# Package 'elements'

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**Title** Tools for Data Treatment and Visualization

**Version** 0.1.0

**Description**
Advanced plotting and statistical analysis tools for environmental and ecotoxicological datasets.

**License** MIT + file LICENSE

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biostat

**Remotes** github::GegznaV/biostat

**URL** https://github.com/ArnaudMarois/elements

**BugReports** https://github.com/ArnaudMarois/elements/issues

## Contents

`get.plot` *Generate statistical plots with tests, post-hoc results, and compact letter displays*

## Description

This function creates boxplots or mean plots for one or more response variables, performs the specified statistical tests, and optionally adds post-hoc results, compact letter displays (CLD), and annotations. It can also arrange plots into a grid, save plots to files, and export statistical summaries to a PDF.

## Usage

```
get.plot(
  data,
  response,
  factor,
  method = NULL,
  adjust = NULL,
  var.method = NULL,
  var.adjust = NULL,
  flip = FALSE,
  filter.na = FALSE,
  group.order = NULL,
  print.test = FALSE,
  export.test = FALSE,
  show.test = FALSE,
  show.ph = FALSE,
  show.letters = FALSE,
  show.brackets = FALSE,
  plot.type = "boxplot",
  fill = FALSE,
  fill.box = "white",
  box.alpha = 1,
  fill.point = "white",
  point.alpha = 1,
  fill.mean = "black",
  mean.alpha = 1,
  log = FALSE,
  group.label = NULL,
  show.legend = FALSE,
  point.shape = 21,
  mean.shape = 21,
  point.size = 2.5,
  mean.size = 2.5,
  jitter.width = 0.2,
  error.width = 0.2,
  error.alpha = 1,
  axis.title.x = NULL,
  axis.title.y = NULL,
```

```
  axis.breaks.size = 12,
  axis.title.size = 12,
  axis.title.face = "plain",
  label.angle = 0,
  label.face = "plain",
  letters.face = "plain",
  letters.size = 5,
  text.family = "sans",
  theme.style = "classic",
  padding = 0.2,
  grid = FALSE,
  grid.axis = FALSE,
  ncol,
  nrow,
  grid.axis.x = factor,
  grid.axis.y = "Concentration",
  x.title.shift = 0.02,
  var.size = 18,
  var.face = "bold",
  save.plot = FALSE,
  by.var = FALSE,
  plot.height = 5,
  plot.width = 5,
  plot.name = "plot_{var}.png",
  save.grid = FALSE,
  grid.name = "grid.png",
  grid.height = 8,
  grid.width = 7
)
```

## Arguments

| | |
|---|---|
| `data` | A data.frame. |
| `response` | Character vector of response variables. |
| `factor` | Character string for the factor variable. |
| `method` | The statistical test to perform. Available options are:<br>• `"aov"` or `"anova"`: Analysis of Variance (ANOVA). TukeyHSD as default posthoc test (pairwise t.test with an adjustment method).<br>• `"kw"` or `"kruskal"` or `"kruskal-wallis"`: Kruskal-Wallis test. Dunn's test as default posthoc test.<br>• `"t.test"` or `"student"` or `"t"`: Student's t-test.<br>• `"wilcox"` or `"wilcox.test"` or `"wilcoxon"` or `"mann-whitney"`: Wilcoxon test. |
| `adjust` | The p-value adjustment method to apply in post-hoc tests. Available options are `"holm"`, `"hochberg"`, `"bonferroni"`, `"bh"`, `"by"`, `"fdr"`, `"hommel"` (for aov), `"sidak"` (for kw), `"hs"` (for kw), and `"none"`. Default is `"none"`. |
| `var.method` | Named character vector specifying the statistical test to use for each response variable. The names must match exactly the variable names provided in `response`, and the values must be valid options accepted for the `method` argument. |

`var.adjust` Named character vector specifying the p-value adjustment method to use for each response variable. The names must match exactly the variable names provided in `response`, and the values must be valid options accepted for the `adjust` argument.

`flip` Logical. If `TRUE`, the axes are inverted: the `factor` variable is plotted on the y-axis, and the `response` variables are plotted on the x-axis. Default is `FALSE`.

`filter.na` Logical. If `TRUE`, rows with `NA` values in the current response variable are removed before analysis. Default is `FALSE`.

`group.order` Optional character vector specifying the order of the `x`-axis categories in the plot. Values must exactly match the factor levels in `x`.

`print.test` Logical. If `TRUE`, prints the test summary results to the console. Default is `FALSE`.

`export.test` Logical. If `TRUE`, exports statistical test details (test table, post-hoc, CLD) to a PDF report. Default is `FALSE`.

`show.test` Logical. If `TRUE`, the statistical test name and p-value are displayed in the top-left corner. Default is `FALSE`.

`show.ph` Logical. If `TRUE`, the post-hoc test name and p-value are displayed in the top-left corner. Default is `FALSE`.

`show.letters` Logical. If `TRUE`, significance letters for all groups are displayed (only for ANOVA and Kruskal-Wallis). Default is `FALSE`.

`show.brackets` Logical. If `TRUE` when `show.letters` is `TRUE`, a bracket is displayed for adjacent groups sharing the same letter. Default is `FALSE`.

`plot.type` Character string specifying the type of plot to produce. Either `"boxplot"` for box-and-whisker plots or `"meanplot"` for plots with group means and error bars. Default is `"boxplot"`.

`fill` Optional character. Specifies which plot element is filled with colors based on the factor variable. Default is `FALSE`.

- With `plot.type = "boxplot"`:
  - `"box"`: fills the boxes according to the factor levels.
  - `"point"`: fills the points according to the factor levels.
  - `"both"`: fills both boxes and points independently.
- With `plot.type = "meanplot"`:
  - `"point"`: fills the points according to the factor levels.
- If `FALSE`, no elements are colored by factor.

`fill.box` Optional. Depending on the `fill` argument, is either a single color (e.g., `"white"`) applied to all boxes, a character vector of colors (length matching the number of factor levels), or the name of a ColorBrewer palette to fill the boxes. Default is `"white"`.

`box.alpha` Optional numeric between 0 and 1. Specifies the transparency (alpha) of the box fill when `plot.type = "boxplot"`. Default is 1 (fully opaque).

`fill.point` Optional. Depending on the `fill` argument, is either a single color (e.g., `"black"`) applied to all points, a character vector of colors (length matching the number of factor levels), or the name of a ColorBrewer palette to fill the points. Default is `"white"`.

`point.alpha` Optional numeric between 0 and 1. Specifies the transparency (alpha) of the points. Default is 1 (fully opaque).

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|---|---|
| fill.mean | Optional. A single color used to fill all mean points when plot.type = "meanplot". Default is "black". |
| mean.alpha | Optional numeric between 0 and 1. Specifies the transparency (alpha) of the mean points when plot.type = "meanplot". Default is 1 (fully opaque). |
| log | Logical. If TRUE, y-axis breaks and limits are adjusted to properly accommodate data values that may be negative or positive as a result of a logarithmic transformation. Default is FALSE. |
| group.label | Optional character vector specifying the labels to display on the x-axis. |
| show.legend | Logical. If TRUE, the plot legend is displayed. Default is FALSE. |
| point.shape | Optional numeric. Specifies the shape of the points in the plot. Default is 21. |
| mean.shape | Optional numeric. Specifies the shape of the mean points in the plot. Default is 21. |
| point.size | Optional numeric. Specifies the size of the points in the plot. Default is 2.5. |
| mean.size | Optional numeric. Specifies the size of the mean points in the plot. Default is 2.5. |
| jitter.width | Optional numeric. Specifies the amount of horizontal jitter applied to points. Default is 0.2. |
| error.width | Optional numeric. Specifies the width of the error bars when plot.type = "meanplot". Default is 0.2. |
| error.alpha | Optional numeric between 0 and 1. Specifies the transparency (alpha) of the error bars when plot.type = "meanplot". Default is 1 (fully opaque). |
| axis.title.x | Optional character string to rename the x-axis title. If not provided, the default x variable name is used. |
| axis.title.y | Optional character string to rename the y-axis title. If not provided, the default y variable name is used. |
| axis.breaks.size | Optional numeric. Specifies the size of all axis breaks text. Default is 12. |
| axis.title.size | Optional numeric. Specifies the size of the axis title text. Default is 12. |
| axis.title.face | Optional character. Specifies the font face (e.g., "plain", "bold", "italic") for both axis titles. Default is "plain". |
| label.angle | Optional numeric. Angle of the axis tick labels. Default is 0. |
| label.face | Optional character. Font face for the axis tick labels. Default is "plain". |
| letters.face | Optional character. Specifies the font face for all significance letters. Default is "plain". |
| letters.size | Optional numeric. Specifies the size of all significance letters. Default is 5. |
| text.family | Optional character. Specifies the font family for all text elements in the plot. Default is "sans". |
| theme.style | Character. Specifies the ggplot2 theme style preset to apply to the plot. Options include "classic", "bw", "minimal", "light", "dark", "gray", and "void". Default is "classic". |
| padding | Optional numeric. Proportion of extra space added to the top of the y-axis to avoid clipping letters/brackets. Default is 0.2. |
| grid | Optional logical. If TRUE, arranges all response variable plots into a combined grid layout. Default is FALSE. |

| | |
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| grid.axis | Optional logical. If TRUE and grid = TRUE, individual plot axes are hidden and shared x and y axes are displayed for the entire grid. Default is FALSE. |
| ncol | Integer. Number of columns in the combined grid plot. |
| nrow | Integer. Number of rows in the combined grid plot. |
| grid.axis.x | Optional character string to name the shared x-axis title. Default is factor. |
| grid.axis.y | Optional character string to name the shared y-axis title. Default is "Concentration". |
| x.title.shift | Optional numeric. Horizontal shift applied to the shared x-axis label in grid layouts. Default is 0.02. |
| var.size | Optional numeric. Size of the labels displaying the name of each individual plot in the combined grid. Default is 18. |
| var.face | Optional character. Specifies the font face of the labels displaying the name of each individual plot in the combined grid. Default is "bold". |
| save.plot | Optional logical. If TRUE, saves each individual plot as a png file in the working directory. Default is FALSE. |
| by.var | Optional logical. Used only if save.plot = TRUE. If TRUE, saves each plot individually in separate folders named after each response variable. Default is FALSE. |
| plot.height | Optional numeric. Height of the saved plot image in inches when save.plot = TRUE. Default is 5. |
| plot.width | Optional numeric. Width of the saved plot image in inches when save.plot = TRUE. Default is 5. |
| plot.name | Optional character. Name of the saved plot file. Defaults to "plot_{var}.png", where {var} is replaced by the response variable name when saving multiple plots. |
| save.grid | Optional logical. If TRUE, saves the combined grid as a JPEG file in the working directory. Default is FALSE. |
| grid.name | Optional character. Name of the saved combined grid plot file. Default is "grid.png". |
| grid.height | Optional numeric. Height of the saved combined grid plot image in inches when save.grid = TRUE. Default is 8. |
| grid.width | Optional numeric. Width of the saved combined grid plot image in inches when save.grid = TRUE. Default is 7. |

## Value

- If grid = TRUE: returns a single ggplot object representing the combined grid of all response variable plots.
- If grid = FALSE: each plot (p) is printed to the current graphics device as it is built. In addition, the function invisibly returns a list containing:
  - plots: the individual ggplot objects (p) for each response variable.
  - plots1: the alternative versions of each plot (p1) used for grid construction.
- If export.test = TRUE: in addition to plots, a PDF file (Stats_Report.pdf) is created in the "elements" folder containing tables of statistical test results, post-hoc results, and compact letter displays (CLD).
- If save.plot = TRUE or save.grid = TRUE: plots or the grid are saved to file as PNG images in the specified location.

## Examples

```
# Example dataset
df <- data.frame(
  group = rep(c("A", "B", "C"), each = 10),
  value1 = c(rnorm(10, 5), rnorm(10, 6), rnorm(10, 7)),
  value2 = c(rnorm(10, 3), rnorm(10, 4), rnorm(10, 5))
)

# Basic boxplot with ANOVA and significance letters
get.plot(
  data = df,
  response = "value1",
  factor = "group",
  method = "aov",
  group.order = c("A", "B", "C"),
  show.letters = TRUE,
  plot.type = "boxplot"
)

# Mean plot with Kruskal-Wallis test and error bars
get.plot(
  data = df,
  response = "value2",
  factor = "group",
  method = "kw",
  group.order = c("A", "B", "C"),
  plot.type = "meanplot",
  fill = "point",
  show.test = TRUE
)

# Multiple response variables arranged in a grid
get.plot(
  data = df,
  response = c("value1", "value2"),
  factor = "group",
  method = "aov",
  group.order = c("A", "B", "C"),
  grid = TRUE,
  nrow = 1,
  ncol = 2,
  grid.axis = TRUE,
  grid.axis.x = "Experimental group",
  grid.axis.y = "Measured value"
)
```

# Index