

Online Resource 3

- Article Title: Effect of the discussion frame on finding a compromise: A group decision experiment about removed soil management in Japan
- Journal: Environmental management
- Authors name: Yume Souma, Yukihide Shibata, Mie Tsujimoto, Qinglin Cui, Takashi Nakazawa, Tomoyuki Tatsumi, Yoshiko Arima, Susumu Ohnuma
- Correspondence author: Yume Souma (souma.yume.l6[at]elms.hokudai.ac.jp)
- Description: Analysis code for opinion changes and decision evaluation.

Opinion Changes

Load packages

```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v dplyr      1.1.4      v readr      2.1.5
## v forcats    1.0.0      v stringr   1.5.1
## v ggplot2    3.5.1      v tibble    3.2.1
## v lubridate  1.9.3      v tidyr     1.3.1
## v purrr      1.0.2
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(dplyr)
library(readxl)
library(rstanarm)
```

```
## Loading required package: Rcpp
## This is rstanarm version 2.32.1
## - See https://mc-stan.org/rstanarm/articles/priors for changes to default priors!
## - Default priors may change, so it's safest to specify priors, even if equivalent to the defaults.
## - For execution on a local, multicore CPU with excess RAM we recommend calling
##   options(mc.cores = parallel::detectCores())
```

```
library(openxlsx)
```

pre-questionnaire

- ```
before.dat <- readxl::read_excel("Pre_questionnaire_res.xlsx")

q1 <- c(paste0("q1_", 1:9))
q2 <- c(paste0("q2_", 1:4))
q3 <- c(paste0("q3_", 1:7))
q4 <- c(paste0("q4_", 1:2))
q5 <- c(paste0("position"))

colnames(before.dat) <- c("time", "id_b", "grade", "measure", "sex", "region",
 q1, q2, q3, q4, q5)

condition <- factor(c(rep("K",4), rep("H",4), rep("K",4), rep("H",4), rep("K",4),
 rep("H",4), rep("H",4), rep("K",4), rep("K",4), rep("K",4),
 rep("H",4), rep("K",4), rep("H",4), rep("H",4), rep("K",4),
 rep("K",4), rep("H",4), rep("K",4), rep("H",4), rep("H",4),
 rep("H",4), rep("K",4), rep("K",4), rep("H",4), rep("K",4),
 rep("H",4), rep("K",4), rep("H",4), rep("K",4), rep("H",4),
 rep("H",4), rep("K",4))),
 levels = c("K", "H"))

before.dat$condition <- condition
before.dat$position <- ifelse(before.dat$position == " 赞成", 1, 0)
before.dat$position <- as.factor(before.dat$position)
before.dat$group <- as.factor(rep(c(1:32), each = 4))
```

- The dataset is located in the working directory

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```

 rep("H",4), rep("K",4)),
 levels = c("K", "H"))
after.dat$condition <- condition
after.dat$group <- as.factor(rep(c(1:32), each = 4))
position.df <- before.dat[,c(2,29)]
after.dat <- full_join(after.dat, position.df, by = c("id_a" = "id_b"))

```

```

----- pre-questionnaire summary -----
before.summary.df <- before.dat %>%
 select(c(id_b, q1_1:q1_9, q2_1:q2_4, position, condition, group)) %>%
 gather(key = "question",
 value = "score",
 q1_1:q2_4,
 factor_key = TRUE) %>%
 group_by(condition, group, question) %>%
 summarise(mean = mean(score),
 sd = sd(score))

```

## `summarise()` has grouped output by 'condition', 'group'. You can override  
## using the `.groups` argument.

```

----- post-questionnaire summary -----
after.summary.df <- after.dat %>%
 select(c(id_a, q2_1:q2_9, q3_1:q3_4, position, condition, group)) %>%
 gather(key = "question",
 value = "score",
 q2_1:q3_4,
 factor_key = TRUE) %>%
 group_by(condition, group, question) %>%
 summarise(mean = mean(score),
 sd = sd(score))

```

## `summarise()` has grouped output by 'condition', 'group'. You can override  
## using the `.groups` argument.

## Analysis for opinion changes

```

----- mean change regression -----
before_mean_df <- list()
after_mean_df <- list()
mean_df <- list()

q1 <- paste0(c("q1_"), 1:9)
q2 <- paste0(c("q2_"), 1:9)

result <- list()
output <- list()

for(i in 1:9){
 before_mean_df[[i]] <- before.summary.df %>%

```

```

 filter(question == q1[i]) %>%
 select(mean, condition, group)
before_mean_df[[i]]$time <- c(0)

after_mean_df[[i]] <- after.summary.df %>%
 filter(question == q2[i]) %>%
 select(mean, condition, group)
after_mean_df[[i]]$time <- c(1)

mean_df[[i]] <- rbind(before_mean_df[[i]], after_mean_df[[i]])
mean_df[[i]]$time <- factor(mean_df[[i]]$time, levels = c(0,1))

result[[i]] <- stan_lmer(mean ~ condition * time + (1|group),
 data = mean_df[[i]],
 refresh = 0)
output[[i]] <- round(result[[i]][["stan_summary"]][1:4,],2)
}

----- sd change regression -----
before_sd_df <- list()
after_sd_df <- list()
sd_df <- list()

q1 <- paste0(c("q1_"), 1:9)
q2 <- paste0(c("q2_"), 1:9)

result <- list()
output <- list()

for(i in 1:9){
 before_sd_df[[i]] <- before.summary.df %>%
 filter(question == q1[i]) %>%
 select(sd, condition, group)
 before_sd_df[[i]]$time <- c(0)

 after_sd_df[[i]] <- after.summary.df %>%
 filter(question == q2[i]) %>%
 select(sd, condition, group)
 after_sd_df[[i]]$time <- c(1)

 sd_df[[i]] <- rbind(before_sd_df[[i]], after_sd_df[[i]])
 sd_df[[i]]$time <- factor(sd_df[[i]]$time, levels = c(0,1))

 result[[i]] <- stan_lmer(sd ~ condition * time + (1|group),
 data = sd_df[[i]],
 refresh = 0)

 output[[i]] <- round(result[[i]][["stan_summary"]][1:4,],2)
}

```

# Decision Evaluation

## Load packages

```
library(tidyverse)
library(dplyr)
library(readxl)
library(rstanarm)
library(openxlsx)
```

## Load data

### pre-questionnaire

- The dataset is located in the working directory

```
before.dat <- readxl::read_excel("Pre_questionnaire_res.xlsx")

q1 <- c(paste0("q1_", 1:9))
q2 <- c(paste0("q2_", 1:4))
q3 <- c(paste0("q3_", 1:7))
q4 <- c(paste0("q4_", 1:2))
q5 <- c(paste0("position"))
colnames(before.dat) <- c("time", "id_b", "grade", "measure", "sex", "region",
 q1, q2, q3, q4, q5)

condition <- factor(c(rep("K",4), rep("H",4), rep("K",4), rep("H",4), rep("K",4),
 rep("H",4), rep("H",4), rep("K",4), rep("K",4), rep("K",4),
 rep("H",4), rep("K",4), rep("H",4), rep("H",4), rep("K",4),
 rep("K",4), rep("H",4), rep("K",4), rep("H",4), rep("H",4),
 rep("H",4), rep("K",4), rep("K",4), rep("H",4), rep("K",4),
 rep("H",4), rep("K",4), rep("H",4), rep("K",4), rep("H",4),
 rep("H",4), rep("K",4)),
 levels = c("K", "H"))
before.dat$condition <- condition
before.dat$position <- ifelse(before.dat$position == " 賛成", 1, 0)
before.dat$position <- as.factor(before.dat$position)
before.dat$group <- as.factor(rep(c(1:32), each = 4))
```

### post-questionnaire

```
after.dat <- readxl::read_excel("Post_questionnaire_res.xlsx")

q1 <- c(paste0("q1_", 1:2))
q2 <- c(paste0("q2_", 1:9))
q3 <- c(paste0("q3_", 1:4))
q4 <- c(paste0("q4_", 1:6))
q5 <- c(paste0("q5_", 1:6))
q6 <- c(paste0("q6_", 1:6))
```

```

q7 <- c(paste0("q7_", 1:14))
q8 <- c(paste0("q8_", 1:14))
q9 <- c(paste0("q9_", 1:8))
colnames(after.dat) <- c("time", "id_a", q1, q2, q3, q4, q5, q6, q7, q8, q9)

condition <- factor(c(rep("K",4), rep("H",4), rep("K",4), rep("H",4), rep("K",4),
 rep("H",4), rep("H",4), rep("K",4), rep("K",4), rep("K",4),
 rep("H",4), rep("K",4), rep("H",4), rep("H",4), rep("K",4),
 rep("K",4), rep("H",4), rep("K",4), rep("H",4), rep("H",4),
 rep("H",4), rep("K",4), rep("K",4), rep("H",4), rep("K",4),
 rep("H",4), rep("K",4), rep("H",4), rep("K",4), rep("H",4),
 rep("H",4), rep("K",4)),
 levels = c("K", "H"))
after.dat$condition <- condition
after.dat$group <- as.factor(rep(c(1:32), each = 4))
position.df <- before.dat[,c(2,29)]
after.dat <- full_join(after.dat, position.df, by = c("id_a" = "id_b"))

```

## Analysis for decision evaluation

```

target_df <- data.frame(
 id = after.dat$id_a,
 decision_eva = apply(after.dat[,62:63], 1, mean),
 condition = after.dat$condition,
 group = after.dat$group
)

reg_result <- stan_lmer(decision_eva ~ condition + (1|group), data = target_df, refresh = 0)
reg_output <- reg_result[["stan_summary"]][1:2,]

```