**# add return.ggplot = FALSE, from boxplot**

**# add facet from boxplot if data1 is a dataframe or list of length 1**

**# inter.tick x and y do not work: see labbook CL**

**# change the rule of categ**

**# add dot.size and line.size as list except if one value, idem color and geom and alpha**

**# http://www.sthda.com/english/articles/24-ggpubr-publication-ready-plots/76-add-p-values-and-significance-levels-to-ggplots/**

**# geom\_step. Add "hv" or "vh", see also https://stackoverflow.com/questions/42633374/how-to-get-a-step-plot-using-geom-step-with-different-colors-for-the-segments**

**# add categ.order**

*# add categ.class.order replacing levels(factor(data1[[i1]][, categ[[i1]]])), thus check data1[[i1]][, categ[[i1]]]*

**# for the length of ticks see ?unit in grid package and https://stackoverflow.com/questions/17311917/ggplot2-the-unit-of-size**

**# Problem of 1: Ignoring unknown parameters: lineend**

**# problem of 2nd tick values not printed**

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

**data1,**

**x,**

**y,**

**categ = NULL,**

**legend.name = NULL,**

**color = NULL,**

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

**alpha = 0.5,**

**dot.size = 2,**

**line.size = 0.5,**

**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,**

**raster = FALSE,**

**raster.ratio = 1,**

**raster.threshold = NULL,**

**article = TRUE,**

**grid = FALSE,**

**return = FALSE,**

**plot = TRUE,**

**add = NULL,**

**warn.print = FALSE,**

**lib.path = NULL**

**){**

*# AIM*

*# 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(y, categ)] will be removed before processing, with a warning (see below)*

*# ARGUMENTS*

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

*# x: character string of the data1 column name for x-axis. If data1 is a list, then x must be a list of 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: character string of the data1 column name for y-axis. If data1 is a list, then y must be a list of 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: character string of the data1 column name for categories. If categ == NULL, no categories -> no legend displayed. If data1 is a list, then categ 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*

*# legend.name: character string of the legend title. If legend.name == NULL and categ != 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 # add with other legends below*

*# color: vector of character string of the colors of categ arguments. If color == NULL, default colors of ggplot2. If non null, it can be either: (1) a single color string (all the dots of the corresponding data1 will have this color, whatever categ NULL or not), (2) if categ non null, a vector of string colors, one for each class of categ (each color will be associated according to the alphabetical order of categ classes), (3) if categ non null, a vector or factor of string colors, like if it was one of the column of data1 data frame (beware: 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. If data1 is a list, then color must be a list of character strings or integers, of same size as data1, with compartment 1 related to compartment 1 of data1, etc. Some of the compartments can be NULL. In that case, a different grey color will be used for each NULL compartment*

*# geom: character string of the kind of plot. Either "geom\_point" (scatterplot), "geom\_line" (coordinates plotted then line connection from the lowest to highest coordinates), "geom\_path" (line connection respecting the order in data1), "geom\_step" line connection respecting the order in data1 but drawn in steps), "geom\_hline" (horizontal line) or "geom\_vline" (vertical line). BEWARE: for "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"), (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. If data1 is a list, then geom must be a list of character strings, of same size as data1, with compartment 1 related to compartment 1 of data1, etc.*

*# alpha: numeric value (from 0 to 1) of transparency. If data1 is a list, then alpha must be a list of numeric value, of same size as data1, with compartment 1 related to compartment 1 of data1, etc.*

*# dot.size: numeric value of point size*

*# line.size: numeric value of line size*

*# x.lim: 2 numeric values for x-axis range. If NULL, range of x in data1. Order of the 2 values matters (for inverted axis). BEWARE: values of the x.lim must be already in the corresponding log if x.log argument is not "no" (see below)*

*# x.lab: a character string or expression for x-axis legend. If NULL, x 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 argument column of the data1 data frame will be log2 transformed and x-axis will be log2 scaled) or "log10" (values in the x argument column of the data1 data frame will be log10 transformed and x-axis will be log10 scaled)*

*# x.tick.nb: approximate number of desired label values on the x-axis (n argument of the fun\_scale() function). If NULL, the number is managed by ggplot2*

*# 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 \* 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 bottom of x-axis*

*# x.text.angle: integer value of the text angle for the x-axis labels. Positive values for counterclockwise rotation: 0 for horizontal, 90 for vertical, 180 for upside down etc. Negative values for clockwise rotation: 0 for horizontal, -90 for vertical, -180 for upside down etc.*

*# y.lim: 2 numeric values for y-axis range. If NULL, range of y in data1. Order of the 2 values matters (for inverted axis). BEWARE: values of the y.lim must be already in the corresponding log if y.log argument is not "no" (see below)*

*# y.lab: a character string or expression for y-axis legend. If NULL, y 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 argument column of the data1 data frame will be log2 transformed and y-axis will be log2 scaled) or "log10" (values in the y argument column of the data1 data frame will be log10 transformed and y-axis will be log10 scaled)*

*# y.tick.nb: approximate number of desired label values on the y-axis (n argument of the fun\_scale() function). If NULL, the number is managed by ggplot2*

*# 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.left.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 \* y.left.extra.margin (e.g., abs(y.lim[2] - y.lim[1]) \* y.left.extra.margin) to the left of y-axis*

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

*# y.text.angle: integer value of the text angle for the y-axis labels. Positive values for counterclockwise rotation: 0 for horizontal, 90 for vertical, 180 for upside down etc. Negative values for clockwise rotation: 0 for horizontal, -90 for vertical, -180 for upside down etc.*

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

*# title: character string of the graph title*

*# title.text.size: numeric value of the title size (in points)*

*# legend.show: logical. Show legend? Ignored if categ argument is NULL, because this already generate no legend*

*# 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. If categ argument is NULL or legend.show argument is FALSE, an empty legend space is created, which can be useful when desiring graphs of exactly the same width, whatever they have legends or not. 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*

*# raster: logical. Dots in raster mode? If FALSE, dots from each geom\_point from geom argument are in vectorial mode (bigger pdf and long to display if millions of dots). If TRUE, dots from each geom\_point from geom argument are in matricial mode (smaller pdf and easy display if millions of dots, but long 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 raster.threshold if non NULL*

*# raster.ratio: single numeric value indicating the height / width ratio of the graphic device used (for instance provided by the $dim of 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 from geom argument switch from vectorial mode to raster mode (see the raster argument). If any layer is raster, then raster.ratio argument is used to avoid an ellipsoid representation of the dots. Inactive the raster argument if non NULL*

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

*# grid: logical. Draw horizontal and vertical lines in the background to better read the values? Not considered if article == FALSE*

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

*# 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*

*# BEWARE: (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\_boxplot() (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 TRUE, no print if no warning message generated*

*# 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*

*# 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 is 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). BEWARE: 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*

*# $ggplot: ggplot object that can be used for reprint (use print($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*

*# 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") ; legend.name = NULL ; color = list(L1 = 4:5, L2 = 7:8) ; geom = list(L1 = "geom\_point", L2 = "geom\_point") ; alpha = list(L1 = 0.5, L2 = 0.5) ; dot.size = 3 ; line.size = 0.5 ; 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 ; 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) ; legend.name = NULL ; color = NULL ; geom = list(L1 = "geom\_point", L2 = "geom\_point", L3 = "geom\_hline") ; alpha = list(L1 = 0.5, L2 = 0.5, L3 = 0.5) ; dot.size = 1 ; line.size = 0.5 ; 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 ; 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"; legend.name = NULL ; color = NULL ; geom = "geom\_point"; alpha = 0.1 ; dot.size = 1 ; line.size = 0.5 ; 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 ; plot = TRUE ; add = NULL ; warn.print = TRUE ; lib.path = NULL*

*# function name*

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

*# 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", "color")**

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

*# 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", na.contain = TRUE, 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(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)**

**}**

**}**

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

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

**}**

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

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

**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 = 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*

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

**warn <- NULL**

**warn.count <- 0**

**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(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)**

**}**

**}**

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

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

**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\n\n================\n\n")**

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

**}**

**}**

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

**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\n\n================\n\n")**

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

**}**

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

**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\n\n================\n\n")**

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

**}**

**}**

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

**}**

**}**

**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(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)**

**}**

**}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)**

**}**

**# data, x, y, geom, alpha are list now**

**# if non NULL, categ, 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("color NUMBER ", i1)), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 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("color NUMBER ", i1)), 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*

**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)){**

**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, print = TRUE)**

*# 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)**

**}**

*# 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"), length = 1, fun.name = function.name, print = TRUE)**

*# 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)**

**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, print = TRUE)**

**}**

**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)**

**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, print = TRUE)**

**}**

**# 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")), "\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")), "\n\n================\n\n")**

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

**}**

*# na detection and removal (done now to be sure of the correct length of categ)*

**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(any(is.na(data1[[i1]][, c(if(x[[i1]] == "fake\_x"){NULL}else{x[[i1]]}, if(y[[i1]] == "fake\_y"){NULL}else{y[[i1]]})]))){**

**tempo.removed.row.nb <- unlist(lapply(lapply(c(data1[[i1]][c(if(x[[i1]] == "fake\_x"){NULL}else{x[[i1]]}, if(y[[i1]] == "fake\_y"){NULL}else{y[[i1]]})]), FUN = is.na), FUN = which))**

**removed.row.nb[[i1]] <- c(removed.row.nb[[i1]], tempo.removed.row.nb)**

*# report of removed rows will be performed at the very end*

**data1[[i1]] <- data1[[i1]][-tempo.removed.row.nb, ]**

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

**tempo.warn <- paste0("(", warn.count,") NA DETECTED IN COLUMN ", if(x[[i1]] == "fake\_x"){""}else{ifelse(length(x) == 1, "x", paste0("ELEMENT ", i1, " OF x ARGUMENT"))}, if(x[[i1]] != "fake\_x" & y[[i1]] != "fake\_y"){" AND "}, if(y[[i1]] == "fake\_y"){""}else{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")), ". CORRESPONDING ROWS HAVE BEEN REMOVED (SEE $removed.row.nb AND $removed.rows)")**

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

**}**

*# end na detection and removal (done now to be sure of the correct length of categ)*

**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 = ifelse(x[[i1]] == "fake\_x", TRUE, FALSE), fun.name = function.name, print = TRUE)**

**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 = ifelse(y[[i1]] == "fake\_y", TRUE, FALSE), fun.name = function.name, print = TRUE)**

**if(( ! is.null(categ)) & ( ! is.null(categ[[i1]]))){** *# 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, print = TRUE)**

**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")), "\n\n================\n\n")**

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

**}**

*# na detection and removal (done now to be sure of the correct length of categ)*

**if(any(is.na(data1[[i1]][, categ[[i1]]]))){**

**tempo.removed.row.nb <- unlist(lapply(lapply(c(data1[[i1]][categ[[i1]]]), FUN = is.na), FUN = which))**

**removed.row.nb[[i1]] <- c(removed.row.nb[[i1]], tempo.removed.row.nb)**

*# report of removed rows will be performed at the very end*

**data1[[i1]] <- data1[[i1]][-tempo.removed.row.nb, ]**

**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 CATEGORY COLUMN:\n", paste(categ[[i1]], collapse = " "), "\nCONTAINS NA")**

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

**}**

*# end na detection and removal (done now to be sure of the correct length of categ)*

**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 = FALSE, 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 = FALSE, 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)))**

**}**

**# OK: all the non NULL categ columns of data1 are factors from here**

**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]])){** *# if categ[[i1]] = NULL, fake\_categ will be created. BEWARE: 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]]) 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("color NUMBER ", i1)), " 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 = "")**

*# 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)))**

**}**

**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, print = TRUE)**

**}**

**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("color NUMBER ", i1)), " IN ", 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("color NUMBER ", i1)), class = "vector", mode = "character", na.contain = TRUE, fun.name = function.name)**

**tempo2 <- fun\_check(data = color[[i1]], data.name = ifelse(length(color) == 1, "color", paste0("color NUMBER ", i1)), 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(color) == 1, "color", paste0("color NUMBER ", i1)), " 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("color NUMBER ", i1)), " 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("color NUMBER ", i1)), " IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i1, " OF data1 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("color NUMBER ", i1)), " 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("color NUMBER ", i1)), " 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]])**

**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("color NUMBER ", i1)), " 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\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("color NUMBER ", i1)), " 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("color NUMBER ", i1)), " 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. HERE 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(color) == 1, "color", paste0("color NUMBER ", i1)), prop = TRUE, length = 1, fun.name = function.name, print = TRUE)**

*# 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))) > 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))) > 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*

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

**if( ! grepl(pattern = "^\\+", add)){** *# check that the add string start by +*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": add ARGUMENT MUST START WITH \"+\": ", paste(unique(add), collapse = " "), "\n\n================\n\n")**

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

**}else if( ! grepl(pattern = "ggplot2::", add)){** *#*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": add ARGUMENT MUST CONTAIN \"ggplot2::\" IN FRONT OF EACH GGPLOT2 FUNCTION: ", paste(unique(add), collapse = " "), "\n\n================\n\n")**

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

**}else if( ! grepl(pattern = ")$", add)){** *# check that the add string finished by )*

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, ": add ARGUMENT MUST FINISH BY \")\": ", paste(unique(add), collapse = " "), "\n\n================\n\n")**

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

**}**

**}**

*# 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) == "geom\_vline")){**

**tempo.cat <- paste0("\n\n================\n\nERROR IN ", function.name, " NOT POSSIBLE TO ONLY DRAW geom\_vline KIND OF LINES 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 ONLY DRAW geom\_vline KIND OF LINES 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 = "")**

**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)))**

**}**

*# end create a fake categ if NULL to deal with legend display*

*# vector of color with length as in 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(i3 in 1:length(data1)){**

**color[[i3]] <- tempo.color[(1:length.categ.list[[i3]]) + tempo.count]**

**tempo.count <- tempo.count + length.categ.list[[i3]]**

**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 ", i3, " OF categ ARGUMENT")), " (", categ[[i3]], ") IN ", ifelse(length(data1) == 1, "data1 ARGUMENT", paste0("DATA FRAME NUMBER ", i3, " OF data1 ARGUMENT")), ":\n", paste(color[[i3]], collapse = " "), "\n", paste(if(all(levels(data1[[i3]][, categ[[i3]]]) == "")){'\"\"'}else{levels(data1[[i3]][, categ[[i3]]])}, collapse = " "))**

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

**}**

**}**

*# end vector of color with length as in data1*

*# 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("color NUMBER ", i1)), " 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("color NUMBER ", i1)), " 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("color NUMBER ", i1)), " 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), ggplot2::ggplot())**

**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 -> INTERNAL GGPLOT2 THEME FUNCTIONS theme() AND theme\_classic() HAVE BEEN INACTIVATED, TO BE USED BY THE USER.**

**\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){**

*# BEWARE: 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*

*# add categ.class.order replacing levels(factor(data1[[i1]][, categ[[i1]]])), thus check data1[[i1]][, categ[[i1]]]*

*# 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.alpha <- vector(mode = "list", length = 6)** *# order of the legend*

**lg.alpha <- lapply(lg.alpha, as.numeric)** *# alpha of the legend*

**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.alpha[[1]] <- 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 = scatter.kind[[i1]]))(data = tempo.data.frame, mapping = ggplot2::aes\_string(x = x[[i1]], y = y[[i1]], fill = categ[[i1]]), size = dot.size, color = color[[i1]][i5], alpha = alpha[[i1]]))** *# beware: 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.)*

**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, guide = ggplot2::guide\_legend(override.aes = list(colour = color[[i1]], linetype = 0))))** *# 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)*

**}**

**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.alpha[[2]] <- 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 = scatter.kind[[i1]]))(data = tempo.data.frame, mapping = ggplot2::aes\_string(x = x[[i1]], y = y[[i1]], shape = categ[[i1]]), size = dot.size, color = color[[i1]][i5], alpha = alpha[[i1]]))** *# beware: 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.)*

**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(19, length(color[[i1]])), breaks = class.categ, guide = ggplot2::guide\_legend(override.aes = list(colour = color[[i1]], linetype = 0))))** *# values are the values of shape, breaks reorder the classes according to class.categ in the legend*

**}**

**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.alpha[[3]] <- 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 = scatter.kind[[i1]]))(data = tempo.data.frame, mapping = ggplot2::aes\_string(x = x[[i1]], y = y[[i1]], stroke = categ[[i1]]), size = dot.size, color = color[[i1]][i5], alpha = alpha[[i1]]))** *# beware: 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.)*

**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(0.5, length(color[[i1]])), breaks = class.categ, guide = ggplot2::guide\_legend(override.aes = list(colour = color[[i1]], linetype = 0))))** *# values are the values of stroke, breaks reorder the classes according to class.categ in the legend*

**}**

**}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]]**

**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 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 = paste("ggplot2::", geom[[i1]], sep ="")))(data = tempo.data.frame, mapping = ggplot2::aes\_string(x = x[[i1]], y = y[[i1]], linetype = categ[[i1]]), color = color[[i1]][i5], size = line.size, lineend = "round", alpha = alpha[[i1]]))** *# beware: 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.)*

**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(1, length(color[[i1]])), breaks = class.categ, guide = ggplot2::guide\_legend(override.aes = list(colour = color[[i1]], shape = NA))))** *# 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]]**

**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 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 = paste("ggplot2::", geom[[i1]], sep ="")))(data = tempo.data.frame, mapping = ggplot2::aes\_string(x = x[[i1]], y = y[[i1]], alpha = categ[[i1]]), color = color[[i1]][i5], size = line.size, lineend = "round"))** *# beware: 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.)*

**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, guide = ggplot2::guide\_legend(override.aes = list(colour = color[[i1]], shape = NA))))** *# 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]]**

**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 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 = paste("ggplot2::", geom[[i1]], sep ="")))(data = tempo.data.frame, mapping = ggplot2::aes\_string(x = x[[i1]], y = y[[i1]], size = categ[[i1]]), color = color[[i1]][i5], alpha = alpha[[i1]], lineend = "round"))** *# beware: 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.)*

**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, length(color[[i1]])), breaks = class.categ, guide = ggplot2::guide\_legend(override.aes = list(colour = color[[i1]], shape = NA))))** *# 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(alpha = lg.alpha[[1]], color = lg.color[[1]]))}else{FALSE}, shape = if(fin.lg.disp[[2]] == TRUE){ggplot2::guide\_legend(order = lg.order[[2]], override.aes = list(alpha = lg.alpha[[2]], color = lg.color[[2]]))}else{FALSE}, stroke = if(fin.lg.disp[[3]] == TRUE){ggplot2::guide\_legend(order = lg.order[[3]], override.aes = list(alpha = lg.alpha[[2]], color = lg.color[[3]]))}else{FALSE}, linetype = if(fin.lg.disp[[4]] == TRUE){ggplot2::guide\_legend(order = lg.order[[4]], override.aes = list(alpha = lg.alpha[[4]], color = lg.color[[4]]))}else{FALSE}, alpha = if(fin.lg.disp[[5]] == TRUE){ggplot2::guide\_legend(order = lg.order[[5]], override.aes = list(alpha = lg.alpha[[5]], color = lg.color[[5]]))}else{FALSE}, size = if(fin.lg.disp[[6]] == TRUE){ggplot2::guide\_legend(order = lg.order[[6]], override.aes = list(alpha = lg.alpha[[6]], color = lg.color[[6]]))}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::coord\_cartesian(xlim = if(diff(x.lim) < 0){rev(x.lim)}else{x.lim}, ylim = if(diff(y.lim) < 0){rev(y.lim)}else{y.lim})'))))$layout$panel\_params[[1]])**

*# 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 = tempo.coord$y.range[1], yend = tempo.coord$y.range[1] + 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 = tempo.coord$y.range[1],**

**yend = tempo.coord$y.range[1] + diff(tempo.coord$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 = tempo.coord$x.range[1], xend = tempo.coord$x.range[1] + 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(vertical == TRUE){tempo.coord$x.range[1]}else{tempo.coord$y.range[1]},**

**xend = if(vertical == TRUE){tempo.coord$x.range[1] + diff(tempo.coord$x.range) / 80}else{tempo.coord$y.range[1] + diff(tempo.coord$y.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 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 does not work # rev() because of a bug in ggplot2, see my issue in ggplot2 github # at that stage, x.lim and y.lim not NULL anymore*

*# end scale management*

*# drawing*

**fin.plot <- eval(parse(text = paste(paste(paste0(tempo.gg.name, 1:tempo.gg.count), collapse = " + "),if(is.null(add)){NULL}else{add})))**

**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*

**suppressMessages(suppressWarnings(gridExtra::grid.arrange(fin.plot, legend.final, ncol=2, widths=c(1, legend.width))))**

**}else{**

**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)){**

**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)),**

**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")**

**)**

**return(output)**

**}**

*# end outputs*

*# end main code*

**}**