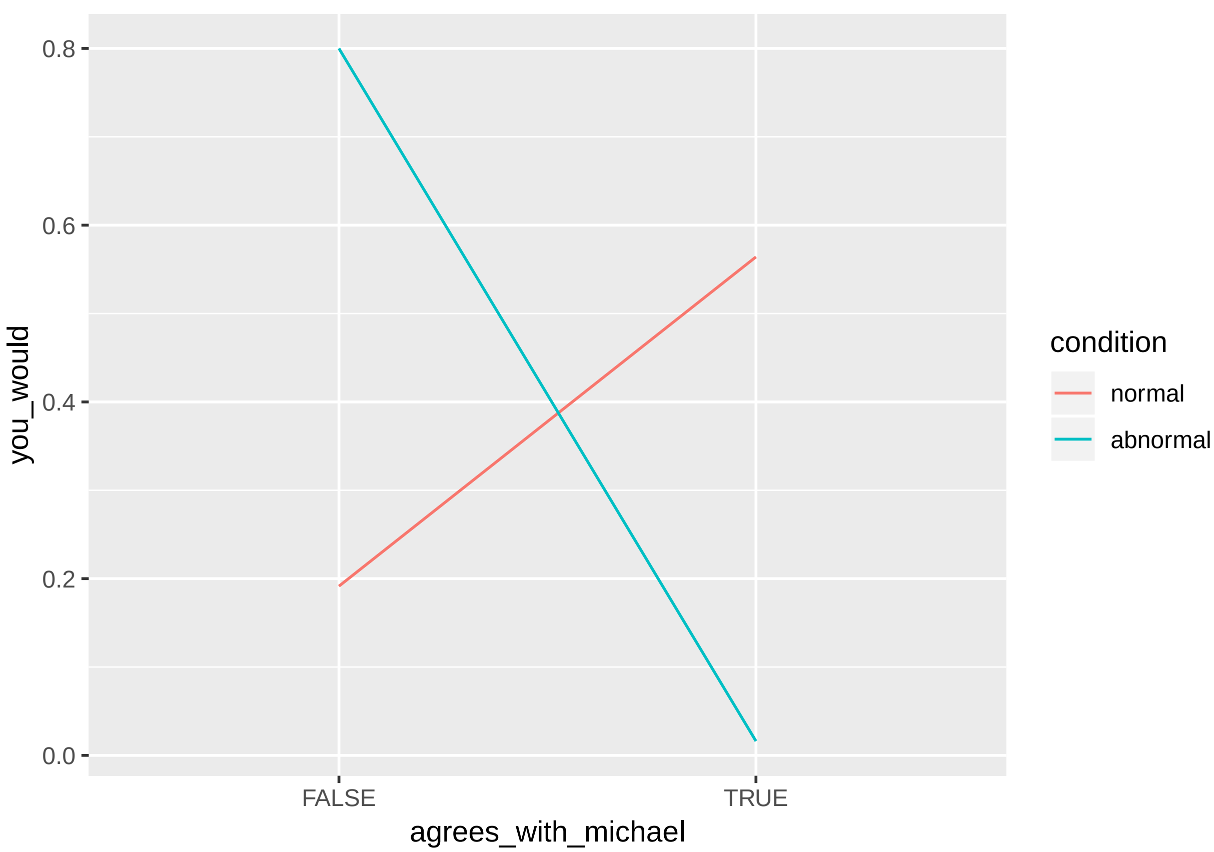
First-person ANOVAs

There is a significant interaction between mechanism type and participant agreement with Michael. Participants reported that explanations that appealed to abnormal functioning would reinforce their own beliefs *more* than explanations that appealed to normal functioning, *as long as those explanations were for the* *opposing belief*. The pattern was reversed if they read explanations for their belief. No significant main effects or other significant interactions.

```
exp3_you_would_lm <-
  exp3_with_belief %$%
  lm(you_would ~ condition * discipline * agrees_with_michael)
ANOVA(exp3_you_would_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	0.0133	1	0.0064	0.9362	0.0007
discipline	1.7718	3	0.2859	0.8355	0.0018
agrees_with_michael	0.8166	1	0.3954	0.5301	0.0035
condition:discipline	2.4132	3	0.3895	0.7607	0.0038
condition:agrees_with_michael	15.8164	1	7.6577	0.0061	0.0354
discipline:agrees_with_michael	5.7500	3	0.9280	0.4280	0.0125
condition:discipline:agrees_with_michael	5.1246	3	0.8271	0.4802	0.0109
Residuals	466.7837	226			

```
exp3_with_belief %>%
  ggplot(
    aes(x = agrees_with_michael, y = you_would,
        group = condition, color = condition)
  ) +
  geom_line(stat = "summary", fun.y = "mean")
```



```
exp3_with_belief %>%
  group_by(agrees_with_michael) %>%
  do(tidy(t.test(.$you_would ~ .$condition))) %>%
  select(-c(method, alternative))
```

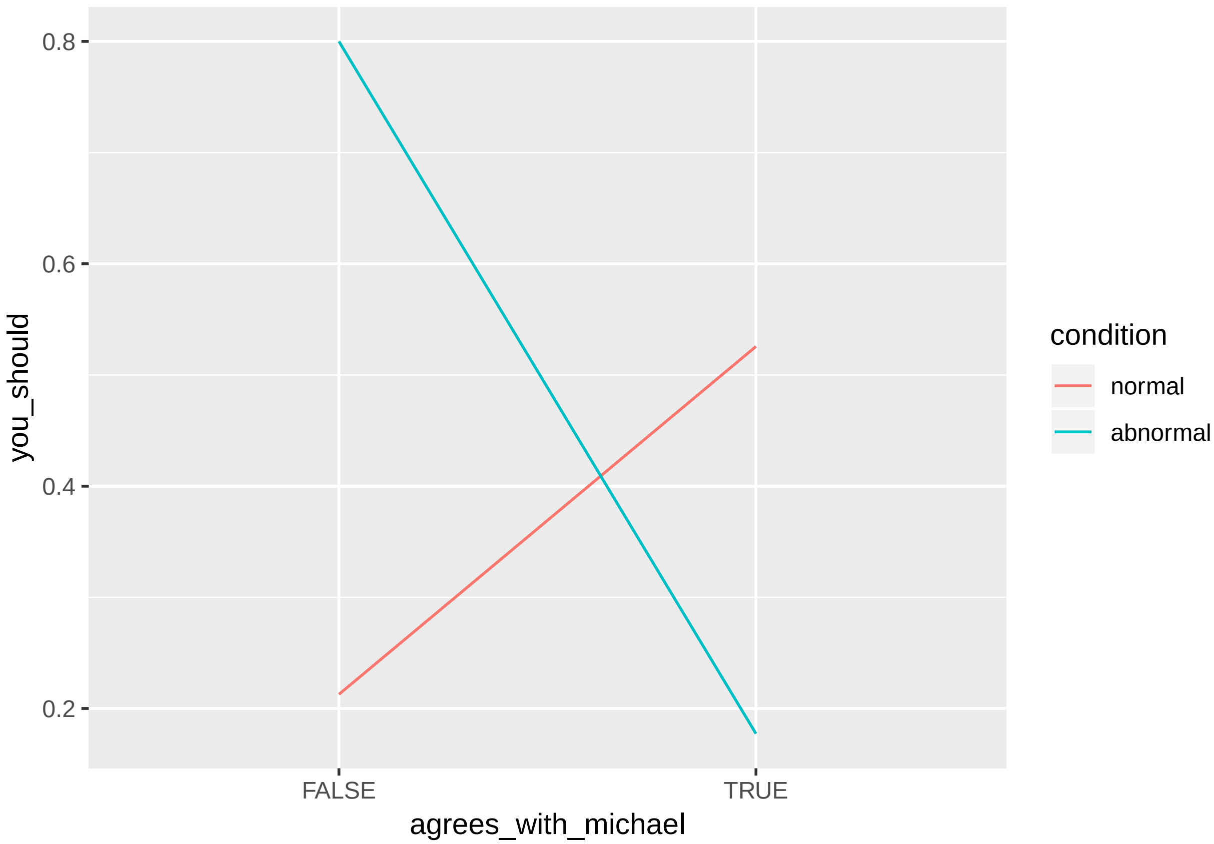
agrees_with_michael	estimate	estimate1	estimate2	statistic	p.value	parameter	conf.low	conf.high
FALSE	-0.6085	0.1915	0.8000	-2.072	0.0409	99.65	-1.1912	-0.0258
TRUE	0.5480	0.5641	0.0161	2.357	0.0199	131.47	0.0881	1.0079

Again, the same effects are seen for predictive and normative judgments.

```
exp3_you_should_lm <-
  exp3_with_belief %$%
  lm(you_should ~ condition * discipline * agrees_with_michael)
ANOVA(exp3_you_should_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	0.9444	1	0.5125	0.4748	0.0001
discipline	2.3748	3	0.4296	0.7320	0.0084
agrees_with_michael	0.4224	1	0.2292	0.6326	0.0026
condition:discipline	0.7689	3	0.1391	0.9365	0.0026
condition:agrees_with_michael	11.5186	1	6.2508	0.0131	0.0266
discipline:agrees_with_michael	8.6538	3	1.5654	0.1986	0.0197
condition:discipline:agrees_with_michael	5.9860	3	1.0828	0.3572	0.0142
Residuals	416.4621	226			

```
exp3_with_belief %>%
  ggplot(
    aes(x = agrees_with_michael, y = you_should,
        group = condition, color = condition)
  ) +
  geom_line(stat = "summary", fun.y = "mean")
```




```
exp3_with_belief %>%
  group_by(agrees_with_michael) %>%
  do(tidy(t.test(.$you_should ~ .$condition))) %>%
  select(-c(method, alternative))
```

agrees_with_michael	estimate	estimate1	estimate2	statistic	p.value	parameter	conf.low	conf.high
FALSE	-0.5872	0.2128	0.8000	-2.183	0.0316	93.9	-1.1215	-0.053
TRUE	0.3482	0.5256	0.1774	1.515	0.1322	133.3	-0.1065	0.803

Check assumptions for first-person ANOVAs

Shapiro-Wilk test is significant here too, but results are again the same using a robust test, and previous visualization still doesn't suggest any issues with using the mean as a summary statistic.

```
exp3_included %$%
  leveneTest(you_would ~ condition * discipline * agrees_with_michael)
```

	Df	F value	Pr(>F)
group	15	0.5248	0.9257
	242		

```
exp3_included %$%
  leveneTest(you_should ~ condition * discipline * agrees_with_michael)
```

	Df	F value	Pr(>F)
group	15	0.7921	0.686
	242		

```
exp3_you_would_lm %>% residuals() %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
## W = 0.96, p-value = 4e-06
```

```
exp3_included %>%
  mutate(agrees_fac = parse_factor(agrees_with_michael, NULL)) %$%
  t2way(you_would ~ condition * agrees_fac)
```

```
## Call:
## t2way(formula = you_would ~ condition * agrees_fac)
##
##                          value p.value
## condition               0.0007   0.979
## agrees_fac              1.8870   0.172
## condition:agrees_fac 13.5911   0.001
```

```
exp3_included %>%
  mutate(agrees_fac = parse_factor(agrees_with_michael, NULL)) %$%
  t2way(you_should ~ condition * agrees_fac)
```

```
## Call:
## t2way(formula = you_should ~ condition * agrees_fac)
##
##                         value p.value
## condition              0.1291   0.720
## agrees_fac             0.4057   0.526
## condition:agrees_fac 4.6264   0.034
```

Confirm first-person results the same across belief domains

Interaction between participant's belief and mechanism type is seen for all belief domains.

```
exp3_with_belief %>%
  group_by(condition, agrees_with_michael, domain) %>%
  summarise(mean(you_would), mean(you_should))
```

condition	agrees_with_michael	domain	mean(you_would)	mean(you_should)
normal	FALSE	scientific	0.6111	0.5000
normal	FALSE	religious	-0.3571	0.2857
normal	FALSE	moral	0.2000	-0.2000
normal	TRUE	scientific	0.6000	0.4571
normal	TRUE	religious	0.6842	0.7895
normal	TRUE	moral	0.4167	0.4167
abnormal	FALSE	scientific	0.8824	0.9412
abnormal	FALSE	religious	0.4706	0.7647

condition	agrees_with_michael	domain	mean(you_would)	mean(you_should)
abnormal	FALSE	moral	1.0000	0.7143
abnormal	TRUE	scientific	0.0625	0.0625
abnormal	TRUE	religious	0.0000	0.2400
abnormal	TRUE	moral	0.0000	0.1905

Experiment 4

Load data.

```
exp4_raw <- read_csv("data/experiment4_data.csv")
exp4_data <-
  exp4_raw %>%
  select(
    participant_id = ResponseId,
    consent = Q1,
    belief_in_god = Q26_18,
    conf_in_existing = Q27_29, heard_of_existing = Q29,
    michael_should = Q33, michael_would = Q31,
    plausible = Q34, realistic = Q35,
    common_check = Q36, proper_check = Q37, agree_check = Q38,
    done_before = Q106,
    sex = Q81, age = Q82,
    common = CommonUncommon, proper = ProperImproper
  ) %>%
  # Drop extra header rows.
  slice(-1:-2) %>%
  type_convert() %>%
  # Center Likerts at 0.
  mutate_at(
    vars(belief_in_god, michael_should, michael_would, plausible, realistic),
    funs(. - 4)
  ) %>%
  mutate(
    theism = case_when(
      belief_in_god > 0 ~ "theist",
      belief_in_god < 0 ~ "atheist",
      belief_in_god == 0 ~ "neither") %>%
      parse_factor(levels = c("theist", "atheist", "neither")),
    consent = consent %>%
      recode_factor("2" = "consent", "1" = "no_consent"),
    done_before = done_before %>%
      recode_factor("1" = "yes", "2" = "maybe", "3" = "no"),
    sex = sex %>%
      recode_factor("1" = "male", "2" = "female", "3" = "other"),
    common = common %>%
      parse_factor(levels = c("common", "uncommon"), include_na = FALSE),
    proper = proper %>%
      parse_factor(levels = c("proper", "improper"), include_na = FALSE),
    pass.common = ((common == "common" & common_check == 1)
                   | (common == "uncommon" & common_check == 4)),
    pass.proper = ((proper == "proper" & proper_check == 1)
```

```
                    | (proper == "improper" & proper_check == 2)),
    pass.agree = agree_check == 1
  )
```

Participants

6 participants didn't complete the experiment. Another 12 participants think they might have done a similar study before. 189 of the rest missed at least 1 of 3 reading comprehension questions. Analyses will focus on data from the remaining 196 participants.

```
exp4_data %>%
  filter(consent == "consent") %>%
  count(
    complete.cases(.),
    done_before,
    pass.common & pass.proper & pass.agree
  )
exp4_included <-
  exp4_data %>%
  drop_na() %>%
  filter(done_before == "no", pass.common, pass.proper, pass.agree)
```

complete.cases(.)	done_before	pass.common & pass.proper & pass.agree	n
FALSE	no	FALSE	1
FALSE	no	TRUE	3
FALSE	no	NA	1
FALSE	NA	FALSE	1
TRUE	yes	FALSE	3
TRUE	yes	TRUE	2
TRUE	maybe	FALSE	5
TRUE	maybe	TRUE	2
TRUE	no	FALSE	189
TRUE	no	TRUE	196

Demographics

```
exp4_included %>% select(sex, age) %>% summary() %>% kable()
```

sex	age
male :98	Min. :18.0
female:98	1st Qu.:29.0
other : 0	Median :35.0
	Mean :38.1
	3rd Qu.:45.0
	Max. :73.0

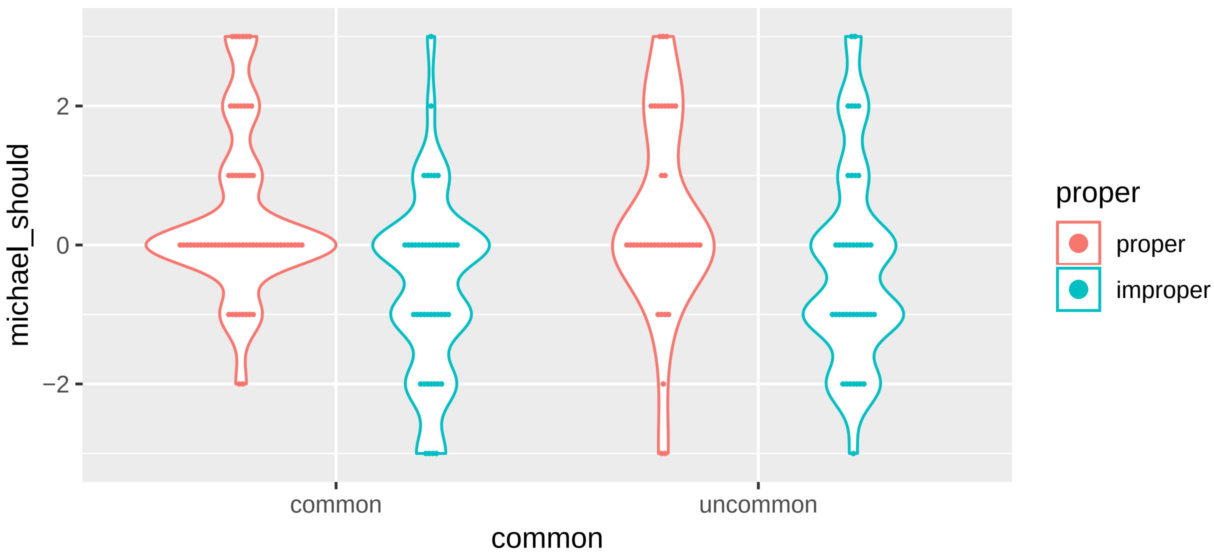
Inclusion/exclusion by condition

```
exp4_included %>% count(common, proper) %>% spread(proper, n)
```

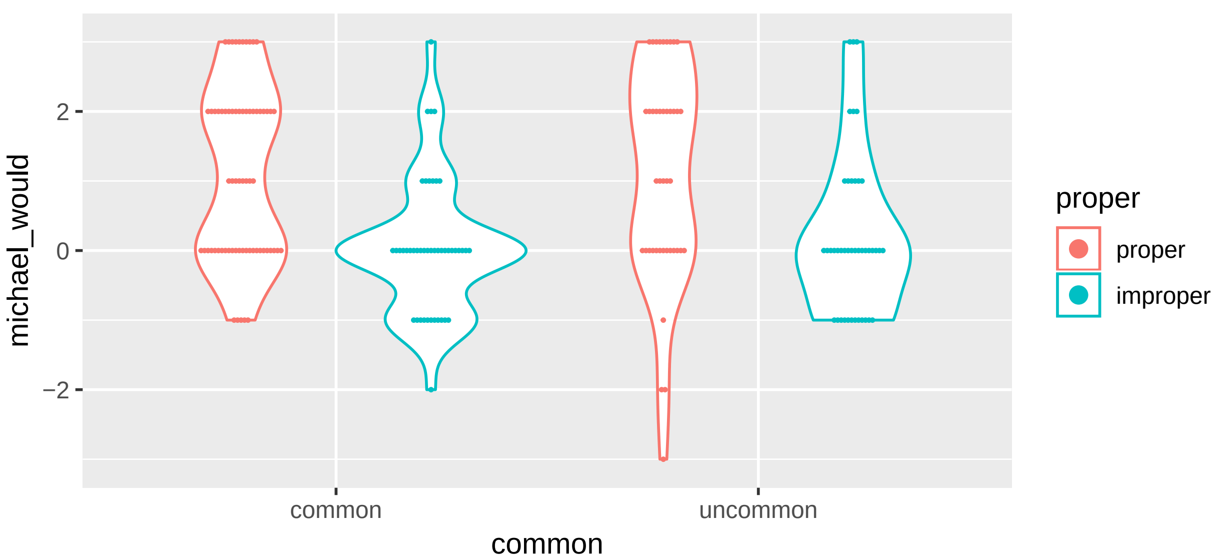
common	proper	improper
common	67	45
uncommon	42	42

Distribution and Means

```
exp4_included %>% vio_dot("michael_should", "common", "proper", dotsize = 0.25)
```




```
exp4_included %>% vio_dot("michael_would", "common", "proper", dotsize = 0.25)
```



Group means

Participants report that association with a properly functioning mechanism supports belief reinforcement, association with an improperly functioning one supports belief undermining. Whether the associated mechanism is common or uncommon appears to make no difference.

```
exp4_included %$%
  tapply(michael_should, list(common, proper), mean) %>%
  kable()
```

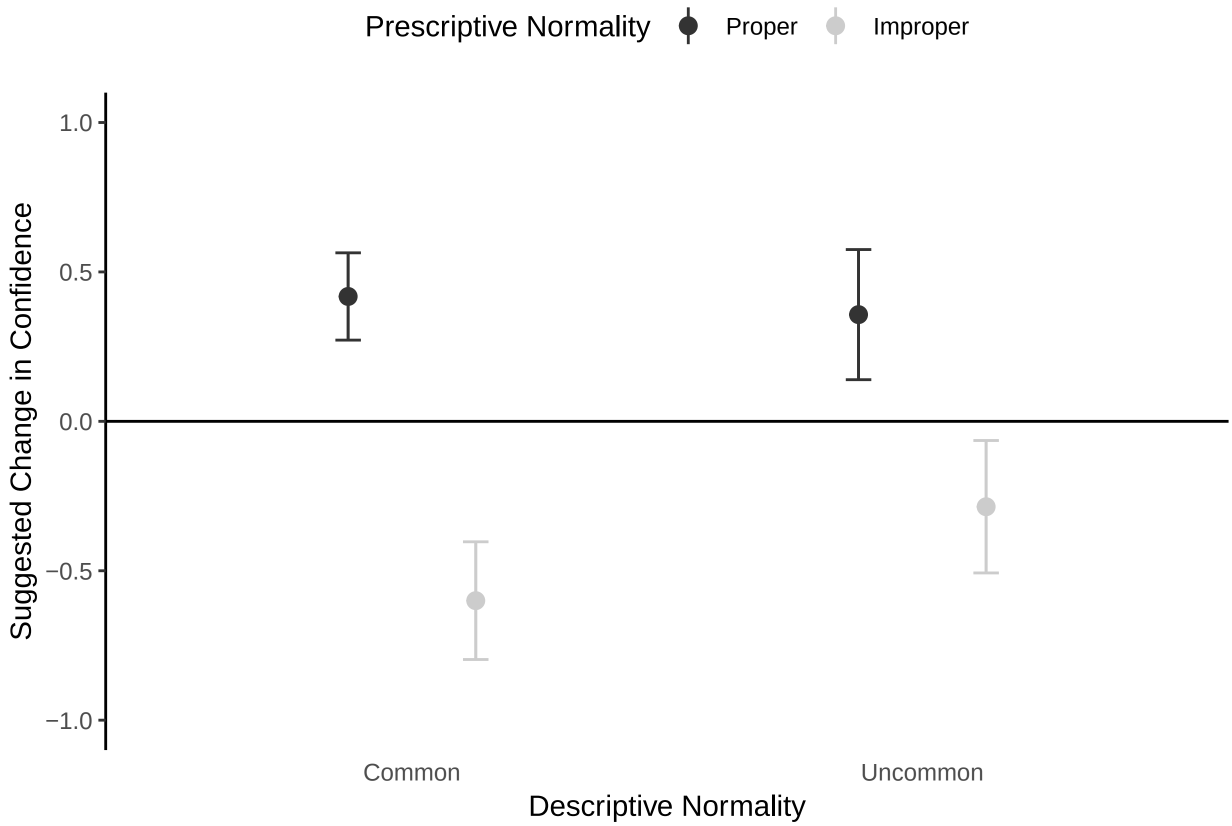
	proper	improper
common	0.4179	-0.6000
uncommon	0.3571	-0.2857

```
exp4_included %$%
  tapply(michael_would, list(common, proper), mean) %>%
  kable()
```

	proper	improper
common	1.090	0.0444
uncommon	1.095	0.2143

Plot for Paper

```
exp4_included %>%
  paper_plot(
    y = "michael_should",
    x = "common", x_lab = "Descriptive Normality",
    color = "proper", color_lab = "Prescriptive Normality",
    ylim = c(-1, 1), dodge = 0.5
  )
```



ANOVAs

ANOVA confirms a main effect of prescriptive normality (proper functioning), no indications of an effect of statistical normality, and no interaction.

```
exp4_should_lm <- exp4_included %$% lm(michael_should ~ common * proper)
ANOVA(exp4_should_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
common	0.7582	1	0.4316	0.5120	0.0017
proper	32.5381	1	18.5209	0.0000	0.0938
common:proper	1.6594	1	0.9446	0.3323	0.0049
Residuals	337.3128	192			

As in previous experiments, the same effects are seen for predictive judgments.

```
exp4_would_lm <- exp4_included %$% lm(michael_would ~ common * proper)
ANOVA(exp4_would_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
common	0.3635	1	0.2341	0.6290	0.0010
proper	43.7638	1	28.1907	0.0000	0.1321
common:proper	0.3179	1	0.2048	0.6514	0.0011
Residuals	298.0643	192			

Check assumptions for ANOVAs

There is variance heterogeneity for “would” judgments and Shapiro-Wilk test is significant in both cases. But the results are the same using robust tests.

```
exp4_included %$% leveneTest(michael_should ~ common * proper)
```

	Df	F value	Pr(>F)
group	3	1.336	0.2639
	192		

```
exp4_included %$% leveneTest(michael_would ~ common * proper)
```

	Df	F value	Pr(>F)
group	3	7.369	1e-04
	192		

```
exp4_should_lm %>% residuals() %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
## W = 0.95, p-value = 3e-06
```

```
exp4_would_lm %>% residuals() %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
## W = 0.94, p-value = 5e-07
```

```
exp4_included %$% t2way(michael_should ~ common * proper)
```

```
## Call:
## t2way(formula = michael_should ~ common * proper)
##
##                 value p.value
## common         0.4124   0.523
## proper        15.0737   0.001
## common:proper  0.0027   0.959
```

```
exp4_included %$% t2way(michael_would ~ common * proper)
```

```
## Call:
## t2way(formula = michael_would ~ common * proper)
##
##                 value p.value
## common         0.2100   0.648
## proper        25.7131   0.001
## common:proper  0.0155   0.902
```

Verify results hold without strict exclusion criteria

With all participants who completed the experiment included, the effect of prescriptive normality remains and there is still no effect of statistical normality or evidence of an interaction.

```
exp4_finishers <- exp4_data %>% drop_na()
ANOVA(exp4_finishers %$% lm(michael_should ~ common * proper))
```

term	sumsq	df	statistic	p.value	Partial eta^2
common	0.0160	1	0.0085	0.9267	0.0000
proper	30.9789	1	16.4150	0.0001	0.0401
common:proper	0.1607	1	0.0852	0.7706	0.0002
Residuals	741.6839	393			

```
ANOVA(exp4_finishers %$% lm(michael_would ~ common * proper))
```

term	sumsq	df	statistic	p.value	Partial eta^2
common	1.2170	1	0.6873	0.4076	0.0017
proper	31.4231	1	17.7454	0.0000	0.0432
common:proper	0.0249	1	0.0141	0.9056	0.0000
Residuals	695.9121	393			

Belief Reinforcement/Undermining

```
exp4_included %>%
  group_by(proper) %>%
  summarise(mean(michael_should), mean(michael_would))
```

proper	mean(michael_should)	mean(michael_would)
proper	0.3945	1.0917
improper	-0.4483	0.1264

Testing against the scale midpoint confirms reinforcement for association with properly functioning mechanisms, undermining for association with improperly functioning mechanisms (except that people merely predict no reinforcement, rather that significant undermining, when making "would" judgments).

```
exp4_included %>%
  group_by(proper) %>%
  do(tidy(t.test(.$michael_should))) %>%
  select(-c(method, alternative))
```

proper	estimate	statistic	p.value	parameter	conf.low	conf.high
proper	0.3945	3.226	0.0017	108	0.1521	0.6369
improper	-0.4483	-3.032	0.0032	86	-0.7422	-0.1544

```
exp4_included %>%
  group_by(proper) %>%
  do(tidy(t.test(.$michael_would))) %>%
```

```
  select(-c(method, alternative))
```

proper	estimate	statistic	p.value	parameter	conf.low	conf.high
proper	1.0917	8.353	0.0000	108	0.8327	1.3508
improper	0.1264	1.107	0.2714	86	-0.1006	0.3535

Confirm Scenarios Are Plausible and Realistic

Participants find the hypothetical explanations at least somewhat plausible and realistic.

```
exp4_included %>% select("plausible", "realistic") %>% summary() %>% kable()
```

plausible	realistic
Min. :-3.000	Min. :-3.000
1st Qu.:-1.000	1st Qu.:-1.000
Median : 1.000	Median : 1.000
Mean : 0.255	Mean : 0.628
3rd Qu.: 1.000	3rd Qu.: 2.000
Max. : 3.000	Max. : 3.000

Explanations that appeal to improper functioning are seen as plausible. Explanations that appeal to common and uncommon mechanisms were seen as equally plausible.

```
exp4_included %>%
  ezANOVA(
    wid = .(participant_id),
    dv = .(plausible),
    between = .(common, proper),
    type = 3,
    detailed = TRUE
  )
```

```
## Coefficient covariances computed by hccm()

## $ANOVA
##           Effect DFn DFd      SSn   SSd       F       p p<.05       ges
## 1    (Intercept)   1 192  8.74167 488.2 3.43826 0.06524       1.759e-02
## 2         common   1 192  0.03104 488.2 0.01221 0.91214       6.357e-05
## 3         proper   1 192 15.08121 488.2 5.93172 0.01578     * 2.997e-02
## 4 common:proper    1 192  0.60199 488.2 0.23677 0.62710       1.232e-03
##
## $`Levene's Test for Homogeneity of Variance`
##   DFn DFd   SSn   SSd     F      p p<.05
## 1   3 192 4.406 189.2 1.491 0.2184
```

```
exp4_included %>%
  ezANOVA(
    wid = .(participant_id),
    dv = .(realistic),
    between = .(common, proper),
    type = 3,
    detailed = TRUE
```

```
  )
```

```
## Coefficient covariances computed by hccm()

## $ANOVA
##          Effect DFn DFd     SSn   SSd        F         p p<.05       ges
## 1   (Intercept)   1 192 70.6334 523.1 25.92676 8.431e-07     * 0.1189701
## 2        common   1 192  0.1829 523.1  0.06714 7.958e-01       0.0003496
## 3        proper   1 192  4.2369 523.1  1.55520 2.139e-01       0.0080349
## 4 common:proper   1 192  0.1788 523.1  0.06562 7.981e-01       0.0003416
##
## $`Levene's Test for Homogeneity of Variance`
##   DFn DFd   SSn   SSd      F      p p<.05
## 1   3 192 1.029 227.4 0.2897 0.8328
```

Confirm effects are not a consequence of differences in plausibility

We find the same results (a main effect of proper functioning and no other significant effects or interactions) when including plausibility as a covariate.

```r
exp4_should_plaus_lm <- exp4_included %$%
  lm(michael_should ~ common * proper + plausible)
ANOVA(exp4_should_plaus_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
common	0.7522	1	0.4261	0.5147	0.0017
proper	32.4134	1	18.3640	0.0000	0.0931
plausible	0.1886	1	0.1068	0.7441	0.0006
common:proper	1.6969	1	0.9614	0.3281	0.0050
Residuals	337.1242	191			

```r
exp4_would_plaus_lm <- exp4_included %$% aov(michael_would ~ common * proper + plausible)
ANOVA(exp4_would_plaus_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
common	0.3662	1	0.2347	0.6286	0.0011
proper	41.8095	1	26.7989	0.0000	0.1267
plausible	0.0818	1	0.0524	0.8191	0.0003
common:proper	0.3063	1	0.1963	0.6582	0.0010
Residuals	297.9825	191			

Experiment 5

Load data.

```r
exp5_raw <- read_csv("data/experiment5_data.csv")
exp5_data <-
  exp5_raw %>%
  select(
    participant_id = ResponseId,
```

```r
    consent = Q1,
    important = Q27_1, science_class = Q27_2, theology_class = Q27_3,
    accept = Q27_4, gov_funding = Q27_5, who_funded = Q27_6,
    replicated = Q27_7,
    belief_likert = Q26_18,
    attention_check = Q13_9_TEXT, reading_check = Q19,
    sex = Q81, age = Q82,
    done_before = Q106,
    explained_belief = GodAtheism, condition = NormalAbnormal,
    presence = PossessLack
  ) %>%
  # Drop extra header rows.
  slice(-1:-2) %>%
  type_convert() %>%
  # Center Likerts at 0.
  mutate_at(
    vars(important, science_class, theology_class, accept,
         gov_funding, who_funded, replicated),
    funs(. - 18)
  ) %>%
  mutate(
    # Center another Likert at 0.
    belief_likert = belief_likert - 4,
    # Two items are reverse coded.
    who_funded = who_funded * -1,
    replicated = replicated * -1,
    composite_trust = (
      important + science_class + theology_class + accept
      + gov_funding + who_funded + replicated
    ) / 7,
    consent = consent %>%
      recode_factor("2" = "consent", "1" = "no_consent"),
    done_before = done_before %>%
      recode_factor("1" = "yes", "2" = "maybe", "3" = "no"),
    sex = sex %>%
      recode_factor("1" = "male", "2" = "female", "3" = "other"),
    explained_belief = explained_belief %>%
      recode_factor("God" = "god", "Atheism" = "atheism"),
    condition = condition %>%
      recode_factor("Normal" = "normal", "Abnormal" = "abnormal"),
    presence = presence %>%
      recode_factor("Possess" = "possess", "Lack" = "lack"),
    theism = case_when(
      belief_likert > 0 ~ "theist",
      belief_likert < 0 ~ "atheist",
      belief_likert == 0 ~ "neither"
    ) %>%
    parse_factor(
      levels = c("theist", "atheist", "neither"),
      include_na = FALSE
    ),
    reading_check = ifelse(is.na(reading_check), 0, reading_check),
    attention_correct = grepl("dax", attention_check, ignore.case = TRUE)
```

```
  )
```

Participants

44 participants didn't complete the experiment. Another 41 participants think they might have done a similar study before. 17 of the rest missed a catch question, leaving 539 participants.

```
exp5_data %>%
  # Don't count leaving attention check blank as not finishing, just as wrong.
  select(-c(attention_check)) %>%
  filter(consent == "consent") %>%
  count(complete.cases(.), done_before, attention_correct)
exp5_included <-
  exp5_data %>%
  drop_na() %>%
  filter(consent == "consent", done_before == "no", attention_correct)
```

complete.cases(.)	done_before	attention_correct	n
FALSE	yes	TRUE	1
FALSE	no	TRUE	5
FALSE	NA	FALSE	21
FALSE	NA	TRUE	17
TRUE	yes	TRUE	9
TRUE	maybe	FALSE	3
TRUE	maybe	TRUE	29
TRUE	no	FALSE	17
TRUE	no	TRUE	539

Demographics

```
exp5_included %>% select(sex, age, theism) %>% summary() %>% kable()
```

sex	age	theism
male :309	Min. :18.0	theist :230
female:228	1st Qu.:24.0	atheist:231
other : 2	Median :28.0	neither: 78
	Mean :30.7	
	3rd Qu.:34.0	
	Max. :73.0	

For results to be interpretable, limited to looking at participants who were not neutral on belief in God. Analyses will focus on data from the remaining 461 participants.

```
exp5_with_belief <-
  exp5_included %>%
  filter(theism != "neither") %>%
  droplevels() %>%
  mutate(
    own_opposing = case_when(
      explained_belief == "god" & theism == "theist" ~ "own",
```

```r
      explained_belief == "atheism" & theism == "atheist" ~ "own",
      explained_belief == "god" & theism == "atheist" ~ "opposing",
      explained_belief == "atheism" & theism == "theist" ~ "opposing"
    ) %>%
    parse_factor(levels = c("own", "opposing"))
  )
nrow(exp5_with_belief)
```

```
## [1] 461
```

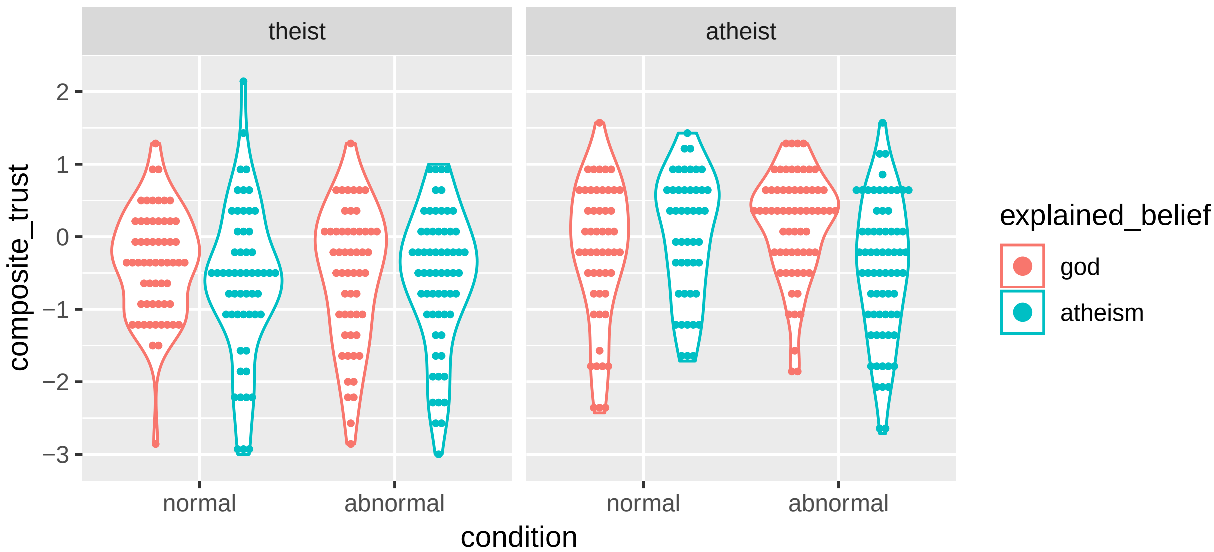
Number of participants per condition (and prior belief in God)

```r
exp5_with_belief %>% count(condition, explained_belief, theism, presence)
```

condition	explained_belief	theism	presence	n
normal	god	theist	possess	32
normal	god	theist	lack	27
normal	god	atheist	possess	22
normal	god	atheist	lack	30
normal	atheism	theist	possess	34
normal	atheism	theist	lack	21
normal	atheism	atheist	possess	24
normal	atheism	atheist	lack	22
abnormal	god	theist	possess	23
abnormal	god	theist	lack	31
abnormal	god	atheist	possess	32
abnormal	god	atheist	lack	33
abnormal	atheism	theist	possess	35
abnormal	atheism	theist	lack	27
abnormal	atheism	atheist	possess	38
abnormal	atheism	atheist	lack	30

Distribution and Means

```r
exp5_with_belief %>%
  vio_dot("composite_trust", "condition", "explained_belief") +
  facet_grid(. ~ theism)
```



Group means

Theists overall more skeptical of any hypothetical finding. Predicted interaction is seen (more skepticism for explanations of own belief by appeal to abnormal mechanism, *less* skepticism for explanations of opposing belief by appeal to abnormal mechanism). Although in predicted direction, effect is tiny (at best) among theists. But, that the effect reverses at all is important to showing the effect is about one's own beliefs, and not merely that everyone thinks abnormal mechanism explanations of atheism are more dubious than abnormal mechanism explanations of theism (and vice versa).

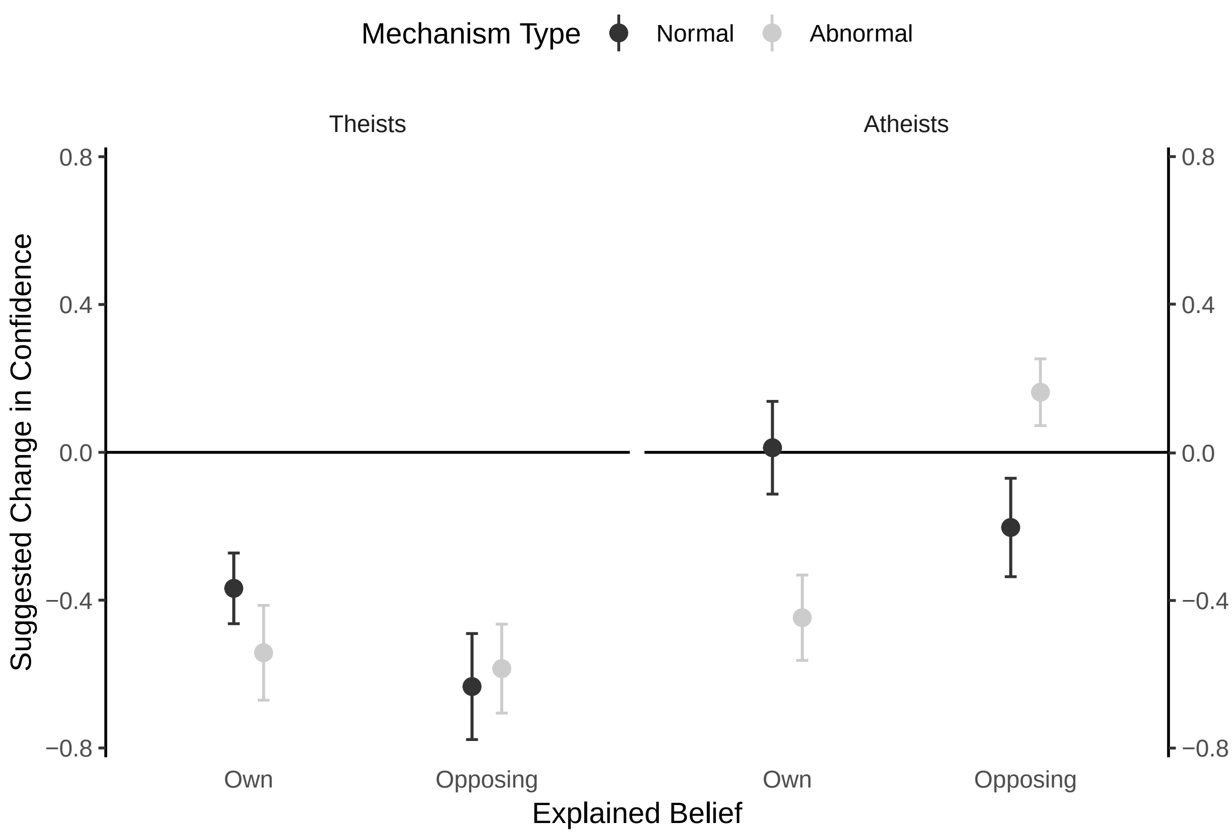
```
exp5_with_belief %>%
  group_by(theism, explained_belief, condition) %>%
  summarise(mean(composite_trust))
```

theism	explained_belief	condition	mean(composite_trust)
theist	god	normal	-0.3680
theist	god	abnormal	-0.5423
theist	atheism	normal	-0.6338
theist	atheism	abnormal	-0.5853
atheist	god	normal	-0.2033
atheist	god	abnormal	0.1626
atheist	atheism	normal	0.0124
atheist	atheism	abnormal	-0.4475

Plot for Paper

```
exp5_with_belief %>%
  ggplot(aes(x = own_opposing, y = composite_trust, color = condition)) +
  facet_grid(
    . ~ theism,
    labeller = labeller(theism = c(theist = "Theists", atheist = "Atheists"))
  ) +
  geom_hline(yintercept = 0) +
  geom_pointrange(
```

```
    stat = "summary",
    fun.data = mean_se,
    position = position_dodge(0.25)
  ) +
  geom_errorbar(
    stat = "summary",
    fun.data = mean_se,
    position = position_dodge(0.25),
    width = 0.1,
    show.legend = FALSE
  ) +
  scale_color_grey(name = "Mechanism Type", labels = str_to_title) +
  scale_x_discrete(name = "Explained Belief", labels = str_to_title) +
  scale_y_continuous(sec.axis = sec_axis(~ .)) +
  coord_cartesian(ylim = c(-0.75, 0.75)) +
  labs(y = "Suggested Change in Confidence") +
  theme_classic() +
  theme(
    legend.position = "top",
    axis.line.x = element_blank(),
    axis.ticks.x = element_blank(),
    strip.background = element_blank()
  )
```



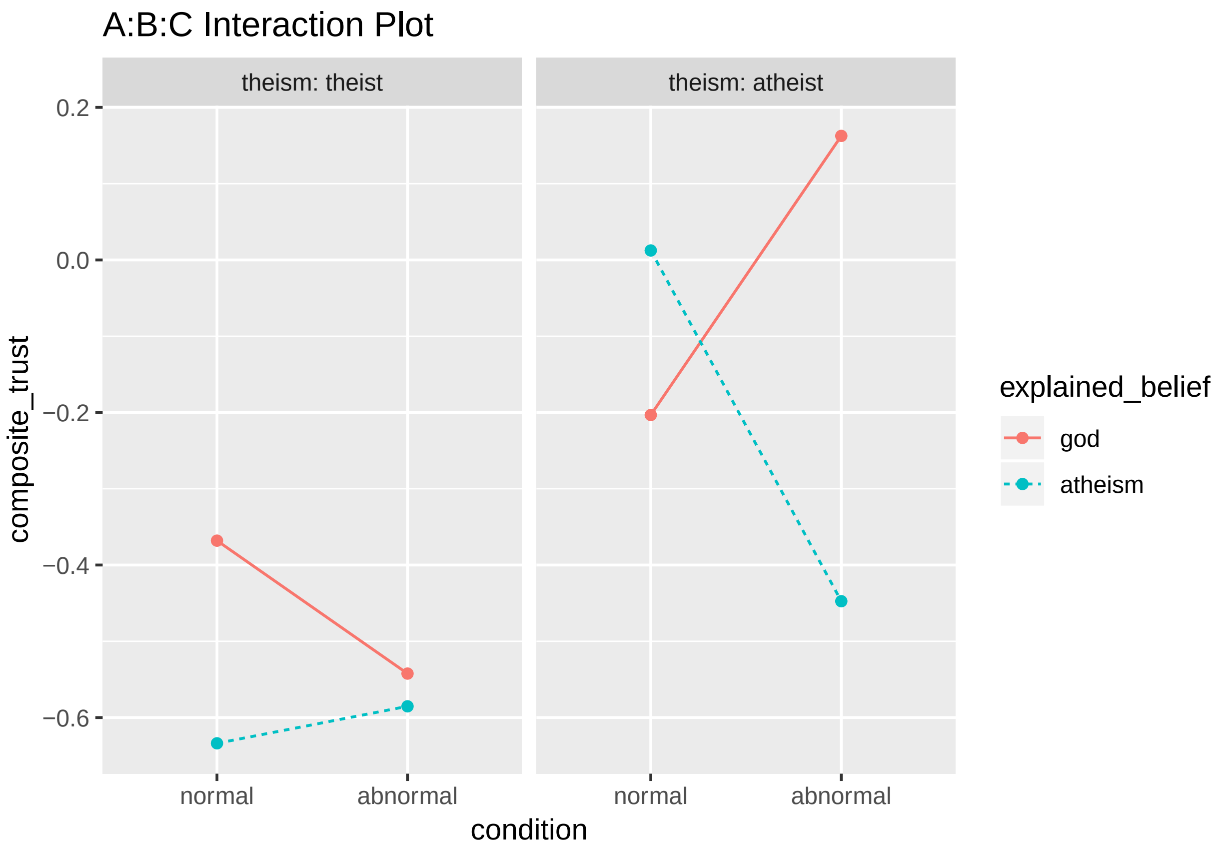
ANOVA

There is a significant interaction between mechanism type, explained belief, and participant's belief, which reflects the hypothesized result, as described above. The main effect of participant's belief described above is also significant. Additionally, there is a significant main effect of explained belief: explanations for atheism were overall regarded more skeptically. Finally, there is an unpredicted three-way interaction between mechanism type, participant's belief, and presence/absence. It might indicate that atheists are somewhat more skeptical of abnormal presence explanations (i.e., displaying an abnormal pattern of brain activity) than they are of normal presence explanations (i.e., displaying a normal pattern of brain activity), but are somewhat less skeptical of abnormal absence explanations than normal absence explanations.

```
exp5_lm <-
  exp5_with_belief %$%
  lm(composite_trust ~ condition * explained_belief * theism * presence)
ANOVA(exp5_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	0.3116	1	0.3901	0.5326	0.0007
explained_belief	3.3894	1	4.2432	0.0400	0.0139
theism	20.5175	1	25.6863	0.0000	0.0494
presence	0.0425	1	0.0532	0.8177	0.0006
condition:explained_belief	2.1762	1	2.7244	0.0995	0.0059
condition:theism	0.0428	1	0.0536	0.8170	0.0000
explained_belief:theism	0.0168	1	0.0211	0.8847	0.0004
condition:presence	0.8296	1	1.0385	0.3087	0.0022
explained_belief:presence	1.4685	1	1.8384	0.1758	0.0053
theism:presence	0.4200	1	0.5258	0.4687	0.0022
condition:explained_belief:theism	6.2747	1	7.8555	0.0053	0.0178
condition:explained_belief:presence	0.5510	1	0.6898	0.4067	0.0015
condition:theism:presence	4.6591	1	5.8329	0.0161	0.0128
explained_belief:theism:presence	2.2832	1	2.8584	0.0916	0.0072
condition:explained_belief:theism:presence	1.1415	1	1.4291	0.2326	0.0032
Residuals	355.4537	445			

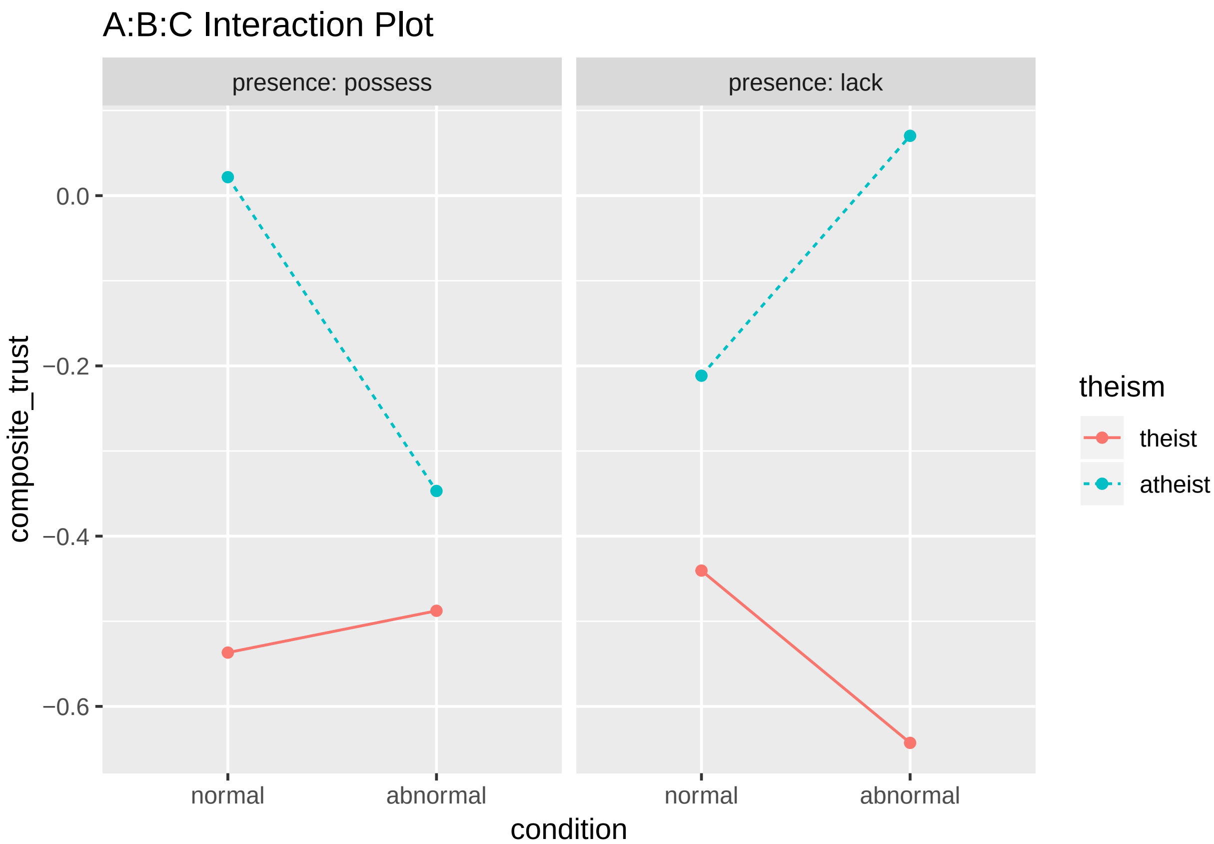
```
interaction.ABC.plot(
  composite_trust, condition, explained_belief, theism,
  data = exp5_with_belief
)
```




```r
exp5_with_belief %>%
  group_by(theism, explained_belief) %>%
  do(tidy(t.test(.$composite_trust ~ .$condition))) %>%
  select(-c(method, alternative))
```

theism	explained_belief	estimate	estimate1	estimate2	statistic	p.value	parameter	conf.low	conf.high
theist	god	0.1743	-0.3680	-0.5423	1.089	0.2786	100.07	-0.1431	0.4917
theist	atheism	-0.0485	-0.6338	-0.5853	-0.259	0.7961	109.01	-0.4197	0.3227
atheist	god	-0.3659	-0.2033	0.1626	-2.274	0.0253	93.04	-0.6855	-0.0464
atheist	atheism	0.4599	0.0124	-0.4475	2.698	0.0081	103.59	0.1219	0.7979

```r
interaction.ABC.plot(
  composite_trust, condition, theism, presence,
  data = exp5_with_belief
)
```



Check assumptions for ANOVA

Shapiro-Wilk test is significant, but the key interaction remains using a robust test.

```
exp5_with_belief %$%
  leveneTest(
    composite_trust ~ condition * explained_belief * theism * presence
  )
```

	Df	F value	Pr(>F)
group	15	1.392	0.1467
	445		

```
exp5_lm %>% residuals() %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
## W = 0.98, p-value = 4e-05
```

```
exp5_with_belief %$%
  t3way(composite_trust ~ condition * explained_belief * theism)
```

```
## Call:
## t3way(formula = composite_trust ~ condition * explained_belief *
```

```
##     theism)
##
##                                    value p.value
## condition                         0.2867   0.600
## explained_belief                  4.0328   0.046
## theism                           23.2930   0.001
## condition:explained_belief        2.7610   0.098
## condition:theism                  0.2649   0.608
## explained_belief:theism           0.3615   0.549
## condition:explained_belief:theism  7.6310   0.007
```

Scale Items

Reasonable reliability.

```
exp5_included %>%
  select(
    important, science_class, theology_class, accept, gov_funding, who_funded,
    replicated
  ) %>%
  psych::alpha(warnings = FALSE)
```

```
##
## Reliability analysis
## Call: psych::alpha(x = ., warnings = FALSE)
##
##   raw_alpha std.alpha G6(smc) average_r S/N   ase  mean   sd median_r
##       0.69      0.65    0.74      0.21 1.9 0.019 -0.33 0.94     0.37
##
##  lower alpha upper     95% confidence boundaries
## 0.66 0.69 0.73
##
##  Reliability if an item is dropped:
##                raw_alpha std.alpha G6(smc) average_r S/N alpha se var.r
## important           0.65      0.61    0.70      0.21 1.6    0.022 0.104
## science_class       0.58      0.53    0.63      0.16 1.1    0.026 0.090
## theology_class      0.61      0.56    0.66      0.17 1.3    0.024 0.103
## accept              0.58      0.52    0.64      0.15 1.1    0.026 0.105
## gov_funding         0.62      0.57    0.68      0.18 1.3    0.024 0.114
## who_funded          0.74      0.70    0.74      0.28 2.3    0.015 0.111
## replicated          0.75      0.74    0.76      0.32 2.8    0.015 0.077
##                 med.r
## important       0.078
## science_class   0.078
## theology_class  0.078
## accept         -0.019
## gov_funding     0.078
## who_funded      0.420
## replicated      0.420
##
##  Item statistics
##                  n raw.r std.r  r.cor r.drop   mean  sd
## important      539 0.620  0.58  0.491   0.43  0.852 1.6
## science_class  539 0.788  0.75  0.756   0.65  0.258 1.7
```

```
## theology_class 539 0.726  0.70  0.667   0.57  0.273 1.7
## accept         539 0.793  0.78  0.756   0.67  0.139 1.6
## gov_funding    539 0.716  0.68  0.607   0.53 -0.063 1.8
## who_funded     539 0.243  0.32  0.153   0.03 -1.677 1.4
## replicated     539 0.067  0.17 -0.019  -0.11 -2.087 1.1
##
## Non missing response frequency for each item
##                  -3   -2   -1    0    1    2    3 miss
## important      0.04 0.06 0.08 0.15 0.26 0.25 0.15    0
## science_class  0.09 0.11 0.12 0.17 0.24 0.21 0.07    0
## theology_class 0.09 0.10 0.12 0.20 0.24 0.21 0.06    0
## accept         0.08 0.12 0.11 0.25 0.24 0.17 0.05    0
## gov_funding    0.13 0.14 0.12 0.17 0.21 0.15 0.08    0
## who_funded     0.34 0.31 0.21 0.06 0.04 0.03 0.02    0
## replicated     0.46 0.31 0.13 0.06 0.01 0.01 0.01    0
```

Single item analyses

```
exp5_with_belief %>%
  group_by(condition, explained_belief, theism) %>%
  select(
    important, science_class, theology_class, accept, gov_funding,
    who_funded, replicated
  ) %>%
  summarise_all(mean) %>%
  kable(
    col.names = c(
      "condition", "belief", "theism", "important", "sci. class", "theo. class",
      "accept", "gov. fund", "funder", "replicated"
    )
  )
```

condition	belief	theism	important	sci. class	theo. class	accept	gov. fund	funder	replicated
normal	god	theist	0.7288	0.1356	0.3390	0.1525	-0.5593	-1.695	-1.678
normal	god	atheist	1.0962	0.4808	0.4615	0.3654	0.2308	-1.712	-2.346
normal	atheism	theist	0.4545	0.0182	0.1455	-0.2545	-0.8000	-1.709	-2.291
normal	atheism	atheist	1.1304	0.8913	0.4783	0.5217	0.8261	-1.630	-2.130
abnormal	god	theist	0.5185	-0.0741	0.1296	-0.0185	-0.3704	-1.889	-2.093
abnormal	god	atheist	1.6615	1.0000	0.7231	0.7846	0.6615	-1.554	-2.139
abnormal	atheism	theist	0.4032	-0.0806	-0.0323	-0.1129	-0.5000	-1.677	-2.097
abnormal	atheism	atheist	0.7647	-0.0441	-0.0147	-0.1176	0.2206	-1.779	-2.162

```
exp5_with_belief %$%
  ANOVA(lm(important ~ condition * explained_belief * theism * presence))
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	0.1706	1	0.0695	0.7922	0.0000
explained_belief	11.0170	1	4.4851	0.0347	0.0136
theism	44.6803	1	18.1898	0.0000	0.0402
presence	0.6181	1	0.2516	0.6162	0.0003
condition:explained_belief	4.6072	1	1.8756	0.1715	0.0040

term	sumsq	df	statistic	p.value	Partial eta^2
condition:theism	1.8419	1	0.7498	0.3870	0.0012
explained_belief:theism	2.0234	1	0.8237	0.3646	0.0024
condition:presence	0.0321	1	0.0131	0.9090	0.0000
explained_belief:presence	5.7559	1	2.3433	0.1265	0.0053
theism:presence	0.4984	1	0.2029	0.6526	0.0001
condition:explained_belief:theism	5.0497	1	2.0558	0.1523	0.0047
condition:explained_belief:presence	0.3993	1	0.1626	0.6870	0.0004
condition:theism:presence	17.8202	1	7.2548	0.0073	0.0160
explained_belief:theism:presence	0.0276	1	0.0112	0.9156	0.0001
condition:explained_belief:theism:presence	0.7481	1	0.3046	0.5813	0.0007
Residuals	1093.0708	445			

```r
exp5_with_belief %$%
  ANOVA(lm(science_class ~ condition * explained_belief * theism * presence))
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	2.4455	1	0.8776	0.3494	0.0022
explained_belief	5.0521	1	1.8129	0.1788	0.0068
theism	43.5158	1	15.6155	0.0001	0.0301
presence	7.2670	1	2.6077	0.1071	0.0042
condition:explained_belief	10.6758	1	3.8310	0.0509	0.0086
condition:theism	0.3108	1	0.1115	0.7386	0.0004
explained_belief:theism	1.2294	1	0.4411	0.5069	0.0017
condition:presence	8.6998	1	3.1219	0.0779	0.0069
explained_belief:presence	5.9838	1	2.1472	0.1435	0.0056
theism:presence	4.8255	1	1.7316	0.1889	0.0046
condition:explained_belief:theism	14.5431	1	5.2188	0.0228	0.0117
condition:explained_belief:presence	2.1428	1	0.7689	0.3810	0.0017
condition:theism:presence	2.9449	1	1.0568	0.3045	0.0024
explained_belief:theism:presence	2.3543	1	0.8448	0.3585	0.0021
condition:explained_belief:theism:presence	0.4522	1	0.1623	0.6873	0.0004
Residuals	1240.0839	445			

```r
exp5_with_belief %$%
  ANOVA(lm(theology_class ~ condition * explained_belief * theism * presence))
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	2.2851	1	0.8162	0.3668	0.0018
explained_belief	8.9271	1	3.1886	0.0748	0.0083
theism	8.4742	1	3.0269	0.0826	0.0066
presence	0.0022	1	0.0008	0.9778	0.0002
condition:explained_belief	3.0280	1	1.0816	0.2989	0.0026
condition:theism	0.0619	1	0.0221	0.8819	0.0001
explained_belief:theism	0.7063	1	0.2523	0.6157	0.0008
condition:presence	3.5265	1	1.2596	0.2623	0.0029
explained_belief:presence	0.4433	1	0.1583	0.6909	0.0003
theism:presence	1.8614	1	0.6649	0.4153	0.0018
condition:explained_belief:theism	3.4600	1	1.2359	0.2669	0.0026
condition:explained_belief:presence	0.1371	1	0.0490	0.8249	0.0001

term	sumsq	df	statistic	p.value	Partial eta^2
condition:theism:presence	7.1047	1	2.5377	0.1119	0.0057
explained_belief:theism:presence	0.0139	1	0.0050	0.9438	0.0001
condition:explained_belief:theism:presence	2.4172	1	0.8634	0.3533	0.0019
Residuals	1245.8478	445			

```
exp5_with_belief %$%
  ANOVA(lm(accept ~ condition * explained_belief * theism * presence))
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	0.2070	1	0.0879	0.7670	0.0002
explained_belief	9.8435	1	4.1775	0.0416	0.0132
theism	24.4837	1	10.3907	0.0014	0.0190
presence	0.6432	1	0.2730	0.6016	0.0014
condition:explained_belief	3.1912	1	1.3543	0.2451	0.0029
condition:theism	0.0763	1	0.0324	0.8573	0.0004
explained_belief:theism	0.1842	1	0.0782	0.7799	0.0005
condition:presence	2.2816	1	0.9683	0.3256	0.0020
explained_belief:presence	12.1811	1	5.1696	0.0235	0.0145
theism:presence	2.4632	1	1.0454	0.3071	0.0037
condition:explained_belief:theism	9.9122	1	4.2067	0.0409	0.0099
condition:explained_belief:presence	6.2883	1	2.6687	0.1030	0.0060
condition:theism:presence	10.1713	1	4.3166	0.0383	0.0095
explained_belief:theism:presence	5.9768	1	2.5365	0.1120	0.0067
condition:explained_belief:theism:presence	6.0472	1	2.5664	0.1099	0.0057
Residuals	1048.5618	445			

```
exp5_with_belief %$%
  ANOVA(lm(gov_funding ~ condition * explained_belief * theism * presence))
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	0.5499	1	0.1796	0.6719	0.0006
explained_belief	0.2917	1	0.0953	0.7577	0.0009
theism	123.9891	1	40.5040	0.0000	0.0794
presence	0.1601	1	0.0523	0.8192	0.0000
condition:explained_belief	5.9055	1	1.9292	0.1655	0.0040
condition:theism	1.9573	1	0.6394	0.4244	0.0024
explained_belief:theism	2.1400	1	0.6991	0.4035	0.0012
condition:presence	0.2483	1	0.0811	0.7759	0.0001
explained_belief:presence	0.0002	1	0.0001	0.9931	0.0001
theism:presence	0.0000	1	0.0000	0.9988	0.0001
condition:explained_belief:theism	7.1177	1	2.3251	0.1280	0.0056
condition:explained_belief:presence	0.7073	1	0.2310	0.6310	0.0005
condition:theism:presence	10.2369	1	3.3441	0.0681	0.0073
explained_belief:theism:presence	1.7763	1	0.5803	0.4466	0.0019
condition:explained_belief:theism:presence	8.8618	1	2.8949	0.0896	0.0065
Residuals	1362.2161	445			

```r
exp5_with_belief %$%
  ANOVA(lm(who_funded ~ condition * explained_belief * theism * presence))
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	0.2037	1	0.1073	0.7434	0.0003
explained_belief	0.1811	1	0.0954	0.7576	0.0001
theism	1.0779	1	0.5677	0.4516	0.0005
presence	7.2877	1	3.8385	0.0507	0.0083
condition:explained_belief	0.0000	1	0.0000	0.9975	0.0000
condition:theism	0.7166	1	0.3775	0.5393	0.0005
explained_belief:theism	0.6248	1	0.3291	0.5665	0.0011
condition:presence	0.0766	1	0.0404	0.8409	0.0001
explained_belief:presence	0.0013	1	0.0007	0.9792	0.0001
theism:presence	0.0491	1	0.0259	0.8723	0.0001
condition:explained_belief:theism	2.3024	1	1.2127	0.2714	0.0030
condition:explained_belief:presence	0.4238	1	0.2232	0.6368	0.0005
condition:theism:presence	0.2788	1	0.1469	0.7017	0.0004
explained_belief:theism:presence	11.7319	1	6.1793	0.0133	0.0154
condition:explained_belief:theism:presence	5.5237	1	2.9094	0.0888	0.0065
Residuals	844.8674	445			

```r
exp5_with_belief %$%
  ANOVA(lm(replicated ~ condition * explained_belief * theism * presence))
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	0.0645	1	0.0552	0.8143	0.0000
explained_belief	1.1673	1	0.9987	0.3182	0.0022
theism	2.5792	1	2.2067	0.1381	0.0060
presence	3.1558	1	2.7000	0.1011	0.0058
condition:explained_belief	1.0811	1	0.9250	0.3367	0.0021
condition:theism	1.5102	1	1.2921	0.2563	0.0030
explained_belief:theism	4.9298	1	4.2178	0.0406	0.0075
condition:presence	0.8403	1	0.7189	0.3970	0.0016
explained_belief:presence	0.2185	1	0.1870	0.6657	0.0004
theism:presence	0.0115	1	0.0098	0.9212	0.0000
condition:explained_belief:theism	5.1991	1	4.4482	0.0355	0.0098
condition:explained_belief:presence	0.0000	1	0.0000	0.9958	0.0000
condition:theism:presence	0.4171	1	0.3569	0.5505	0.0008
explained_belief:theism:presence	3.2108	1	2.7471	0.0981	0.0060
condition:explained_belief:theism:presence	0.0841	1	0.0720	0.7886	0.0002
Residuals	520.1200	445			

Supplementary Experiment

Load data.

```r
sup_raw <-
  read_csv("data/supplementary_data.csv")
sup_data <-
  sup_raw %>%
```

```r
select(
  participant_id = ResponseId,
  consent = Q1,
  you_should = Q16, you_would = Q14,
  michael_should = Q15, michael_would = Q100,
  plausible = Q97, attention_check = Q13_9_TEXT, done_before = Q106,
  sex = Q81, age = Q82,
  valence = AcceptReject, domain = SciRelMor, prevalence = CommonRare,
  discipline = PsychBrain, condition = NormalAbnormal,
  own_belief = TargetRating
) %>%
# Drop extra header rows.
slice(-1:-2) %>%
type_convert() %>%
# Center Likerts at 0.
mutate_at(
  vars(contains("should"), contains("would"), own_belief),
  funs(. - 4)
) %>%
mutate(
  consent = consent %>%
    recode_factor("2" = "consent", "1" = "no_consent"),
  done_before = done_before %>%
    recode_factor("1" = "yes", "2" = "maybe", "3" = "no"),
  sex = sex %>%
    recode_factor("1" = "male", "2" = "female", "3" = "other"),
  domain = domain %>%
    recode_factor("1" = "scientific", "2" = "religious", "3" = "moral"),
  prevalence = prevalence %>%
    recode_factor("1" = "common", "2" = "rare"),
  condition = condition %>%
    recode_factor("Normal" = "neutral", "Abnormal" = "implied_abnormality"),
  discipline = discipline %>%
    recode_factor("Brain" = "neuroscience", "Psych" = "cognitive"),
  valence = valence %>%
    recode_factor("1" = "accept", "2" = "reject"),
  pass_check = grepl("dax", attention_check, ignore.case = TRUE),
  agrees_with_michael = ((valence == "accept" & own_belief > 0)
                         | (valence == "reject" & own_belief < 0))
) %>%
mutate_at(
  vars(contains("michael_")),
  funs(. * if_else(valence == "accept", 1, -1))
) %>%
mutate_at(
  vars(contains("you_")),
  funs(. * if_else(own_belief > 0, 1, -1))
)
```

Participants

4 participants didn't complete the experiment. Another 15 participants think they might have done a similar study before. 5 of the rest missed a catch question. Analyses will focus on data from the remaining 160 participants.

```r
sup_data %>%
  # Don't count leaving attention check blank as not finishing, just as wrong.
  select(-attention_check) %>%
  filter(consent == "consent") %>%
  count(complete.cases(.), done_before == "no", pass_check)
sup_included <-
  sup_data %>%
  drop_na() %>%
  filter(consent == "consent", done_before == "no", pass_check)
```

complete.cases(.)	done_before == "no"	pass_check	n
FALSE	NA	FALSE	4
TRUE	FALSE	FALSE	1
TRUE	FALSE	TRUE	14
TRUE	TRUE	FALSE	5
TRUE	TRUE	TRUE	160

Demographics

```r
sup_included %>% select(sex, age) %>% summary() %>% kable()
```

sex	age
male :88	Min. :18.0
female:72	1st Qu.:23.8
	Median :27.0
	Mean :31.0
	3rd Qu.:34.0
	Max. :74.0

Inclusion/exclusion by conditions

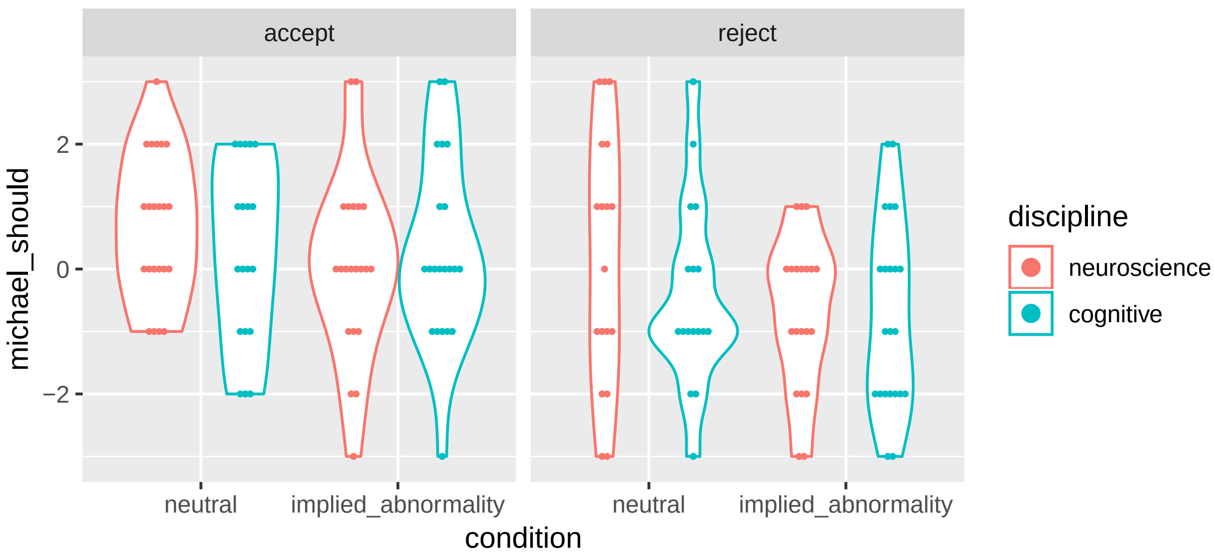
```r
sup_included %>% count(condition, discipline, prevalence, valence)
```

condition	discipline	prevalence	valence	n
neutral	neuroscience	common	accept	12
neutral	neuroscience	common	reject	8
neutral	neuroscience	rare	accept	10
neutral	neuroscience	rare	reject	10
neutral	cognitive	common	accept	9
neutral	cognitive	common	reject	8
neutral	cognitive	rare	accept	10
neutral	cognitive	rare	reject	9
implied_abnormality	neuroscience	common	accept	11

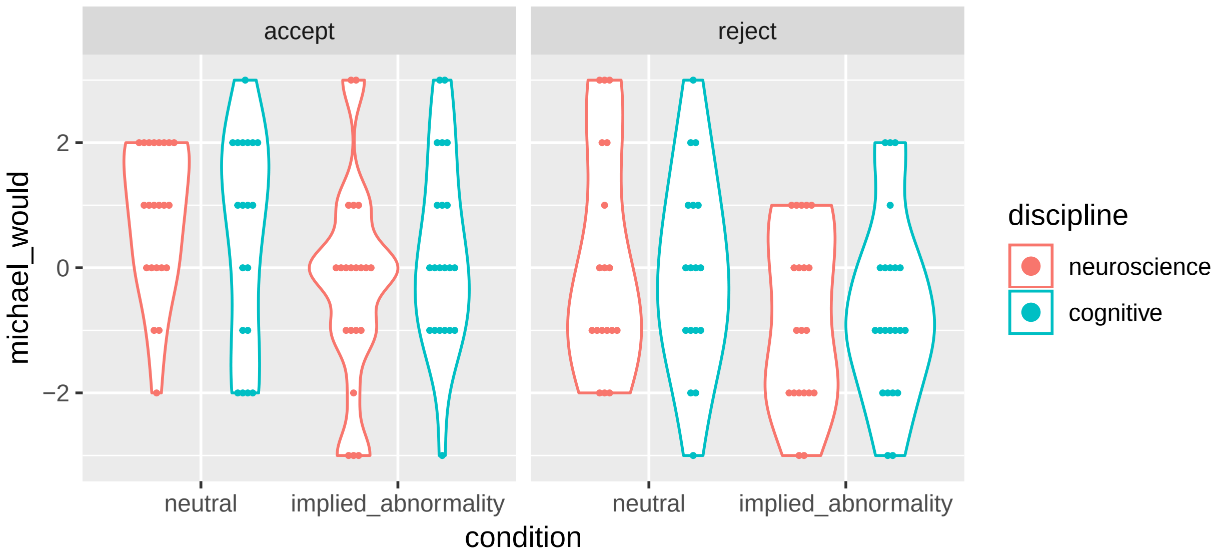
condition	discipline	prevalence	valence	n
implied_abnormality	neuroscience	common	reject	11
implied_abnormality	neuroscience	rare	accept	10
implied_abnormality	neuroscience	rare	reject	9
implied_abnormality	cognitive	common	accept	10
implied_abnormality	cognitive	common	reject	11
implied_abnormality	cognitive	rare	accept	11
implied_abnormality	cognitive	rare	reject	11

Distribution and Means

```
sup_included %>%
  vio_dot("michael_should", "condition", "discipline") +
  facet_grid(. ~ valence)
```




```
sup_included %>%
  vio_dot("michael_would", "condition", "discipline") +
  facet_grid(. ~ valence)
```



Group means

Many between-subjects factors, but the effect of implied abnormality is in the predicted direction across all but one (cognitive explanation for accepting a common belief): association with a mechanism that is implied to be functioning abnormally produces less reinforcement (more undermining). Also a clear effect of valence, with more belief reinforcement suggested for positive, rather than negative beliefs.

```
sup_included %>%
  group_by(condition, discipline, prevalence, valence) %>%
  summarise(mean(michael_should), mean(michael_would))
```

condition	discipline	prevalence	valence	mean(michael_should)	mean(michael_would)
neutral	neuroscience	common	accept	0.5000	0.5833
neutral	neuroscience	common	reject	-0.3750	0.0000
neutral	neuroscience	rare	accept	0.9000	1.1000
neutral	neuroscience	rare	reject	0.6000	0.2000
neutral	cognitive	common	accept	0.2222	0.2222
neutral	cognitive	common	reject	-0.6250	-0.1250
neutral	cognitive	rare	accept	0.3000	0.7000
neutral	cognitive	rare	reject	-0.2222	0.0000
implied_abnormality	neuroscience	common	accept	0.0000	-0.7273
implied_abnormality	neuroscience	common	reject	-0.9091	-0.8182
implied_abnormality	neuroscience	rare	accept	0.1000	0.2000
implied_abnormality	neuroscience	rare	reject	-0.4444	-0.7778
implied_abnormality	cognitive	common	accept	0.5000	0.6000
implied_abnormality	cognitive	common	reject	-1.0909	-1.0909
implied_abnormality	cognitive	rare	accept	0.0909	0.0000
implied_abnormality	cognitive	rare	reject	-0.3636	-0.1818

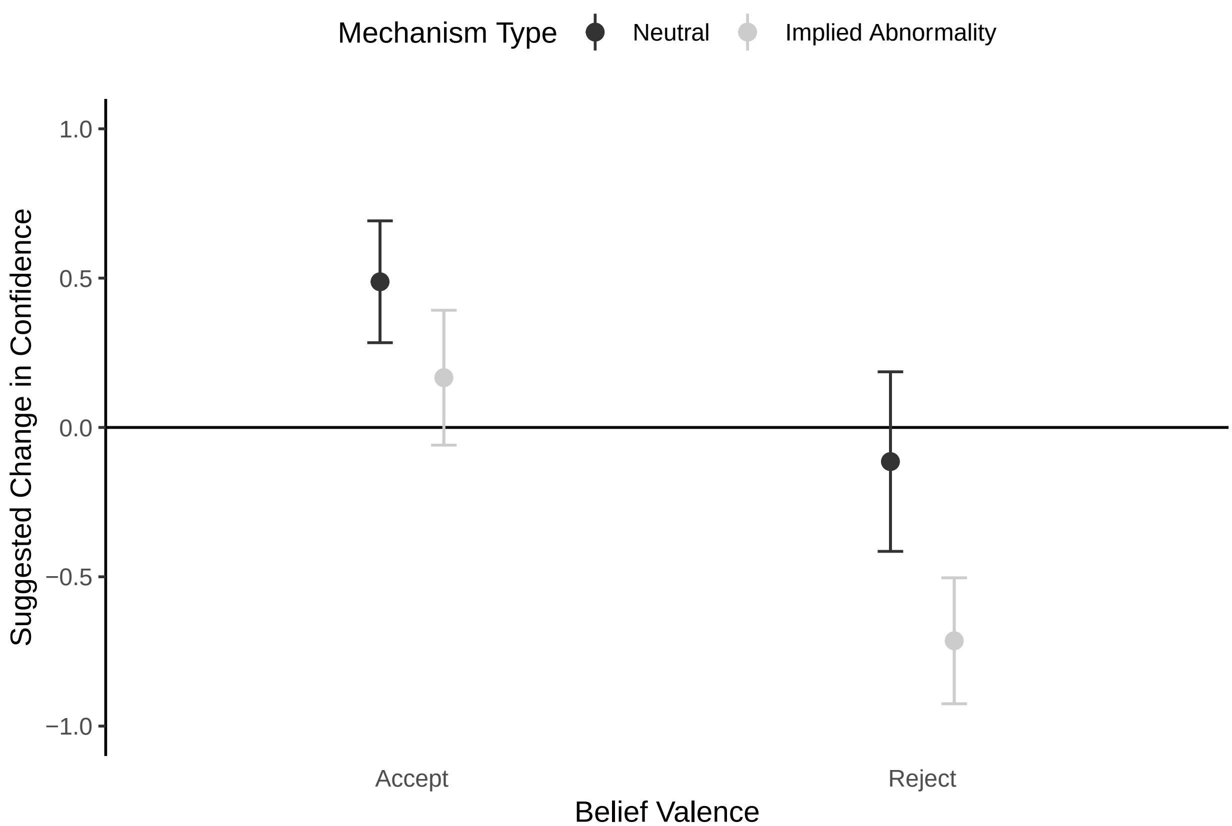
Direction of the effect is consistent across belief domains as well.

```
sup_included %>%
  group_by(condition, domain) %>%
  summarise(mean(michael_should), mean(michael_would))
```

condition	domain	mean(michael_should)	mean(michael_would)
neutral	scientific	-0.2333	0.0000
neutral	religious	0.6087	0.6522
neutral	moral	0.3913	0.5652
implied_abnormality	scientific	-0.5000	-0.4643
implied_abnormality	religious	-0.0345	-0.4483
implied_abnormality	moral	-0.2963	-0.1481

Plot for Paper

```
sup_included %>%
  paper_plot(
    y = "michael_should",
    x = "valence", x_lab = "Belief Valence",
    color = "condition", color_lab = "Mechanism Type",
    ylim = c(-1, 1), dodge = 0.25
  ) +
  # Remove underscore from "implied_abnormality" condition name.
  scale_color_grey(
    name = "Mechanism Type",
    labels = c(
      neutral = "Neutral",
      implied_abnormality = "Implied Abnormality"
    )
  )
```



ANOVAs

Marginal evidence for a main effect of mechanism type (for normative/"should" judgments, significant evidence for such an effect for predictive/"would" judgments). The main effect of valence (with more reinforcement advised for all positive beliefs) is significant.

```
sup_should_lm <-
  sup_included %$%
  lm(michael_should ~ condition * discipline * prevalence * valence)
ANOVA(sup_should_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	7.2027	1	3.1996	0.0758	0.0218
discipline	1.5013	1	0.6669	0.4155	0.0042
prevalence	4.6254	1	2.0547	0.1539	0.0135
valence	22.5283	1	10.0077	0.0019	0.0660
condition:discipline	3.3772	1	1.5002	0.2226	0.0106
condition:prevalence	0.5836	1	0.2593	0.6114	0.0018
discipline:prevalence	0.8029	1	0.3567	0.5513	0.0023
condition:valence	0.5620	1	0.2497	0.6181	0.0016
discipline:valence	0.3814	1	0.1694	0.6812	0.0013
prevalence:valence	3.5559	1	1.5796	0.2108	0.0115
condition:discipline:prevalence	0.2590	1	0.1151	0.7350	0.0007
condition:discipline:valence	0.0974	1	0.0433	0.8355	0.0003
condition:prevalence:valence	0.2228	1	0.0990	0.7535	0.0007
discipline:prevalence:valence	0.1679	1	0.0746	0.7852	0.0006
condition:discipline:prevalence:valence	0.6439	1	0.2860	0.5936	0.0020
Residuals	324.1561	144			

```
sup_included %$% t.test(michael_should ~ condition, alternative = "greater")
```

```
##
##  Welch Two Sample t-test
##
## data:  michael_should by condition
## t = 2, df = 150, p-value = 0.02
## alternative hypothesis: true difference in means is greater than 0
## 95 percent confidence interval:
##  0.08595     Inf
## sample estimates:
##             mean in group neutral mean in group implied_abnormality
##                            0.2105                             -0.2738
```

The same effects are seen for predictive judgments, except that there is significant–rather than marginal–evidence for an effect of mechanism type.

```
sup_would_lm <-
  sup_included %$%
  lm(michael_would ~ condition * discipline * prevalence * valence)
ANOVA(sup_would_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	18.4999	1	7.7471	0.0061	0.0532
discipline	0.0819	1	0.0343	0.8533	0.0003

term	sumsq	df	statistic	p.value	Partial eta^2
prevalence	4.1576	1	1.7411	0.1891	0.0130
valence	18.4692	1	7.7343	0.0061	0.0509
condition:discipline	3.9689	1	1.6620	0.1994	0.0122
condition:prevalence	0.0011	1	0.0005	0.9827	0.0000
discipline:prevalence	0.3681	1	0.1541	0.6952	0.0012
condition:valence	0.1041	1	0.0436	0.8349	0.0002
discipline:valence	0.0835	1	0.0350	0.8519	0.0005
prevalence:valence	0.0014	1	0.0006	0.9809	0.0000
condition:discipline:prevalence	0.1830	1	0.0766	0.7823	0.0008
condition:discipline:valence	0.9487	1	0.3973	0.5295	0.0027
condition:prevalence:valence	1.0291	1	0.4310	0.5126	0.0029
discipline:prevalence:valence	3.4350	1	1.4385	0.2324	0.0111
condition:discipline:prevalence:valence	3.6485	1	1.5279	0.2184	0.0105
Residuals	343.8664	144			

Check assumptions for ANOVAs

```
sup_included %$%
  leveneTest(michael_would ~ condition * discipline * prevalence * valence)
```

	Df	F value	Pr(>F)
group	15	0.7985	0.6778
	144		

```
sup_included %$%
  leveneTest(michael_should ~ condition * discipline * prevalence * valence)
```

	Df	F value	Pr(>F)
group	15	0.5538	0.9051
	144		

```
residuals(sup_should_lm) %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
## W = 1, p-value = 0.9
```

```
residuals(sup_would_lm) %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
## W = 0.99, p-value = 0.3
```

Belief Reinforcement/Undermining

Looking at things separately for "accept" and "reject" conditions because of the main effect of valence. In the accept condition, neutral explanations support belief reinforcement, but explanations that imply an abnormal mechanism do not. In the reject condition, everything shifts downward, with neutral explanations near the scale midpoint and implied abnormality explanations taken to support belief undermining.

```
sup_included %>%
  group_by(condition, valence) %>%
  summarise(
    michael_should = mean(michael_should),
    michael_would = mean(michael_would)
  )
```

condition	valence	michael_should	michael_would
neutral	accept	0.4878	0.6585
neutral	reject	-0.1143	0.0286
implied_abnormality	accept	0.1667	0.0000
implied_abnormality	reject	-0.7143	-0.7143

Tests against the scale midpoint confirm significant reinforcement for {accept, neutral} and undermining for {reject, implied abnormality}, with the other two conditions not significantly different from the scale midpoint.

```
sup_included %>%
  group_by(condition, valence) %>%
  do(tidy(t.test(.$michael_should))) %>%
  select(-c(method, alternative))
```

condition	valence	estimate	statistic	p.value	parameter	conf.low	conf.high
neutral	accept	0.4878	2.3913	0.0216	40	0.0755	0.9001
neutral	reject	-0.1143	-0.3802	0.7062	34	-0.7252	0.4966
implied_abnormality	accept	0.1667	0.7380	0.4647	41	-0.2894	0.6228
implied_abnormality	reject	-0.7143	-3.3873	0.0016	41	-1.1401	-0.2884

```
sup_included %>%
  group_by(condition, valence) %>%
  do(tidy(t.test(.$michael_would))) %>%
  select(-c(method, alternative))
```

condition	valence	estimate	statistic	p.value	parameter	conf.low	conf.high
neutral	accept	0.6585	2.9592	0.0052	40	0.2088	1.1083
neutral	reject	0.0286	0.1011	0.9200	34	-0.5455	0.6027
implied_abnormality	accept	0.0000	0.0000	1.0000	41	-0.4963	0.4963
implied_abnormality	reject	-0.7143	-3.2619	0.0022	41	-1.1565	-0.2721

First-Person Judgments

Exclude participants who were neutral about explained belief in analyzing "you" data. Use the remaining 141 participants.

```r
sup_with_belief <-
  sup_included %>%
  filter(own_belief != 0) %>%
  mutate(
    own_opposing = agrees_with_michael %>%
      parse_factor(levels = c("TRUE", "FALSE")) %>%
      fct_recode(own = "TRUE", opposing = "FALSE")
  ) %>%
  droplevels()
nrow(sup_with_belief)
```

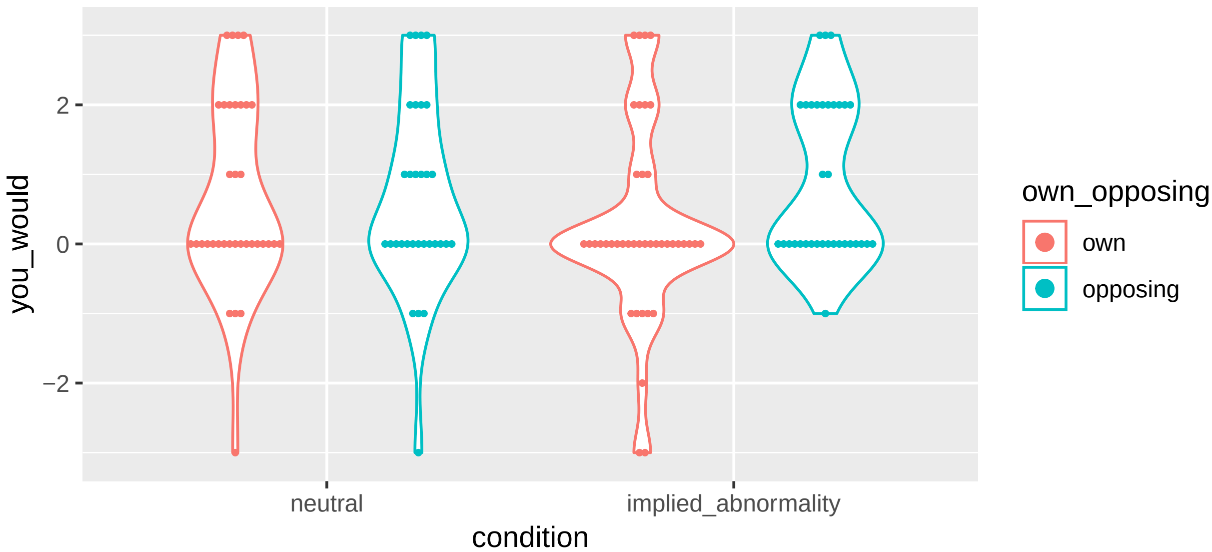
```
## [1] 141
```

```r
sup_with_belief %>% count(condition, valence, discipline, own_opposing)
```

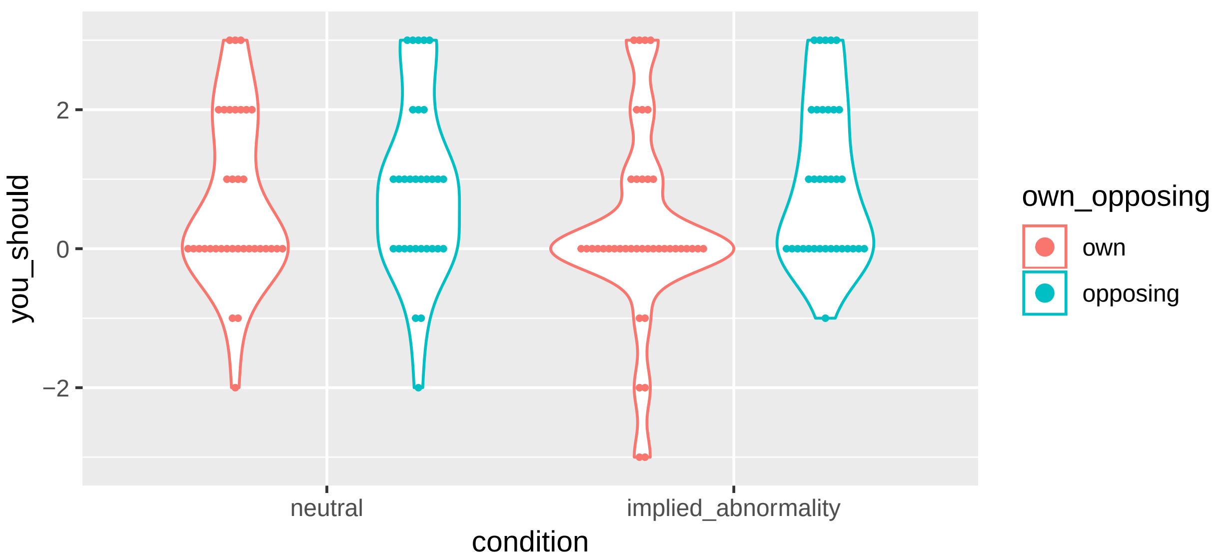
condition	valence	discipline	own_opposing	n
neutral	accept	neuroscience	own	13
neutral	accept	neuroscience	opposing	5
neutral	accept	cognitive	own	13
neutral	accept	cognitive	opposing	4
neutral	reject	neuroscience	own	6
neutral	reject	neuroscience	opposing	12
neutral	reject	cognitive	own	3
neutral	reject	cognitive	opposing	10
implied_abnormality	accept	neuroscience	own	15
implied_abnormality	accept	neuroscience	opposing	3
implied_abnormality	accept	cognitive	own	10
implied_abnormality	accept	cognitive	opposing	8
implied_abnormality	reject	neuroscience	own	6
implied_abnormality	reject	neuroscience	opposing	13
implied_abnormality	reject	cognitive	own	10
implied_abnormality	reject	cognitive	opposing	10

First-person distribution and means

```r
sup_with_belief %>%
  vio_dot("you_would", "condition", "own_opposing")
```




```
sup_with_belief %>%
  vio_dot("you_should", "condition", "own_opposing")
```



Explanations that appeal to neutral mechanisms are received about equally by all participants. But, participants whose belief is opposite the explained belief think that their own belief is *more* reinforced by explanations for the target belief that imply an abnormally functioning mechanism, whereas participants who share the target belief think that their belief is *less* reinforced (more undermined) if the explanation for it implies an abnormal mechanism. (This is consistent with the first-person results from Experiment 3.)

```
sup_with_belief %$%
  tapply(you_would, list(condition, own_opposing), mean) %>% kable()
```

	own	opposing
neutral	0.6571	0.6452
implied_abnormality	0.2439	0.8824

```
sup_with_belief %$%
  tapply(you_should, list(condition, own_opposing), mean) %>% kable()
```

	own	opposing
neutral	0.6571	0.8710
implied_abnormality	0.2683	0.9706

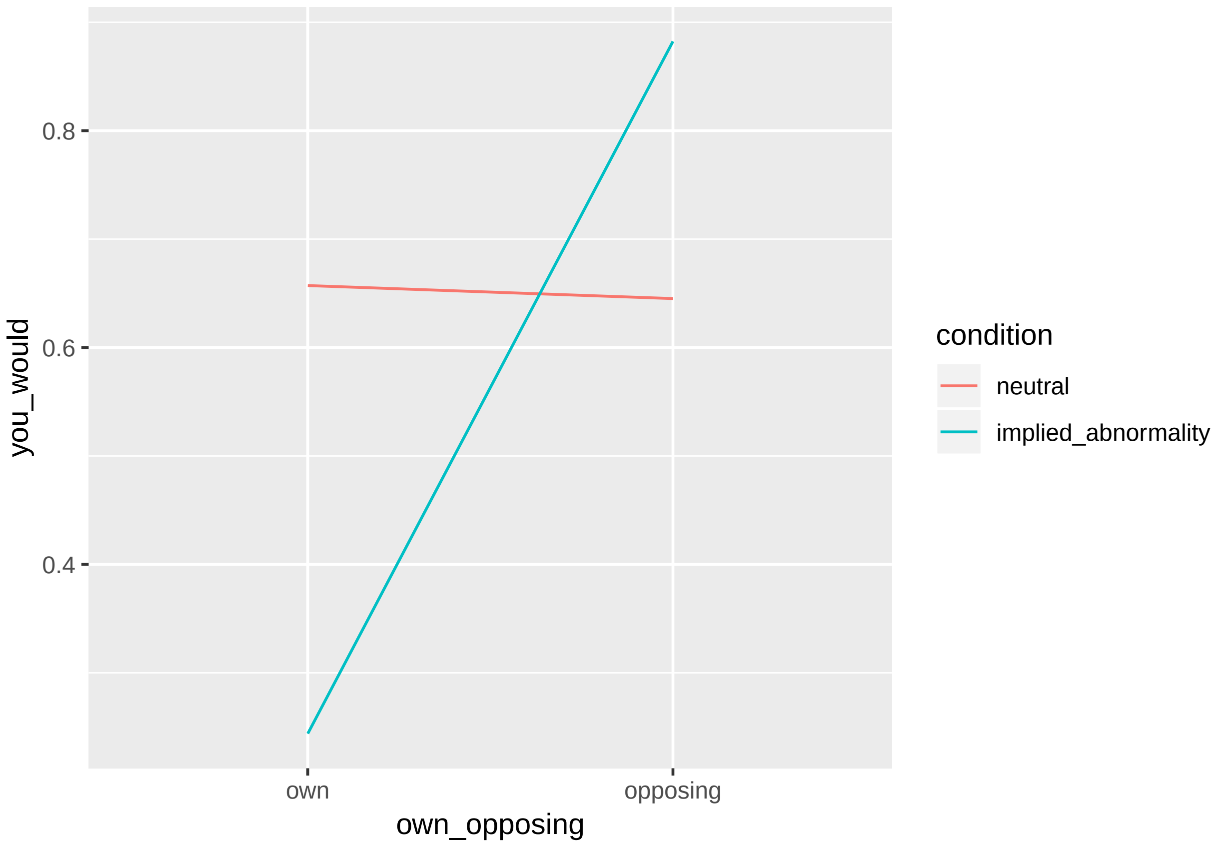
First-person ANOVAs

Marginal evidence of the interaction described above. Also a significant interaction between explanation discipline and participants' belief, which appears to reflect that people also find neuroscientific explanations for their own beliefs less reinforcing (regardless of implied abnormality).

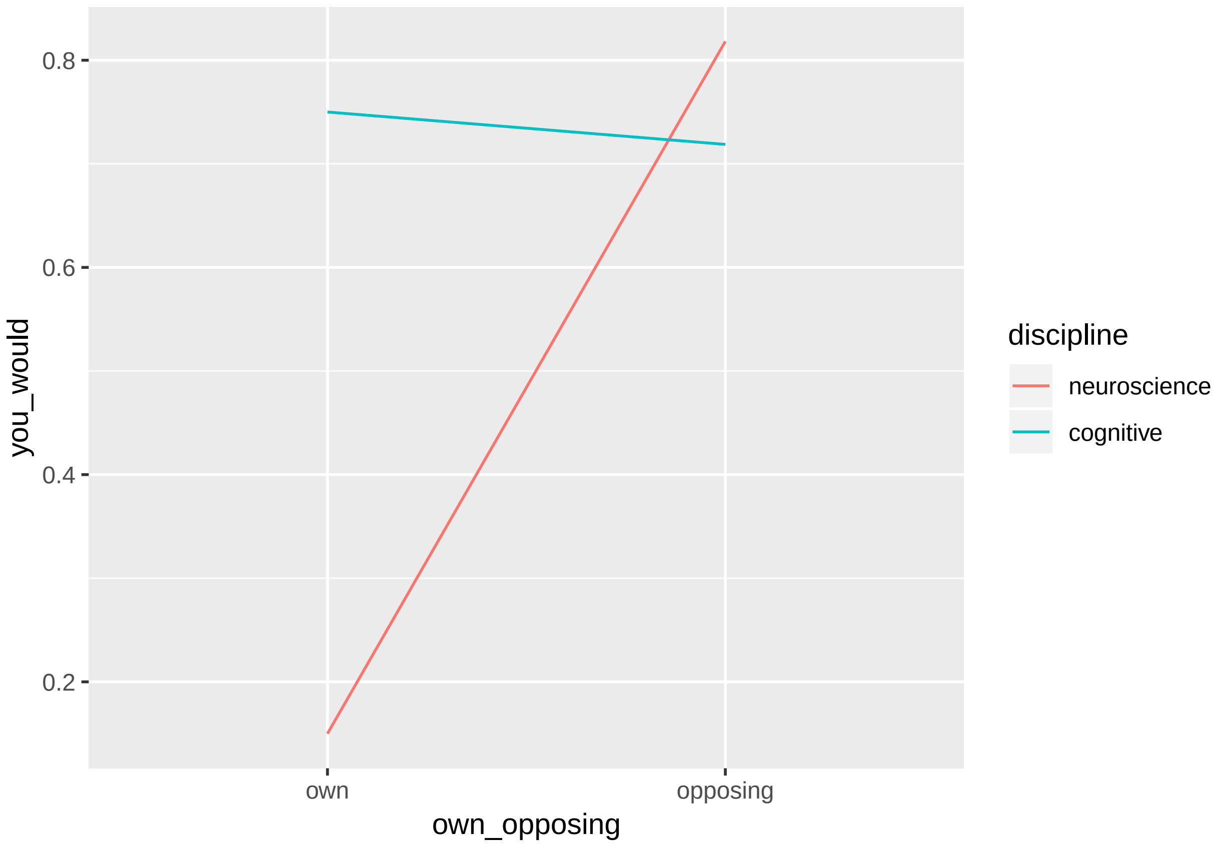
```
sup_you_would_lm <-
  sup_with_belief %$%
  lm(you_would ~ condition * discipline * own_opposing * valence)
ANOVA(sup_you_would_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	0.1234	1	0.0691	0.7932	0.0020
discipline	2.0010	1	1.1200	0.2920	0.0135
own_opposing	1.8617	1	1.0420	0.3093	0.0080
valence	0.3522	1	0.1971	0.6578	0.0005
condition:discipline	1.0530	1	0.5894	0.4441	0.0009
condition:own_opposing	6.3782	1	3.5700	0.0611	0.0257
discipline:own_opposing	8.2493	1	4.6173	0.0336	0.0369
condition:valence	1.7672	1	0.9891	0.3219	0.0062
discipline:valence	4.7402	1	2.6531	0.1059	0.0170
own_opposing:valence	0.1847	1	0.1034	0.7484	0.0020
condition:discipline:own_opposing	2.5734	1	1.4404	0.2323	0.0107
condition:discipline:valence	0.7309	1	0.4091	0.5236	0.0040
condition:own_opposing:valence	0.0152	1	0.0085	0.9267	0.0001
discipline:own_opposing:valence	0.0150	1	0.0084	0.9272	0.0002
condition:discipline:own_opposing:valence	1.4398	1	0.8059	0.3711	0.0064
Residuals	223.3276	125			

```
sup_with_belief %>%
  ggplot(
    aes(x = own_opposing, y = you_would,
        group = condition, color = condition)
  ) +
  geom_line(stat = "summary", fun.y = "mean")
```




```
sup_with_belief %>%
  ggplot(
    aes(x = own_opposing, y = you_would,
        group = discipline, color = discipline)
  ) +
  geom_line(stat = "summary", fun.y = "mean")
```



The same effects are seen for normative judgments.

```
sup_you_should_lm <-
  sup_with_belief %$%
  lm(you_should ~ condition * discipline * own_opposing * valence)
ANOVA(sup_you_should_lm)
```

term	sumsq	df	statistic	p.value	Partial eta^2
condition	0.2400	1	0.1509	0.6983	0.0042
discipline	1.3124	1	0.8253	0.3654	0.0101
own_opposing	3.3631	1	2.1150	0.1484	0.0186
valence	1.1298	1	0.7105	0.4009	0.0034
condition:discipline	0.4859	1	0.3056	0.5814	0.0000
condition:own_opposing	5.0920	1	3.2022	0.0760	0.0218
discipline:own_opposing	13.4863	1	8.4810	0.0043	0.0628
condition:valence	2.5547	1	1.6065	0.2073	0.0100
discipline:valence	1.8961	1	1.1924	0.2770	0.0073
own_opposing:valence	1.0599	1	0.6665	0.4158	0.0088
condition:discipline:own_opposing	1.0089	1	0.6345	0.4272	0.0044
condition:discipline:valence	0.0651	1	0.0410	0.8400	0.0007
condition:own_opposing:valence	0.0686	1	0.0431	0.8358	0.0004
discipline:own_opposing:valence	0.0215	1	0.0135	0.9076	0.0000
condition:discipline:own_opposing:valence	2.3379	1	1.4702	0.2276	0.0116
Residuals	198.7712	125			

Check assumptions for first-person ANOVAs

Mean looks to be a good measure, but effects are weaker with trimmed means.

```
sup_with_belief %$%
  leveneTest(you_would ~ condition * discipline * own_opposing * valence)
```

	Df	F value	Pr(>F)
group	15	0.1831	0.9997
	125		

```
sup_with_belief %$%
  leveneTest(you_should ~ condition * discipline * own_opposing * valence)
```

	Df	F value	Pr(>F)
group	15	0.457	0.9572
	125		

```
residuals(sup_you_would_lm) %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
## W = 0.97, p-value = 0.003
```

```
residuals(sup_you_should_lm) %>% shapiro.test()
```

```
##
##  Shapiro-Wilk normality test
##
## data:  .
## W = 0.97, p-value = 0.01
```

```
sup_with_belief %$%
  t3way(you_would ~ condition * discipline * own_opposing)
```

```
## Call:
## t3way(formula = you_would ~ condition * discipline * own_opposing)
##
##                                    value p.value
## condition                         0.2944   0.590
## discipline                        1.0868   0.310
## own_opposing                      1.3391   0.252
## condition:discipline              0.5170   0.475
## condition:own_opposing            1.6102   0.209
## discipline:own_opposing           2.4892   0.120
## condition:discipline:own_opposing 0.7198   0.400
```

```
sup_with_belief %$%
  t3way(you_would ~ condition * discipline * own_opposing)
```

```
## Call:
## t3way(formula = you_would ~ condition * discipline * own_opposing)
##
##                                    value p.value
```

```
## condition                          0.2944   0.590
## discipline                         1.0868   0.310
## own_opposing                       1.3391   0.252
## condition:discipline               0.5170   0.475
## condition:own_opposing             1.6102   0.209
## discipline:own_opposing            2.4892   0.120
## condition:discipline:own_opposing 0.7198   0.400
```