**fun\_gg\_scatter <- function(**

**data1,**

**x,**

**y,**

**categ = NULL,**

**categ.class.order = NULL,**

**color = NULL,**

**geom = "geom\_point",**

**geom.step.dir = "hv",**

**alpha = 0.5,**

**dot.size = 2,**

**dot.shape = 21,**

**dot.border.size = 0.5,**

**dot.border.color = NULL,**

**line.size = 0.5,**

**line.type = "solid",**

**x.lim = NULL,**

**x.lab = NULL,**

**x.log = "no",**

**x.tick.nb = NULL,**

**x.second.tick.nb = NULL,**

**x.include.zero = FALSE,**

**x.left.extra.margin = 0.05,**

**x.right.extra.margin = 0.05,**

**x.text.angle = 0,**

**y.lim = NULL,**

**y.lab = NULL,**

**y.log = "no",**

**y.tick.nb = NULL,**

**y.second.tick.nb = NULL,**

**y.include.zero = FALSE,**

**y.top.extra.margin = 0.05,**

**y.bottom.extra.margin = 0.05,**

**y.text.angle = 0,**

**text.size = 12,**

**title = "",**

**title.text.size = 12,**

**legend.show = TRUE,**

**legend.width = 0.5,**

**legend.name = NULL,**

**raster = FALSE,**

**raster.ratio = 1,**

**raster.threshold = NULL,**

**article = TRUE,**

**grid = FALSE,**

**return = FALSE,**

**return.ggplot = FALSE,**

**return.gtable = TRUE,**

**plot = TRUE,**

**add = NULL,**

**warn.print = FALSE,**

**lib.path = NULL**

**){**

*# AIM*

*# plot ggplot2 scatterplot with the possibility to overlay dots from up to 3 different data frames (-> three different legends) and lines from up to 3 different data frames (-> three different legends) -> up to 6 overlays totally*

*# for ggplot2 specifications, see: https://ggplot2.tidyverse.org/articles/ggplot2-specs.html*

*# WARNINGS*

*# Rows containing NA in data1[, c(x, y, categ)] will be removed before processing, with a warning (see below)*

*# Size arguments (dot.size, dot.border.size, line.size, text.size and title.text.size) are in mm. See Hadley comment in https://stackoverflow.com/questions/17311917/ggplot2-the-unit-of-size. See also http://sape.inf.usi.ch/quick-reference/ggplot2/size). Unit object are not accepted, but conversion can be used (e.g., grid::convertUnit(grid::unit(0.2, "inches"), "mm", valueOnly = TRUE))*

*# The function uses options(warning.length = 8170) which increases the length of warning messages. Use options(warning.length = 1000) after using fun\_gg\_scatter() to go back to the default value*

*# ARGUMENTS*

*# data1: a dataframe compatible with ggplot2, or a list of data frames*

*# x: single character string of the data1 column name for x-axis coordinates. If data1 is a list, then x must be a list of single character strings, of same size as data1, with compartment 1 related to compartment 1 of data1, etc. Write NULL for each "geom\_hline" in geom argument*

*# y: single character string of the data1 column name for y-axis coordinates. If data1 is a list, then y must be a list of single character strings, of same size as data1, with compartment 1 related to compartment 1 of data1, etc. Write NULL for each "geom\_vline" in geom argument*

*# categ: either NULL or a single character string or a list of single character strings, indicating the data1 column names to use for categories which creates legend display*

*# If categ == NULL, no categories -> no legend displayed*

*# If data1 is a data frame, categ must be a single character string of the data1 column name for categories*

*# If data1 is a list, then categ must be a list of single character strings, of same size as data1, with compartment 1 related to compartment 1 of data1, etc. Some of the list compartments can be NULL (no legend display for these compartments), and other not*

*# categ.class.order: either (1) NULL or (2) a vector of character strings or (3) a list of these vectors, setting the order of the classes of categ in the legend display*

*# If categ.class.order is NULL, classes are represented according to the alphabetical order*

*# If data1 is a data frame, categ.class.order must be a vector of character strings specifying the different classes in the categ column name of data1*

*# If data1 is a list, then categ.class.order must be a list of vector of character strings, of same size as data1, with compartment 1 related to compartment 1 of data1, etc. Some of the list compartments can be NULL (alphabetical order for these compartments), and other not*

*# color: either (1) NULL, or (2) a vector of character strings or integers, or (3) a list of vectors of character strings or integers*

*# If color is NULL, default colors of ggplot2*

*# If data1 is a data frame, color argument can be either:*

*# (1) a single color string. All the dots of the corresponding data1 will have this color, whatever the categ value (NULL or not)*

*# (2) if categ is non-null, a vector of string colors, one for each class of categ. Each color will be associated according to the categ.class.order argument if specified, or to the alphabetical order of categ classes otherwise*

*# (3) if categ is non-null, a vector or factor of string colors, like if it was one of the column of data1 data frame. WARNING: a single color per class of categ and a single class of categ per color must be respected*

*# Integers are also accepted instead of character strings, as long as above rules about length are respected. Integers will be processed by fun\_gg\_palette() using the max integer value among all the integers in color (see fun\_gg\_palette())*

*# If data1 is a list, then color argument must be either:*

*# (1) a list of character strings or integers, of same size as data1, with compartment 1 related to compartment 1 of data1, etc.*

*# (2) a single character string or a single integer*

*# With a list (first possibility), the rules described for when data1 is a data frame apply to each compartment of the list. Some of the compartments can be NULL. In that case, a different grey color will be used for each NULL compartment. With a single value (second possibility), the same color will be used for all the dots and lines, whatever the data1 list*

*# geom: single character string of the kind of plot, or a list of single character strings*

*# Either:*

*# "geom\_point" (scatterplot)*

*# "geom\_line" (coordinates plotted then line connection from the lowest to highest coordinates)*

*# "geom\_path" (coordinates plotted then line connection respecting the order in data1)*

*# "geom\_step" coordinates plotted then line connection respecting the order in data1 but drawn in steps). See the geom.step.dir argument*

*# "geom\_hline" (horizontal line, no x value provided)*

*# "geom\_vline" (vertical line, no y value provided)*

*# "geom\_stick" (dots as vertical bars)*

*# If data1 is a list, then geom must be either:*

*# (1) a list of single character strings, of same size as data1, with compartment 1 related to compartment 1 of data1, etc.*

*# (2) a single character string. In that case the same kind of plot will apply for the different compartments of the data1 list*

*# WARNING concerning "geom\_hline" or "geom\_vline":*

*# (1) x or y argument must be NULL, respectively*

*# (2) x.lim or y.lim argument must NOT be NULL, respectively, if only these kind of lines are drawn (if other geom present, then x.lim = NULL and y.lim = NULL will generate x.lim and y.lim defined by these other geom, which is not possible with "geom\_hline" or "geom\_vline" alone)*

*# (3) the function will draw n lines for n values in the x argument column name of the data1 data frame. If several colors required, the categ argument must be specified and the corresponding categ column name must exist in the data1 data frame with a different class name for each row*

*# geom.step.dir: single character string indicating the direction when using "geom\_step" of the geom argument, or a list of single character strings*

*# Either:*

*# "vh" (vertical then horizontal)*

*# "hv" (horizontal then vertical)*

*# "mid" (step half-way between adjacent x-values)*

*# See https://ggplot2.tidyverse.org/reference/geom\_path.html*

*# If data1 is a list, then geom must be either:*

*# (1) a list of single character strings, of same size as data1, with compartment 1 related to compartment 1 of data1, etc. The value in compartments related to other geom values than "geom\_step" will be ignored*

*# (2) a single character string, which will be used for all the "geom\_step" values of the geom argument, whatever the data1 list*

*# alpha: single numeric value (from 0 to 1) of transparency. If data1 is a list, then alpha must be either (1) a list of single numeric values, of same size as data1, with compartment 1 related to compartment 1 of data1, etc., or (2) a single numeric value. In that case the same transparency will apply for the different compartments of the data1 list*

*# dot.size: single numeric value of dot diameter in mm. If data1 is a list, then dot.size must be either (1) a list of single numeric values, of same size as data1, with compartment 1 related to compartment 1 of data1, etc., or (2) a single numeric value. With a list (former possibility), the value in compartments related to lines will be ignored. With a single value (latter possibility), the same dot.size will be used for all the dots, whatever the data1 list*

*# dot.shape: value indicating the shape of the dots (see https://ggplot2.tidyverse.org/articles/ggplot2-specs.html) If data1 is a list, then dot.shape must be either (1) a list of single shape values, of same size as data1, with compartment 1 related to compartment 1 of data1, etc., or (2) a single shape value. With a list (former possibility), the value in compartments related to lines will be ignored. With a single value (latter possibility), the same dot.shape will be used for all the dots, whatever the data1 list*

*# dot.border.size: single numeric value of border dot width in mm. Write zero for no dot border. If data1 is a list, then dot.border.size must be either (1) a list of single numeric values, of same size as data1, with compartment 1 related to compartment 1 of data1, etc., or (2) a single numeric value. With a list (former possibility), the value in compartments related to lines will be ignored. With a single value (latter possibility), the same dot.border.size will be used for all the dots, whatever the data1 list*

*# dot.border.color: single character color string defining the color of the dot border (same border color for all the dots, whatever their categories). If dot.border.color == NULL, the border color will be the same as the dot color. A single integer is also accepted instead of a character string, that will be processed by fun\_gg\_palette()*

*# line.size: single numeric value of line width in mm. If data1 is a list, then line.size must be either (1) a list of single numeric values, of same size as data1, with compartment 1 related to compartment 1 of data1, etc., or (2) a single numeric value. With a list (former possibility), the value in compartments related to dots will be ignored. With a single value (latter possibility), the same line.size will be used for all the lines, whatever the data1 list*

*# line.type: value indicating the kind of lines (see https://ggplot2.tidyverse.org/articles/ggplot2-specs.html) If data1 is a list, then line.type must be either (1) a list of single line kind values, of same size as data1, with compartment 1 related to compartment 1 of data1, etc., or (2) a single line kind value. With a list (former possibility), the value in compartments related to dots will be ignored. With a single value (latter possibility), the same line.type will be used for all the lines, whatever the data1 list*

*# x.lim: 2 numeric values setting the x-axis range. Order of the 2 values matters (for inverted axis). If NULL, the range of the x column name of data1 will be used*

*# x.lab: a character string or expression for x-axis label. If NULL, will use the first value of x (x column name of the first data frame in data1). Warning message if the elements in x are different between data frames in data1*

*# x.log: either "no", "log2" (values in the x column name of the data1 data frame will be log2 transformed and x-axis will be log2 scaled) or "log10" (values in the x column name of the data1 data frame will be log10 transformed and x-axis will be log10 scaled)*

*# x.tick.nb: approximate number of desired values labeling the x-axis (i.e., main ticks, see the n argument of the the cute::fun\_scale() function). If NULL and if x.log is "no", then the number of labeling values is set by ggplot2. If NULL and if x.log is "log2" or "log10", then the number of labeling values corresponds to all the exposant integers in the x.lim range (e.g., 10^1, 10^2 and 10^3, meaning 3 main ticks for x.lim = c(9, 1200)). WARNING: if non-NULL and if x.log is "log2" or "log10", labeling can be difficult to read (e.g., ..., 10^2, 10^2.5, 10^3, ...)*

*# x.second.tick.nb: number of desired secondary ticks between main ticks. Ignored if x.log is other than "no" (log scale plotted). Use argument return = TRUE and see $plot$x.second.tick.values to have the values associated to secondary ticks. IF NULL, no secondary ticks*

*# x.include.zero: logical. Does x.lim range include 0? Ignored if x.log is "log2" or "log10"*

*# x.left.extra.margin: single proportion (between 0 and 1) indicating if extra margins must be added to x.lim. If different from 0, add the range of the axis multiplied by x.left.extra.margin (e.g., abs(x.lim[2] - x.lim[1]) \* x.left.extra.margin) to the left of x-axis*

*# x.right.extra.margin: idem as x.left.extra.margin but to the right of x-axis*

*# x.text.angle: integer value of the text angle for the x-axis labeling values, using the same rules as in ggplot2. Use positive value for clockwise rotation: 0 for horizontal, 90 for vertical, 180 for upside down etc. Use negative values for counterclockwise rotation: 0 for horizontal, -90 for vertical, -180 for upside down etc.*

*# y.lim: 2 numeric values setting the y-axis range. Order of the 2 values matters (for inverted axis). If NULL, the range of the y column name of data1 will be used*

*# y.lab: a character string or expression for y-axis label. If NULL, will use the first value of y (y column name of the first data frame in data1). Warning message if the elements in y are different between data frames in data1*

*# y.log: either "no", "log2" (values in the y column name of the data1 data frame will be log2 transformed and y-axis will be log2 scaled) or "log10" (values in the y column name of the data1 data frame will be log10 transformed and y-axis will be log10 scaled)*

*# y.tick.nb: approximate number of desired values labeling the y-axis (i.e., main ticks, see the n argument of the the cute::fun\_scale() function). If NULL and if y.log is "no", then the number of labeling values is set by ggplot2. If NULL and if y.log is "log2" or "log10", then the number of labeling values corresponds to all the exposant integers in the y.lim range (e.g., 10^1, 10^2 and 10^3, meaning 3 main ticks for y.lim = c(9, 1200)). WARNING: if non-NULL and if y.log is "log2" or "log10", labeling can be difficult to read (e.g., ..., 10^2, 10^2.5, 10^3, ...)*

*# y.second.tick.nb: number of desired secondary ticks between main ticks. Ignored if y.log is other than "no" (log scale plotted). Use argument return = TRUE and see $plot$y.second.tick.values to have the values associated to secondary ticks. IF NULL, no secondary ticks*

*# y.include.zero: logical. Does y.lim range include 0? Ignored if y.log is "log2" or "log10"*

*# y.top.extra.margin: single proportion (between 0 and 1) indicating if extra margins must be added to y.lim. If different from 0, add the range of the axis multiplied by y.top.extra.margin (e.g., abs(y.lim[2] - y.lim[1]) \* y.top.extra.margin) to the top of y-axis*

*# y.bottom.extra.margin: idem as y.top.extra.margin but to the bottom of y-axis*

*# y.text.angle: integer value of the text angle for the y-axis labeling values, using the same rules as in ggplot2. Use positive value for clockwise rotation: 0 for horizontal, 90 for vertical, 180 for upside down etc. Use negative values for counterclockwise rotation: 0 for horizontal, -90 for vertical, -180 for upside down etc.*

*# text.size: numeric value of the font size of the (1) axis numbers and axis legends and (2) texts in the graphic legend (in mm)*

*# title: character string of the graph title*

*# title.text.size: numeric value of the title font size in mm*

*# legend.show: logical. Show legend? Not considered if categ argument is NULL, because this already generate no legend, excepted if legend.width argument is non-NULL. In that specific case (categ is NULL, legend.show is TRUE and legend.width is non-NULL), an empty legend space is created. This can be useful when desiring graphs of exactly the same width, whatever they have legends or not*

*# legend.width: single proportion (between 0 and 1) indicating the relative width of the legend sector (on the right of the plot) relative to the width of the plot. Value 1 means that the window device width is split in 2, half for the plot and half for the legend. Value 0 means no room for the legend, which will overlay the plot region. Write NULL to inactivate the legend sector. In such case, ggplot2 will manage the room required for the legend display, meaning that the width of the plotting region can vary between graphs, depending on the text in the legend*

*# legend.name: character string of the legend title. If legend.name is NULL and categ argument is not NULL, then legend.name <- categ. If data1 is a list, then legend.name must be a list of character strings, of same size as data1, with compartment 1 related to compartment 1 of data1, etc. Some of the list compartments can be NULL, and other not*

*# raster: logical. Dots in raster mode? If FALSE, dots from each "geom\_point" from geom argument are plotted in vectorial mode (bigger pdf and long to display if lots of dots). If TRUE, dots from each "geom\_point" from geom argument are plotted in matricial mode (smaller pdf and easy display if lots of dots, but it takes time to generate the layer). If TRUE, the raster.ratio argument is used to avoid an ellipsoid representation of the dots. If TRUE, solve the transparency problem with some GUI. Overriden by the non-NULL raster.threshold argument*

*# raster.ratio: single numeric value indicating the height / width ratio of the graphic device used (for instance provided by the $dim compartment in the output of the fun\_open() function). The default value is 1 because by default R opens a square graphic device. But this argument has to be set when using other device dimensions. Ignored if raster == FALSE*

*# raster.threshold: positive integer value indicating the limit of the dot number above which "geom\_point" layers from the geom argument switch from vectorial mode to matricial mode (see the raster argument). If any layer is matricial, then the raster.ratio argument is used to avoid an ellipsoid representation of the dots. If non-NULL, it overrides the raster argument*

*# article: logical. If TRUE, use an article theme (article like). If FALSE, use a classic related ggplot theme. Use the add argument (e.g., add = "+ggplot2::theme\_classic()" for the exact classic ggplot theme*

*# grid: logical. Draw lines in the background to better read the box values? Not considered if article == FALSE (grid systematically present)*

*# return: logical. Return the graph parameters?*

*# return.ggplot: logical. Return the ggplot object in the output list? Ignored if return argument is FALSE. WARNING: always assign the fun\_gg\_scatter() function (e.g., a <- fun\_gg\_scatter()) if return.ggplot argument is TRUE, otherwise, double plotting is performed. See $ggplot in the RETURN section below for more details*

*# return.gtable: logical. Return the ggplot object as gtable of grobs in the output list? Ignored if plot argument is FALSE. Indeed, the graph must be plotted to get the grobs dispositions. See $gtable in the RETURN section below for more details*

*# plot: logical. Plot the graphic? If FALSE and return argument is TRUE, graphical parameters and associated warnings are provided without plotting*

*# add: character string allowing to add more ggplot2 features (dots, lines, themes, facet, etc.). Ignored if NULL*

*# WARNING: (1) the string must start with "+", (2) the string must finish with ")" and (3) each function must be preceded by "ggplot2::". Example: "+ ggplot2::coord\_flip() + ggplot2::theme\_bw()"*

*# If the character string contains the "ggplot2::theme" string, then the article argument of fun\_gg\_scatter() (see above) is ignored with a warning*

*# Handle the add argument with caution since added functions can create conflicts with the preexisting internal ggplot2 functions*

*# warn.print: logical. Print warnings at the end of the execution? ? If FALSE, warning messages are never printed, but can still be recovered in the returned list. Some of the warning messages (those delivered by the internal ggplot2 functions) are not apparent when using the argument plot = FALSE*

*# lib.path: character string indicating the absolute path of the required packages (see below). if NULL, the function will use the R library default folders*

*# REQUIRED PACKAGES*

*# ggplot2*

*# scales*

*# if raster plots are drawn (see the raster and raster.threshold arguments):*

*# Cairo*

*# grid*

*# REQUIRED FUNCTIONS FROM CUTE\_LITTLE\_R\_FUNCTION*

*# fun\_gg\_empty\_graph()*

*# fun\_gg\_palette()*

*# fun\_gg\_point\_rast()*

*# fun\_pack()*

*# fun\_check()*

*# fun\_round()*

*# fun\_scale()*

*# fun\_inter\_ticks()*

*# RETURN*

*# a scatter plot if plot argument is TRUE*

*# a list of the graph info if return argument is TRUE:*

*# $data: the initial data with graphic information added. WARNING: if the x.log or y.log argument is not "no", x or y argument column of the data1 data frame are log2 or log10 converted in $data, respectively. Use 2^values or 10^$values to recover the initial values*

*# $removed.row.nb: a list of the removed rows numbers in data frames (because of NA). NULL if no row removed*

*# $removed.rows: a list of the removed rows in data frames (because of NA). NULL if no row removed*

*# $plot: the graphic box and dot coordinates*

*# $dots: dot coordinates*

*# y.second.tick.positions: coordinates of secondary ticks (only if y.second.tick.nb argument is non-null or if y.log argument is different from "no")*

*# y.second.tick.values: values of secondary ticks. NULL except if y.second.tick.nb argument is non-null or if y.log argument is different from "no")*

*# $panel: the variable names used for the panels (NULL if no panels). WARNING: NA can be present according to ggplot2 upgrade to v3.3.0*

*# $axes: the x-axis and y-axis info*

*# $warn: the warning messages. Use cat() for proper display. NULL if no warning. WARNING: warning messages delivered by the internal ggplot2 functions are not apparent when using the argument plot = FALSE*

*# $ggplot: ggplot object that can be used for reprint (use print($ggplot) or update (use $ggplot + ggplot2::...). NULL if return.ggplot argument is FALSE. Of note, a non-null $ggplot in the output list is sometimes annoying as the manipulation of this list prints the plot*

*# $gtable: gtable object that can be used for reprint (use gridExtra::grid.arrange(...$ggplot) or with additionnal grobs (see the grob decomposition in the examples). NULL if return.ggplot argument is FALSE. Contrary to $ggplot, a non-NULL $gtable in the output list is not annoying as the manipulation of this list does not print the plot*

*# EXAMPLES*

*# DEBUGGING*

*# set.seed(1) ; obs1 <- data.frame(km = rnorm(1000, 10, 3), time = rnorm(1000, 10, 3), group1 = rep(c("A1", "A2"), 500)) ; obs2 <-data.frame(km = rnorm(1000, 15, 3), time = rnorm(1000, 15, 3), group2 = rep(c("G1", "G2"), 500)) ; set.seed(NULL) ; obs1$km[2:3] <- NA ; data1 = list(L1 = obs1, L2 = obs2) ; x = list(L1 = "km", L2 = "km") ; y = list(L1 = "time", L2 = "time") ; categ = list(L1 = "group1", L2 = "group2") ; categ.class.order = NULL ; legend.name = NULL ; color = list(L1 = 4:5, L2 = 7:8) ; geom = list(L1 = "geom\_point", L2 = "geom\_point") ; geom.step.dir = "hv" ; alpha = list(L1 = 0.5, L2 = 0.5) ; dot.size = 3 ; dot.shape = 21 ; dot.border.size = 0.5 ; dot.border.color = NULL ; line.size = 0.5 ; line.type = "solid" ; x.lim = NULL ; x.lab = "KM" ; x.log = "no" ; x.tick.nb = 10 ; x.second.tick.nb = 1 ; x.left.extra.margin = 0 ; x.right.extra.margin = 0 ; y.lim = c(1, 25) ; y.lab = "TIME (s)" ; y.log = "no" ; y.tick.nb = 5 ; y.second.tick.nb = 2 ; y.top.extra.margin = 0 ; y.bottom.extra.margin = 0 ; x.include.zero = TRUE ; y.include.zero = TRUE ; x.text.angle = 0 ; y.text.angle = 0 ; text.size = 12 ; title = "" ; title.text.size = 8 ; legend.show = TRUE ; legend.width = 0.5 ; article = FALSE ; grid = FALSE ; raster = TRUE ; raster.ratio = 1 ; raster.threshold = NULL ; return = FALSE ; return.ggplot = FALSE ; return.gtable = FALSE ; plot = TRUE ; add = NULL ; warn.print = TRUE ; lib.path = NULL*

*# data1 <- list(L1 = data.frame(a = 1:6, b = (1:6)^2, group = c("A", "A", "A", "B", "B", "B")), L2 = data.frame(a = (1:6)\*2, b = ((1:6)^2)\*2, group = c("A1", "A1", "A1", "B1", "B1", "B1")), L3 = data.frame(a = (1:6)\*3, b = ((1:6)^2)\*3, group3 = c("A4", "A5", "A6", "A7", "B4", "B5"))) ; data1$L1$a[3] <- NA ; data1$L1$group[5] <- NA ; data1$L3$group3[4] <- NA ; data1 ; x = list(L1 = names(data1$L1)[1], L2 = names(data1$L2)[1], L3 = NULL) ; y = list(L1 = names(data1$L1)[2], L2 = names(data1$L2)[2], L3 = "a") ; categ = list(L1 = "group", L2 = NULL, L3 = NULL) ; categ.class.order = NULL ; legend.name = NULL ; color = NULL ; geom = list(L1 = "geom\_point", L2 = "geom\_point", L3 = "geom\_hline") ; geom.step.dir = "hv" ; alpha = list(L1 = 0.5, L2 = 0.5, L3 = 0.5) ; dot.size = 1 ; dot.shape = 21 ; dot.border.size = 0.5 ; dot.border.color = NULL ; line.size = 0.5 ; line.type = "solid" ; x.lim = c(14, 4) ; x.lab = NULL ; x.log = "log10" ; x.tick.nb = 10 ; x.second.tick.nb = 4 ; x.left.extra.margin = 0 ; x.right.extra.margin = 0 ; y.lim = c(60, 5) ; y.lab = NULL ; y.log = "log10" ; y.tick.nb = 10 ; y.second.tick.nb = 2 ; y.top.extra.margin = 0 ; y.bottom.extra.margin = 0 ; x.include.zero = TRUE ; y.include.zero = TRUE ; x.text.angle = 0 ; y.text.angle = 0 ; text.size = 12 ; title = "" ; title.text.size = 8 ; legend.show = TRUE ; legend.width = 0.5 ; article = TRUE ; grid = FALSE ; raster = FALSE ; raster.ratio = 1 ; raster.threshold = NULL ; return = TRUE ; return.ggplot = FALSE ; return.gtable = FALSE ; plot = TRUE ; add = NULL ; warn.print = TRUE ; lib.path = NULL*

*# data1 <- data.frame(km = 2:7, time = (2:7)^2, group = c("A", "A", "A", "B", "B", "B")) ; data1 ; x = "km"; y = "time"; categ = "group" ; categ.class.order = NULL ; legend.name = NULL ; color = NULL ; geom = "geom\_point" ; geom.step.dir = "hv" ; alpha = 0.1 ; dot.size = 3 ; dot.shape = 21 ; dot.border.size = 0.5 ; dot.border.color = NULL ; line.size = 0.5 ; line.type = "solid" ; x.lim = c(1,10) ; x.lab = NULL ; x.log = "log10" ; x.tick.nb = 10 ; x.second.tick.nb = 4 ; x.left.extra.margin = 0 ; x.right.extra.margin = 0 ; y.lim = NULL ; y.lab = expression(paste("TIME (", 10^-20, " s)")) ; y.log = "log10" ; y.tick.nb = 10 ; y.second.tick.nb = 2 ; y.top.extra.margin = 0 ; y.bottom.extra.margin = 0 ; x.include.zero = TRUE ; y.include.zero = TRUE ; x.text.angle = 0 ; y.text.angle = 0 ; text.size = 12 ; title = "" ; title.text.size = 8 ; legend.show = TRUE ; legend.width = 0.5 ; article = FALSE ; grid = FALSE ; raster = FALSE ; raster.ratio = 1 ; raster.threshold = NULL ; return = FALSE ; return.ggplot = FALSE ; return.gtable = FALSE ; plot = TRUE ; add = NULL ; warn.print = TRUE ; lib.path = NULL*

*# function name*

**function.name <- paste0(as.list(match.call(expand.dots=FALSE))[[1]], "()")**

**arg.user.setting <- as.list(match.call(expand.dots=FALSE))[-1]** *# list of the argument settings (excluding default values not provided by the user)*

*# end function name*

*# required function checking*

**req.function <- c(**

**"fun\_check",**

**"fun\_gg\_just",**

**"fun\_gg\_empty\_graph",**

**"fun\_gg\_palette",**

**"fun\_gg\_point\_rast",**

**"fun\_round",**

**"fun\_pack",**

**"fun\_scale",**

**"fun\_inter\_ticks"**

**)**

**for(i1 in req.function){**

**if(length(find(i1, mode = "function")) == 0){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": REQUIRED ", i1, "() FUNCTION IS MISSING IN THE R ENVIRONMENT\n\n================\n\n")**

**stop(tempo.cat)**

**}**

**}**

*# end required function checking*

*# reserved words to avoid bugs (used in this function)*

**reserved.words <- c("fake\_x", "fake\_y", "fake\_categ")**

*# end reserved words to avoid bugs (used in this function)*

*# arg with no default values*

**if(any(missing(data1) | missing(x) | missing(y))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ARGUMENTS data1, x AND y HAVE NO DEFAULT VALUE AND REQUIRE ONE\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

*# end arg with no default values*

*# primary argument checking*

**arg.check <- NULL** *#*

**text.check <- NULL** *#*

**checked.arg.names <- NULL** *# for function debbuging: used by r\_debugging\_tools*

**ee <- expression(arg.check <- c(arg.check, tempo$problem) , text.check <- c(text.check, tempo$text) , checked.arg.names <- c(checked.arg.names, tempo$fun.name))**

**tempo1 <- fun\_check(data = data1, class = "data.frame", na.contain = TRUE, fun.name = function.name)**

**tempo2 <- fun\_check(data = data1, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": data1 ARGUMENT MUST BE A DATA FRAME OR A LIST OF DATA FRAMES")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**if( ! is.null(x)){**

**tempo1 <- fun\_check(data = x, class = "vector", mode = "character", na.contain = TRUE, length = 1, fun.name = function.name)**

**tempo2 <- fun\_check(data = x, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": x ARGUMENT MUST BE A SINGLE CHARACTER STRING OR A LIST OF CHARACTER STRINGS")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**if( ! is.null(y)){**

**tempo1 <- fun\_check(data = y, class = "vector", mode = "character", na.contain = TRUE, length = 1, fun.name = function.name)**

**tempo2 <- fun\_check(data = y, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": y ARGUMENT MUST BE A SINGLE CHARACTER STRING OR A LIST OF CHARACTER STRINGS")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**if( ! is.null(categ)){**

**tempo1 <- fun\_check(data = categ, class = "vector", mode = "character", length = 1, fun.name = function.name)**

**tempo2 <- fun\_check(data = categ, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": categ ARGUMENT MUST BE A SINGLE CHARACTER STRING OR A LIST OF CHARACTER STRINGS")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**if( ! is.null(categ.class.order)){**

**tempo1 <- fun\_check(data = categ.class.order, class = "vector", mode = "character", fun.name = function.name)**

**tempo2 <- fun\_check(data = categ.class.order, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": categ.class.order ARGUMENT MUST BE A VECTOR OF CHARACTER STRINGS OR A LIST OF VECTOR OF CHARACTER STRINGS")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**if( ! is.null(legend.name)){**

**tempo1 <- fun\_check(data = legend.name, class = "vector", mode = "character", na.contain = TRUE, length = 1, fun.name = function.name)**

**tempo2 <- fun\_check(data = legend.name, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": legend.name ARGUMENT MUST BE A SINGLE CHARACTER STRING OR A LIST OF CHARACTER STRINGS")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**if( ! is.null(color)){**

**tempo1 <- fun\_check(data = color, class = "vector", mode = "character", na.contain = TRUE, fun.name = function.name)**

**tempo2 <- fun\_check(data = color, class = "factor", na.contain = TRUE, fun.name = function.name)**

**tempo3 <- fun\_check(data = color, class = "integer", double.as.integer.allowed = TRUE, na.contain = TRUE, fun.name = function.name)**

**tempo4 <- fun\_check(data = color, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE & tempo3$problem == TRUE & tempo4$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": color ARGUMENT MUST BE A VECTOR (OF CHARACTER STRINGS OR INTEGERS) OR A FACTOR OR A LIST OF THESE POSSIBILITIES")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**tempo1 <- fun\_check(data = geom, class = "vector", mode = "character", na.contain = FALSE, length = 1, fun.name = function.name)**

**tempo2 <- fun\_check(data = geom, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": geom ARGUMENT MUST BE A SINGLE CHARACTER STRING OR A LIST OF CHARACTER STRINGS")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**tempo1 <- fun\_check(data = geom.step.dir, options = c("vh", "hv", "mid"), na.contain = FALSE, length = 1, fun.name = function.name)**

**tempo2 <- fun\_check(data = geom.step.dir, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": geom.step.dir ARGUMENT MUST BE A SINGLE CHARACTER STRING (\"vh\" OR \"hv\" OR \"mid\") OR A LIST OF THESE CHARACTER STRINGS")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**tempo1 <- fun\_check(data = alpha, prop = TRUE, length = 1, fun.name = function.name)**

**tempo2 <- fun\_check(data = alpha, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": alpha ARGUMENT MUST BE A SINGLE NUMERIC VALUE BETWEEN 0 AND 1 OR A LIST OF SUCH VALUES")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**tempo1 <- fun\_check(data = dot.size, class = "vector", mode = "numeric", length = 1, neg.values = FALSE, fun.name = function.name)**

**tempo2 <- fun\_check(data = dot.size, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": dot.size ARGUMENT MUST BE A SINGLE NUMERIC VALUE OR A LIST OF SINGLE NUMERIC VALUES")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**tempo1 <- fun\_check(data = dot.shape, class = "vector", length = 1, fun.name = function.name)**

**tempo2 <- fun\_check(data = dot.shape, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": dot.shape ARGUMENT MUST BE A SINGLE SHAPE VALUE OR A LIST OF SINGLE SHAPE VALUES (SEE** *https://ggplot2.tidyverse.org/articles/ggplot2-specs.html***)")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**tempo1 <- fun\_check(data = dot.border.size, class = "vector", mode = "numeric", length = 1, neg.values = FALSE, fun.name = function.name)**

**tempo2 <- fun\_check(data = dot.border.size, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": dot.border.size ARGUMENT MUST BE A SINGLE NUMERIC VALUE OR A LIST OF SINGLE NUMERIC VALUES")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**if( ! is.null(dot.border.color)){**

**tempo1 <- fun\_check(data = dot.border.color, class = "vector", mode = "character", length = 1, fun.name = function.name)**

**tempo2 <- fun\_check(data = dot.border.color, class = "vector", typeof = "integer", double.as.integer.allowed = TRUE, length = 1, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

*# integer colors -> gg\_palette*

**tempo.cat <- paste0("ERROR IN ", function.name, ": dot.border.color MUST BE A SINGLE CHARACTER STRING OF COLOR OR A SINGLE INTEGER VALUE")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**tempo1 <- fun\_check(data = line.size, class = "vector", mode = "numeric", length = 1, neg.values = FALSE, fun.name = function.name)**

**tempo2 <- fun\_check(data = line.size, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": line.size ARGUMENT MUST BE A SINGLE NUMERIC VALUE OR A LIST OF SINGLE NUMERIC VALUES")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**tempo1 <- fun\_check(data = line.type, class = "vector", typeof = "integer", double.as.integer.allowed = FALSE, length = 1, fun.name = function.name)**

**tempo2 <- fun\_check(data = line.type, class = "vector", mode = "character", length = 1, fun.name = function.name)**

**tempo3 <- fun\_check(data = line.type, class = "list", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE & tempo3$problem == TRUE){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": line.type ARGUMENT MUST BE A SINGLE LINE KIND VALUE OR A LIST OF SINGLE LINE KIND VALUES (SEE** *https://ggplot2.tidyverse.org/articles/ggplot2-specs.html***)")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**if( ! is.null(x.lim)){**

**tempo <- fun\_check(data = x.lim, class = "vector", mode = "numeric", length = 2, fun.name = function.name) ; eval(ee)**

**if(tempo$problem == FALSE & any(x.lim %in% c(Inf, -Inf))){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": x.lim ARGUMENT CANNOT CONTAIN -Inf OR Inf VALUES")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**if( ! is.null(x.lab)){**

**if(all(class(x.lab) %in% "expression")){** *# to deal with math symbols*

**tempo <- fun\_check(data = x.lab, class = "expression", length = 1, fun.name = function.name) ; eval(ee)**

**}else{**

**tempo <- fun\_check(data = x.lab, class = "vector", mode = "character", length = 1, fun.name = function.name) ; eval(ee)**

**}**

**}**

**tempo <- fun\_check(data = x.log, options = c("no", "log2", "log10"), length = 1, fun.name = function.name) ; eval(ee)**

**if( ! is.null(x.tick.nb)){**

**tempo <- fun\_check(data = x.tick.nb, class = "vector", typeof = "integer", length = 1, double.as.integer.allowed = TRUE, fun.name = function.name) ; eval(ee)**

**if(tempo$problem == FALSE & x.tick.nb < 0){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": x.tick.nb ARGUMENT MUST BE A NON-NULL POSITIVE INTEGER")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**if( ! is.null(x.second.tick.nb)){**

**tempo <- fun\_check(data = x.second.tick.nb, class = "vector", typeof = "integer", length = 1, double.as.integer.allowed = TRUE, fun.name = function.name) ; eval(ee)**

**if(tempo$problem == FALSE & x.second.tick.nb <= 0){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": x.second.tick.nb ARGUMENT MUST BE A NON-NULL POSITIVE INTEGER")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**tempo <- fun\_check(data = x.include.zero, class = "vector", mode = "logical", length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = x.left.extra.margin, prop = TRUE, length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = x.right.extra.margin, prop = TRUE, length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = x.text.angle, class = "vector", typeof = "integer", double.as.integer.allowed = TRUE, length = 1, neg.values = TRUE, fun.name = function.name) ; eval(ee)**

**if( ! is.null(y.lim)){**

**tempo <- fun\_check(data = y.lim, class = "vector", mode = "numeric", length = 2, fun.name = function.name) ; eval(ee)**

**if(tempo$problem == FALSE & any(y.lim %in% c(Inf, -Inf))){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": y.lim ARGUMENT CANNOT CONTAIN -Inf OR Inf VALUES")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**if( ! is.null(y.lab)){**

**if(all(class(y.lab) %in% "expression")){** *# to deal with math symbols*

**tempo <- fun\_check(data = y.lab, class = "expression", length = 1, fun.name = function.name) ; eval(ee)**

**}else{**

**tempo <- fun\_check(data = y.lab, class = "vector", mode = "character", length = 1, fun.name = function.name) ; eval(ee)**

**}**

**}**

**tempo <- fun\_check(data = y.log, options = c("no", "log2", "log10"), length = 1, fun.name = function.name) ; eval(ee)**

**if( ! is.null(y.tick.nb)){**

**tempo <- fun\_check(data = y.tick.nb, class = "vector", typeof = "integer", length = 1, double.as.integer.allowed = TRUE, fun.name = function.name) ; eval(ee)**

**if(tempo$problem == FALSE & y.tick.nb < 0){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": y.tick.nb ARGUMENT MUST BE A NON-NULL POSITIVE INTEGER")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**if( ! is.null(y.second.tick.nb)){**

**tempo <- fun\_check(data = y.second.tick.nb, class = "vector", typeof = "integer", length = 1, double.as.integer.allowed = TRUE, fun.name = function.name) ; eval(ee)**

**if(tempo$problem == FALSE & y.second.tick.nb <= 0){**

**tempo.cat <- paste0("ERROR IN ", function.name, ": y.second.tick.nb ARGUMENT MUST BE A NON-NULL POSITIVE INTEGER")**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**tempo <- fun\_check(data = y.include.zero, class = "vector", mode = "logical", length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = y.top.extra.margin, prop = TRUE, length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = y.bottom.extra.margin, prop = TRUE, length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = y.text.angle, class = "vector", typeof = "integer", double.as.integer.allowed = TRUE, length = 1, neg.values = TRUE, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = text.size, class = "vector", mode = "numeric", length = 1, neg.values = FALSE, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = title, class = "vector", mode = "character", length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = title.text.size, class = "vector", mode = "numeric", length = 1, neg.values = FALSE, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = legend.show, class = "logical", length = 1, fun.name = function.name) ; eval(ee)**

**if( ! is.null(legend.width)){**

**tempo <- fun\_check(data = legend.width, prop = TRUE, length = 1, fun.name = function.name) ; eval(ee)**

**}**

**tempo <- fun\_check(data = raster, class = "logical", length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = raster.ratio, class = "vector", mode = "numeric", length = 1, neg.values = FALSE, fun.name = function.name) ; eval(ee)**

**if( ! is.null(raster.threshold)){**

**tempo <- fun\_check(data = raster.threshold, class = "vector", typeof = "integer", neg.values = FALSE, double.as.integer.allowed = TRUE, fun.name = function.name) ; eval(ee)**

**}**

**tempo <- fun\_check(data = article, class = "logical", length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = grid, class = "logical", length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = return, class = "logical", length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = return.ggplot, class = "logical", length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = return.gtable, class = "logical", length = 1, fun.name = function.name) ; eval(ee)**

**tempo <- fun\_check(data = plot, class = "logical", length = 1, fun.name = function.name) ; eval(ee)**

**if( ! is.null(add)){**

**tempo <- fun\_check(data = add, class = "vector", mode = "character", length = 1, fun.name = function.name) ; eval(ee)**

**}**

**tempo <- fun\_check(data = warn.print, class = "logical", length = 1, fun.name = function.name) ; eval(ee)**

**if( ! is.null(lib.path)){**

**tempo <- fun\_check(data = lib.path, class = "vector", mode = "character", fun.name = function.name) ; eval(ee)**

**if(tempo$problem == FALSE){**

**if( ! all(dir.exists(lib.path))){** *# separation to avoid the problem of tempo$problem == FALSE and lib.path == NA*

**tempo.cat <- paste0("ERROR IN ", function.name, ": DIRECTORY PATH INDICATED IN THE lib.path ARGUMENT DOES NOT EXISTS:\n", paste(lib.path, collapse = "\n"))**

**text.check <- c(text.check, tempo.cat)**

**arg.check <- c(arg.check, TRUE)**

**}**

**}**

**}**

**if(any(arg.check) == TRUE){**

**stop(paste0("\n\n================\n\n", paste(text.check[arg.check], collapse = "\n"), "\n\n================\n\n"), call. = FALSE)** *#*

**}**

*# source("C:/Users/Gael/Documents/Git\_versions\_to\_use/debugging\_tools\_for\_r\_dev-v1.2/r\_debugging\_tools-v1.2.R") ; eval(parse(text = str\_basic\_arg\_check\_dev)) ; eval(parse(text = str\_arg\_check\_with\_fun\_check\_dev)) # activate this line and use the function (with no arguments left as NULL) to check arguments status and if they have been checked using fun\_check()*

*# end primary argument checking*

*# second round of checking and data preparation*

*# dealing with NA*

**tempo <- suppressWarnings(unlist(lapply(lapply(X = arg.user.setting, FUN = is.na), FUN = any)))** *# logical vector of the argument with NA. Here means that the user cannot use NA as value for any argument*

**if(any(tempo) == TRUE){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": THESE ARGUMENTS\n", paste(names(tempo)[tempo], collapse = "\n"), "\nCANNOT HAVE NA\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

*# end dealing with NA*

*# dealing with NULL*

**null.count <- NULL**

**for(i1 in c(**

**"data1",**

*# "x", # inactivated because of hline or vline*

*# "y", # inactivated because of hline or vline*

**"geom",**

**"geom.step.dir",**

**"alpha",**

**"dot.size",**

**"dot.shape",**

**"dot.border.size",**

**"line.size",**

**"line.type",**

**"x.log",**

**"x.include.zero",**

**"x.left.extra.margin",**

**"x.right.extra.margin",**

**"x.text.angle",**

**"y.log",**

**"y.include.zero",**

**"y.top.extra.margin",**

**"y.bottom.extra.margin",**

**"y.text.angle",**

**"text.size",**

**"title",**

**"title.text.size",**

**"legend.show",**

*# "legend.width", # inactivated because can be null*

**"raster",**

**"raster.ratio",**

**"article",**

**"grid",**

**"return",**

**"return.ggplot",**

**"return.gtable",**

**"plot",**

**"warn.print"**

**)){**

**if(is.null(eval(parse(text = i1)))){**

**null.count <- c(null.count, i1)**

**}**

**}**

**if( ! is.null(null.count)){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": THESE ARGUMENTS\n", paste(null.count, collapse = "\n"), "\nCANNOT BE NULL\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

*# end dealing with NULL*

*# check list lengths (and names of data1 compartments if present)*

**warn <- NULL**

**warn.count <- 0**

**list.color <- NULL**

**list.geom <- NULL**

**list.geom.step.dir <- NULL**

**list.alpha <- NULL**

**list.dot.size <- NULL**

**list.dot.shape <- NULL**

**list.dot.border.size <- NULL**

**list.dot.border.color <- NULL**

**list.line.size <- NULL**

**list.line.type <- NULL**

**if(all(class(data1) == "list")){**

**if(length(data1) > 6){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": data1 ARGUMENT MUST BE A LIST OF 6 DATA FRAMES MAXIMUM (6 OVERLAYS MAX)\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**if(is.null(names(data1))){**

**names(data1) <- paste0("L", 1:length(data1))**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") NULL NAME COMPARTMENT OF data1 LIST -> NAMES RESPECTIVELY ATTRIBUTED TO EACH COMPARTMENT:\n", paste(names(data1), collapse = " "))**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**if( ! is.null(x)){**

**if( ! (all(class(x) == "list") & length(data1) == length(x))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": x ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**}else{**

**x <- vector("list", length(data1))**

**}**

**if( ! is.null(y)){**

**if( ! (all(class(y) == "list") & length(data1) == length(y))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": y ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**}else{**

**y <- vector("list", length(data1))**

**}**

**if( ! is.null(categ)){**

**if( ! (all(class(categ) == "list") & length(data1) == length(categ))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": categ ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**}**

**if( ! is.null(categ.class.order)){**

**if( ! (all(class(categ.class.order) == "list") & length(data1) == length(categ.class.order))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": categ.class.order ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**}**

**if( ! is.null(color)){**

**if( ! ((all(class(color) == "list") & length(data1) == length(color)) | ((all(mode(color) == "character") | all(mode(color) == "numeric")) & length(color) == 1))){** *# list of same length as data1 or single value*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": color ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST, OR A SINGLE CHARACTER STRING OR INTEGER\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if((all(mode(color) == "character") | all(mode(color) == "numeric")) & length(color) == 1){** *# convert the single value into a list of single value*

**list.color <- vector(mode = "list", length = length(data1))**

**list.color[] <- color**

**}**

**}**

**if( ! ((all(class(geom) == "list") & length(data1) == length(geom)) | (all(mode(geom) == "character") & length(geom) == 1))){** *# list of same length as data1 or single value*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": geom ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST, OR A SINGLE CHARACTER VALUE\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(all(mode(geom) == "character") & length(geom) == 1){** *# convert the single value into a list of single value*

**list.geom <- vector(mode = "list", length = length(data1))**

**list.geom[] <- geom**

**}**

**if( ! ((all(class(geom.step.dir) == "list") & length(data1) == length(geom.step.dir)) | (all(mode(geom.step.dir) == "character") & length(geom.step.dir) == 1))){** *# list of same length as data1 or single value*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": geom.step.dir ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST, OR A SINGLE CHARACTER VALUE\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(all(mode(geom.step.dir) == "character") & length(geom.step.dir) == 1){** *# convert the single value into a list of single value*

**list.geom.step.dir <- vector(mode = "list", length = length(data1))**

**list.geom.step.dir[] <- geom.step.dir**

**}**

**if( ! ((all(class(alpha) == "list") & length(data1) == length(alpha)) | (all(mode(alpha) == "numeric") & length(alpha) == 1))){** *# list of same length as data1 or single value*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": alpha ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST, OR A SINGLE NUMERIC VALUE\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(all(mode(alpha) == "numeric") & length(alpha) == 1){** *# convert the single value into a list of single value*

**list.alpha <- vector(mode = "list", length = length(data1))**

**list.alpha[] <- alpha**

**}**

**if( ! ((all(class(dot.size) == "list") & length(data1) == length(dot.size)) | (all(mode(dot.size) == "numeric") & length(dot.size) == 1))){** *# list of same length as data1 or single value*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": dot.size ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST, OR A SINGLE NUMERIC VALUE\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(all(mode(dot.size) == "numeric") & length(dot.size) == 1){** *# convert the single value into a list of single value*

**list.dot.size <- vector(mode = "list", length = length(data1))**

**list.dot.size[] <- dot.size**

**}**

**if( ! ((all(class(dot.shape) == "list") & length(data1) == length(dot.shape)) | (all(mode(dot.shape) != "list") & length(dot.shape) == 1))){** *# list of same length as data1 or single value*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": dot.shape ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST, OR A SINGLE SHAPE VALUE\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(all(mode(dot.shape) != "list") & length(dot.shape) == 1){** *# convert the single value into a list of single value*

**list.dot.shape <- vector(mode = "list", length = length(data1))**

**list.dot.shape[] <- dot.shape**

**}**

**if( ! ((all(class(dot.border.size) == "list") & length(data1) == length(dot.border.size)) | (all(mode(dot.border.size) == "numeric") & length(dot.border.size) == 1))){** *# list of same length as data1 or single value*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": dot.border.size ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST, OR A SINGLE NUMERIC VALUE\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(all(mode(dot.border.size) == "numeric") & length(dot.border.size) == 1){** *# convert the single value into a list of single value*

**list.dot.border.size <- vector(mode = "list", length = length(data1))**

**list.dot.border.size[] <- dot.border.size**

**}**

**if( ! is.null(dot.border.color)){**

**if( ! ((all(class(dot.border.color) == "list") & length(data1) == length(dot.border.color)) | ((all(mode(dot.border.color) == "character") | all(mode(dot.border.color) == "numeric")) & length(dot.border.color) == 1))){** *# list of same length as data1 or single value*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": dot.border.color ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST, OR A SINGLE CHARACTER STRING OR INTEGER\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if((all(mode(dot.border.color) == "character") | all(mode(dot.border.color) == "numeric")) & length(dot.border.color) == 1){** *# convert the single value into a list of single value*

**list.dot.border.color <- vector(mode = "list", length = length(data1))**

**list.dot.border.color[] <- dot.border.color**

**}**

**}**

**if( ! ((all(class(line.size) == "list") & length(data1) == length(line.size)) | (all(mode(line.size) == "numeric") & length(line.size) == 1))){** *# list of same length as data1 or single value*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": line.size ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST, OR A SINGLE NUMERIC VALUE\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(all(mode(line.size) == "numeric") & length(line.size) == 1){** *# convert the single value into a list of single value*

**list.line.size <- vector(mode = "list", length = length(data1))**

**list.line.size[] <- line.size**

**}**

**if( ! ((all(class(line.type) == "list") & length(data1) == length(line.type)) | (all(mode(line.type) != "list") & length(line.type) == 1))){** *# list of same length as data1 or single value*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": line.type ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST, OR A SINGLE LINE KIND VALUE\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(all(mode(line.type) != "list") & length(line.type) == 1){** *# convert the single value into a list of single value*

**list.line.type <- vector(mode = "list", length = length(data1))**

**list.line.type[] <- line.type**

**}**

**if( ! is.null(legend.name)){**

**if( ! (all(class(legend.name) == "list") & length(data1) == length(legend.name))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": legend.name ARGUMENT MUST BE A LIST OF SAME LENGTH AS data1 IF data1 IS A LIST\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**}**

**}**

*# end check list lengths (and names of data1 compartments if present)*

*# conversion into lists*

**if(all(is.data.frame(data1))){**

**data1 <- list(L1 = data1)**

**if(all(class(x) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": x ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**x <- list(L1 = x)**

**}**

**if(all(class(y) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": y ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**y <- list(L1 = y)**

**}**

**if( ! is.null(categ)){**

**if(all(class(categ) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": categ ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**categ <- list(L1 = categ)**

**}**

**}**

**if( ! is.null(categ.class.order)){**

**if(all(class(categ.class.order) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": categ.class.order ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**categ.class.order <- list(L1 = categ.class.order)**

**}**

**}**

**if( ! is.null(color)){**

**if(all(class(color) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": color ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**color <- list(L1 = color)**

**}**

**}**

**if(all(class(geom) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": geom ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**geom <- list(L1 = geom)**

**}**

**if(all(class(geom.step.dir) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": geom.step.dir ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**geom.step.dir <- list(L1 = geom.step.dir)**

**}**

**if(all(class(alpha) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": alpha ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**alpha <- list(L1 = alpha)**

**}**

**if(all(class(dot.size) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": dot.size ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**dot.size <- list(L1 = dot.size)**

**}**

**if(all(class(dot.shape) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": dot.shape ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**dot.shape <- list(L1 = dot.shape)**

**}**

**if(all(class(dot.border.size) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": dot.border.size ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**dot.border.size <- list(L1 = dot.border.size)**

**}**

**if( ! is.null(dot.border.color)){**

**if(all(class(dot.border.color) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": dot.border.color ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**dot.border.color <- list(L1 = dot.border.color)**

**}**

**}**

**if(all(class(line.size) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": line.size ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**line.size <- list(L1 = line.size)**

**}**

**if(all(class(line.type) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": line.type ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**line.type <- list(L1 = line.type)**

**}**

**if( ! is.null(legend.name)){**

**if(all(class(legend.name) == "list")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": legend.name ARGUMENT CANNOT BE A LIST IF data1 IS A DATA FRAME\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**legend.name <- list(L1 = legend.name)**

**}**

**}**

**}else if( ! all(sapply(data1, FUN = "class") == "data.frame")){** *# if not a data frame, data1 can only be a list, as tested above*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": data1 ARGUMENT MUST BE A DATA FRAME OR A LIST OF DATA FRAMES\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

*# single value converted into list now reattributed to the argument name*

**if( ! is.null(color)){**

**if( ! is.null(list.color)){**

**color <- list.color**

**}**

**}**

**if( ! is.null(list.geom)){**

**geom <- list.geom**

**}**

**if( ! is.null(list.geom.step.dir)){**

**geom.step.dir <- list.geom.step.dir**

**}**

**if( ! is.null(list.alpha)){**

**alpha <- list.alpha**

**}**

**if( ! is.null(list.dot.size)){**

**dot.size <- list.dot.size**

**}**

**if( ! is.null(list.dot.shape)){**

**dot.shape <- list.dot.shape**

**}**

**if( ! is.null(list.dot.border.size)){**

**dot.border.size <- list.dot.border.size**

**}**

**if( ! is.null(dot.border.color)){**

**if( ! is.null(list.dot.border.color)){**

**dot.border.color <- list.dot.border.color**

**}**

**}**

**if( ! is.null(list.line.size)){**

**line.size <- list.line.size**

**}**

**if( ! is.null(list.line.type)){**

**line.type <- list.line.type**

**}**

*# end single value converted into list now reattributed to the argument name*

**# data, x, y, geom, alpha, dot.size, shape, dot.border.size, line.size, line.type, legend.name are list now**

**# if non-null, categ, categ.class.order, legend.name, color are list now**

*# end conversion into lists*

*# legend name filling*

**if(is.null(legend.name) & ! is.null(categ)){**

**legend.name <- categ**

**}else if(is.null(legend.name) & is.null(categ)){**

**legend.name <- vector("list", length(data1))** *# null list*

**}**

**# legend.name not NULL anymore (list)**

*# end legend name filling*

*# ini categ for legend display*

**fin.lg.disp <- vector("list", 6)** *# will be used at the end to display or not legends*

**fin.lg.disp[] <- FALSE**

**legend.disp <- vector("list", length(data1))**

**if(is.null(categ) | legend.show == FALSE){**

**legend.disp[] <- FALSE**

**}else{**

**for(i2 in 1:length(data1)){**

**if(is.null(categ[[i2]])){**

**legend.disp[[i2]] <- FALSE**

**}else{**

**legend.disp[[i2]] <- TRUE**

**}**

**}**

**}**

*# end ini categ for legend display*

*# integer colors into gg\_palette*

**tempo.check.color <- NULL**

**for(i1 in 1:length(data1)){**

**if(any(is.na(color[[i1]]))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), ": color ARGUMENT CANNOT CONTAIN NA\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**tempo.check.color <- c(tempo.check.color, fun\_check(data = color[[i1]], data.name = ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), class = "integer", double.as.integer.allowed = TRUE, na.contain = TRUE, fun.name = function.name)$problem)**

**}**

**tempo.check.color <- ! tempo.check.color** *# invert TRUE and FALSE because if integer, then problem = FALSE*

**if(any(tempo.check.color == TRUE)){** *# convert integers into colors*

**tempo.integer <- unlist(color[tempo.check.color])**

**tempo.color <- fun\_gg\_palette(max(tempo.integer, na.rm = TRUE))**

**for(i1 in 1:length(data1)){**

**if(tempo.check.color[i1] == TRUE){**

**color[[i1]] <-tempo.color[color[[i1]]]**

**}**

**}**

**}**

*# end integer colors into gg\_palette*

*# second round of argument checking*

**compart.null.color <- 0** *# will be used to attribute a color when color is non-null but a compartment of color is NULL*

**for(i1 in 1:length(data1)){**

**tempo <- fun\_check(data = data1[[i1]], data.name = ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), class = "data.frame", na.contain = TRUE, fun.name = function.name)**

**if(tempo$problem == TRUE){**

**stop(paste0("\n\n================\n\n", tempo$text, "\n\n================\n\n"), call. = FALSE)**

**}**

*# reserved word checking*

**if(any(names(data1[[i1]]) %in% reserved.words)){** *# I do not use fun\_name\_change() because cannot control y before creating "fake\_y". But ok because reserved are not that common*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": COLUMN NAMES OF ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), " ARGUMENT CANNOT BE ONE OF THESE WORDS\n", paste(reserved.words, collapse = " "), "\nTHESE ARE RESERVED FOR THE ", function.name, " FUNCTION\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**if( ! (is.null(add))){**

**if(grepl(x = add, pattern = paste(reserved.words, collapse = "|"))){**

**tempo.cat <- paste0("ERROR IN ", function.name, "\nDETECTION OF COLUMN NAMES OF data1 IN THE add ARGUMENT STRING, THAT CORRESPOND TO RESERVED STRINGS FOR ", function.name, "\nCOLUMN NAMES HAVE TO BE CHANGED\nFOR INFORMATION, THE RESERVED WORDS ARE:\n", paste(reserved.words, collapse = "\n"))**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}**

**}**

*# end reserved word checking*

*# check of geom now because required for y argument*

**tempo <- fun\_check(data = geom[[i1]], data.name = ifelse(length(geom) == 1, "geom", paste0("geom NUMBER ", i1)), options = c("geom\_point", "geom\_line", "geom\_path", "geom\_step", "geom\_hline", "geom\_vline", "geom\_stick"), length = 1, fun.name = function.name)**

**if(tempo$problem == TRUE){**

**stop(paste0("\n\n================\n\n", tempo$text, "\n\n================\n\n"), call. = FALSE)**

**}**

**tempo <- fun\_check(data = geom.step.dir[[i1]], data.name = ifelse(length(geom.step.dir) == 1, "geom.step.dir", paste0("geom.step.dir NUMBER ", i1)), options = c("vh", "hv", "mid"), length = 1, fun.name = function.name)**

**if(tempo$problem == TRUE){**

**stop(paste0("\n\n================\n\n", tempo$text, "\n\n================\n\n"), call. = FALSE)**

**}**

*# end check of geom now because required for y argument*

**if(is.null(x[[i1]])){**

**if(all(geom[[i1]] != "geom\_hline")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(x) == 1, "x", paste0("ELEMENT ", i1, " OF x ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), ": x ARGUMENT CANNOT BE NULL EXCEPT IF ", ifelse(length(geom) == 1, "x", paste0("geom NUMBER ", i1)), " ARGUMENT IS \"geom\_hline\"\nHERE geom ARGUMENT IS: ", paste(geom[[i1]], collapse = " "), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**x[[i1]] <- "fake\_x"**

**data1[[i1]] <- cbind(data1[[i1]], fake\_x = NA, stringsAsFactors = TRUE)**

**data1[[i1]][, "fake\_x"] <- as.numeric(data1[[i1]][, "fake\_x"])**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") NULL ", ifelse(length(x) == 1, "x", paste0("ELEMENT ", i1, " OF x")), " ARGUMENT ASSOCIATED TO ", ifelse(length(geom) == 1, "geom", paste0("geom NUMBER ", i1)), " ARGUMENT ", geom[[i1]], " -> FAKE COLUMN ADDED TO DATA FRAME ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), ", NAMED \"fake\_x\" FOR FINAL DRAWING")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}else{**

**if(all(geom[[i1]] == "geom\_hline")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(x) == 1, "x", paste0("ELEMENT ", i1, " OF x ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), ": x ARGUMENT MUST BE NULL IF ", ifelse(length(geom) == 1, "geom", paste0("geom NUMBER ", i1)), " ARGUMENT IS \"geom\_hline\"\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**tempo <- fun\_check(data = x[[i1]], data.name = ifelse(length(x) == 1, "x", paste0("ELEMENT ", i1, " OF x ARGUMENT")), class = "vector", mode = "character", length = 1, fun.name = function.name)**

**if(tempo$problem == TRUE){**

**stop(paste0("\n\n================\n\n", tempo$text, "\n\n================\n\n"), call. = FALSE)**

**}**

**}**

**if(is.null(y[[i1]])){**

**if(all(geom[[i1]] != "geom\_vline")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(y) == 1, "y", paste0("ELEMENT ", i1, " OF y ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), ": y ARGUMENT CANNOT BE NULL EXCEPT IF ", ifelse(length(geom) == 1, "y", paste0("geom NUMBER ", i1)), " ARGUMENT IS \"geom\_vline\"\nHERE geom ARGUMENT IS: ", paste(geom[[i1]], collapse = " "), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**y[[i1]] <- "fake\_y"**

**data1[[i1]] <- cbind(data1[[i1]], fake\_y = NA, stringsAsFactors = TRUE)**

**data1[[i1]][, "fake\_y"] <- as.numeric(data1[[i1]][, "fake\_y"])**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") NULL ", ifelse(length(y) == 1, "y", paste0("ELEMENT ", i1, " OF y")), " ARGUMENT ASSOCIATED TO ", ifelse(length(geom) == 1, "geom", paste0("geom NUMBER ", i1)), " ARGUMENT ", geom[[i1]], " -> FAKE COLUMN ADDED TO DATA FRAME ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), ", NAMED \"fake\_y\" FOR FINAL DRAWING")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}else{**

**if(all(geom[[i1]] == "geom\_vline")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(y) == 1, "y", paste0("ELEMENT ", i1, " OF y ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), ": y ARGUMENT MUST BE NULL IF ", ifelse(length(geom) == 1, "geom", paste0("geom NUMBER ", i1)), " ARGUMENT IS \"geom\_vline\"\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**tempo <- fun\_check(data = y[[i1]], data.name = ifelse(length(y) == 1, "y", paste0("ELEMENT ", i1, " OF y ARGUMENT")), class = "vector", mode = "character", length = 1, fun.name = function.name)**

**if(tempo$problem == TRUE){**

**stop(paste0("\n\n================\n\n", tempo$text, "\n\n================\n\n"), call. = FALSE)**

**}**

**}**

**# x[[i1]] and y[[i1]] not NULL anymore**

**if( ! (x[[i1]] %in% names(data1[[i1]]))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(x) == 1, "x", paste0("ELEMENT ", i1, " OF x")), " ARGUMENT MUST BE A COLUMN NAME OF ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT\nHERE IT IS: ", paste(x[[i1]], collapse = " "))), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**if( ! (y[[i1]] %in% names(data1[[i1]]))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(y) == 1, "y", paste0("ELEMENT ", i1, " OF y")), " ARGUMENT MUST BE A COLUMN NAME OF ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT\nHERE IT IS: ", paste(y[[i1]], collapse = " "))), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**tempo <- fun\_check(data = data1[[i1]][, x[[i1]]], data.name = ifelse(length(x) == 1, "x ARGUMENT (AS COLUMN NAME OF data1 DATA FRAME)", paste0("ELEMENT ", i1, " OF x ARGUMENT", " (AS COLUMN NAME OF data1 DATA FRAME NUMBER ", i1, ")")), class = "vector", mode = "numeric", na.contain = TRUE, fun.name = function.name)**

**if(tempo$problem == TRUE){**

**stop(paste0("\n\n================\n\n", tempo$text, "\n\n================\n\n"), call. = FALSE)**

**}**

**tempo <- fun\_check(data = data1[[i1]][, y[[i1]]], data.name = ifelse(length(y) == 1, "y ARGUMENT (AS COLUMN NAME OF data1 DATA FRAME)", paste0("ELEMENT ", i1, " OF y ARGUMENT", " (AS COLUMN NAME OF data1 DATA FRAME NUMBER ", i1, ")")), class = "vector", mode = "numeric", na.contain = TRUE, fun.name = function.name)**

**if(tempo$problem == TRUE){**

**stop(paste0("\n\n================\n\n", tempo$text, "\n\n================\n\n"), call. = FALSE)**

**}**

**if(x[[i1]] == "fake\_x" & y[[i1]] == "fake\_y"){** *# because the code cannot accept to be both "fake\_x" and "fake\_y" at the same time*

**tempo.cat <- paste0("\n\n============\n\nERROR IN ", function.name, ": CODE INCONSISTENCY 2\nTHE CODE CANNOT ACCEPT x AND y TO BE \"fake\_x\" AND \"fake\_y\" IN THE SAME DATA FRAME ", i1, " \n\n============\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**if(( ! is.null(categ)) & ( ! is.null(categ[[i1]]))){** *# is.null(categ[[i1]]) works even if categ is NULL # is.null(categ[[i1]]) works even if categ is NULL # if categ[[i1]] = NULL, fake\_categ will be created later on*

**tempo <- fun\_check(data = categ[[i1]], data.name = ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")),, class = "vector", mode = "character", length = 1, fun.name = function.name)**

**if(tempo$problem == TRUE){**

**stop(paste0("\n\n================\n\n", tempo$text, "\n\n================\n\n"), call. = FALSE)**

**}**

**if( ! (categ[[i1]] %in% names(data1[[i1]]))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ")), " ARGUMENT MUST BE A COLUMN NAME OF ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT\nHERE IT IS: ", paste(categ[[i1]], collapse = " "))), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**tempo1 <- fun\_check(data = data1[[i1]][, categ[[i1]]], data.name = ifelse(length(categ) == 1, "categ OF data1 ARGUMENT", paste0("ELEMENT ", i1, " OF categ ARGUMENT IN DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), class = "vector", mode = "character", na.contain = TRUE, fun.name = function.name)**

**tempo2 <- fun\_check(data = data1[[i1]][, categ[[i1]]], data.name = ifelse(length(categ) == 1, "categ OF data1 ARGUMENT", paste0("ELEMENT ", i1, " OF categ ARGUMENT IN DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), class = "factor", na.contain = TRUE, fun.name = function.name)**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(categ) == 1, "categ OF data1 ARGUMENT", paste0("ELEMENT ", i1, " OF categ ARGUMENT IN DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), " MUST BE A FACTOR OR CHARACTER VECTOR\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(tempo1$problem == FALSE){**

**data1[[i1]][, categ[[i1]]] <- factor(data1[[i1]][, categ[[i1]]])** *# if already a factor, change nothing, if characters, levels according to alphabetical order*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") IN ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), ", THE CHARACTER COLUMN HAS BEEN CONVERTED TO FACTOR")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**if(geom[[i1]] == "geom\_vline" | geom[[i1]] == "geom\_hline"){**

**if(length(unique(data1[[i1]][, categ[[i1]]])) != nrow(data1[[i1]])){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(geom) == 1, "geom OF data1 ARGUMENT", paste0("geom NUMBER ", i1, " OF DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), " ARGUMENT IS ", geom[[i1]], ", MEANING THAT ", ifelse(length(categ) == 1, "categ OF data1 ARGUMENT", paste0("ELEMENT ", i1, " OF categ ARGUMENT IN DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), " MUST HAVE A DIFFERENT CLASS PER LINE OF data1 (ONE x VALUE PER CLASS)\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**}**

**}else if(( ! is.null(categ)) & is.null(categ[[i1]])){** *# is.null(categ[[i1]]) works even if categ is NULL # if categ[[i1]] = NULL, fake\_categ will be created. WARNING: is.null(categ[[i1]]) means no legend display (see above), because categ has not been precised. This also means a single color for data1[[i1]]*

**if(length(color[[i1]]) > 1){** *# 0 means is.null(color[[i1]]) or is.null(color) and 1 is ok -> single color for data1[[i1]]*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") NULL ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ")), " ARGUMENT BUT CORRESPONDING COLORS IN ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), " HAS LENGTH OVER 1\n", paste(color[[i1]], collapse = " "), "\nWHICH IS NOT COMPATIBLE WITH NULL CATEG -> COLOR RESET TO A SINGLE COLOR")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**color[[i1]] <- NULL** *# will provide a single color below*

**}**

**categ[[i1]] <- "fake\_categ"**

**data1[[i1]] <- cbind(data1[[i1]], fake\_categ = "", stringsAsFactors = TRUE)**

*# inactivated because give a different color to different "Line\_" categ while a single color for all the data1[[i1]] required. Thus, put back after the color management*

*# if(geom[[i1]] == "geom\_hline" | geom[[i1]] == "geom\_vline"){*

*# data1[[i1]][, "fake\_categ"] <- paste0("Line\_", 1:nrow(data1[[i1]]))*

*# }else{*

**data1[[i1]][, "fake\_categ"] <- data1[[i1]][, "fake\_categ"]** *# as.numeric("") create a vector of NA but class numeric*

*# }*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") NULL ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ")), " ARGUMENT -> FOR DATA FRAME ", ifelse(length(data1) == 1, "data1 ARGUMENT:", paste0("NUMBER ", i1, " OF data1 ARGUMENT:")), "\n- FAKE \"fake\_categ\" COLUMN ADDED FILLED WITH \"\"(OR WITH \"Line\_...\" FOR LINES)\n- SINGLE COLOR USED FOR PLOTTING\n- NO LEGEND DISPLAYED")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**# OK: if categ is not NULL, all the non-null categ columns of data1 are factors from here**

**if( ! is.null(categ.class.order)){**

*# the following check will be done several times but I prefer to keep it here, after the creation of categ*

**if(is.null(categ[[i1]]) & ! is.null(categ.class.order[[i1]])){**

**tempo.cat <- paste0("ERROR IN ", function.name, "\nCOMPARTMENT ", i1, " OF categ ARGUMENT CANNOT BE NULL IF COMPARTMENT ", i1, " OF categ.class.order ARGUMENT IS NOT NULL: ", paste(categ.class.order, collapse = " "))**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}else{**

**if(is.null(categ.class.order[[i1]])){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") THE categ.class.order COMPARTMENT ", i1, " IS NULL. ALPHABETICAL ORDER WILL BE APPLIED")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**data1[[i1]][, categ[[i1]]] <- factor(as.character(data1[[i1]][, categ[[i1]]]))** *# if already a factor, change nothing, if characters, levels according to alphabetical order*

**categ.class.order[[i1]] <- levels(data1[[i1]][, categ[[i1]]])** *# character vector that will be used later*

**}else{**

**tempo <- fun\_check(data = categ.class.order[[i1]], data.name = paste0("COMPARTMENT ", i1 , " OF categ.class.order ARGUMENT"), class = "vector", mode = "character", length = length(levels(data1[[i1]][, categ[[i1]]])), fun.name = function.name)** *# length(data1[, categ[i1]) -> if data1[, categ[i1] was initially character vector, then conversion as factor after the NA removal, thus class number ok. If data1[, categ[i1] was initially factor, no modification after the NA removal, thus class number ok*

**if(tempo$problem == TRUE){**

**stop(paste0("\n\n================\n\n", tempo$text, "\n\n================\n\n"), call. = FALSE)**

**}**

**}**

**if(any(duplicated(categ.class.order[[i1]]))){**

**tempo.cat <- paste0("ERROR IN ", function.name, "\nCOMPARTMENT ", i1, " OF categ.class.order ARGUMENT CANNOT HAVE DUPLICATED CLASSES: ", paste(categ.class.order[[i1]], collapse = " "))**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}else if( ! (all(categ.class.order[[i1]] %in% unique(data1[[i1]][, categ[[i1]]])) & all(unique(data1[[i1]][, categ[[i1]]]) %in% categ.class.order[[i1]]))){**

**tempo.cat <- paste0("ERROR IN ", function.name, "\nCOMPARTMENT ", i1, " OF categ.class.order ARGUMENT MUST BE CLASSES OF COMPARTMENT ", i1, " OF categ ARGUMENT\nHERE IT IS:\n", paste(categ.class.order[[i1]], collapse = " "), "\nFOR COMPARTMENT ", i1, " OF categ.class.order AND IT IS:\n", paste(unique(data1[[i1]][, categ[[i1]]]), collapse = " "), "\nFOR COLUMN ", categ[[i1]], " OF data1 NUMBER ", i1)**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}else{**

**data1[[i1]][, categ[[i1]]] <- factor(data1[[i1]][, categ[[i1]]], levels = categ.class.order[[i1]])** *# reorder the factor*

**}**

**names(categ.class.order)[i1] <- categ[[i1]]**

**}**

**}**

**# OK: if categ.class.order is not NULL, all the NULL categ.class.order columns of data1 are character from here**

**if( ! is.null(legend.name[[i1]])){**

**tempo <- fun\_check(data = legend.name[[i1]], data.name = ifelse(length(legend.name) == 1, "legend.name", paste0("legend.name NUMBER ", i1)),, class = "vector", mode = "character", length = 1, fun.name = function.name)**

**if(tempo$problem == TRUE){**

**stop(paste0("\n\n================\n\n", tempo$text, "\n\n================\n\n"), call. = FALSE)**

**}**

**}**

**if( ! is.null(color)){** *# if color is NULL, will be filled later on*

*# check the nature of color*

**if(is.null(color[[i1]])){**

**compart.null.color <- compart.null.color + 1**

**color[[i1]] <- grey(compart.null.color / 8)** *# cannot be more than 7 overlays. Thus 7 different greys. 8/8 is excluded because white dots*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") NULL COLOR IN ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), " ASSOCIATED TO ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), ", SINGLE COLOR ", paste(color[[i1]], collapse = " "), " HAS BEEN ATTRIBUTED")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**tempo1 <- fun\_check(data = color[[i1]], data.name = ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), class = "vector", mode = "character", na.contain = TRUE, fun.name = function.name) # na.contain = TRUE in case of colum of data1**

**tempo2 <- fun\_check(data = color[[i1]], data.name = ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), class = "factor", na.contain = TRUE, fun.name = function.name) # idem**

**if(tempo1$problem == TRUE & tempo2$problem == TRUE){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), " MUST BE A FACTOR OR CHARACTER VECTOR OR INTEGER VECTOR\n\n================\n\n")** *# integer possible because dealt above*

**stop(tempo.cat, call. = FALSE)**

**}else if( ! (all(color[[i1]] %in% colors() | grepl(pattern = "^#", color[[i1]])))){** *# check that all strings of low.color start by #*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), " MUST BE A HEXADECIMAL COLOR VECTOR STARTING BY # AND/OR COLOR NAMES GIVEN BY colors(): ", paste(unique(color[[i1]]), collapse = " "), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**if(any(is.na(color[[i1]]))){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") IN ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), ", THE COLORS:\n", paste(unique(color[[i1]]), collapse = " "), "\nCONTAINS NA")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

*# end check the nature of color*

*# check the length of color*

**if(is.null(categ) & length(color[[i1]]) != 1){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), " MUST BE A SINGLE COLOR IF categ IS NULL\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if( ! is.null(categ)){**

*# No problem of NA management by ggplot2 because already removed*

**if(categ[[i1]] == "fake\_categ" & length(color[[i1]]) != 1){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), " MUST BE A SINGLE COLOR IF ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")), " IS NULL\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(length(color[[i1]]) == length(unique(data1[[i1]][, categ[[i1]]]))){** *# here length(color) is equal to the different number of categ*

**data1[[i1]][, categ[[i1]]] <- factor(data1[[i1]][, categ[[i1]]])** *# if already a factor, change nothing, if characters, levels according to alphabetical order*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") IN ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), ", THE FOLLOWING COLORS:\n", paste(color[[i1]], collapse = " "), "\nHAVE BEEN ATTRIBUTED TO THESE CLASSES:\n", paste(levels(factor(data1[[i1]][, categ[[i1]]])), collapse = " "))**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}else if(length(color[[i1]]) == length(data1[[i1]][, categ[[i1]]])){***# here length(color) is equal to nrow(data1[[i1]]) -> Modif to have length(color) equal to the different number of categ (length(color) == length(levels(data1[[i1]][, categ[[i1]]])))*

**data1[[i1]] <- cbind(data1[[i1]], color = color[[i1]], stringsAsFactors = TRUE)**

**tempo.check <- unique(data1[[i1]][ , c(categ[[i1]], "color")])**

**if( ! (nrow(data1[[i1]]) == length(color[[i1]]) & nrow(tempo.check) == length(unique(data1[[i1]][ , categ[[i1]]])))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color")), " ARGUMENT HAS THE LENGTH OF ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), "\nBUT IS INCORRECTLY ASSOCIATED TO EACH CLASS OF THIS categ:\n", paste(unique(mapply(FUN = "paste", data1[[i1]][ ,categ[[i1]]], data1[[i1]][ ,"color"])), collapse = "\n"), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**data1[[i1]][, categ[[i1]]] <- factor(data1[[i1]][, categ[[i1]]])** *# if already a factor, change nothing, if characters, levels according to alphabetical order*

**color[[i1]] <- unique(color[[i1]][order(data1[[i1]][, categ[[i1]]])])** *# Modif to have length(color) equal to the different number of categ (length(color) == length(levels(data1[[i1]][, categ[[i1]]])))*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count, ") FROM FUNCTION ", function.name, ": ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), " HAS THE LENGTH OF ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), " COLUMN VALUES\nCOLORS HAVE BEEN RESPECTIVELY ASSOCIATED TO EACH CLASS OF categ AS:\n", paste(levels(factor(data1[[i1]][, categ[[i1]]])), collapse = " "), "\n", paste(color[[i1]], collapse = " "))**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}else if(length(color[[i1]]) == 1){**

**data1[[i1]][, categ[[i1]]] <- factor(data1[[i1]][, categ[[i1]]])** *# if already a factor, change nothing, if characters, levels according to alphabetical order*

**color[[i1]] <- rep(color[[i1]], length(levels(data1[[i1]][, categ[[i1]]])))**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") IN ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), ", COLOR HAS LENGTH 1 MEANING THAT ALL THE DIFFERENT CLASSES OF ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")), "\n", paste(levels(factor(data1[[i1]][, categ[[i1]]])), collapse = " "), "\nWILL HAVE THE SAME COLOR\n", paste(color[[i1]], collapse = " "))**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}else{**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), " MUST BE (1) LENGTH 1, OR (2) THE LENGTH OF ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), " COLUMN VALUES, OR (3) THE LENGTH OF THE CLASSES IN THIS COLUMN\nHERE IT IS COLOR LENGTH ", length(color[[i1]]), " VERSUS CATEG LENGTH ", length(data1[[i1]][, categ[[i1]]]), " AND CATEG CLASS LENGTH ", length(unique(data1[[i1]][, categ[[i1]]])), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**}**

**}**

**if((geom[[i1]] == "geom\_hline" | geom[[i1]] == "geom\_vline") & ! is.null(categ[[i1]])){** *# add here after the color management, to deal with the different lines to plot inside any data[[i1]]*

**if(categ[[i1]] == "fake\_categ"){**

**data1[[i1]][, "fake\_categ"] <- factor(paste0("Line\_", formatC(1:nrow(data1[[i2]]), width = nchar(nrow(data1[[i2]])), flag = "0")))**

**}**

**}**

**tempo <- fun\_check(data = alpha[[i1]], data.name = ifelse(length(alpha) == 1, "alpha", paste0("alpha NUMBER ", i1)), prop = TRUE, length = 1, fun.name = function.name)**

**if(tempo$problem == TRUE){**

**stop(paste0("\n\n================\n\n", tempo$text, "\n\n================\n\n"), call. = FALSE)**

**}**

*# management of log scale*

**if(x.log != "no"){**

**data1[[i1]][, x[[i1]]] <- suppressWarnings(get(x.log)(data1[[i1]][, x[[i1]]]))**

**}**

**if(y.log != "no"){**

**data1[[i1]][, y[[i1]]] <- suppressWarnings(get(y.log)(data1[[i1]][, y[[i1]]]))**

**}**

*# end management of log scale*

**}**

**if(length(data1) > 1){**

**if(length(unique(unlist(x)[ ! x == "fake\_x"])) > 1){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") THE x ARGUMENT DOES NOT CONTAIN IDENTICAL COLUMN NAMES:\n", paste(unlist(x), collapse = " "), "\nX-AXIS OVERLAYING DIFFERENT VARIABLES?")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}**

**if(length(data1) > 1){**

**if(length(unique(unlist(y)[ ! y == "fake\_y"])) > 1){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") THE y ARGUMENT DOES NOT CONTAIN IDENTICAL COLUMN NAMES:\n", paste(unlist(y), collapse = " "), "\nY-AXIS OVERLAYING DIFFERENT VARIABLES?")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}**

**if(sum(geom %in% "geom\_point") > 3){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": geom ARGUMENT CANNOT HAVE MORE THAN THREE \"geom\_point\" ELEMENTS\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(length(geom) - sum(geom %in% "geom\_point") > 3){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": geom ARGUMENT CANNOT HAVE MORE THAN THREE LINE ELEMENTS\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**if(x.log != "no" & ! is.null(x.lim)){**

**if(any(x.lim <= 0)){**

**tempo.cat <- paste0("ERROR IN ", function.name, "\nx.lim ARGUMENT CANNOT HAVE ZERO OR NEGATIVE VALUES WITH THE x.log ARGUMENT SET TO ", x.log, ":\n", paste(x.lim, collapse = " "))**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}else if(any( ! is.finite(if(x.log == "log10"){log10(x.lim)}else{log2(x.lim)}))){**

**tempo.cat <- paste0("ERROR IN ", function.name, "\nx.lim ARGUMENT RETURNS INF WITH THE x.log ARGUMENT SET TO ", x.log, "\nAS SCALE COMPUTATION IS ", ifelse(x.log == "log10", "log10", "log2"), ":\n", paste(if(x.log == "log10"){log10(x.lim)}else{log2(x.lim)}, collapse = " "))**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}**

**}**

**if(x.log != "no" & x.include.zero == TRUE){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") x.log ARGUMENT SET TO ", x.log, " AND x.include.zero ARGUMENT SET TO TRUE -> x.include.zero ARGUMENT RESET TO FALSE BECAUSE 0 VALUE CANNOT BE REPRESENTED IN LOG SCALE")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**x.include.zero <- FALSE**

**}**

**if(y.log != "no" & ! is.null(y.lim)){**

**if(any(y.lim <= 0)){**

**tempo.cat <- paste0("ERROR IN ", function.name, "\ny.lim ARGUMENT CANNOT HAVE ZERO OR NEGATIVE VALUES WITH THE y.log ARGUMENT SET TO ", y.log, ":\n", paste(y.lim, collapse = " "))**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}else if(any( ! is.finite(if(y.log == "log10"){log10(y.lim)}else{log2(y.lim)}))){**

**tempo.cat <- paste0("ERROR IN ", function.name, "\ny.lim ARGUMENT RETURNS INF WITH THE y.log ARGUMENT SET TO ", y.log, "\nAS SCALE COMPUTATION IS ", ifelse(y.log == "log10", "log10", "log2"), ":\n", paste(if(y.log == "log10"){log10(y.lim)}else{log2(y.lim)}, collapse = " "))**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}**

**}**

**if(y.log != "no" & y.include.zero == TRUE){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") y.log ARGUMENT SET TO ", y.log, " AND y.include.zero ARGUMENT SET TO TRUE -> y.include.zero ARGUMENT RESET TO FALSE BECAUSE 0 VALUE CANNOT BE REPRESENTED IN LOG SCALE")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**y.include.zero <- FALSE**

**}**

*# end management of log scale*

*# verif of add*

**if( ! is.null(add)){**

**if( ! grepl(pattern = "^\\s\*\\+", add)){** *# check that the add string start by +*

**tempo.cat <- paste0("ERROR IN ", function.name, ": add ARGUMENT MUST START WITH \"+\": ", paste(unique(add), collapse = " "))**

**stop(tempo.cat, call. = FALSE)**

**}else if( ! grepl(pattern = "(ggplot2|lemon)\\s\*::", add)){** *#*

**tempo.cat <- paste0("ERROR IN ", function.name, ": FOR EASIER FUNCTION DETECTION, add ARGUMENT MUST CONTAIN \"ggplot2::\" OR \"lemon::\" IN FRONT OF EACH GGPLOT2 FUNCTION: ", paste(unique(add), collapse = " "))**

**stop(tempo.cat, call. = FALSE)**

**}else if( ! grepl(pattern = ")\\s\*$", add)){** *# check that the add string finished by )*

**tempo.cat <- paste0("ERROR IN ", function.name, ": add ARGUMENT MUST FINISH BY \")\": ", paste(unique(add), collapse = " "))**

**stop(tempo.cat, call. = FALSE)**

**}**

**}**

*# end verif of add*

*# management of add containing facet*

**facet.categ <- NULL**

**if( ! is.null(add)){**

**facet.check <- TRUE**

**tempo <- unlist(strsplit(x = add, split = "\\s\*\\+\\s\*(ggplot2|lemon)\\s\*::\\s\*"))** *#*

**tempo <- sub(x = tempo, pattern = "^facet\_wrap", replacement = "ggplot2::facet\_wrap")**

**tempo <- sub(x = tempo, pattern = "^facet\_grid", replacement = "ggplot2::facet\_grid")**

**tempo <- sub(x = tempo, pattern = "^facet\_rep", replacement = "lemon::facet\_rep")**

**if(length(data1) > 1 & (any(grepl(x = tempo, pattern = "ggplot2::facet\_wrap|lemon::facet\_rep\_wrap")) | grepl(x = add, pattern = "ggplot2::facet\_grid|lemon::facet\_rep\_grid"))){**

**tempo.cat <- paste0("ERROR IN ", function.name, "\nfacet PANELS CANNOT BE USED IF MORE THAN ONE DATA FRAME IN THE data1 ARGUMENT\nPLEASE REWRITE THE add STRING AND RERUN")**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}else{**

**if(any(grepl(x = tempo, pattern = "ggplot2::facet\_wrap|lemon::facet\_rep\_wrap"))){**

**tempo1 <- suppressWarnings(eval(parse(text = tempo[grepl(x = tempo, pattern = "ggplot2::facet\_wrap|lemon::facet\_rep\_wrap")])))**

**facet.categ <- list(names(tempo1$params$facets)) # list of length 1**

**tempo.text <- "facet\_wrap OR facet\_rep\_wrap"**

**facet.check <- FALSE**

**}else if(grepl(x = add, pattern = "ggplot2::facet\_grid|lemon::facet\_rep\_grid")){**

**tempo1 <- suppressWarnings(eval(parse(text = tempo[grepl(x = tempo, pattern = "ggplot2::facet\_grid|lemon::facet\_rep\_grid")])))**

**facet.categ <- list(c(names(tempo1$params$rows), names(tempo1$params$cols))) # list of length 1**

**tempo.text <- "facet\_grid OR facet\_rep\_grid"**

**facet.check <- FALSE**

**}**

**if(facet.check == FALSE & ! all(facet.categ %in% names(data1[[1]]))){** *# WARNING: all(facet.categ %in% names(data1)) is TRUE when facet.categ is NULL*

**tempo.cat <- paste0("ERROR IN ", function.name, "\nDETECTION OF \"", tempo.text, "\" STRING IN THE add ARGUMENT BUT PROBLEM OF VARIABLE DETECTION (COLUMN NAMES OF data1)\nTHE DETECTED VARIABLES ARE:\n", paste(facet.categ, collapse = " "), "\nTHE data1 COLUMN NAMES ARE:\n", paste(names(data1[[1]]), collapse = " "), "\nPLEASE REWRITE THE add STRING AND RERUN")**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}**

**}**

**}**

**# if facet.categ is not NULL, it is a list of length 1 now**

*# end management of add containing facet*

*# end second round of argument checking*

*# end second round of checking and data preparation*

*# package checking*

**fun\_pack(req.package = c("ggplot2", "gridExtra"), lib.path = lib.path)**

*# packages Cairo and grid tested by fun\_gg\_point\_rast()*

*# end package checking*

*# main code*

*# axes management*

**if(is.null(x.lim)){**

**if(any(unlist(mapply(FUN = "[[", data1, x, SIMPLIFY = FALSE)) %in% c(Inf, -Inf))){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") THE x COLUMN IN data1 CONTAINS -Inf OR Inf VALUES THAT WILL NOT BE CONSIDERED IN THE PLOT RANGE")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**x.lim <- suppressWarnings(range(unlist(mapply(FUN = "[[", data1, x, SIMPLIFY = FALSE)), na.rm = TRUE, finite = TRUE))** *# finite = TRUE removes all the -Inf and Inf except if only this. In that case, whatever the -Inf and/or Inf present, output -Inf;Inf range. Idem with NA only. y.lim added here. If NULL, ok if y argument has values*

**}else if(x.log != "no"){**

**x.lim <- get(x.log)(x.lim)**

**}**

**if(x.log != "no"){**

**if(any( ! is.finite(x.lim))){**

**tempo.cat <- paste0("ERROR IN ", function.name, "\nx.lim ARGUMENT CANNOT HAVE ZERO OR NEGATIVE VALUES WITH THE x.log ARGUMENT SET TO ", x.log, ":\n", paste(x.lim, collapse = " "), "\nPLEASE, CHECK DATA VALUES (PRESENCE OF ZERO OR INF VALUES)")**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}**

**}**

**if(suppressWarnings(all(x.lim %in% c(Inf, -Inf)))){** *# happen when x is only NULL*

**if(all(unlist(geom) %in% c("geom\_vline", "geom\_stick"))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, " NOT POSSIBLE TO DRAW geom\_vline OR geom\_stick KIND OF LINES ALONE IF x.lim ARGUMENT IS SET TO NULL, SINCE NO X-AXIS DEFINED (", ifelse(length(x) == 1, "x", paste0("ELEMENT ", i1, " OF x")), " ARGUMENT MUST BE NULL FOR THESE KIND OF LINES)\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, " x.lim ARGUMENT MADE OF NA, -Inf OR Inf ONLY: ", paste(x.lim, collapse = " "), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**}**

**x.lim.order <- order(x.lim)** *# to deal with inverse axis*

**# print(x.lim.order)**

**x.lim <- sort(x.lim)**

**x.lim[1] <- x.lim[1] - abs(x.lim[2] - x.lim[1]) \* ifelse(diff(x.lim.order) > 0, x.right.extra.margin, x.left.extra.margin)** *# diff(x.lim.order) > 0 means not inversed axis*

**x.lim[2] <- x.lim[2] + abs(x.lim[2] - x.lim[1]) \* ifelse(diff(x.lim.order) > 0, x.left.extra.margin, x.right.extra.margin)** *# diff(x.lim.order) > 0 means not inversed axis*

**if(x.include.zero == TRUE){** *# no need to check x.log != "no" because done before*

**x.lim <- range(c(x.lim, 0), na.rm = TRUE, finite = TRUE)** *# finite = TRUE removes all the -Inf and Inf except if only this. In that case, whatever the -Inf and/or Inf present, output -Inf;Inf range. Idem with NA only*

**}**

**x.lim <- x.lim[x.lim.order]**

**if(any(is.na(x.lim))){**

**tempo.cat <- paste0("\n\n============\n\nERROR IN ", function.name, ": CODE INCONSISTENCY 3\n\n============\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**if(is.null(y.lim)){**

**if(any(unlist(mapply(FUN = "[[", data1, y, SIMPLIFY = FALSE)) %in% c(Inf, -Inf))){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") THE y COLUMN IN data1 CONTAINS -Inf OR Inf VALUES THAT WILL NOT BE CONSIDERED IN THE PLOT RANGE")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**y.lim <- suppressWarnings(range(unlist(mapply(FUN = "[[", data1, y, SIMPLIFY = FALSE)), na.rm = TRUE, finite = TRUE))** *# finite = TRUE removes all the -Inf and Inf except if only this. In that case, whatever the -Inf and/or Inf present, output -Inf;Inf range. Idem with NA only. y.lim added here. If NULL, ok if y argument has values*

**}else if(y.log != "no"){**

**y.lim <- get(y.log)(y.lim)**

**}**

**if(y.log != "no"){**

**if(any( ! is.finite(y.lim))){**

**tempo.cat <- paste0("ERROR IN ", function.name, "\ny.lim ARGUMENT CANNOT HAVE ZERO OR NEGATIVE VALUES WITH THE y.log ARGUMENT SET TO ", y.log, ":\n", paste(y.lim, collapse = " "), "\nPLEASE, CHECK DATA VALUES (PRESENCE OF ZERO OR INF VALUES)")**

**stop(paste0("\n\n================\n\n", tempo.cat, "\n\n================\n\n"), call. = FALSE)**

**}**

**}**

**if(suppressWarnings(all(y.lim %in% c(Inf, -Inf)))){** *# happen when y is only NULL*

**if(all(unlist(geom) == "geom\_vline")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, " NOT POSSIBLE TO DRAW geom\_vline KIND OF LINES ALONE IF y.lim ARGUMENT IS SET TO NULL, SINCE NO Y-AXIS DEFINED (", ifelse(length(y) == 1, "y", paste0("ELEMENT ", i1, " OF y")), " ARGUMENT MUST BE NULL FOR THESE KIND OF LINES)\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else{**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, " y.lim ARGUMENT MADE OF NA, -Inf OR Inf ONLY: ", paste(y.lim, collapse = " "), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**}**

**y.lim.order <- order(y.lim)** *# to deal with inverse axis*

**y.lim <- sort(y.lim)**

**y.lim[1] <- y.lim[1] - abs(y.lim[2] - y.lim[1]) \* ifelse(diff(y.lim.order) > 0, y.bottom.extra.margin, y.top.extra.margin)** *# diff(y.lim.order) > 0 means not inversed axis*

**y.lim[2] <- y.lim[2] + abs(y.lim[2] - y.lim[1]) \* ifelse(diff(y.lim.order) > 0, y.top.extra.margin, y.bottom.extra.margin)** *# diff(y.lim.order) > 0 means not inversed axis*

**if(y.include.zero == TRUE){** *# no need to check y.log != "no" because done before*

**y.lim <- range(c(y.lim, 0), na.rm = TRUE, finite = TRUE)** *# finite = TRUE removes all the -Inf and Inf except if only this. In that case, whatever the -Inf and/or Inf present, output -Inf;Inf range. Idem with NA only*

**}**

**y.lim <- y.lim[y.lim.order]**

**if(any(is.na(y.lim))){**

**tempo.cat <- paste0("\n\n============\n\nERROR IN ", function.name, ": CODE INCONSISTENCY 4\n\n============\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

*# end axes management*

*# create a fake categ if NULL to deal with legend display*

**if(is.null(categ)){**

**categ <- vector("list", length(data1))**

**categ[] <- "fake\_categ"**

**for(i2 in 1:length(data1)){**

**data1[[i2]] <- cbind(data1[[i2]], fake\_categ = "", stringsAsFactors = TRUE)**

**if(geom[[i2]] == "geom\_hline" | geom[[i2]] == "geom\_vline"){**

**data1[[i2]][, "fake\_categ"] <- factor(paste0("Line\_", 1:nrow(data1[[i2]])))**

**}**

**}**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") NULL categ ARGUMENT -> FAKE \"fake\_categ\" COLUMN ADDED TO EACH DATA FRAME OF data1, AND FILLED WITH \"\"")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**# categ is not NULL anymore**

**if(is.null(categ.class.order)){**

**categ.class.order <- vector("list", length = length(data1))**

**tempo.categ.class.order <- NULL**

**for(i2 in 1:length(categ.class.order)){**

**categ.class.order[[i2]] <- levels(data1[[i2]][, categ[[i2]]])**

**names(categ.class.order)[i2] <- categ[[i2]]**

**tempo.categ.class.order <- c(tempo.categ.class.order, ifelse(i2 != 1, "\n", ""), categ.class.order[[i2]])**

**}**

**if(any(unlist(legend.disp))){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") THE categ.class.order SETTING IS NULL. ALPHABETICAL ORDER WILL BE APPLIED FOR CLASS ORDERING:\n", paste(tempo.categ.class.order, collapse = " "))**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}**

*# end create a fake categ if NULL to deal with legend display*

**# categ.class.order is not NULL anymore**

*# vector of color with length as in levels(categ) of data1*

**if(is.null(color)){**

**color <- vector("list", length(data1))**

**length.categ.list <- lapply(lapply(mapply(FUN = "[[", data1, categ, SIMPLIFY = FALSE), FUN = unique), FUN = function(x){length(x[ ! is.na(x)])})**

**length.categ.list[sapply(categ, FUN = "==", "fake\_categ")] <- 1** *# when is.null(color), a single color for all the dots or lines of data[[i1]] that contain "fake\_categ" category*

**total.categ.length <- sum(unlist(length.categ.list), na.rm = TRUE)**

**tempo.color <- fun\_gg\_palette(total.categ.length)**

**tempo.count <- 0**

**for(i2 in 1:length(data1)){**

**color[[i2]] <- tempo.color[(1:length.categ.list[[i2]]) + tempo.count]**

**tempo.count <- tempo.count + length.categ.list[[i2]]**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") NULL color ARGUMENT -> COLORS RESPECTIVELY ATTRIBUTED TO EACH CLASS OF ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i2, " OF categ ARGUMENT")), " (", categ[[i2]], ") IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i2, " OF data1 ARGUMENT")), ":\n", paste(color[[i2]], collapse = " "), "\n", paste(if(all(levels(data1[[i2]][, categ[[i2]]]) == "")){'\"\"'}else{levels(data1[[i2]][, categ[[i2]]])}, collapse = " "))**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}**

*# end vector of color with length as in levels(categ) of data1*

**# color is not NULL anymore**

*# na detection and removal*

**data1.ini <- data1** *# to report NA removal*

**removed.row.nb <- vector("list", length = length(data1))** *# to report NA removal*

**removed.rows <- vector("list", length = length(data1))** *# to report NA removal*

**for(i1 in 1:length(data1)){**

**column.check <- unlist(c( #unlist because creates a list**

**if(x[[i1]] == "fake\_x"){NULL}else{x[[i1]]},**

**if(y[[i1]] == "fake\_y"){NULL}else{y[[i1]]},**

**if(is.null(categ[[i1]])){NULL}else{categ[[i1]]},**

**if(is.null(facet.categ)){NULL}else{facet.categ}**

**))** *# dot.categ because can be a 3rd column of data1*

**if(any(is.na(data1[[i1]][, column.check]))){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") NA DETECTED IN COLUMNS ", paste(column.check, collapse = " "), " OF ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), " AND CORRESPONDING ROWS REMOVED (SEE $removed.row.nb AND $removed.rows)")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**for(i3 in 1:length(column.check)){**

**if(any(is.na(data1[[i1]][, column.check[i3]]))){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") NA REMOVAL DUE TO COLUMN ", column.check[i3], " OF ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")))**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}**

**removed.row.nb[[i1]] <- unlist(lapply(lapply(c(data1[[i1]][column.check]), FUN = is.na), FUN = which))**

**removed.rows[[i1]] <- data1[[i1]][removed.row.nb[[i1]], ]**

**column.check <- column.check[ ! (column.check == x[[i1]] | column.check == y[[i1]])]** *# remove x and y to keep quali columns*

**if(length(removed.row.nb[[i1]]) != 0){**

**data1[[i1]] <- data1[[i1]][-removed.row.nb[[i1]], ]**

**for(i4 in 1:length(column.check)){**

**if(any( ! unique(removed.rows[[i1]][, column.check[i4]]) %in% unique(data1[[i1]][, column.check[i4]]))){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") IN COLUMN ", column.check[i4], " OF ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), ", THE FOLLOWING CLASSES HAVE DISAPPEARED AFTER NA REMOVAL\n(IF COLUMN USED IN THE PLOT, THIS CLASS WILL NOT BE DISPLAYED):\n", paste(unique(removed.rows[[i1]][, column.check[i4]])[ ! unique(removed.rows[[i1]][, column.check[i4]]) %in% unique(data1[[i1]][, column.check[i4]])], collapse = " "))**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**if(column.check[i4] %in% categ[[i1]]){**

**categ.class.order[[i1]] <- levels(data1[[i1]][, column.check[i4]])[levels(data1[[i1]][, column.check[i4]]) %in% unique(data1[[i1]][, column.check[i4]])] # remove the absent class in the categ.class.order vector**

**color[[i1]] <-color[[i1]][levels(data1[[i1]][, column.check[i4]]) %in% unique(data1[[i1]][, column.check[i4]])] # remove the absent color in the character vector**

**data1[[i1]][, column.check[i4]] <- factor(as.character(data1[[i1]][, column.check[i4]]), levels = unique(categ.class.order[[i1]]))**

**}**

**if(column.check[i4] %in% facet.categ){** *# works if facet.categ == NULL this method should keep the order of levels when removing some levels*

**tempo.levels <- levels(data1[[i1]][, column.check[i4]])[levels(data1[[i1]][, column.check[i4]]) %in% unique(as.character(data1[[i1]][, column.check[i4]]))]**

**data1[[i1]][, column.check[i4]] <- factor(as.character(data1[[i1]][, column.check[i4]]), levels = tempo.levels)**

**}**

**}**

**}**

**}**

**}else{**

**removed.row.nb[[i1]] <- NULL**

**removed.rows[[i1]] <- NULL**

**}**

**}**

*# end na detection and removal*

*# last check*

**for(i1 in 1:length(data1)){**

**if(categ[[i1]] != "fake\_categ" & length(color[[i1]]) != length(unique(data1[[i1]][, categ[[i1]]]))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, " LAST CHECK: ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), " MUST HAVE THE LENGTH OF LEVELS OF ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), "\nHERE IT IS COLOR LENGTH ", length(color[[i1]]), " VERSUS CATEG LEVELS LENGTH ", length(unique(data1[[i1]][, categ[[i1]]])), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}else if(categ[[i1]] == "fake\_categ" & length(color[[i1]]) != 1){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, " LAST CHECK: ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), " MUST HAVE LENGTH 1 WHEN ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")), " IS NULL\nHERE IT IS COLOR LENGTH ", length(color[[i1]]), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**}**

*# end last check*

*# conversion of geom\_hline and geom\_vline*

**for(i1 in 1:length(data1)){**

**if(geom[[i1]] == "geom\_hline" | geom[[i1]] == "geom\_vline"){**

**final.data.frame <- data.frame()**

**for(i3 in 1:nrow(data1[[i1]])){**

**tempo.data.frame <- rbind(data1[[i1]][i3, ], data1[[i1]][i3, ])**

**if(geom[[i1]] == "geom\_hline"){**

**tempo.data.frame[, x[[i1]]] <- x.lim**

**}else if(geom[[i1]] == "geom\_vline"){**

**tempo.data.frame[, y[[i1]]] <- y.lim**

**}else{**

**tempo.cat <- paste0("\n\n============\n\nERROR IN ", function.name, ": CODE INCONSISTENCY 5\n\n============\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

*# 3 lines below inactivated because I put that above*

*# if(is.null(categ[[i1]])){*

*# data1[, "fake\_categ"] <- paste0("Line\_", i3)*

*# }*

**final.data.frame <- rbind(final.data.frame, tempo.data.frame)**

**}**

**data1[[i1]] <- final.data.frame**

**geom[[i1]] <- "geom\_line"**

**if(length(color[[i1]]) == 1){**

**color[[i1]] <- rep(color[[i1]], length(unique(data1[[i1]][ , categ[[i1]]])))**

**}else if(length(color[[i1]]) != length(unique(data1[[i1]][ , categ[[i1]]]))){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, " geom\_hline AND geom\_vline CONVERSION TO FIT THE XLIM AND YLIM LIMITS OF THE DATA: ", ifelse(length(color) == 1, "color", paste0("ELEMENT NUMBER ", i1, " OF color ARGUMENT")), " MUST HAVE THE LENGTH OF LEVELS OF ", ifelse(length(categ) == 1, "categ", paste0("ELEMENT ", i1, " OF categ ARGUMENT")), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 ARGUMENT")), "\nHERE IT IS COLOR LENGTH ", length(color[[i1]]), " VERSUS CATEG LEVELS LENGTH ", length(unique(data1[[i1]][, categ[[i1]]])), "\n\n================\n\n")**

**stop(tempo.cat, call. = FALSE)**

**}**

**}**

**}**

*# end conversion of geom\_hline and geom\_vline*

*# kind of geom\_point (vectorial or raster)*

**scatter.kind <- vector("list", length = length(data1))** *# list of same length as data1, that will be used to use either ggplot2::geom\_point() (vectorial dot layer) or fun\_gg\_point\_rast() (raster dot layer)*

**fix.ratio <- FALSE**

**if(is.null(raster.threshold)){**

**if(raster == TRUE){**

**scatter.kind[] <- "fun\_gg\_point\_rast"** *# not important to fill everything: will be only used when geom == "geom\_point"*

**fix.ratio <- TRUE**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") RASTER PLOT GENERATED -> ASPECT RATIO OF THE PLOT REGION SET BY THE raster.ratio ARGUMENT (", fun\_round(raster.ratio, 2), ") TO AVOID A BUG OF ELLIPSOID DOT DRAWING")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}else{**

**scatter.kind[] <- "ggplot2::geom\_point"**

**}**

**}else{**

**for(i2 in 1:length(data1)){**

**if(geom[[i2]] == "geom\_point"){**

**if(nrow(data1[[i2]]) <= raster.threshold){**

**scatter.kind[[i2]] <- "ggplot2::geom\_point"**

**}else{**

**scatter.kind[[i2]] <- "fun\_gg\_point\_rast"**

**fix.ratio <- TRUE**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i2, " OF data1 ARGUMENT")), " LAYER AS RASTER (NOT VECTORIAL)")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}**

**}**

**if(any(unlist(scatter.kind) == "fun\_gg\_point\_rast")){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") RASTER PLOT GENERATED -> ASPECT RATIO OF THE PLOT REGION SET BY THE raster.ratio ARGUMENT (", fun\_round(raster.ratio, 2), ") TO AVOID A BUG OF ELLIPSOID DOT DRAWING")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}**

*# end kind of geom\_point (vectorial or raster)*

*# no need loop part*

**coord.names <- NULL**

**tempo.gg.name <- "gg.indiv.plot."**

**tempo.gg.count <- 0**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), eval(parse(text = paste0("ggplot2::ggplot()", if(is.null(add)){""}else{add}))))** *# add added here to have the facets*

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::xlab(if(is.null(x.lab)){x[[1]]}else{x.lab}))**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::ylab(if(is.null(y.lab)){y[[1]]}else{y.lab}))**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::ggtitle(title))**

*# text angle management*

**x.tempo.just <- fun\_gg\_just(angle = x.text.angle, axis = "x")**

**y.tempo.just <- fun\_gg\_just(angle = y.text.angle, axis = "y")**

*# end text angle management*

**add.check <- TRUE**

**if( ! is.null(add)){** *# if add is NULL, then = 0*

**if(grepl(pattern = "ggplot2::theme", add) == TRUE){**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") \"ggplot2::theme\" STRING DETECTED IN THE add ARGUMENT\n-> INTERNAL GGPLOT2 THEME FUNCTIONS theme() AND theme\_classic() HAVE BEEN INACTIVATED, TO BE USED BY THE USER\n-> article ARGUMENT WILL BE IGNORED\nIT IS RECOMMENDED TO USE \"+ theme(aspect.ratio = raster.ratio)\" IF RASTER MODE IS ACTIVATED")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**add.check <- FALSE**

**}**

**}**

**if(add.check == TRUE & article == TRUE){**

*# WARNING: not possible to add several times theme(). NO message but the last one overwrites the others*

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::theme\_classic(base\_size = text.size))**

**if(grid == TRUE){**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), m.gg <- ggplot2::theme(**

**text = ggplot2::element\_text(size = text.size),**

**plot.title = ggplot2::element\_text(size = title.text.size),** *# stronger than text*

**legend.key = ggplot2::element\_rect(color = "white", size = 1.5), # size of the frame of the legend**

**line = ggplot2::element\_line(size = 0.5),**

**axis.line.y.left = ggplot2::element\_line(colour = "black"),** *# draw lines for the y axis*

**axis.line.x.bottom = ggplot2::element\_line(colour = "black"),** *# draw lines for the x axis*

**panel.grid.major.x = ggplot2::element\_line(colour = "grey85", size = 0.75),**

**panel.grid.minor.x = ggplot2::element\_line(colour = "grey90", size = 0.25),**

**panel.grid.major.y = ggplot2::element\_line(colour = "grey85", size = 0.75),**

**panel.grid.minor.y = ggplot2::element\_line(colour = "grey90", size = 0.25),**

**axis.text.x = ggplot2::element\_text(angle = x.tempo.just$angle, hjust = x.tempo.just$hjust, vjust = x.tempo.just$vjust),**

**axis.text.y = ggplot2::element\_text(angle = y.tempo.just$angle, hjust = y.tempo.just$hjust, vjust = y.tempo.just$vjust),**

**aspect.ratio = if(fix.ratio == TRUE){raster.ratio}else{NULL} # for raster**

**))**

**}else{**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), m.gg <- ggplot2::theme(**

**text = ggplot2::element\_text(size = text.size),**

**plot.title = ggplot2::element\_text(size = title.text.size),** *# stronger than text*

**line = ggplot2::element\_line(size = 0.5),**

**legend.key = ggplot2::element\_rect(color = "white", size = 1.5), # size of the frame of the legend**

**axis.line.y.left = ggplot2::element\_line(colour = "black"),**

**axis.line.x.bottom = ggplot2::element\_line(colour = "black"),**

**axis.text.x = ggplot2::element\_text(angle = x.tempo.just$angle, hjust = x.tempo.just$hjust, vjust = x.tempo.just$vjust),**

**axis.text.y = ggplot2::element\_text(angle = y.tempo.just$angle, hjust = y.tempo.just$hjust, vjust = y.tempo.just$vjust),**

**aspect.ratio = if(fix.ratio == TRUE){raster.ratio}else{NULL} # for raster**

**))**

**}**

**}else if(add.check == TRUE & article == FALSE){**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), m.gg <- ggplot2::theme(**

**text = ggplot2::element\_text(size = text.size),**

**plot.title = ggplot2::element\_text(size = title.text.size),** *# stronger than text*

**line = ggplot2::element\_line(size = 0.5),**

**legend.key = ggplot2::element\_rect(color = "white", size = 1.5), # size of the frame of the legend**

**panel.background = ggplot2::element\_rect(fill = "grey95"),**

**axis.line.y.left = ggplot2::element\_line(colour = "black"),**

**axis.line.x.bottom = ggplot2::element\_line(colour = "black"),**

**panel.grid.major.x = ggplot2::element\_line(colour = "grey85", size = 0.75),**

**panel.grid.minor.x = ggplot2::element\_line(colour = "grey90", size = 0.25),**

**panel.grid.major.y = ggplot2::element\_line(colour = "grey85", size = 0.75),**

**panel.grid.minor.y = ggplot2::element\_line(colour = "grey90", size = 0.25),**

**strip.background = ggplot2::element\_rect(fill = "white", colour = "black"),**

**axis.text.x = ggplot2::element\_text(angle = x.tempo.just$angle, hjust = x.tempo.just$hjust, vjust = x.tempo.just$vjust),**

**axis.text.y = ggplot2::element\_text(angle = y.tempo.just$angle, hjust = y.tempo.just$hjust, vjust = y.tempo.just$vjust),**

**aspect.ratio = if(fix.ratio == TRUE){raster.ratio}else{NULL} # for raster**

*# do not work -> legend.position = "none" # to remove the legend completely: https://www.datanovia.com/en/blog/how-to-remove-legend-from-a-ggplot/*

**))**

**}**

*# end no need loop part*

*# loop part*

**point.count <- 0**

**line.count <- 0**

**lg.order <- vector(mode = "list", length = 6)** *# order of the legend*

**lg.order <- lapply(lg.order, as.numeric)** *# order of the legend*

**lg.color <- vector(mode = "list", length = 6)** *# color of the legend*

**lg.dot.shape <- vector(mode = "list", length = 6)** *# etc.*

**lg.dot.size <- vector(mode = "list", length = 6)** *# etc.*

**lg.dot.size <- lapply(lg.dot.size, as.numeric)** *# etc.*

**lg.dot.border.size <- vector(mode = "list", length = 6)** *# etc.*

**lg.dot.border.size <- lapply(lg.dot.border.size, as.numeric)** *# etc.*

**lg.dot.border.color <- vector(mode = "list", length = 6)** *# etc.*

**lg.line.size <- vector(mode = "list", length = 6)** *# etc.*

**lg.line.size <- lapply(lg.line.size, as.numeric)** *# etc.*

**lg.line.type <- vector(mode = "list", length = 6)** *# etc.*

**lg.alpha <- vector(mode = "list", length = 6)** *# etc.*

**lg.alpha <- lapply(lg.alpha, as.numeric)** *# etc.*

**for(i1 in 1:length(data1)){**

**if(geom[[i1]] == "geom\_point"){**

**point.count <- point.count + 1**

**if(point.count == 1){**

**fin.lg.disp[[1]] <- legend.disp[[point.count + line.count]]**

**lg.order[[1]] <- point.count + line.count**

**lg.color[[1]] <- color[[i1]]**

**lg.dot.shape[[1]] <- dot.shape[[i1]]**

**lg.dot.size[[1]] <- dot.size[[i1]]**

**lg.dot.border.size[[1]] <- dot.border.size[[i1]]**

**lg.dot.border.color[[1]] <- dot.border.color[[i1]]**

**lg.alpha[[1]] <- alpha[[i1]]**

**class.categ <- levels(factor(data1[[i1]][, categ[[i1]]]))**

**if(plot == TRUE & fin.lg.disp[[1]] == TRUE & dot.shape[[1]] %in% 0:14 & ((length(dev.list()) > 0 & names(dev.cur()) == "windows") | (length(dev.list()) == 0 & Sys.info()["sysname"] == "Windows"))){** *# if any Graph device already open and this device is "windows", or if no Graph device opened yet and we are on windows system -> prevention of alpha legend bug on windows using value 1*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") GRAPHIC DEVICE USED ON A WINDOWS SYSTEM ->\nTRANSPARENCY OF THE DOTS (DOT LAYER NUMBER ", point.count, ") IS INACTIVATED IN THE LEGEND TO PREVENT A WINDOWS DEPENDENT BUG (SEE** *https://github.com/tidyverse/ggplot2/issues/2452***)\nTO OVERCOME THIS ON WINDOWS, USE ANOTHER DEVICE (pdf() FOR INSTANCE)")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**lg.alpha[[1]] <- 1** *# to avoid a bug on windows: if alpha argument is different from 1 for lines (transparency), then lines are not correctly displayed in the legend when using the R GUI (bug https://github.com/tidyverse/ggplot2/issues/2452). No bug when using a pdf*

**}else{**

**lg.alpha[[1]] <- alpha[[i1]]**

**}**

**for(i5 in 1:length(color[[i1]])){** *# or length(class.categ). It is the same because already checked that lengths are the same*

**tempo.data.frame <- data1[[i1]][data1[[i1]][, categ[[i1]]] == class.categ[i5], ]**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), eval(parse(text = scatter.kind[[i1]]))(data = tempo.data.frame, mapping = ggplot2::aes\_string(x = x[[i1]], y = y[[i1]], fill = categ[[i1]]), shape = dot.shape[[i1]], size = dot.size[[i1]], stroke = dot.border.size[[i1]], color = if(is.null(dot.border.color)){color[[i1]][i5]}else{dot.border.color[[i1]]}, alpha = alpha[[i1]], show.legend = if(i5 == 1){TRUE}else{FALSE}))** *# WARNING: a single color allowed for color argument outside aesthetic, but here a single color for border --> loop could be inactivated but kept for commodity # legend.show option do not remove the legend, only the aesthetic of the legend (dot, line, etc.). Used here to avoid multiple layers of legend which corrupt transparency*

**coord.names <- c(coord.names, paste0(geom[[i1]], ".", class.categ[i5]))**

**}**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::scale\_fill\_manual(name = if(is.null(legend.name)){NULL}else{legend.name[[i1]]}, values = as.character(color[[i1]]), breaks = class.categ))** *# values are the values of fill, breaks reorder the classes according to class.categ in the legend, order argument of guide\_legend determines the order of the different aesthetics in the legend (not order of classes). See guide\_legend settings of scale\_...\_manual below*

**}**

**if(point.count == 2){**

**fin.lg.disp[[2]] <- legend.disp[[point.count + line.count]]**

**lg.order[[2]] <- point.count + line.count**

**lg.color[[2]] <- color[[i1]]**

**lg.dot.shape[[2]] <- dot.shape[[i1]]**

**lg.dot.size[[2]] <- dot.size[[i1]]**

**lg.dot.border.size[[2]] <- dot.border.size[[i1]]**

**lg.dot.border.color[[2]] <- dot.border.color[[i1]]**

**lg.alpha[[2]] <- alpha[[i1]]**

**class.categ <- levels(factor(data1[[i1]][, categ[[i1]]]))**

**if(plot == TRUE & fin.lg.disp[[2]] == TRUE & dot.shape[[2]] %in% 0:14 & ((length(dev.list()) > 0 & names(dev.cur()) == "windows") | (length(dev.list()) == 0 & Sys.info()["sysname"] == "Windows"))){** *# if any Graph device already open and this device is "windows", or if no Graph device opened yet and we are on windows system -> prevention of alpha legend bug on windows using value 1*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") GRAPHIC DEVICE USED ON A WINDOWS SYSTEM ->\nTRANSPARENCY OF THE DOTS (DOT LAYER NUMBER ", point.count, ") IS INACTIVATED IN THE LEGEND TO PREVENT A WINDOWS DEPENDENT BUG (SEE** *https://github.com/tidyverse/ggplot2/issues/2452***)\nTO OVERCOME THIS ON WINDOWS, USE ANOTHER DEVICE (pdf() FOR INSTANCE)")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**lg.alpha[[2]] <- 1** *# to avoid a bug on windows: if alpha argument is different from 1 for lines (transparency), then lines are not correctly displayed in the legend when using the R GUI (bug https://github.com/tidyverse/ggplot2/issues/2452). No bug when using a pdf*

**}else{**

**lg.alpha[[2]] <- alpha[[i1]]**

**}**

**for(i5 in 1:length(color[[i1]])){** *# or length(class.categ). It is the same because already checked that lengths are the same*

**tempo.data.frame <- data1[[i1]][data1[[i1]][, categ[[i1]]] == class.categ[i5], ]**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), eval(parse(text = scatter.kind[[i1]]))(data = tempo.data.frame, mapping = ggplot2::aes\_string(x = x[[i1]], y = y[[i1]], shape = categ[[i1]]), size = dot.size[[i1]], stroke = dot.border.size[[i1]], fill = color[[i1]][i5], color = if(is.null(dot.border.color)){color[[i1]][i5]}else{dot.border.color[[i1]]}, alpha = alpha[[i1]], show.legend = FALSE))** *# WARNING: a single color allowed for fill argument outside aesthetic, hence the loop # legend.show option do not remove the legend, only the aesthetic of the legend (dot, line, etc.). Used here to avoid multiple layers of legend which corrupt transparency*

**coord.names <- c(coord.names, paste0(geom[[i1]], ".", class.categ[i5]))**

**}**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::scale\_shape\_manual(name = if(is.null(legend.name)){NULL}else{legend.name[[i1]]}, values = rep(dot.shape[[i1]], length(color[[i1]])), breaks = class.categ))** *# values are the values of shape, breaks reorder the classes according to class.categ in the legend. See guide\_legend settings of scale\_...\_manual below*

**}**

**if(point.count == 3){**

**fin.lg.disp[[3]] <- legend.disp[[point.count + line.count]]**

**lg.order[[3]] <- point.count + line.count**

**lg.color[[3]] <- color[[i1]]**

**lg.dot.shape[[3]] <- dot.shape[[i1]]**

**lg.dot.size[[3]] <- dot.size[[i1]]**

**lg.dot.border.size[[3]] <- dot.border.size[[i1]]**

**lg.dot.border.color[[3]] <- dot.border.color[[i1]]**

**lg.alpha[[3]] <- alpha[[i1]]**

**class.categ <- levels(factor(data1[[i1]][, categ[[i1]]]))**

**if(plot == TRUE & fin.lg.disp[[3]] == TRUE & dot.shape[[3]] %in% 0:14 & ((length(dev.list()) > 0 & names(dev.cur()) == "windows") | (length(dev.list()) == 0 & Sys.info()["sysname"] == "Windows"))){** *# if any Graph device already open and this device is "windows", or if no Graph device opened yet and we are on windows system -> prevention of alpha legend bug on windows using value 1*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") GRAPHIC DEVICE USED ON A WINDOWS SYSTEM ->\nTRANSPARENCY OF THE DOTS (DOT LAYER NUMBER ", point.count, ") IS INACTIVATED IN THE LEGEND TO PREVENT A WINDOWS DEPENDENT BUG (SEE** *https://github.com/tidyverse/ggplot2/issues/2452***)\nTO OVERCOME THIS ON WINDOWS, USE ANOTHER DEVICE (pdf() FOR INSTANCE)")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**lg.alpha[[3]] <- 1** *# to avoid a bug on windows: if alpha argument is different from 1 for lines (transparency), then lines are not correctly displayed in the legend when using the R GUI (bug https://github.com/tidyverse/ggplot2/issues/2452). No bug when using a pdf*

**}else{**

**lg.alpha[[3]] <- alpha[[i1]]**

**}**

**for(i5 in 1:length(color[[i1]])){** *# or length(class.categ). It is the same because already checked that lengths are the same*

**tempo.data.frame <- data1[[i1]][data1[[i1]][, categ[[i1]]] == class.categ[i5], ]**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), eval(parse(text = scatter.kind[[i1]]))(data = tempo.data.frame, mapping = ggplot2::aes\_string(x = x[[i1]], y = y[[i1]], stroke = categ[[i1]]), shape = dot.shape[[i1]], size = dot.size[[i1]], fill = color[[i1]][i5], stroke = dot.border.size[[i1]], color = if(is.null(dot.border.color)){color[[i1]][i5]}else{dot.border.color[[i1]]}, alpha = alpha[[i1]], show.legend = FALSE))** *# WARNING: a single color allowed for color argument outside aesthetic, hence the loop # legend.show option do not remove the legend, only the aesthetic of the legend (dot, line, etc.). Used here to avoid multiple layers of legend which corrupt transparency*

**coord.names <- c(coord.names, paste0(geom[[i1]], ".", class.categ[i5]))**

**}**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::scale\_discrete\_manual(aesthetics = "stroke", name = if(is.null(legend.name)){NULL}else{legend.name[[i1]]}, values = rep(dot.border.size[[i1]], length(color[[i1]])), breaks = class.categ))** *# values are the values of stroke, breaks reorder the classes according to class.categ in the legend. See guide\_legend settings of scale\_...\_manual below*

**}**

**}else{**

**line.count <- line.count + 1**

**if(line.count == 1){**

**fin.lg.disp[[4]] <- legend.disp[[point.count + line.count]]**

**lg.order[[4]] <- point.count + line.count**

**lg.color[[4]] <- color[[i1]]**

**lg.line.size[[4]] <- line.size[[i1]]**

**lg.line.type[[4]] <- line.type[[i1]]**

**lg.alpha[[4]] <- alpha[[i1]]**

**if(plot == TRUE & fin.lg.disp[[4]] == TRUE & ((length(dev.list()) > 0 & names(dev.cur()) == "windows") | (length(dev.list()) == 0 & Sys.info()["sysname"] == "Windows"))){** *# if any Graph device already open and this device is "windows", or if no Graph device opened yet and we are on windows system -> prevention of alpha legend bug on windows using value 1*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") GRAPHIC DEVICE USED ON A WINDOWS SYSTEM ->\nTRANSPARENCY OF THE LINES (LINE LAYER NUMBER ", line.count, ") IS INACTIVATED IN THE LEGEND TO PREVENT A WINDOWS DEPENDENT BUG (SEE** *https://github.com/tidyverse/ggplot2/issues/2452***)\nTO OVERCOME THIS ON WINDOWS, USE ANOTHER DEVICE (pdf() FOR INSTANCE)")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**lg.alpha[[4]] <- 1** *# to avoid a bug on windows: if alpha argument is different from 1 for lines (transparency), then lines are not correctly displayed in the legend when using the R GUI (bug https://github.com/tidyverse/ggplot2/issues/2452). No bug when using a pdf*

**}else{**

**lg.alpha[[4]] <- alpha[[i1]]**

**}**

**class.categ <- levels(factor(data1[[i1]][, categ[[i1]]]))**

**for(i5 in 1:length(color[[i1]])){** *# or length(class.categ). It is the same because already checked that lengths are the same*

**tempo.data.frame <- data1[[i1]][data1[[i1]][, categ[[i1]]] == class.categ[i5], ]**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), eval(parse(text = paste0(**

**"ggplot2::",**

**ifelse(geom[[i1]] == 'geom\_stick', 'geom\_segment', geom[[i1]]),** *# geom\_segment because geom\_stick converted to geom\_segment for plotting*

**"(data = tempo.data.frame, mapping = ggplot2::aes(x = ",**

**x[[i1]],**

**ifelse(geom[[i1]] == 'geom\_stick', ", yend = ", ", y = "),**

**y[[i1]],**

**if(geom[[i1]] == 'geom\_stick'){paste0(', xend = ', x[[i1]], ', y = ', y.lim[1])},**

**", linetype = ",**

**categ[[i1]],**

**"), color = \"",**

**color[[i1]][i5],**

**"\", size = ",**

**line.size[[i1]],**

**ifelse(geom[[i1]] == 'geom\_path', ', lineend = \"round\"', ''),**

**ifelse(geom[[i1]] == 'geom\_step', paste0(', direction = \"', geom.step.dir[[i1]], '\"'), ''),**

**", alpha = ",**

**alpha[[i1]],**

**", show.legend = FALSE)"**

**))))** *# WARNING: a single color allowed for color argument outside aesthetic, hence the loop # legend.show option do not remove the legend, only the aesthetic of the legend (dot, line, etc.). Used here to avoid multiple layers of legend which corrupt transparency*

**coord.names <- c(coord.names, paste0(geom[[i1]], ".", class.categ[i5]))**

**}**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::scale\_discrete\_manual(aesthetics = "linetype", name = if(is.null(legend.name)){NULL}else{legend.name[[i1]]}, values = rep(line.type[[i1]], length(color[[i1]])), breaks = class.categ))** *# values are the values of linetype. 1 means solid. Regarding the alpha bug, I have tried different things without success: alpha in guide alone, in geom alone, in both, with different values, breaks reorder the classes according to class.categ in the legend*

**}**

**if(line.count == 2){**

**fin.lg.disp[[5]] <- legend.disp[[point.count + line.count]]**

**lg.order[[5]] <- point.count + line.count**

**lg.color[[5]] <- color[[i1]]**

**lg.line.size[[5]] <- line.size[[i1]]**

**lg.line.type[[5]] <- line.type[[i1]]**

**lg.alpha[[5]] <- alpha[[i1]]**

**if(plot == TRUE & fin.lg.disp[[5]] == TRUE & ((length(dev.list()) > 0 & names(dev.cur()) == "windows") | (length(dev.list()) == 0 & Sys.info()["sysname"] == "Windows"))){** *# if any Graph device already open and this device is "windows", or if no Graph device opened yet and we are on windows system -> prevention of alpha legend bug on windows using value 1*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") GRAPHIC DEVICE USED ON A WINDOWS SYSTEM ->\nTRANSPARENCY OF THE LINES (LINE LAYER NUMBER ", line.count, ") IS INACTIVATED IN THE LEGEND TO PREVENT A WINDOWS DEPENDENT BUG (SEE** *https://github.com/tidyverse/ggplot2/issues/2452***)\nTO OVERCOME THIS ON WINDOWS, USE ANOTHER DEVICE (pdf() FOR INSTANCE)")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**lg.alpha[[5]] <- 1** *# to avoid a bug on windows: if alpha argument is different from 1 for lines (transparency), then lines are not correctly displayed in the legend when using the R GUI (bug https://github.com/tidyverse/ggplot2/issues/2452). No bug when using a pdf*

**}else{**

**lg.alpha[[5]] <- alpha[[i1]]**

**}**

**class.categ <- levels(factor(data1[[i1]][, categ[[i1]]]))**

**for(i5 in 1:length(color[[i1]])){** *# or length(class.categ). It is the same because already checked that lengths are the same*

**tempo.data.frame <- data1[[i1]][data1[[i1]][, categ[[i1]]] == class.categ[i5], ]**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), eval(parse(text = paste0(**

**"ggplot2::",**

**ifelse(geom[[i1]] == 'geom\_stick', 'geom\_segment', geom[[i1]]),** *# geom\_segment because geom\_stick converted to geom\_segment for plotting*

**"(data = tempo.data.frame, mapping = ggplot2::aes(x = ",**

**x[[i1]],**

**ifelse(geom[[i1]] == 'geom\_stick', ", yend = ", ", y = "),**

**y[[i1]],**

**if(geom[[i1]] == 'geom\_stick'){paste0(', xend = ', x[[i1]], ', y = ', y.lim[1])},**

**", alpha = ",**

**categ[[i1]],**

**"), color = \"",**

**color[[i1]][i5],**

**"\", size = ",**

**line.size[[i1]],**

**", linetype = ",**

**ifelse(is.numeric(line.type[[i1]]), "", "\""),**

**line.type[[i1]],**

**ifelse(is.numeric(line.type[[i1]]), "", "\""),**

**ifelse(geom[[i1]] == 'geom\_path', ', lineend = \"round\"', ''),**

**ifelse(geom[[i1]] == 'geom\_step', paste0(', direction = \"', geom.step.dir[[i1]], '\"'), ''),**

**", show.legend = ",**

**ifelse(i5 == 1, TRUE, FALSE),**

**")"**

**))))** *# WARNING: a single color allowed for color argument outside aesthetic, hence the loop # legend.show option do not remove the legend, only the aesthetic of the legend (dot, line, etc.). Used here to avoid multiple layers of legend which corrupt transparency*

**coord.names <- c(coord.names, paste0(geom[[i1]], ".", class.categ[i5]))**

**}**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::scale\_discrete\_manual(aesthetics = "alpha", name = if(is.null(legend.name)){NULL}else{legend.name[[i1]]}, values = rep(alpha[[i1]], length(color[[i1]])), breaks = class.categ))** *# values are the values of linetype. 1 means solid. Regarding the alpha bug, I have tried different things without success: alpha in guide alone, in geom alone, in both, with different values, breaks reorder the classes according to class.categ in the legend*

**}**

**if(line.count == 3){**

**fin.lg.disp[[6]] <- legend.disp[[point.count + line.count]]**

**lg.order[[6]] <- point.count + line.count**

**lg.color[[6]] <- color[[i1]]**

**lg.line.size[[6]] <- line.size[[i1]]**

**lg.line.type[[6]] <- line.type[[i1]]**

**lg.alpha[[6]] <- alpha[[i1]]**

**if(plot == TRUE & fin.lg.disp[[6]] == TRUE & ((length(dev.list()) > 0 & names(dev.cur()) == "windows") | (length(dev.list()) == 0 & Sys.info()["sysname"] == "Windows"))){** *# if any Graph device already open and this device is "windows", or if no Graph device opened yet and we are on windows system -> prevention of alpha legend bug on windows using value 1*

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") GRAPHIC DEVICE USED ON A WINDOWS SYSTEM ->\nTRANSPARENCY OF THE LINES (LINE LAYER NUMBER ", line.count, ") IS INACTIVATED IN THE LEGEND TO PREVENT A WINDOWS DEPENDENT BUG (SEE** *https://github.com/tidyverse/ggplot2/issues/2452***)\nTO OVERCOME THIS ON WINDOWS, USE ANOTHER DEVICE (pdf() FOR INSTANCE)")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**lg.alpha[[6]] <- 1** *# to avoid a bug on windows: if alpha argument is different from 1 for lines (transparency), then lines are not correctly displayed in the legend when using the R GUI (bug https://github.com/tidyverse/ggplot2/issues/2452). No bug when using a pdf*

**}else{**

**lg.alpha[[6]] <- alpha[[i1]]**

**}**

**class.categ <- levels(factor(data1[[i1]][, categ[[i1]]]))**

**for(i5 in 1:length(color[[i1]])){** *# or length(class.categ). It is the same because already checked that lengths are the same*

**tempo.data.frame <- data1[[i1]][data1[[i1]][, categ[[i1]]] == class.categ[i5], ]**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), eval(parse(text = paste0("**

**ggplot2::",**

**ifelse(geom[[i1]] == 'geom\_stick', 'geom\_segment', geom[[i1]]),** *# geom\_segment because geom\_stick converted to geom\_segment for plotting*

**"(data = tempo.data.frame, mapping = ggplot2::aes(x = ",**

**x[[i1]],**

**ifelse(geom[[i1]] == 'geom\_stick', ", yend = ", ", y = "),**

**y[[i1]],**

**if(geom[[i1]] == 'geom\_stick'){paste0(', xend = ', x[[i1]], ', y = ', y.lim[1])},**

**", size = ",**

**categ[[i1]],**

**"), color = \"",**

**color[[i1]][i5],**

**"\", linetype = ",**

**ifelse(is.numeric(line.type[[i1]]), "", "\""),**

**line.type[[i1]],**

**ifelse(is.numeric(line.type[[i1]]), "", "\""),**

**ifelse(geom[[i1]] == 'geom\_path', ', lineend = \"round\"', ''),**

**ifelse(geom[[i1]] == 'geom\_step', paste0(', direction = \"', geom.step.dir[[i1]], '\"'), ''),**

**", alpha = ",**

**alpha[[i1]],**

**", show.legend = FALSE)"**

**))))** *# WARNING: a single color allowed for color argument outside aesthetic, hence the loop # legend.show option do not remove the legend, only the aesthetic of the legend (dot, line, etc.). Used here to avoid multiple layers of legend which corrupt transparency*

**coord.names <- c(coord.names, paste0(geom[[i1]], ".", class.categ[i5]))**

**}**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::scale\_discrete\_manual(aesthetics = "size", name = if(is.null(legend.name)){NULL}else{legend.name[[i1]]}, values = rep(line.size[[i1]], length(color[[i1]])), breaks = class.categ))** *# values are the values of linetype. 1 means solid. Regarding the alpha bug, I have tried different things without success: alpha in guide alone, in geom alone, in both, breaks reorder the classes according to class.categ in the legend*

**}**

**}**

**}**

*# end loop part*

*# legend display*

**tempo.legend.final <- 'ggplot2::guides(**

**fill = if(fin.lg.disp[[1]] == TRUE){**

**ggplot2::guide\_legend(**

**order = lg.order[[1]],**

**override.aes = list(**

**fill = lg.color[[1]],**

**colour = if(lg.dot.shape[[1]] %in% 21:24 & ! is.null(dot.border.color)){lg.dot.border.color[[1]]}else{lg.color[[1]]},** *# lg.dot.shape[[1]] %in% 21:24 are the only one that can be filled*

**shape = lg.dot.shape[[1]],**

**size = lg.dot.size[[1]],**

**stroke = lg.dot.border.size[[1]],**

**alpha = lg.alpha[[1]],**

**linetype = 0**

**)**

**)**

**}else{**

**FALSE**

**},**

**shape = if(fin.lg.disp[[2]] == TRUE){**

**ggplot2::guide\_legend(**

**order = lg.order[[2]],**

**override.aes = list(**

**fill = lg.color[[2]],**

**colour = if(lg.dot.shape[[2]] %in% 21:24 & ! is.null(dot.border.color)){lg.dot.border.color[[2]]}else{lg.color[[2]]},** *# lg.dot.shape[[2]] %in% 21:24 are the only one that can be filled*

**shape = lg.dot.shape[[2]],**

**size = lg.dot.size[[2]],**

**stroke = lg.dot.border.size[[2]],**

**alpha = lg.alpha[[2]],**

**linetype = 0**

**)**

**)**

**}else{**

**FALSE**

**},**

**stroke = if(fin.lg.disp[[3]] == TRUE){**

**ggplot2::guide\_legend(**

**order = lg.order[[3]],**

**override.aes = list(**

**fill = lg.color[[3]],**

**colour = if(lg.dot.shape[[3]] %in% 21:24 & ! is.null(dot.border.color)){lg.dot.border.color[[3]]}else{lg.color[[3]]},** *# lg.dot.shape[[3]] %in% 21:24 are the only one that can be filled*

**shape = lg.dot.shape[[3]],**

**size = lg.dot.size[[3]],**

**stroke = lg.dot.border.size[[3]],**

**alpha = lg.alpha[[3]],**

**linetype = 0**

**)**

**)**

**}else{**

**FALSE**

**},**

**linetype = if(fin.lg.disp[[4]] == TRUE){**

**ggplot2::guide\_legend(**

**order = lg.order[[4]],**

**override.aes = list(**

**color = lg.color[[4]],**

**size = lg.line.size[[4]],**

**linetype = lg.line.type[[4]],**

**alpha = lg.alpha[[4]],**

**shape = NA**

**)**

**)**

**}else{**

**FALSE**

**},**

**alpha = if(fin.lg.disp[[5]] == TRUE){**

**ggplot2::guide\_legend(**

**order = lg.order[[5]],**

**override.aes = list(**

**color = lg.color[[5]],**

**size = lg.line.size[[5]],**

**linetype = lg.line.type[[5]],**

**alpha = lg.alpha[[5]],**

**shape = NA**

**)**

**)**

**}else{**

**FALSE**

**},**

**size = if(fin.lg.disp[[6]] == TRUE){**

**ggplot2::guide\_legend(**

**order = lg.order[[6]],**

**override.aes = list(**

**color = lg.color[[6]],**

**size = lg.line.size[[6]],**

**linetype = lg.line.type[[6]],**

**alpha = lg.alpha[[6]],**

**shape = NA**

**)**

**)**

**}else{**

**FALSE**

**}**

**)'** *# clip = "off" to have secondary ticks outside plot region does not work*

**if( ! is.null(legend.width)){**

**if(any(unlist(legend.disp))){ # means some TRUE**

**tempo.graph.info <- suppressMessages(ggplot2::ggplot\_build(eval(parse(text = paste0(paste(paste0(tempo.gg.name, 1:tempo.gg.count), collapse = " + "), ' + ', tempo.legend.final)))))** *# will be recovered later again, when ylim will be considered*

**legend.final <- fun\_gg\_get\_legend(ggplot\_built = tempo.graph.info, fun.name = function.name) # get legend**

**fin.lg.disp[] <- FALSE** *# remove all the legends. Must be done even if fin.lg.disp is not appearing in the code thenafter. Otherwise twice the legend*

**if(is.null(legend.final) & plot == TRUE){** *# even if any(unlist(legend.disp)) is TRUE*

**legend.final <- fun\_gg\_empty\_graph() # empty graph instead of legend**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") LEGEND REQUESTED (NON-NULL categ ARGUMENT OR legend.show ARGUMENT SET TO TRUE)\nBUT IT SEEMS THAT THE PLOT HAS NO LEGEND -> EMPTY LEGEND SPACE CREATED BECAUSE OF THE NON-NULL legend.width ARGUMENT\n")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}else if(plot == TRUE){ # means all FALSE**

**legend.final <- fun\_gg\_empty\_graph() # empty graph instead of legend**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") LEGEND REQUESTED (NON-NULL categ ARGUMENT OR legend.show ARGUMENT SET TO TRUE)\nBUT IT SEEMS THAT THE PLOT HAS NO LEGEND -> EMPTY LEGEND SPACE CREATED BECAUSE OF THE NON-NULL legend.width ARGUMENT\n")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

**}**

**if( ! any(unlist(legend.disp))){**

**fin.lg.disp[] <- FALSE** *# remove all the legends. Must be done even if fin.lg.disp is not appearing in the code thenafter. Otherwise twice the legend*

**}**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), eval(parse(text = tempo.legend.final)))**

*# end legend display*

*# scale management*

**tempo.coord <- suppressMessages(ggplot2::ggplot\_build(eval(parse(text = paste(paste0(tempo.gg.name, 1:tempo.gg.count), collapse = " + ", ' + ggplot2::scale\_x\_continuous(expand = c(0, 0), limits = sort(x.lim), oob = scales::rescale\_none) + ggplot2::scale\_y\_continuous(expand = c(0, 0), limits = sort(y.lim), oob = scales::rescale\_none)'))))$layout$panel\_params[[1]])** *# here I do not need the x-axis and y-axis orientation, I just need the number of main ticks*

*# x.second.tick.positions # coordinates of secondary ticks (only if x.second.tick.nb argument is non-null or if x.log argument is different from "no")*

**if(x.log != "no"){** *# integer main ticks for log2 and log10*

**tempo.scale <- (as.integer(min(x.lim, na.rm = TRUE)) - 1):(as.integer(max(x.lim, na.rm = TRUE)) + 1)**

**}else{**

**tempo <- if(is.null(attributes(tempo.coord$x$breaks))){tempo.coord$x$breaks}else{unlist(attributes(tempo.coord$x$breaks))}**

**if(all(is.na(tempo))){**

**tempo.cat <- paste0("\n\n============\n\nINTERNAL CODE ERROR IN ", function.name, "\nONLY NA IN tempo.coord$x$breaks\n\n============\n\n")**

**stop(tempo.cat)**

**}**

**if(length(unique(x.lim)) <= 1){**

**tempo.cat <- paste0("\n\n============\n\nERROR IN ", function.name, "\nIT SEEMS THAT X-AXIS VALUES HAVE A NULL RANGE: ", paste(x.lim, collapse = " "), "\nPLEASE, USE THE x.lim ARGUMENT WITH 2 DIFFERENT VALUES TO SOLVE THIS\n\n============\n\n")**

**stop(tempo.cat)**

**}else{**

**tempo.scale <- fun\_scale(lim = x.lim, n = ifelse(is.null(x.tick.nb), length(tempo[ ! is.na(tempo)]), x.tick.nb))** *# in ggplot 3.3.0, tempo.coord$x.major\_source replaced by tempo.coord$x$breaks. If fact: n = ifelse(is.null(x.tick.nb), length(tempo[ ! is.na(tempo)]), x.tick.nb)) replaced by n = ifelse(is.null(x.tick.nb), 4, x.tick.nb))*

**}**

**}**

**x.second.tick.values <- NULL**

**x.second.tick.pos <- NULL**

**if(x.log != "no"){**

**tempo <- fun\_inter\_ticks(lim = x.lim, log = x.log)**

**x.second.tick.values <- tempo$values**

**x.second.tick.pos <- tempo$coordinates**

*# if(vertical == TRUE){ # do not remove in case the bug is fixed*

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::annotate(**

**geom = "segment", x = x.second.tick.pos,**

**xend = x.second.tick.pos,**

**y = if(diff(y.lim) > 0){tempo.coord$y.range[1]}else{tempo.coord$y.range[2]},**

**yend = if(diff(y.lim) > 0){tempo.coord$y.range[1] + abs(diff(tempo.coord$y.range)) / 80}else{tempo.coord$y.range[2] - abs(diff(tempo.coord$y.range)) / 80}**

**))**

*# }else{ # not working because of the ggplot2 bug*

*# assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::annotate(geom = "segment", y = x.second.tick.pos, yend = x.second.tick.pos, x = tempo.coord$x.range[1], xend = tempo.coord$x.range[1] + diff(tempo.coord$x.range) / 80))*

*# }*

**coord.names <- c(coord.names, "x.second.tick.positions")**

**}else if(( ! is.null(x.second.tick.nb)) & x.log == "no"){**

*# if(x.second.tick.nb > 0){ #inactivated because already checked before*

**tempo <- fun\_inter\_ticks(lim = x.lim, log = x.log, breaks = tempo.scale, n = x.second.tick.nb)**

**x.second.tick.values <- tempo$values**

**x.second.tick.pos <- tempo$coordinates**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::annotate(**

**geom = "segment",**

**x = x.second.tick.pos,**

**xend = x.second.tick.pos,**

**y = if(diff(y.lim) > 0){tempo.coord$y.range[1]}else{tempo.coord$y.range[2]},**

**yend = if(diff(y.lim) > 0){tempo.coord$y.range[1] + abs(diff(tempo.coord$y.range)) / 80}else{tempo.coord$y.range[2] - abs(diff(tempo.coord$y.range)) / 80}**

**))**

**coord.names <- c(coord.names, "x.second.tick.positions")**

**}**

*# for the ggplot2 bug with x.log, this does not work: eval(parse(text = ifelse(vertical == FALSE & x.log == "log10", "ggplot2::scale\_x\_continuous", "ggplot2::scale\_x\_continuous")))*

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::scale\_x\_continuous(**

**breaks = tempo.scale,**

**minor\_breaks = x.second.tick.pos,**

**labels = if(x.log == "log10"){scales::trans\_format("identity", scales::math\_format(10^.x))}else if(x.log == "log2"){scales::trans\_format("identity", scales::math\_format(2^.x))}else if(x.log == "no"){ggplot2::waiver()}else{tempo.cat <- paste0("\n\n============\n\nINTERNAL CODE ERROR IN ", function.name, "\nCODE INCONSISTENCY 10\n\n============\n\n") ; stop(tempo.cat)},**

**expand = c(0, 0),** *# remove space after after axis limits*

**limits = sort(x.lim),** *# NA indicate that limits must correspond to data limits but xlim() already used*

**oob = scales::rescale\_none,**

**trans = ifelse(diff(x.lim) < 0, "reverse", "identity")** *# equivalent to ggplot2::scale\_x\_reverse() but create the problem of x-axis label disappearance with x.lim decreasing. Thus, do not use. Use xlim() below and after this*

**))**

*# end x.second.tick.positions*

*# y.second.tick.positions # coordinates of secondary ticks (only if y.second.tick.nb argument is non-null or if y.log argument is different from "no")*

**if(y.log != "no"){** *# integer main ticks for log2 and log10*

**tempo.scale <- (as.integer(min(y.lim, na.rm = TRUE)) - 1):(as.integer(max(y.lim, na.rm = TRUE)) + 1)**

**}else{**

**tempo <- if(is.null(attributes(tempo.coord$y$breaks))){tempo.coord$y$breaks}else{unlist(attributes(tempo.coord$y$breaks))}**

**if(all(is.na(tempo))){**

**tempo.cat <- paste0("\n\n============\n\nINTERNAL CODE ERROR IN ", function.name, "\nONLY NA IN tempo.coord$y$breaks\n\n============\n\n")**

**stop(tempo.cat)**

**}**

**if(length(unique(y.lim)) <= 1){**

**tempo.cat <- paste0("\n\n============\n\nERROR IN ", function.name, "\nIT SEEMS THAT Y-AXIS VALUES HAVE A NULL RANGE: ", paste(y.lim, collapse = " "), "\nPLEASE, USE THE y.lim ARGUMENT WITH 2 DIFFERENT VALUES TO SOLVE THIS\n\n============\n\n")**

**stop(tempo.cat)**

**}else{**

**tempo.scale <- fun\_scale(lim = y.lim, n = ifelse(is.null(y.tick.nb), length(tempo[ ! is.na(tempo)]), y.tick.nb))** *# in ggplot 3.3.0, tempo.coord$y.major\_source replaced by tempo.coord$y$breaks. If fact: n = ifelse(is.null(y.tick.nb), length(tempo[ ! is.na(tempo)]), y.tick.nb)) replaced by n = ifelse(is.null(y.tick.nb), 4, y.tick.nb))*

**}**

**}**

**y.second.tick.values <- NULL**

**y.second.tick.pos <- NULL**

**if(y.log != "no"){**

**tempo <- fun\_inter\_ticks(lim = y.lim, log = y.log)**

**y.second.tick.values <- tempo$values**

**y.second.tick.pos <- tempo$coordinates**

*# if(vertical == TRUE){ # do not remove in case the bug is fixed*

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::annotate(**

**geom = "segment",**

**y = y.second.tick.pos,**

**yend = y.second.tick.pos,**

**x = if(diff(x.lim) > 0){tempo.coord$x.range[1]}else{tempo.coord$x.range[2]},**

**xend = if(diff(x.lim) > 0){tempo.coord$x.range[1] + abs(diff(tempo.coord$x.range)) / 80}else{tempo.coord$x.range[2] - abs(diff(tempo.coord$x.range)) / 80}**

**))**

*# }else{ # not working because of the ggplot2 bug*

*# assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::annotate(geom = "segment", x = y.second.tick.pos, xend = y.second.tick.pos, y = tempo.coord$y.range[1], yend = tempo.coord$y.range[1] + diff(tempo.coord$y.range) / 80))*

*# }*

**coord.names <- c(coord.names, "y.second.tick.positions")**

**}else if(( ! is.null(y.second.tick.nb)) & y.log == "no"){**

*# if(y.second.tick.nb > 0){ #inactivated because already checked before*

**tempo <- fun\_inter\_ticks(lim = y.lim, log = y.log, breaks = tempo.scale, n = y.second.tick.nb)**

**y.second.tick.values <- tempo$values**

**y.second.tick.pos <- tempo$coordinates**

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::annotate(**

**geom = "segment",**

**y = y.second.tick.pos,**

**yend = y.second.tick.pos,**

**x = if(diff(x.lim) > 0){tempo.coord$x.range[1]}else{tempo.coord$x.range[2]},**

**xend = if(diff(x.lim) > 0){tempo.coord$x.range[1] + abs(diff(tempo.coord$x.range)) / 80}else{tempo.coord$x.range[2] - abs(diff(tempo.coord$x.range)) / 80}**

**))**

**coord.names <- c(coord.names, "y.second.tick.positions")**

**}**

*# for the ggplot2 bug with y.log, this does not work: eval(parse(text = ifelse(vertical == FALSE & y.log == "log10", "ggplot2::scale\_x\_continuous", "ggplot2::scale\_y\_continuous")))*

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::scale\_y\_continuous(**

**breaks = tempo.scale,**

**minor\_breaks = y.second.tick.pos,**

**labels = if(y.log == "log10"){scales::trans\_format("identity", scales::math\_format(10^.x))}else if(y.log == "log2"){scales::trans\_format("identity", scales::math\_format(2^.x))}else if(y.log == "no"){ggplot2::waiver()}else{tempo.cat <- paste0("\n\n============\n\nINTERNAL CODE ERROR IN ", function.name, "\nCODE INCONSISTENCY 10\n\n============\n\n") ; stop(tempo.cat)},**

**expand = c(0, 0),** *# remove space after axis limits*

**limits = sort(y.lim),** *# NA indicate that limits must correspond to data limits but ylim() already used*

**oob = scales::rescale\_none,**

**trans = ifelse(diff(y.lim) < 0, "reverse", "identity")** *# equivalent to ggplot2::scale\_y\_reverse() but create the problem of y-axis label disappearance with y.lim decreasing. Thus, do not use. Use ylim() below and after this*

**))**

*# end y.second.tick.positions*

**assign(paste0(tempo.gg.name, tempo.gg.count <- tempo.gg.count + 1), ggplot2::coord\_cartesian(xlim = x.lim, ylim = y.lim))** *# clip = "off" to have secondary ticks outside plot region. The problem is that points out of bounds are also drawn outside the plot region. Thus, I cannot use it # at that stage, x.lim and y.lim not NULL anymore*

*# end scale management*

*# drawing*

**fin.plot <- eval(parse(text = paste(paste0(tempo.gg.name, 1:tempo.gg.count), collapse = " + ")))**

**grob.save <- NULL**

**if(plot == TRUE){**

**if( ! is.null(legend.width)){** *# any(unlist(legend.disp)) == TRUE removed to have empty legend space # not & any(unlist(fin.lg.disp)) == TRUE here because converted to FALSE*

**grob.save <- suppressMessages(suppressWarnings(gridExtra::grid.arrange(fin.plot, legend.final, ncol=2, widths=c(1, legend.width))))**

**}else{**

**grob.save <- suppressMessages(suppressWarnings(print(fin.plot)))**

**}**

**}else{**

**warn.count <- warn.count + 1**

**tempo.warn <- paste0("(", warn.count,") PLOT NOT SHOWN AS REQUESTED")**

**warn <- paste0(ifelse(is.null(warn), tempo.warn, paste0(warn, "\n\n", tempo.warn)))**

**}**

*# end drawing*

*# outputs*

**if(warn.print == TRUE & ! is.null(warn)){**

**options(warning.length = 8170)**

**warning(paste0("FROM ", function.name, " FUNCTION:\n\n", warn), call. = FALSE)** *# to recover the warning messages, use return = TRUE*

**}**

**if(return == TRUE){**

**output <- suppressMessages(ggplot2::ggplot\_build(fin.plot))**

*# output$data <- output$data[-1] # yes for boxplot but not for scatter # remove the first data because corresponds to the initial empty boxplot*

**if(length(output$data) != length(coord.names)){**

**tempo.cat <- paste0("\n\n================\n\nINTERNAL CODE ERROR IN ", function.name, ": length(output$data) AND length(coord.names) MUST BE IDENTICAL. CODE HAS TO BE MODIFIED\n\n================\n\n")**

**stop(tempo.cat)**

**}else{**

**names(output$data) <- coord.names**

**}**

**if(is.null(unlist(removed.row.nb))){**

**removed.row.nb <- NULL**

**removed.rows <- NULL**

**}else{**

**for(i3 in 1:length(data1)){**

**if( ! is.null(removed.row.nb[[i3]])){**

**removed.row.nb[[i3]] <- sort(removed.row.nb[[i3]])**

**removed.rows[[i3]] <- data1.ini[[i3]][removed.row.nb[[i3]], ]**

**}**

**}**

**}**

**tempo <- output$layout$panel\_params[[1]]**

**output <- list(**

**data = data1,**

**removed.row.nb = removed.row.nb,**

**removed.rows = removed.rows,**

**plot = c(output$data, x.second.tick.values = list(x.second.tick.values), y.second.tick.values = list(y.second.tick.values)),**

**panel = facet.categ,**

**axes = list(**

**x.range = tempo$x.range,**

**x.labels = if(is.null(attributes(tempo$x$breaks))){tempo$x$breaks}else{tempo$x$scale$get\_labels()},** *# is.null(attributes(tempo$x$breaks)) test if it is number (TRUE) or character (FALSE)*

**x.positions = if(is.null(attributes(tempo$x$breaks))){tempo$x$breaks}else{unlist(attributes(tempo$x$breaks))},**

**y.range = tempo$y.range,**

**y.labels = if(is.null(attributes(tempo$y$breaks))){tempo$y$breaks}else{tempo$y$scale$get\_labels()},**

**y.positions = if(is.null(attributes(tempo$y$breaks))){tempo$y$breaks}else{unlist(attributes(tempo$y$breaks))}**

**),**

**warn = paste0("\n", warn, "\n\n"),**

**ggplot = if(return.ggplot == TRUE){fin.plot}else{NULL},** *# fin.plot plots the graph if return == TRUE*

**gtable = if(return.gtable == TRUE){grob.save}else{NULL}** *#*

**)**

**return(output)** *# this plots the graph if return.ggplot is TRUE and if no assignment*

**}**

*# end outputs*

*# end main code*

**}**