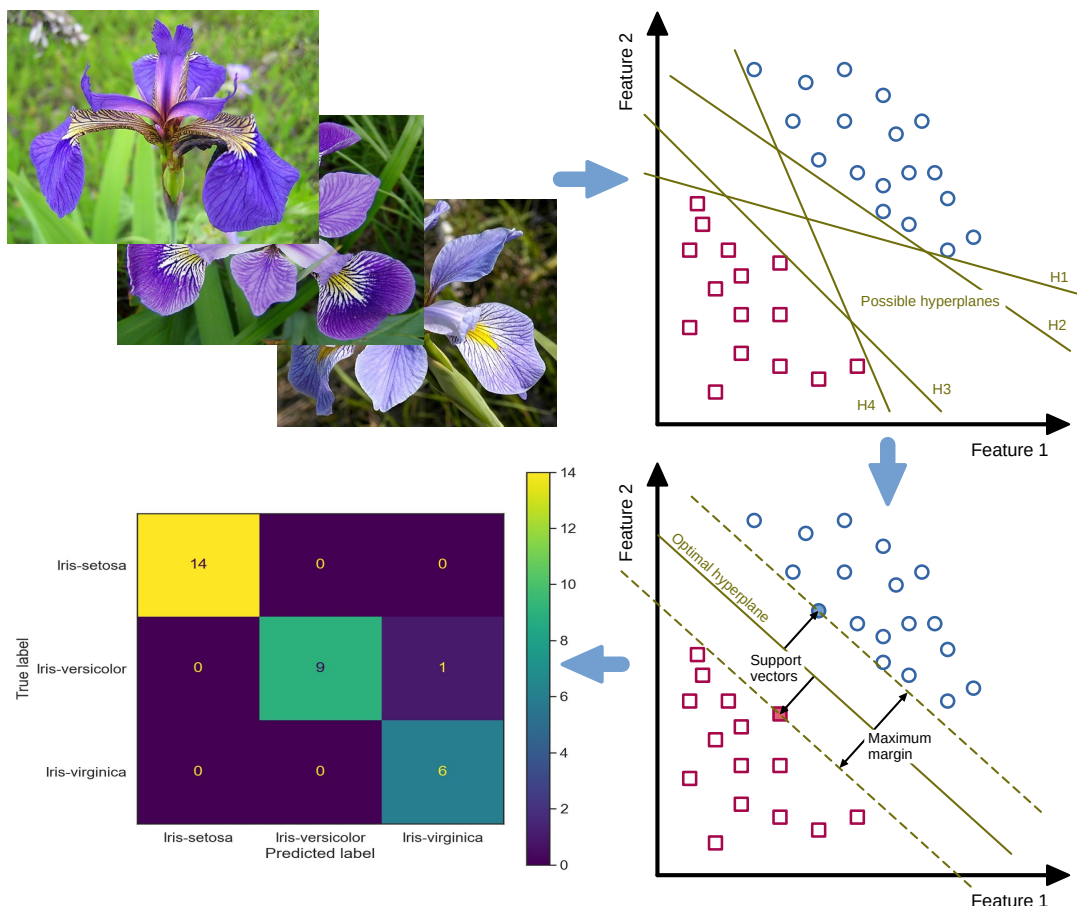


Application of the processed survey data in the analytical hierarchy process (AHP)

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November 29, 2022; version 0.1 (pre-release)



This is a placeholder for the abstract that needs to be added later.



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1 Introduction

Why we use a [Jupyter](#) notebook to to publish the R program examples:

Jupyter is a new **open source** alternative to the proprietary numerical software [Mathematica](#) from **Wolfram Research** that is well on the way to becoming a **standard for exchanging research results** (Somers 2018; Romer 2018).

Originally Jupyter was intended as an IDE for the programming languages **Julia** and **Python**. Besides that it is also possible to install other interpreter kernels, such as the [IRkernel](#) for R. This can be interesting if the IDE **RStudio Desktop** is not available on the target platform used. For example, it is very difficult to install RStudio on the ARM-based embedded computer **Raspberry Pi** due to many technical dependencies. In contrast, using the R kernel in JupyterLab on the Raspberry Pi works very well and performant.

2 Global settings and dependencies

2.1 Install missing packages if not present yet

Attention: For some R packages several dependencies have to be installed first with `apt install <package name>`.

Dependencies for magick:

- libcurl4-openssl-dev - libmagick++-dev

Dependencies for ahpsurvey:

- R package randomNames (it depends on R 4.0, refer to <https://cran.r-project.org/web/packages/randomNames/index.html>)

Drawback for **Raspbian buster**: the dependency randomNames is not available for R v3.5.2 as it depends on R (4.0). Upgrading R following instruction on <https://cran.rstudio.com/bin/linux/debian/#debian-buster-stable> do not work so far ...

```
[3]: list.of.packages <- c("data.table", "ggplot2", "tidyr", "dplyr", "magick",
  ↪ "magrittr", "ahpsurvey")
new.packages <- list.of.packages[!(list.of.packages %in% installed.
  ↪ packages()[, "Package"])]
if(length(new.packages)) {
  install.packages(new.packages)
} else {
  print("All required packages are installed.")
}
```

```
[1] "All required packages are installed."
```

2.2 Load package data.table

The package data.table is used for reading and manipulating tables (data.table inherits from data.frame). Install and load it:

```
[4]: library(data.table)
```

2.3 Load ggplot2

The package ggplot2 is used for plotting diagrams. Install and load it:

```
[5]: library(ggplot2)
```

2.4 Load tidyr for *gather()* function

```
[6]: library(tidyr)
```

2.5 Load dplyr for data manipulation

Load necessary library dplyr for data manipulation with functions like `select()`, `mutate()` and `left_join()`.

```
[7]: library(dplyr)
```

Attache Paket: 'dplyr'

Die folgenden Objekte sind maskiert von 'package:data.table':

between, first, last

Die folgenden Objekte sind maskiert von 'package:stats':

filter, lag

Die folgenden Objekte sind maskiert von 'package:base':

intersect, setdiff, setequal, union

2.6 Load magick for image manipulation

The library magick is the R API to *ImageMagick*.

```
[8]: library(magick)
```

Linking to ImageMagick 6.9.10.23

Enabled features: fontconfig, freetype, fftw, lcms, pango, webp, x11

Disabled features: cairo, ghostscript, heic, raw, rsvg

Using 16 threads

2.7 Use pipes for better coding

HINT: The pipe functionality is already available by loading the library `tidyr` - so you don't have to load it explicitly.

What pipes like `%>%` are and how to use them is described here: <https://statistik-dresden.de/archives/15679>.

Before using pipes in R, you have to install and load the package `magrittr`:

```
[9]: library(magrittr)
```

Attache Paket: 'magrittr'

Das folgende Objekt ist maskiert 'package:tidyr':

extract

2.8 Load package ahpsurvey

The package `ahpsurvey` contains all the necessary mathematical and statistical methods to run the analytical hierarchy process (AHP).

```
[10]: library(ahpsurvey)
```

3 Functions for processing AHP

3.1 Set globally used input and output folders

```
[11]: str_input_path = "./output_data_manipulated"
      str_output_path = "./output_data_AHP"
```

3.2 Function for reading in processed survey data from CSV files to data frames

Define a function for reading in a CSV file to a data frame.

```
[12]: func_readCSVdata_to_dataframe <- function(str_CSVfilename) {

      df_CSVdata <- fread(
        file = str_CSVfilename, encoding = "UTF-8",
        header = TRUE, sep = "\t", quote = "\""
      )

      return(df_CSVdata)
    }
```

3.3 Function for generating a data frame with *eigentrue values* (weights)

```
[13]: func_genEigentrue_to_dataframe <- function(df_surveyData, vec_attributes) {
      list_mat_judgement <- df_surveyData %>%
        ahp.mat(vec_attributes, negconvert = TRUE)

      df_eigentrue <- ahp.indpref(list_mat_judgement, vec_attributes, method = "eigen")

      return(df_eigentrue)
    }
```

3.4 Function for generating an array with consistency ratios

```
[14]: func_genCR_to_arr <- function(df_surveyData, vec_attributes) {
      arr_cr <- df_surveyData %>%
        ahp.mat(vec_attributes, negconvert = TRUE) %>%
        ahp.cr(vec_attributes, ri=0.58)

      return(arr_cr)
    }
```

3.5 Function for generating a data frame with consistency ratios

```
[15]: func_genCR_to_dataframe <- function(df_surveyData, vec_attributes, arr_cr,
      consistency_thres=0.1, str_CRlabel) {
      df_cr <- df_surveyData %>%
        ahp.mat(vec_attributes, negconvert = TRUE) %>%
        ahp.cr(vec_attributes, ri=0.58) %>%
        data.frame() %>%
        mutate(rowid = 1:length(arr_cr), arr_cr.dum = as.factor(ifelse(arr_cr <=
      consistency_thres, 1, 0)))
```

```

# rename column with consistency ratios
colnames(df_cr)[1] <- str_CRlabel

return(df_cr)
}

```

3.6 Function for visualizing individual priorities and consistency ratios

```

[16]: func_visuPriosCRs <- function(df_surveyData, df_cr, arr_cr, consistency_thres=0.1,
  ↪vec_attributes, df_eigentrue, vec_labels, str_image_filename) {
  df_cr_sel <- df_cr %>%
    select(arr_cr.dum, rowid)

  plot <- df_surveyData %>%
    ahp.mat(atts = vec_attributes, negconvert = TRUE) %>%
    ahp.indpref(vec_attributes, method = "eigen") %>%
    mutate(rowid = 1:nrow(df_eigentrue)) %>%
    left_join(df_cr_sel, by = 'rowid') %>%
    gather(all_of(vec_attributes), key = "var", value = "pref") %>%
    ggplot(aes(x = var, y = pref)) +
    geom_violin(alpha = 0.6, width = 0.8, color = "transparent", fill = "gray") +
    geom_jitter(alpha = 0.6, height = 0, width = 0.1, aes(color = arr_cr.dum)) +
    geom_boxplot(alpha = 0, width = 0.3, color = "#808080") +
    scale_x_discrete("Attribute", label = vec_labels) +
    scale_y_continuous("Weight (dominant eigenvalue)",
      labels = scales::percent,
      breaks = c(seq(0,0.7,0.1))) +
    guides(color=guide_legend(title=NULL))+
    scale_color_discrete(breaks = c(0,1),
      labels = c(paste("CR >", consistency_thres),
        paste("CR <", consistency_thres))) +
    labs(NULL, caption = paste("n =", nrow(df_surveyData), ",", "Mean CR =",
      round(mean(arr_cr),3))) +
    theme_minimal() +
    ggtitle("Violins displaying priorities and consistency ratios")

  # save generated ggplot graphic to a PNG image file
  ggsave(filename = str_image_filename, width = 7, height = 7, dpi = 300)

  print(plot)
}

```

3.7 Function for generating geometric mean values from individual judgement matrices

```

[17]: func_aggpref_gmean <- function(df_surveyData, vec_attributes, arr_cr,
  ↪consistency_thres=0.1, str_CRlabel) {
  df_cr <- df_surveyData %>%
    ahp.mat(vec_attributes, negconvert = TRUE) %>%
    ahp.cr(vec_attributes, ri=0.58) %>%
    data.frame() %>%
    mutate(rowid = 1:length(arr_cr), arr_cr.dum = as.factor(ifelse(arr_cr <=
  ↪consistency_thres, 1, 0)))

  # rename column with consistency ratios

```

```

colnames(df_cr)[1] <- str_CRlabel

# combine data frame 'df_cr' with raw survey data ('df_surveyData')
df_cr_wRaw <- cbind(df_cr, df_surveyData)

# remove rows, where 'arr_cr.dum' == 0 (inconsistent data)
df_cr_wRaw_cons <- df_cr_wRaw[df_cr_wRaw$arr_cr.dum != 0, ]

# get individual judgement matrices from last 3 columns
list_mat_judgement <- df_cr_wRaw_cons[tail(names(df_cr_wRaw_cons), 3)] %>%
  ahp.mat(vec_atts, negconvert = TRUE)

# get geometric mean values from judgement matrices
list_gmean_l <- ahp.aggpref(list_mat_judgement, vec_atts, method = "eigen",
  aggmethod = "geometric")

return(list_gmean_l)
}

```

3.8 Function for normalizing the geometric mean values

```

[18]: func_norm_gmean <- function(list_gmeans) {
  # normalization so that the sum of the geometric mean values is 1 (corresponds to
  # 100%)
  df_gmean_l <- data.frame(list_gmeans)
  # rename column with geometric mean values (raw)
  colnames(df_gmean_l)[1] <- "gmean.raw"

  gmean_sum <- 0
  for ( val in list_gmeans ) {
    gmean_sum <- gmean_sum + val
  }
  df_gmean_l["Sum", 1] <- gmean_sum

  for (idx in 1:length(list_gmeans)) {
    gmean_norm <- list_gmeans[[idx]] / gmean_sum
    df_gmean_l[idx, "gmean.norm"] <- gmean_norm
  }

  gmean_sum_norm <- 0
  # iterate over all rows except the last, because this is the sum itself
  for ( row in 1:(nrow(df_gmean_l)-1) ) {
    gmean_sum_norm <- gmean_sum_norm + df_gmean_l[row, 2]
  }
  df_gmean_l["Sum", 2] <- gmean_sum_norm

  return(df_gmean_l)
}

```

4 Create data frames (tables) handling the file names of processed survey data

4.1 File table for all participants

```
[19]: df_csvInputFiles_all <- data.table(
  file_idx = 1:4,
  keys = c("env", "soc", "eco", "crit"),
  filenames = c("rdata_all_env_AHP_edible_Cities_2022-03-18_09-53.csv",
    "rdata_all_soc_AHP_edible_Cities_2022-03-18_09-53.csv",
    "rdata_all_eco_AHP_edible_Cities_2022-03-18_09-53.csv",
    "rdata_all_crit_AHP_edible_Cities_2022-03-18_09-53.csv"),
  descriptions = c("environmental sub-criteria",
    "social sub-criteria",
    "economic sub-criteria",
    "criteria (main criteria)")
)
```

4.2 File table for city administrations

```
[20]: df_csvInputFiles_CA <- data.table(
  file_idx = 1:4,
  keys = c("env", "soc", "eco", "crit"),
  filenames = c("rdata_CA_env_AHP_edible_Cities_2022-03-18_10-28.csv",
    "rdata_CA_soc_AHP_edible_Cities_2022-03-18_10-28.csv",
    "rdata_CA_eco_AHP_edible_Cities_2022-03-18_10-28.csv",
    "rdata_CA_crit_AHP_edible_Cities_2022-03-18_10-28.csv"),
  descriptions = c("environmental sub-criteria",
    "social sub-criteria",
    "economic sub-criteria",
    "criteria (main criteria)")
)
```

4.3 File table for non-governmental organizations

```
[21]: df_csvInputFiles_NGO <- data.table(
  file_idx = 1:4,
  keys = c("env", "soc", "eco", "crit"),
  filenames = c("rdata_NGO_env_AHP_edible_Cities_2022-03-18_10-40.csv",
    "rdata_NGO_soc_AHP_edible_Cities_2022-03-18_10-40.csv",
    "rdata_NGO_eco_AHP_edible_Cities_2022-03-18_10-40.csv",
    "rdata_NGO_crit_AHP_edible_Cities_2022-03-18_10-40.csv"),
  descriptions = c("environmental sub-criteria",
    "social sub-criteria",
    "economic sub-criteria",
    "criteria (main criteria)")
)
```

4.4 File table for practitioners and experts

```
[22]: df_csvInputFiles_PE <- data.table(
  file_idx = 1:4,
  keys = c("env", "soc", "eco", "crit"),
  filenames = c("rdata_PE_env_AHP_edible_Cities_2022-03-18_10-41.csv",
```



```

      "rdata_PE_soc_AHP_edible_Cities_2022-03-18_10-41.csv",
      "rdata_PE_eco_AHP_edible_Cities_2022-03-18_10-41.csv",
      "rdata_PE_crit_AHP_edible_Cities_2022-03-18_10-41.csv"),
descriptions = c("environmental sub-criteria",
                  "social sub-criteria",
                  "economic sub-criteria",
                  "criteria (main criteria)")
)

```

5 Exploit datasets of own survey with package `ahpsurvey` for each group of participants

```

[23]: df_attributes_labels_all <- data.table(
  idx = 1:12,
  attr = c("Clim", "Bdiv", "CiEc",
            "Kedu", "Comm", "Part",
            "Qual", "LVCs", "Affo",
            "Envi", "Soci", "Econ"),
  labels = c("Local microclimate and hydrology regulation", "Biodiversity",
    ↪ "Circular economy",
            "Knowledge sharing and education ", "Community building and social
    ↪ justice", "Participation in food production",
            "Food quality and safety", "Local value chains/networks",
    ↪ "Affordability of food for all social strata",
            "Environment", "Society", "Economy")
)

```

5.1 All participants

```

[24]: row_start = 1
      row_end = 3

      str_participants_group = "all"

      df_outputTable <- data.table()

      for ( file_idx in 1:nrow(df_csvInputFiles_all) ) {
        # create data frame from current input CSV file
        str_filename <- paste(str_input_path, df_csvInputFiles_all[file_idx, filenames],
    ↪ sep="/")
        df_processed_survey_data <- func_readCSVdata_to_dataframe(str_filename)

        # create vectors for attributes and labels from a subset of data frame
    ↪ 'df_attributes_labels_all'
        vec_atts <- df_attributes_labels_all[c(row_start:row_end), attr]
        vec_labels <- df_attributes_labels_all[c(row_start:row_end), labels]
        # shift row interval for next iteration
        row_start = row_start + 3
        row_end = row_end + 3

        # generate data frame with eigentrue values (weights)
        df_eigentrue_weights <- func_genEigentrue_to_dataframe(df_processed_survey_data,
    ↪ vec_atts)
      }

```

```

# generate an array with consistency ratios
arr_CRs <- func_genCR_to_arr(df_processed_survey_data, vec_atts)

# generate a extended data frame with consistency ratios
consistency_thres = 0.1
str_CRlabel <- paste("CR", df_csvInputFiles_all[file_idx, keys], sep="_")
df_CRs <- func_genCR_to_dataframe(df_processed_survey_data, vec_atts, arr_CRs,
  consistency_thres, str_CRlabel)

str_image_filename <- paste("ahp_violin", str_participants_group,
  df_csvInputFiles_PE[file_idx, keys], sep="_")
str_image_filename <- paste(str_image_filename, ".png", sep="")
str_image_filename <- paste(str_output_path, str_image_filename, sep="/")
func_visuPriorsCRs(df_processed_survey_data, df_CRs, arr_CRs, consistency_thres,
  vec_atts, df_eigentrue_weights, vec_labels, str_image_filename)

# combine data frames of eigentrue values (weights) with consistency ratios
df_outputTable <- cbind(df_outputTable, df_eigentrue_weights)
# add only specific columns of 'df_CRs' (omit column 'row_id')
df_outputTable <- cbind(df_outputTable, df_CRs[c(1, 3)])
}

# extend file name by path
str_CSVfilename_output <- paste("rdata", str_participants_group, "eigentrue_CRs",
  sep="_")
str_CSVfilename_output <- paste(str_CSVfilename_output, ".csv", sep="")
str_CSVfilename_output <- paste(str_output_path, str_CSVfilename_output, sep="/")

# write data frame 'df_outputTable' to CSV file
write.table(df_outputTable, file = str_CSVfilename_output,
  fileEncoding = "UTF-8", row.names = FALSE,
  col.names = TRUE, sep = "\t", quote = TRUE)

```

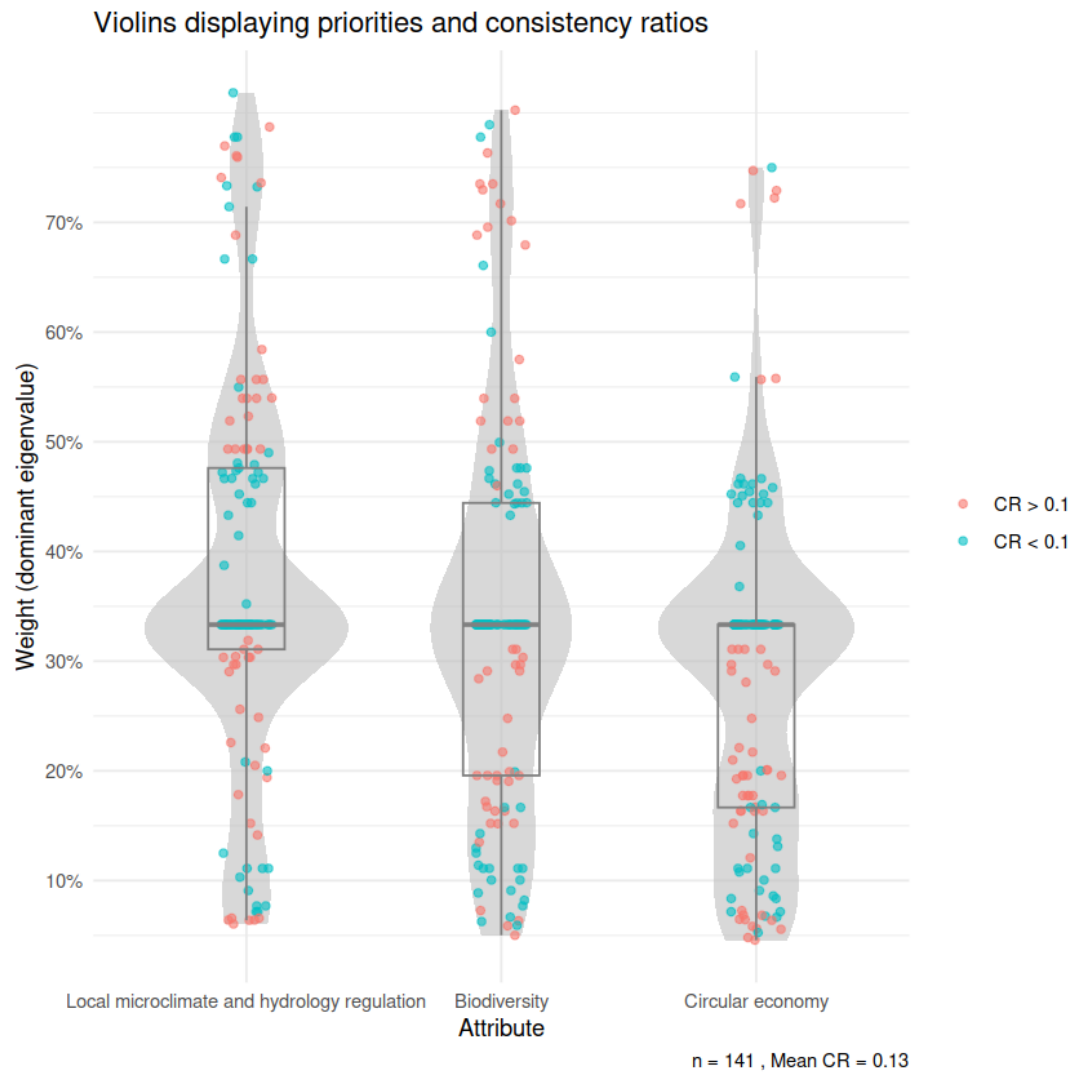


Figure 1: Violins displaying priorities and consistency ratios of all participants

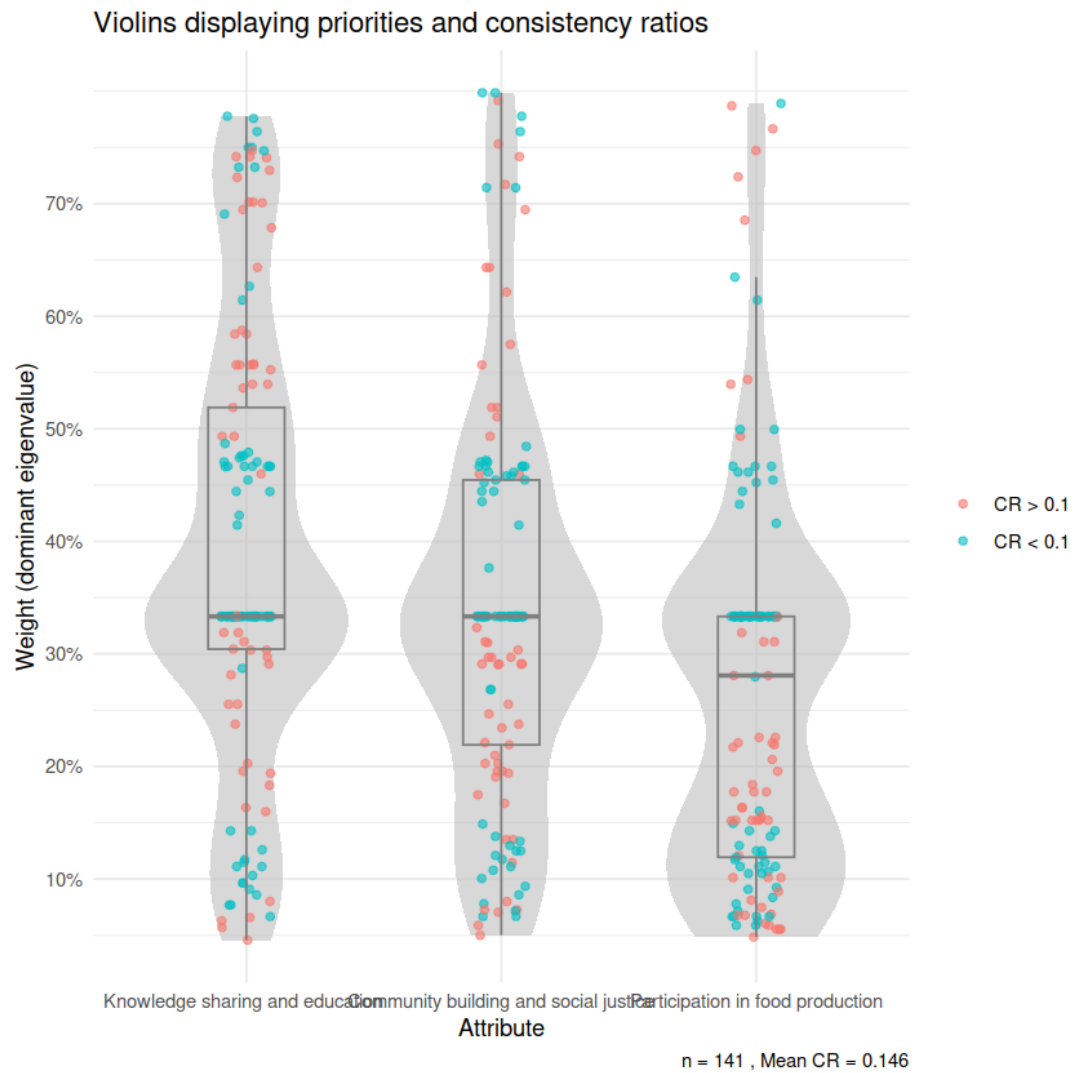


Figure 2: Violins displaying priorities and consistency ratios of all participants

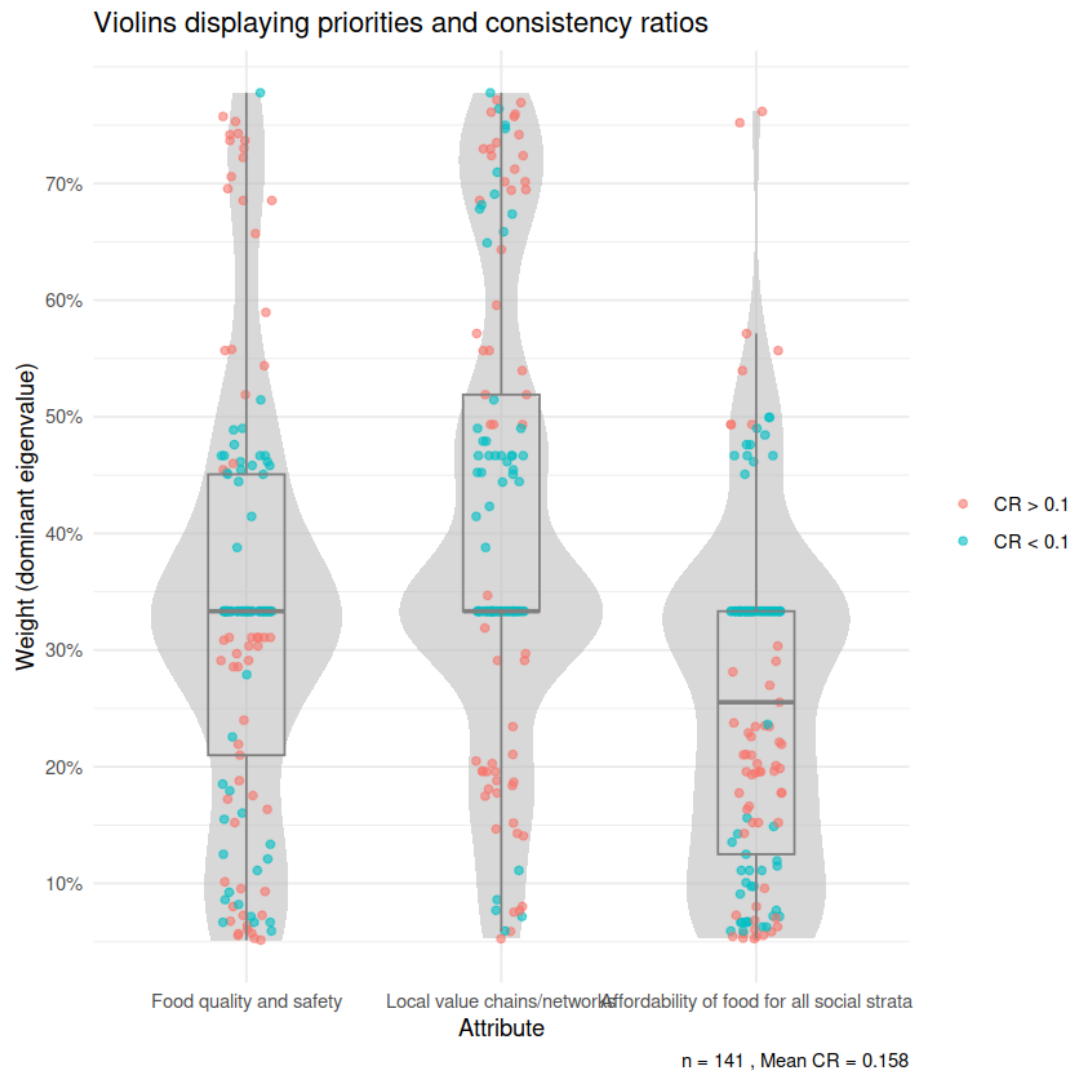


Figure 3: Violins displaying priorities and consistency ratios of all participants

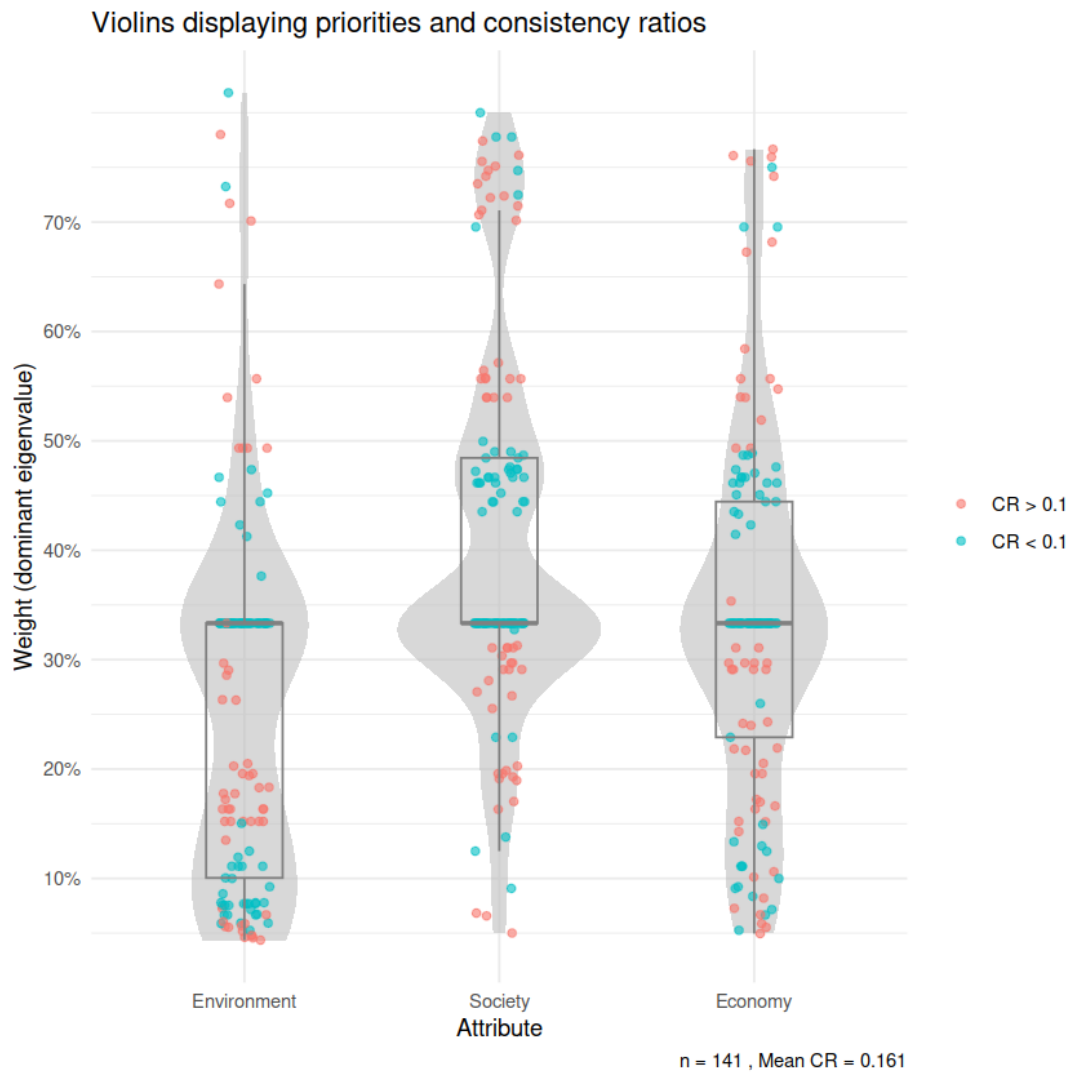


Figure 4: Violins displaying priorities and consistency ratios of all participants

```
[25]: list_gmean <- func_aggpref_gmean(df_processed_survey_data, vec_atts, arr_CRs,
  consistency_thres, str_CRlabel)

df_gmean <- func_norm_gmean(list_gmean)

df_gmean
```

		gmean.raw <dbl>	gmean.norm <dbl>
A data.frame: 4 × 2	Envi	0.3739039	0.4179807
	Soci	0.3023657	0.3380094
	Econ	0.2182787	0.2440099
	Sum	0.8945482	1.0000000

5.2 Participants of city administrations

```
[26]: row_start = 1
row_end = 3
```

```

str_participants_group = "CA"

df_outputTable <- data.table()

for ( file_idx in 1:nrow(df_csvInputFiles_CA) ) {
  # create data frame from current input CSV file
  str_filename <- paste(str_input_path, df_csvInputFiles_CA[file_idx, filenames],
    ↪sep="/")
  df_processed_survey_data <- func_readCSVdata_to_dataframe(str_filename)

  # create vectors for attributes and labels from a subset of data frame
  ↪'df_attributes_labels_all'
  vec_atts <- df_attributes_labels_all[c(row_start:row_end), attr]
  vec_labels <- df_attributes_labels_all[c(row_start:row_end), labels]
  # shift row interval for next iteration
  row_start = row_start + 3
  row_end = row_end + 3

  # generate data frame with eigentrue values (weights)
  df_eigentrue_weights <- func_genEigentrue_to_dataframe(df_processed_survey_data,
    ↪vec_atts)

  # generate an array with consistency ratios
  arr_CRs <- func_genCR_to_arr(df_processed_survey_data, vec_atts)

  # generate a extended data frame with consistency ratios
  consistency_thres = 0.1
  str_CRlabel <- paste("CR", df_csvInputFiles_CA[file_idx, keys], sep="_")
  df_CRs <- func_genCR_to_dataframe(df_processed_survey_data, vec_atts, arr_CRs,
    ↪consistency_thres, str_CRlabel)

  str_image_filename <- paste("ahp_violin", str_participants_group,
    ↪df_csvInputFiles_CA[file_idx, keys], sep="_")
  str_image_filename <- paste(str_image_filename, ".png", sep="")
  str_image_filename <- paste(str_output_path, str_image_filename, sep="/")
  func_visuPriorsCRs(df_processed_survey_data, df_CRs, arr_CRs, consistency_thres,
    ↪vec_atts, df_eigentrue_weights, vec_labels, str_image_filename)

  # combine data frames of eigentrue values (weights) with consistency ratios
  df_outputTable <- cbind(df_outputTable, df_eigentrue_weights)
  # add only specific columns of 'df_CRs' (omit column 'row_id')
  df_outputTable <- cbind(df_outputTable, df_CRs[c(1, 3)])
}

# extend file name by path
str_CSVfilename_output <- paste("rdata", str_participants_group, "eigentrue_CRs",
  ↪sep="_")
str_CSVfilename_output <- paste(str_CSVfilename_output, ".csv", sep="")
str_CSVfilename_output <- paste(str_output_path, str_CSVfilename_output, sep="/")

# write data frame 'df_outputTable' to CSV file
write.table(df_outputTable, file = str_CSVfilename_output,
  fileEncoding = "UTF-8", row.names = FALSE,
  col.names = TRUE, sep = "\t", quote = TRUE)

```

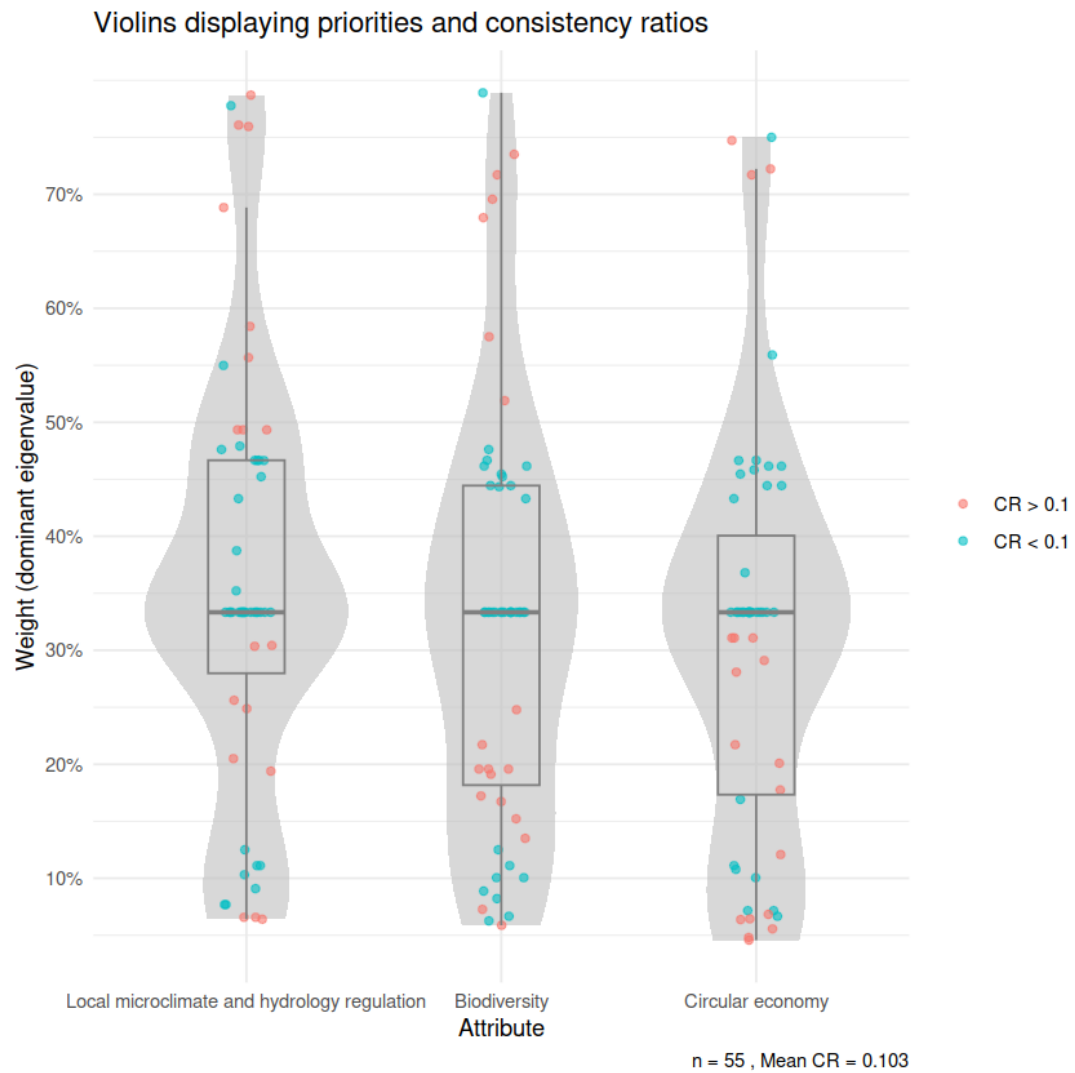


Figure 5: Violins displaying priorities and consistency ratios of participants of city administrations

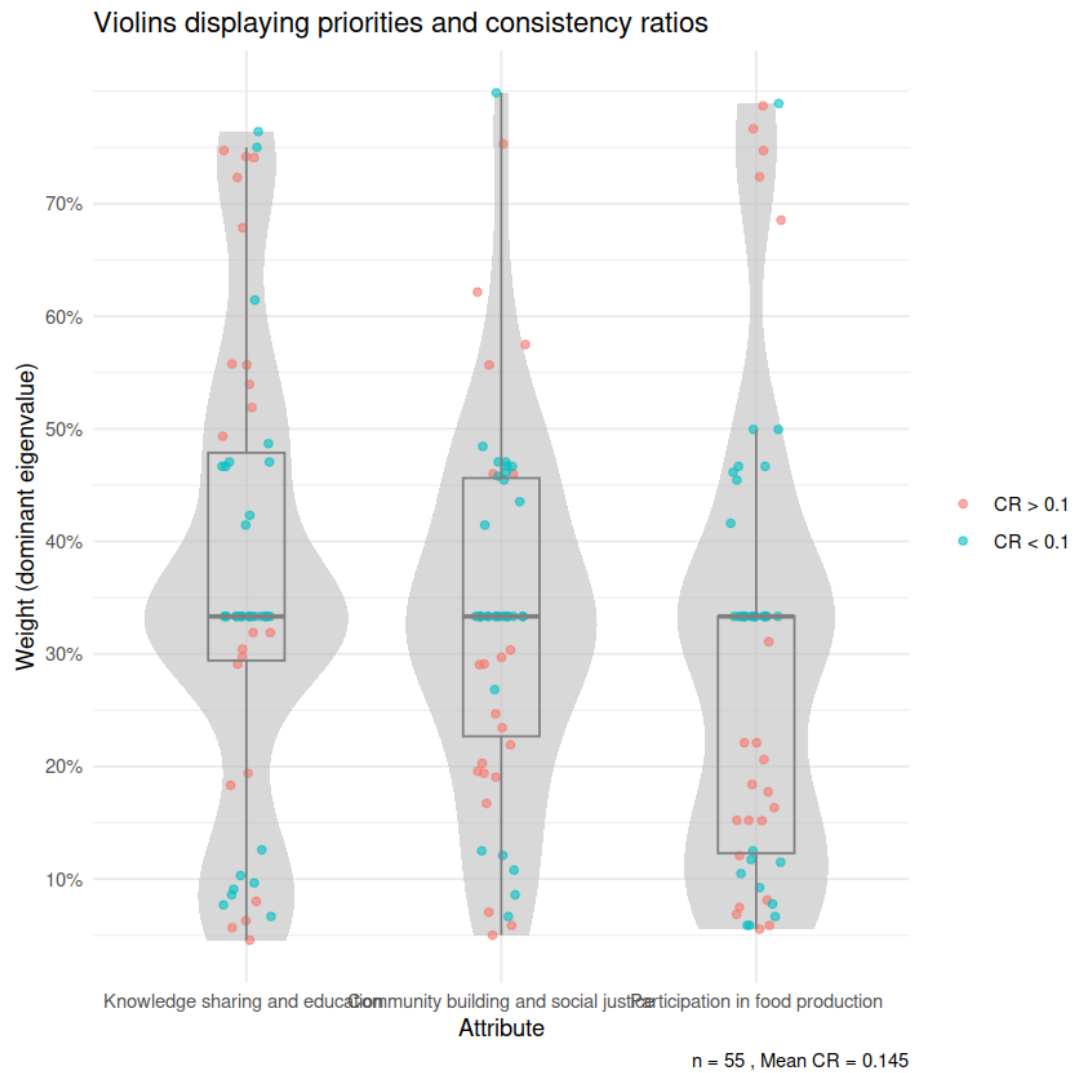


Figure 6: Violins displaying priorities and consistency ratios of participants of city administrations

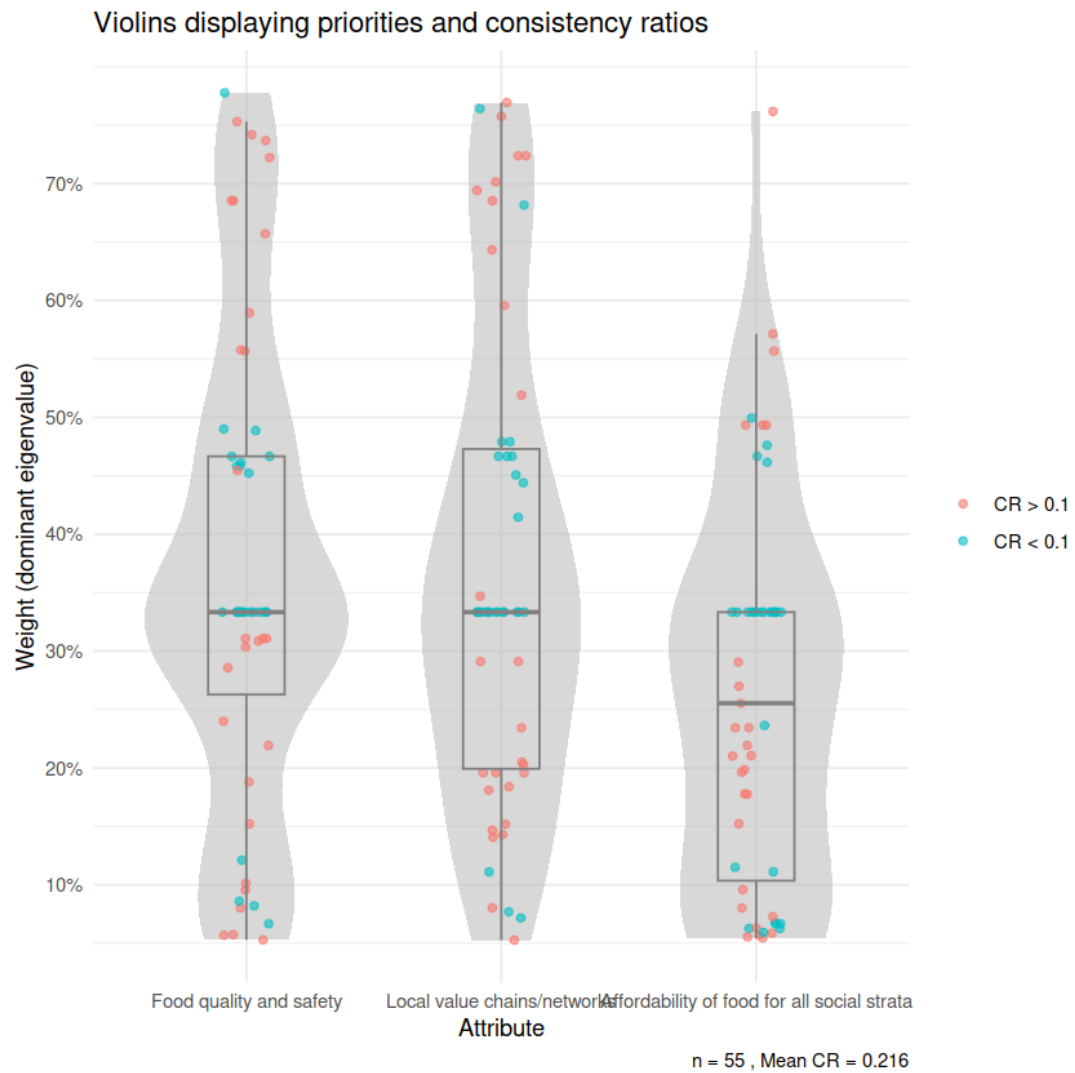


Figure 7: Violins displaying priorities and consistency ratios of participants of city administrations

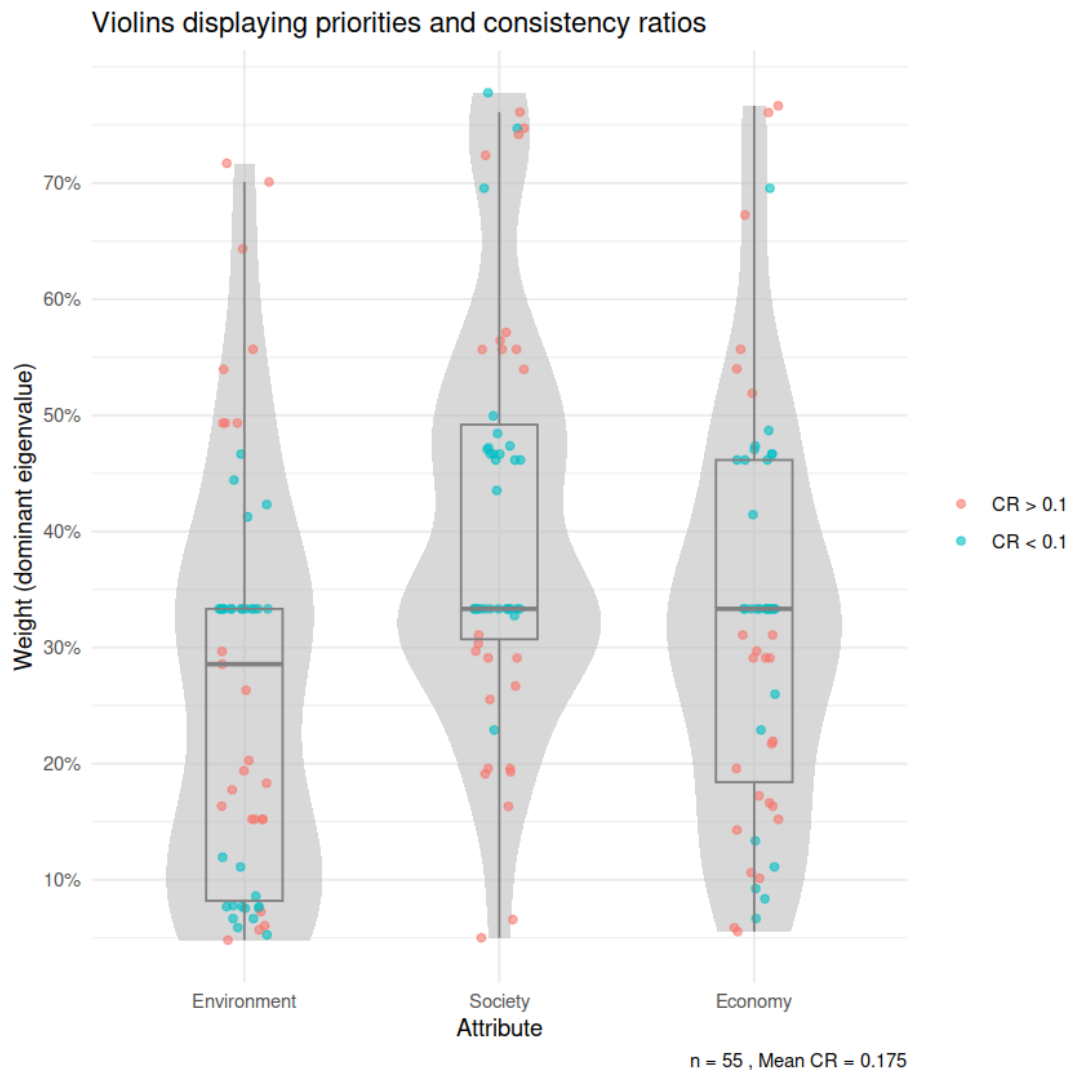


Figure 8: Violins displaying priorities and consistency ratios of participants of city administrations

5.3 Participants of non-governmental organizations

```
[27]: row_start = 1
row_end = 3

str_participants_group = "NGO"

df_outputTable <- data.table()

for ( file_idx in 1:nrow(df_csvInputFiles_NGO) ) {
  # create data frame from current input CSV file
  str_filename <- paste(str_input_path, df_csvInputFiles_NGO[file_idx, filenames],
    sep="/")
  df_processed_survey_data <- func_readCSVdata_to_dataframe(str_filename)

  # create vectors for attributes and labels from a subset of data frame
  'df_attributes_labels_all'
  vec_atts <- df_attributes_labels_all[c(row_start:row_end), attr]
  vec_labels <- df_attributes_labels_all[c(row_start:row_end), labels]
  # shift row interval for next iteration
}
```

```

row_start = row_start + 3
row_end = row_end + 3

# generate data frame with eigenttrue values (weights)
df_eigenttrue_weights <- func_genEigenttrue_to_dataframe(df_processed_survey_data,
↳vec_atts)

# generate an array with consistency ratios
arr_CRs <- func_genCR_to_arr(df_processed_survey_data, vec_atts)

# generate a extended data frame with consistency ratios
consistency_thres = 0.1
str_CRlabel <- paste("CR", df_csvInputFiles_NGO[file_idx, keys], sep="_")
df_CRs <- func_genCR_to_dataframe(df_processed_survey_data, vec_atts, arr_CRs,
↳consistency_thres, str_CRlabel)

str_image_filename <- paste("ahp_violin", str_participants_group,
↳df_csvInputFiles_PE[file_idx, keys], sep="_")
str_image_filename <- paste(str_image_filename, ".png", sep="")
str_image_filename <- paste(str_output_path, str_image_filename, sep="/")
func_visuPriosCRs(df_processed_survey_data, df_CRs, arr_CRs, consistency_thres,
↳vec_atts, df_eigenttrue_weights, vec_labels, str_image_filename)

# combine data frames of eigenttrue values (weights) with consistency ratios
df_outputTable <- cbind(df_outputTable, df_eigenttrue_weights)
# add only specific columns of 'df_CRs' (omit column 'row_id')
df_outputTable <- cbind(df_outputTable, df_CRs[c(1, 3)])
}

# extend file name by path
str_CSVfilename_output <- paste("rdata", str_participants_group, "eigenttrue_CRs",
↳sep="_")
str_CSVfilename_output <- paste(str_CSVfilename_output, ".csv", sep="")
str_CSVfilename_output <- paste(str_output_path, str_CSVfilename_output, sep="/")

# write data frame 'df_outputTable' to CSV file
write.table(df_outputTable, file = str_CSVfilename_output,
  fileEncoding = "UTF-8", row.names = FALSE,
  col.names = TRUE, sep = "\t", quote = TRUE)

```

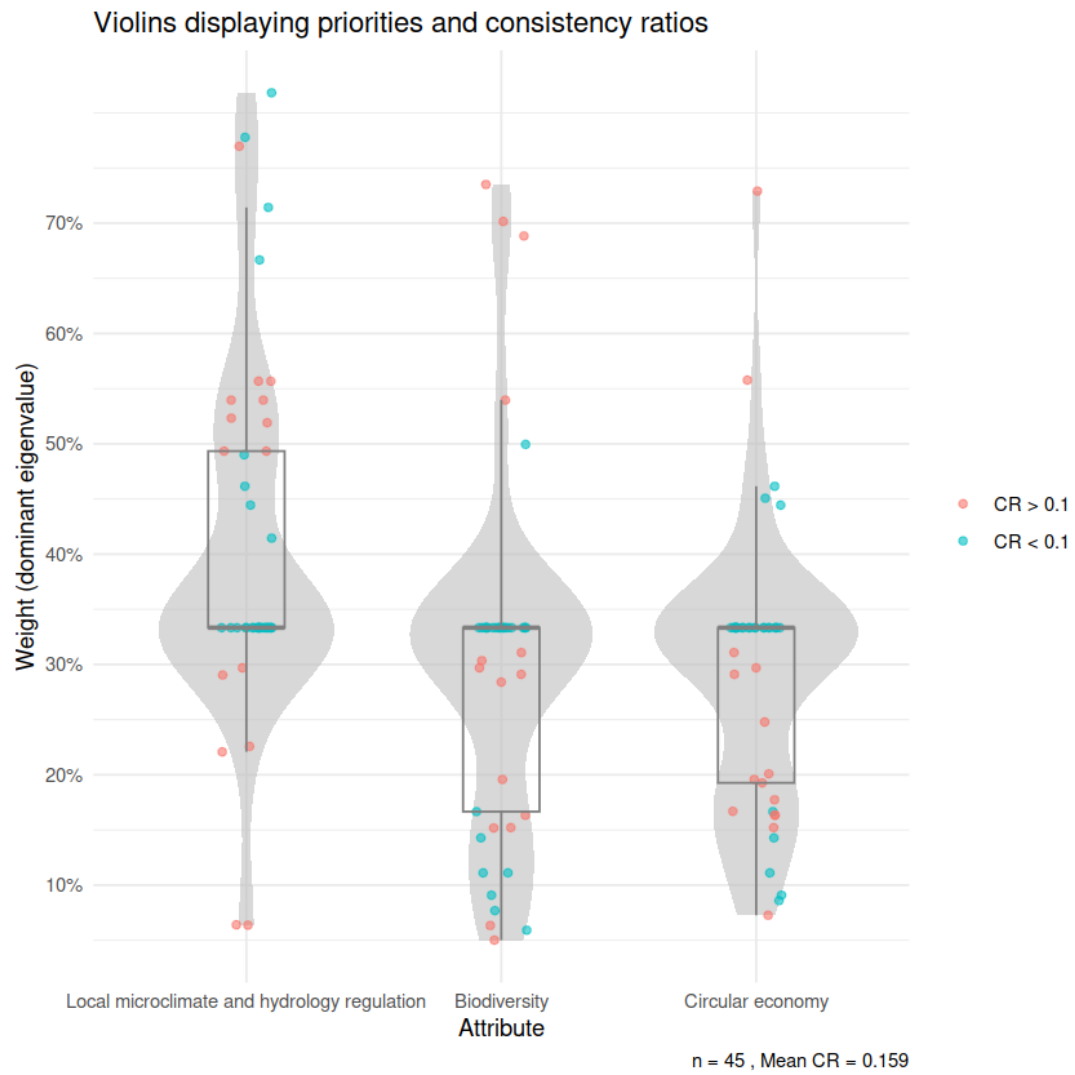


Figure 9: Violins displaying priorities and consistency ratios of participants of non-governmental organizations

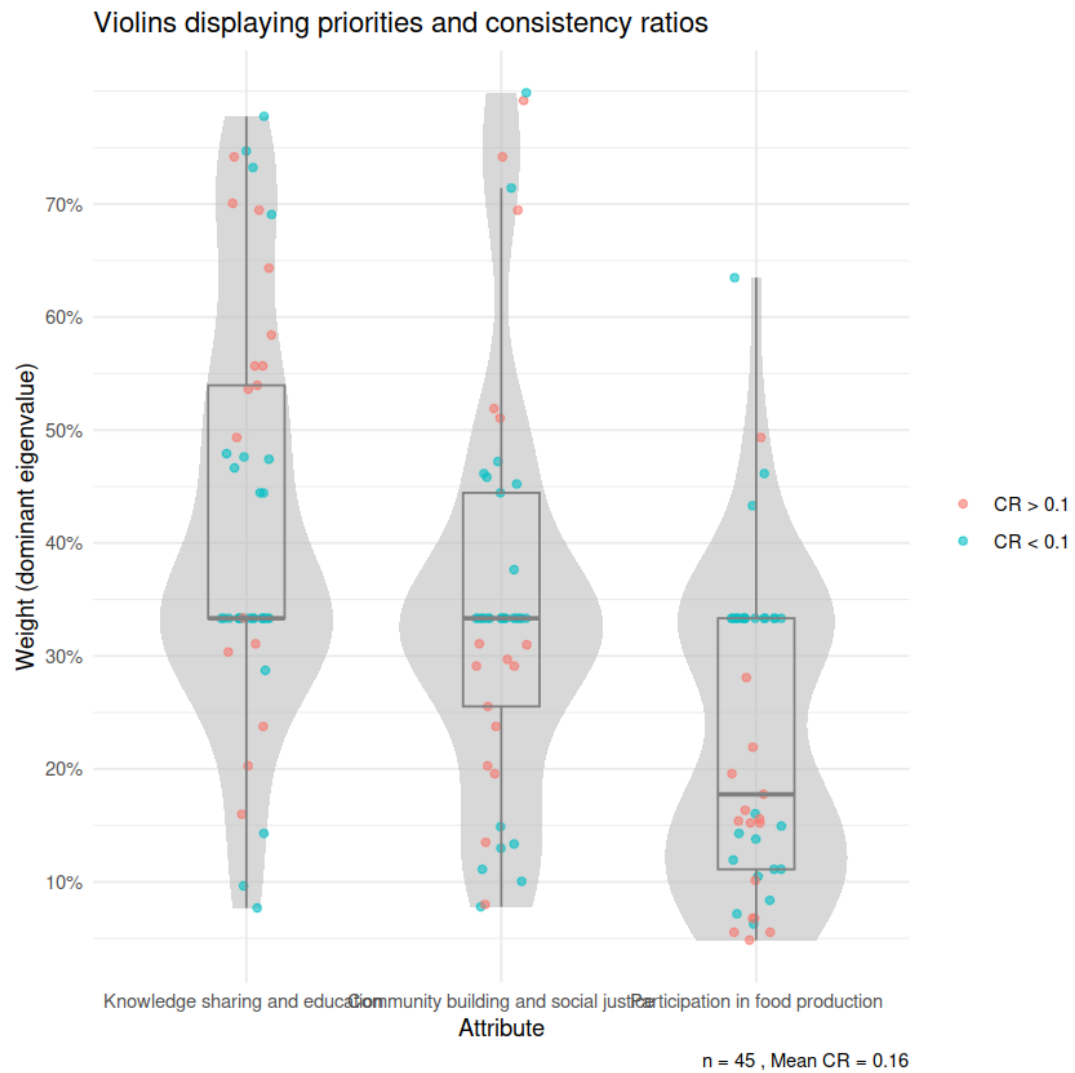


Figure 10: Violins displaying priorities and consistency ratios of participants of non-governmental organizations

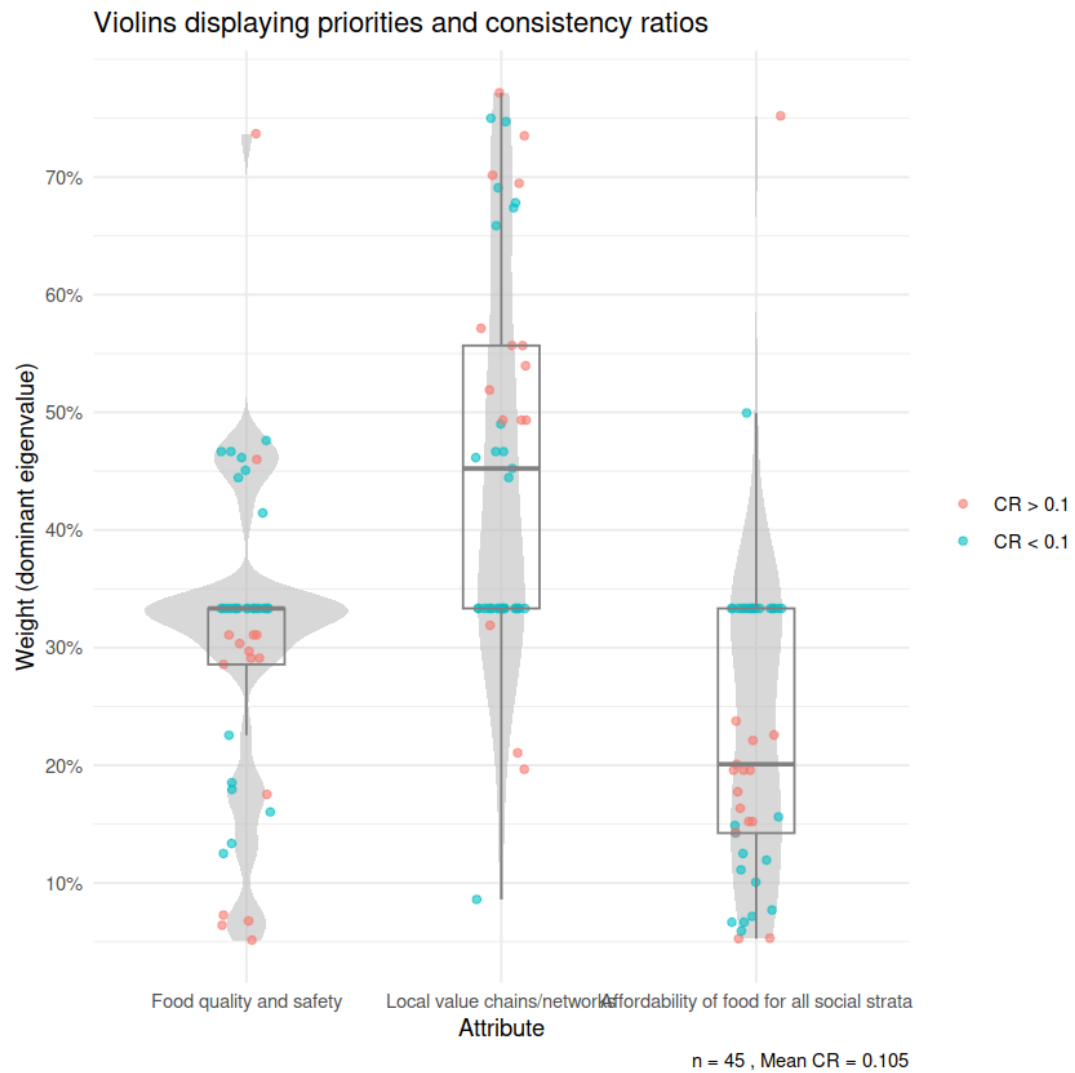


Figure 11: Violins displaying priorities and consistency ratios of participants of non-governmental organizations

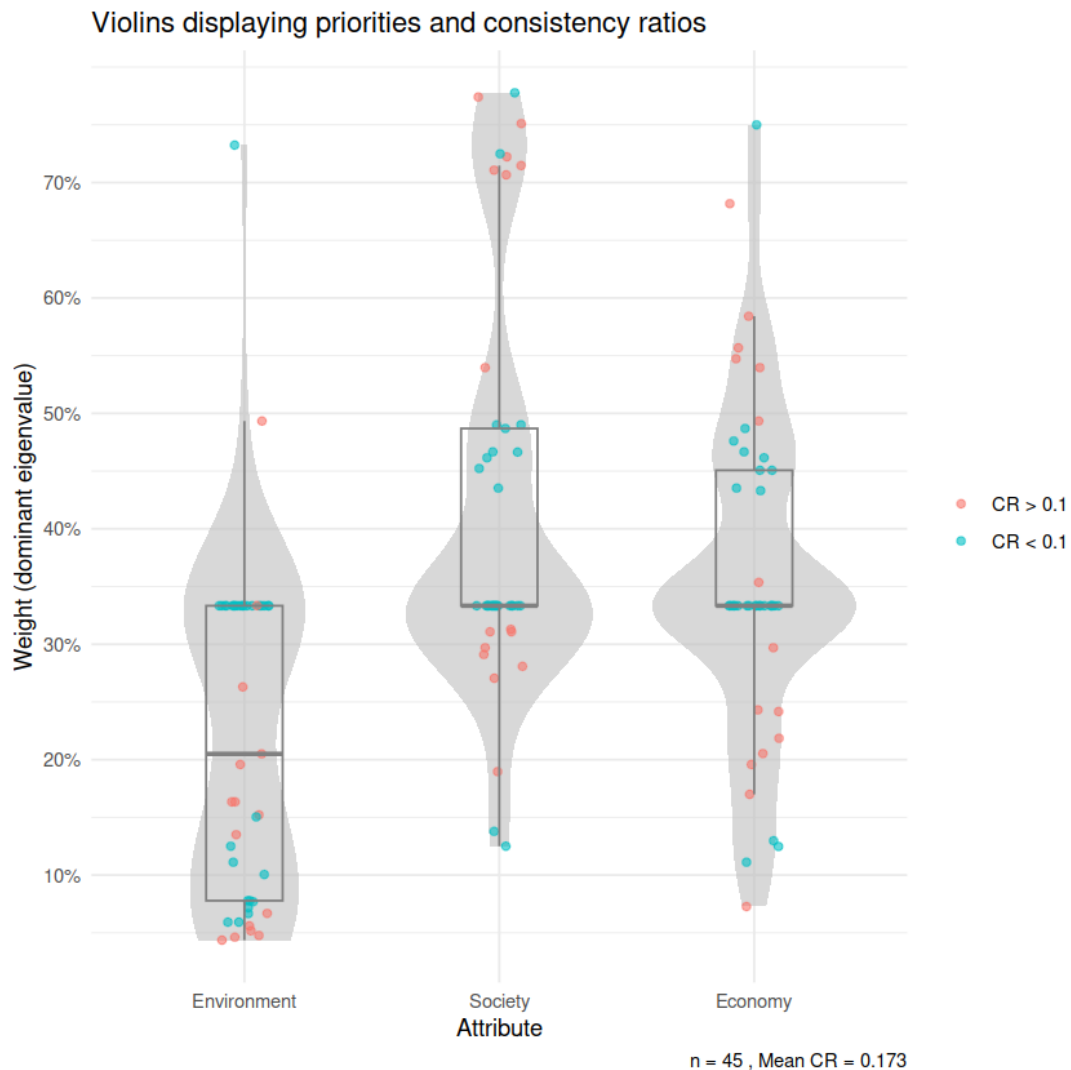


Figure 12: Violins displaying priorities and consistency ratios of participants of non-governmental organizations

5.4 Participants of practitioners and experts

```
[28]: row_start = 1
      row_end = 3

      str_participants_group = "PE"

      df_outputTable <- data.table()

      for ( file_idx in 1:nrow(df_csvInputFiles_PE) ) {
        # create data frame from current input CSV file
        str_filename <- paste(str_input_path, df_csvInputFiles_PE[file_idx, filenames],
                              sep="/")
        df_processed_survey_data <- func_readCSVdata_to_dataframe(str_filename)

        # create vectors for attributes and labels from a subset of data frame
        vec_atts <- df_attributes_labels_all[c(row_start:row_end), attr]
        vec_labels <- df_attributes_labels_all[c(row_start:row_end), labels]
```



```

# shift row interval for next iteration
row_start = row_start + 3
row_end = row_end + 3

# generate data frame with eigenttrue values (weights)
df_eigenttrue_weights <- func_genEigenttrue_to_dataframe(df_processed_survey_data,
↳vec_atts)

# generate an array with consistency ratios
arr_CRs <- func_genCR_to_arr(df_processed_survey_data, vec_atts)

# generate a extended data frame with consistency ratios
consistency_thres = 0.1
str_CRlabel <- paste("CR", df_csvInputFiles_PE[file_idx, keys], sep="_")
df_CRs <- func_genCR_to_dataframe(df_processed_survey_data, vec_atts, arr_CRs,
↳consistency_thres, str_CRlabel)

str_image_filename <- paste("ahp_violin", str_participants_group,
↳df_csvInputFiles_PE[file_idx, keys], sep="_")
str_image_filename <- paste(str_image_filename, ".png", sep="")
str_image_filename <- paste(str_output_path, str_image_filename, sep="/")
func_visuPriosCRs(df_processed_survey_data, df_CRs, arr_CRs, consistency_thres,
↳vec_atts, df_eigenttrue_weights, vec_labels, str_image_filename)

# img <- image_graph(width = 800, height = 800, res = 24)
# img <- image_read(str_image_filename)
# print(img)

# combine data frames of eigenttrue values (weights) with consistency ratios
df_outputTable <- cbind(df_outputTable, df_eigenttrue_weights)
# add only specific columns of 'df_CRs' (omit column 'row_id')
df_outputTable <- cbind(df_outputTable, df_CRs[c(1, 3)])
}

# extend file name by path
str_CSVfilename_output <- paste("rdata", str_participants_group, "eigenttrue_CRs",
↳sep="_")
str_CSVfilename_output <- paste(str_CSVfilename_output, ".csv", sep="")
str_CSVfilename_output <- paste(str_output_path, str_CSVfilename_output, sep="/")

# write data frame 'df_outputTable' to CSV file
write.table(df_outputTable, file = str_CSVfilename_output,
            fileEncoding = "UTF-8", row.names = FALSE,
            col.names = TRUE, sep = "\t", quote = TRUE)

```

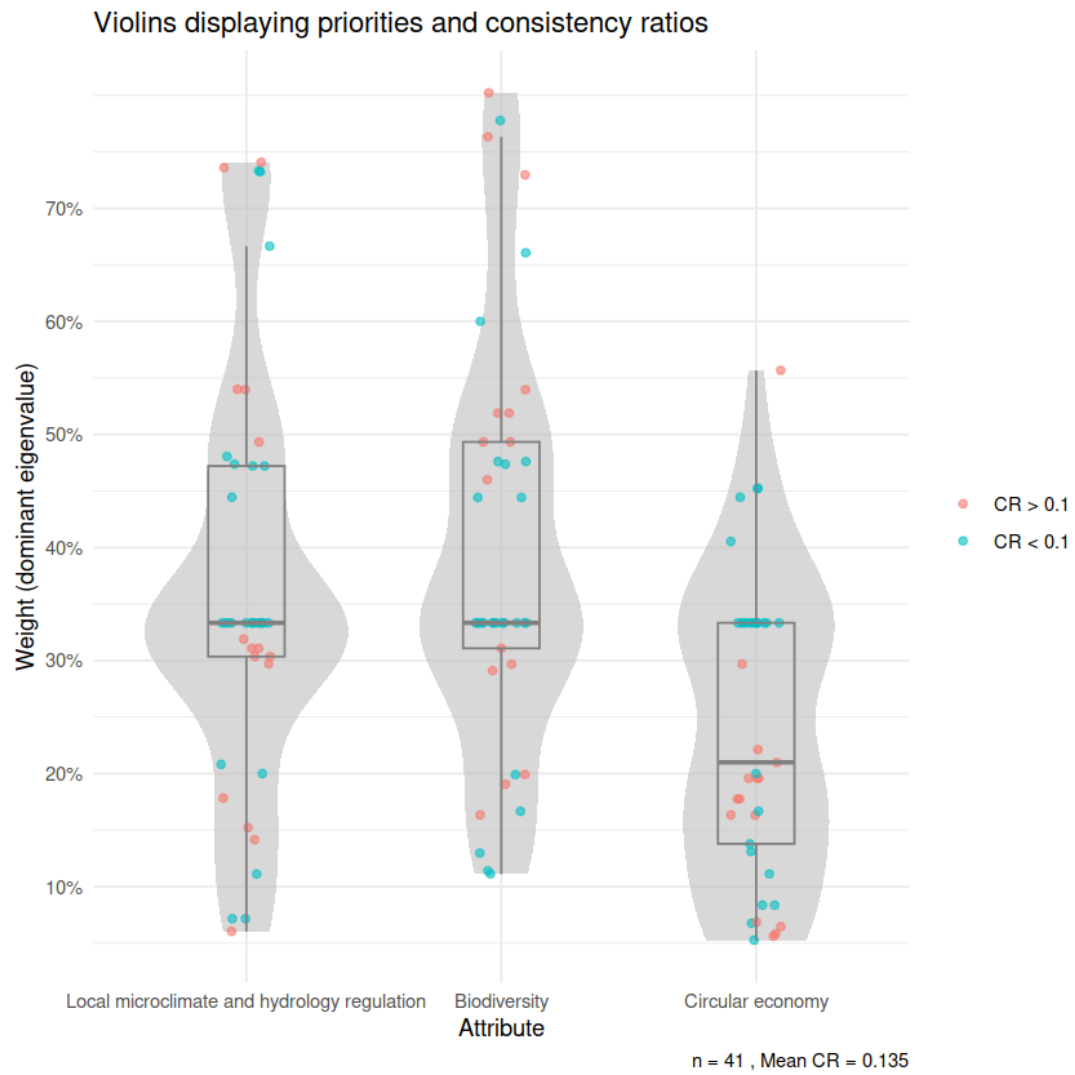


Figure 13: Violins displaying priorities and consistency ratios of participants of practitioners and experts

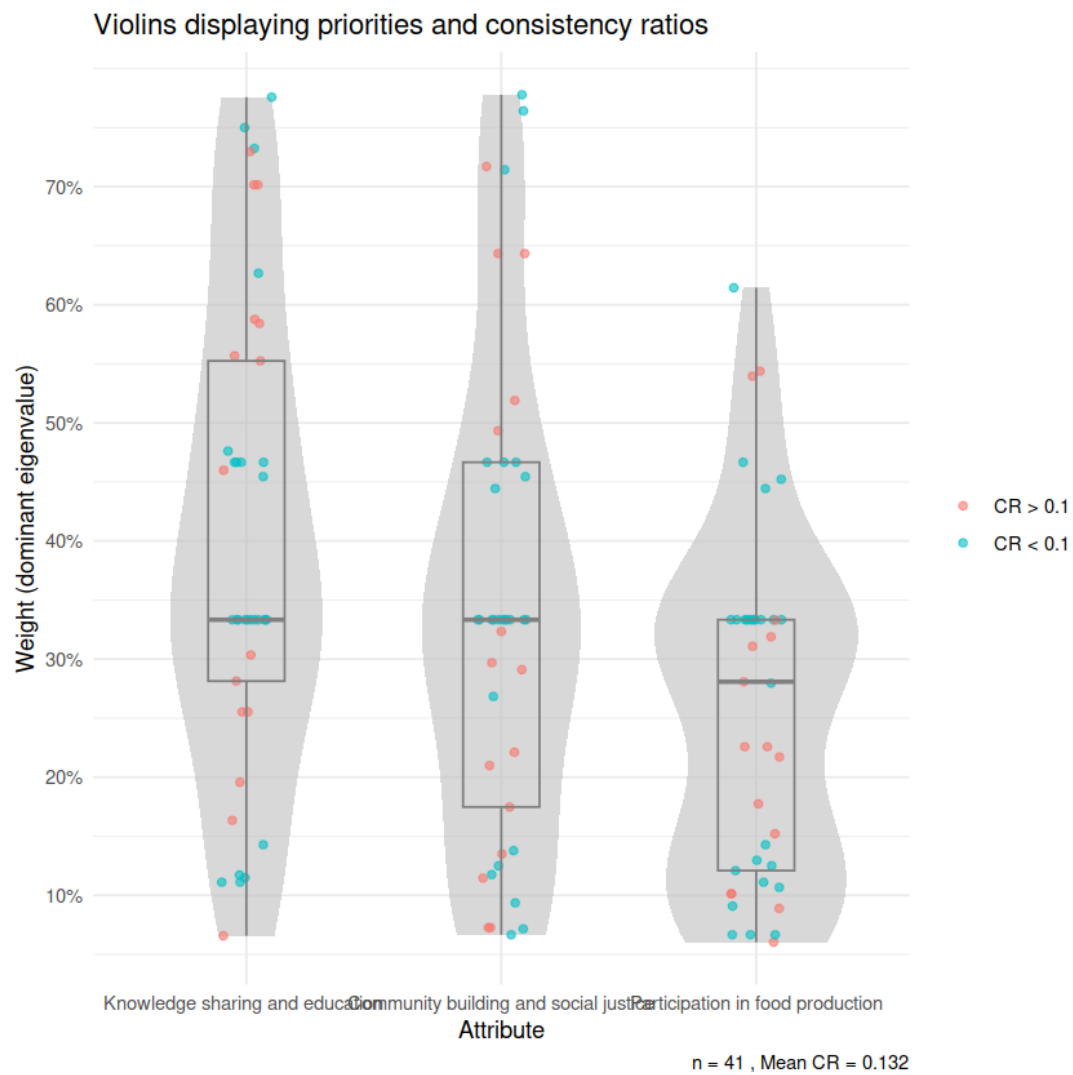


Figure 14: Violins displaying priorities and consistency ratios of participants of practitioners and experts

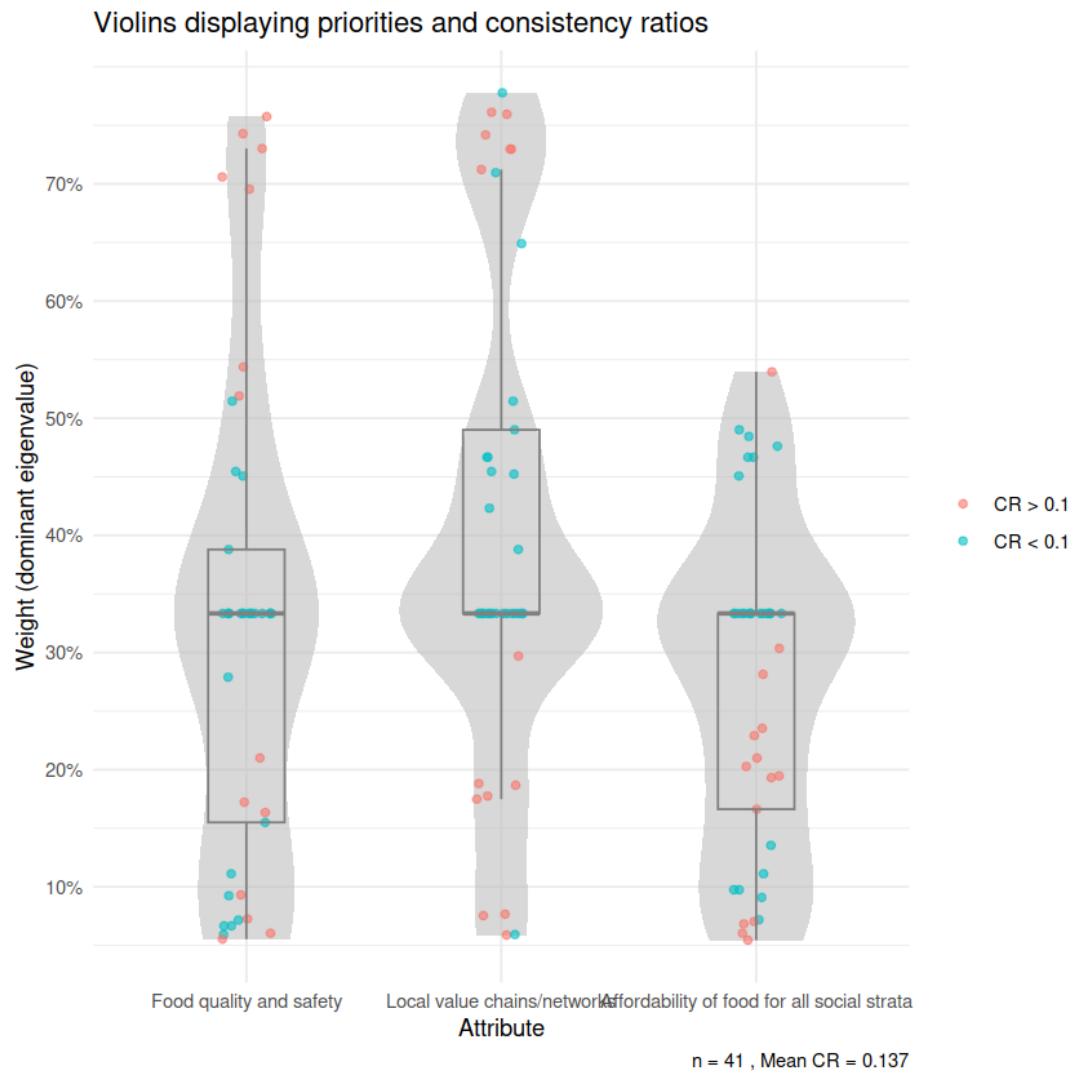


Figure 15: Violins displaying priorities and consistency ratios of participants of practitioners and experts

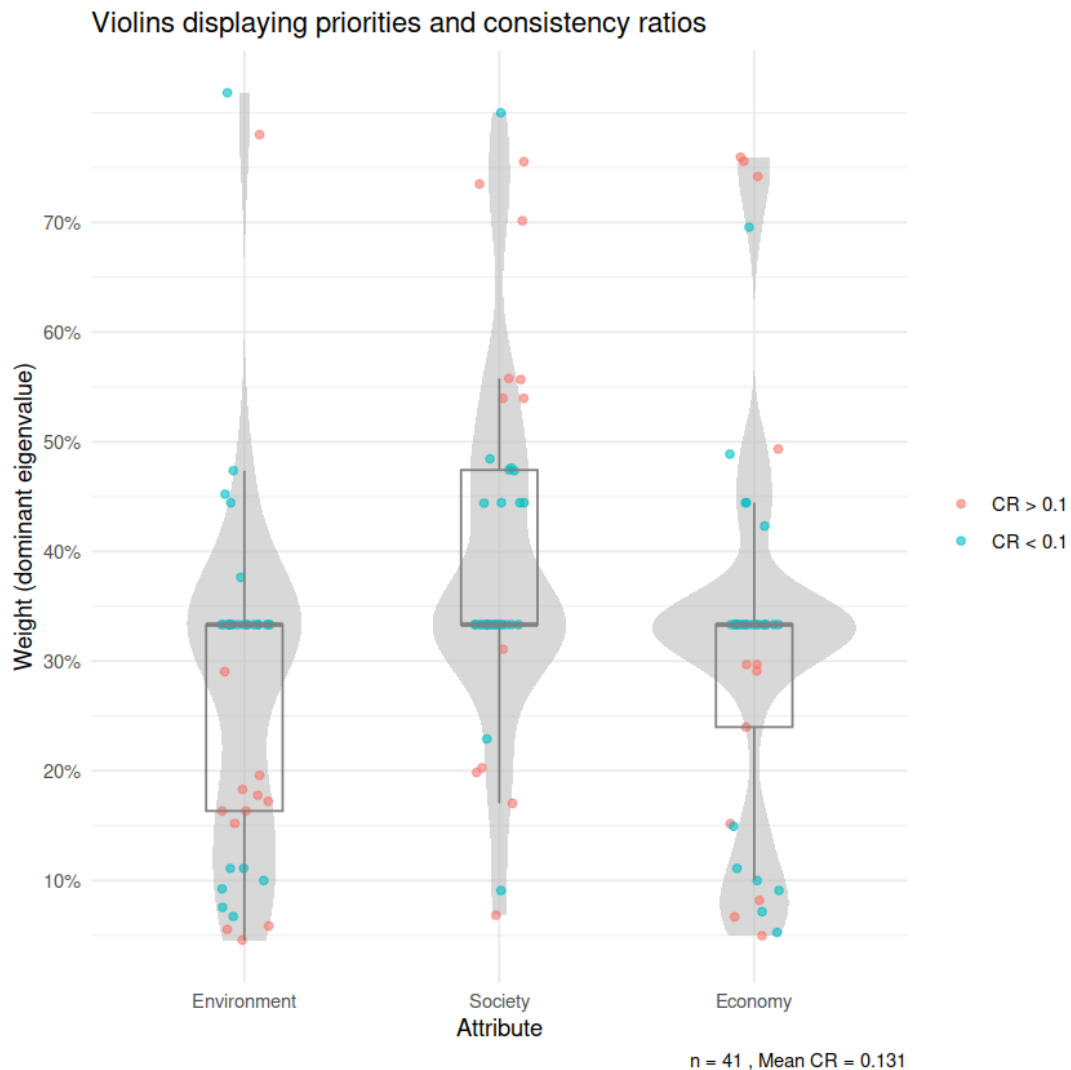


Figure 16: Violins displaying priorities and consistency ratios of participants of practitioners and experts

6 Summary and outlook

[]:

7 References

Online references

- Romer, Paul (Apr. 13, 2018). *Jupyter, Mathematica, and the Future of the Research Paper*. English. URL: <https://paulromer.net/jupyter-mathematica-and-the-future-of-the-research-paper/> (visited on 09/08/2022) (cit. on p. 2).
- Somers, James (Apr. 5, 2018). *The Scientific Paper Is Obsolete*. English. The Atlantic. URL: <https://www.theatlantic.com/science/archive/2018/04/the-scientific-paper-is-obsolete/556676/> (visited on 09/08/2022) (cit. on p. 2).