

bbkplot – Bundesbank Corporate Design in R

Use of R in Official Statistics 2023

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Why facilitate graphic creation in corporate design?



PUBLICATIONS

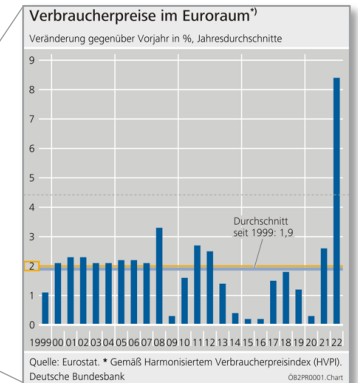
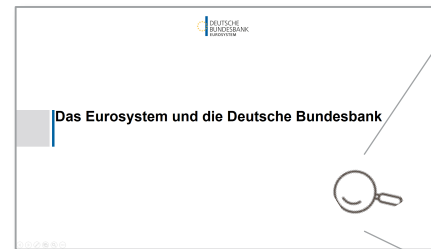
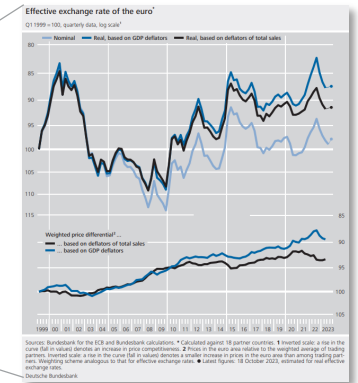
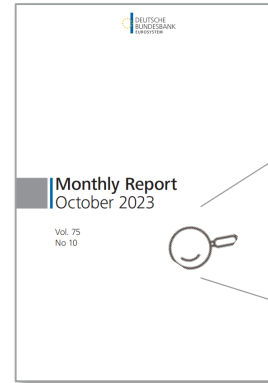
- Deutsche Bundesbank* publishes reports, papers, and presentations as part of its mandate
- Including a large number of graphics

FLAGSHIP PUBLICATIONS

- E.g. Monthly Report, Financial Stability Report
- High visibility
- Complex graphics

OTHER PUBLICATIONS

- E.g. technical reports, presentations
- Lower visibility
- Large number of potentially less complex graphics



* And official statistical offices in general we assume

Why facilitate graphic creation in corporate design?



PUBLICATIONS

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- Including a large number of graphics



CORPORATE DESIGN

- Publications have a unified brand appearance
- To convey reliability of the information source



GRAPHICS CREATION

- Graphics are compiled by a dedicated team
- Based on data and requirements by the respective experts



NEW OPTION

- A tool enabling users to create graphics in corporate design themselves could provide value

Available R packages

Luckily, there are R-packages that allow easy implementation of Corporate Design, e.g.

- ggthemes*
- ggCorpIdent**
- unikn***

Thank you for listening. Any questions?

The situation



CORPORATE DESIGN GUIDE

- 163 pages of detailed requirements
- Makes out-of-the box R packages hard to use
- Requirements cannot all be implemented in `ggplot2` but rather using `grid`

The situation



TYPOGRAPHY REQUIREMENTS

- Font
- Fontsize
- Relations among fontsizes
- Fallback options
- Number formatting
- ...

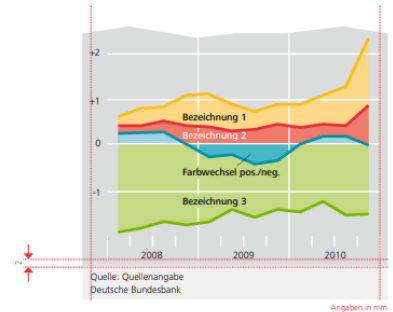
- Generally easy to implement, however non-standard font proves tricky

The situation



CHARTS

- Specific line-by-line requirements for headers, subheaders, footnotes, ...
- Legends
- Non-standard axis labels and axis ticks
- Different requirement for diagrams (bars, dots, circles, areas, boxplots)

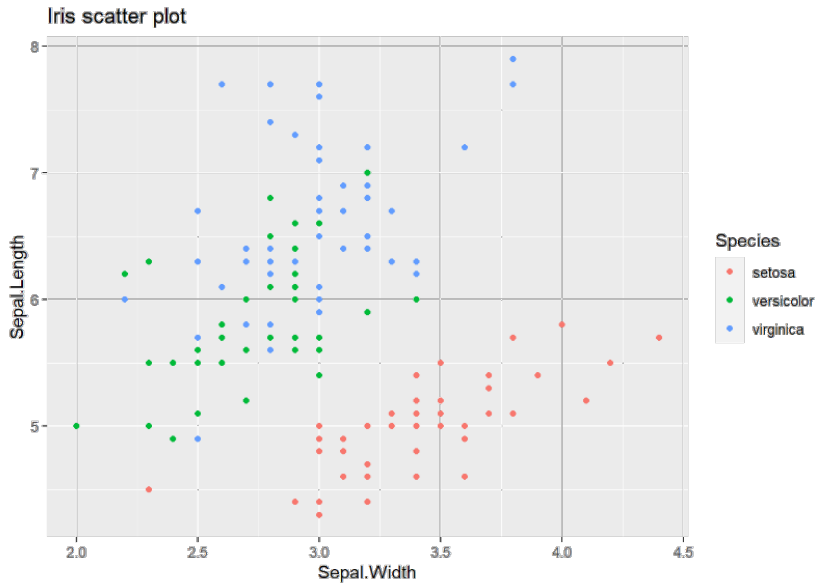


The solution



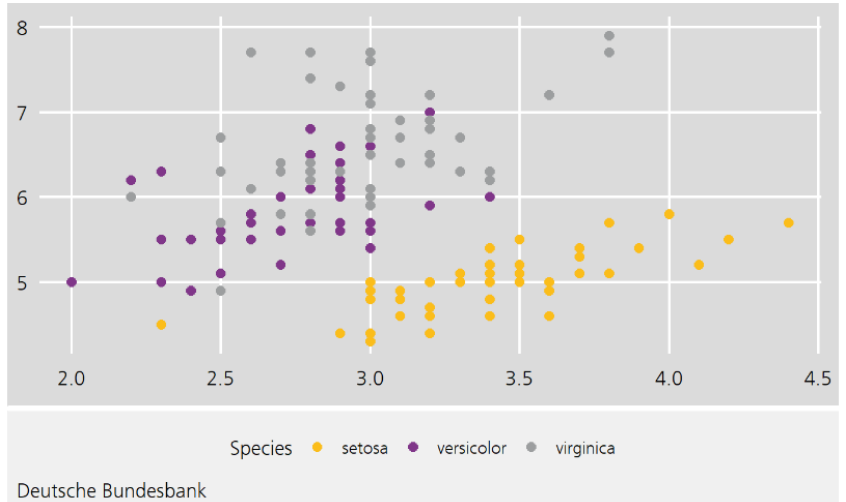
bbkplot – An easy-to-use internal R package for all staff to create graphics in corporate design

```
# Scatterplot with ggplot2  
a <- ggplot(datasets::iris, aes(Sepal.Width, Sepal.Length, color = Species)) +  
  geom_point() +  
  ggtitle("Iris scatter plot")  
a
```



```
# Convert to corporate design  
bbkplot(a)
```

Iris scatter plot



The solution

- `bbkplot` is a user-friendly internal R package
- `bbkplot` is developed to enable staff to produce corporate design adhering graphics
- `bbkplot` allows to convert a wide range of plots, including maps and interactive plots



THE PACKAGE

FUNCTION	DESCRIPTION
<code>bbkplot</code>	Take a ggplot (and selected others) as input and converts it to Bundesbank corporate design relying on <code>grid</code> . Returns a <code>gtable</code> .
<code>bbktable</code>	Construct a table in Bundesbank corporate design (from <code>data.frames</code> and matrices)
<code>tsplot</code>	Create a plot in corporate design from time series
<code>multiplot</code>	Adding several plots together
<code>bbk_fontimport</code>	Import BBk Style Fonts
<code>print.bbkplot</code>	Generic functions for <code>bbkplot</code>
<code>save_plot</code>	Export a <code>bbkplot</code>

Usage

```
# (1) get data
world <- rnaturalearth::ne_countries(scale = "medium", returnclass = "sf")

# (2) plot
maps <- ggplot(data = world) +
  geom_sf(aes(fill = pop_est)) +
  xlab("Longitude") + ylab("Latitude")

# (3) bbkplot
bbkplot(maps, discrete = FALSE, scale_y_continuous = FALSE)

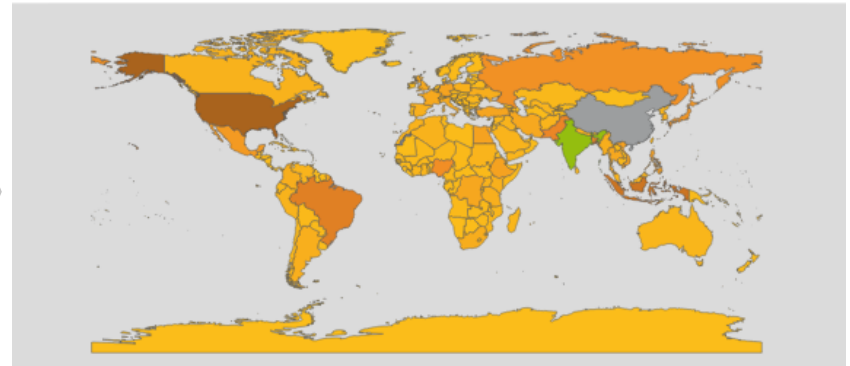
# A suitable title, subtitle and source can be added using bbkplot as shown earlier

bbkplot(maps, discrete = FALSE, title = "World map",
        subtitle = paste0("(" , length(unique(world$name)), " countries)"), scale_y_continuous = FALSE, clear_background = TRUE)
)
```

Any ggplot is supported as input (and grid)

World map

(241 countries)



pop_est
5e+08 1e+09

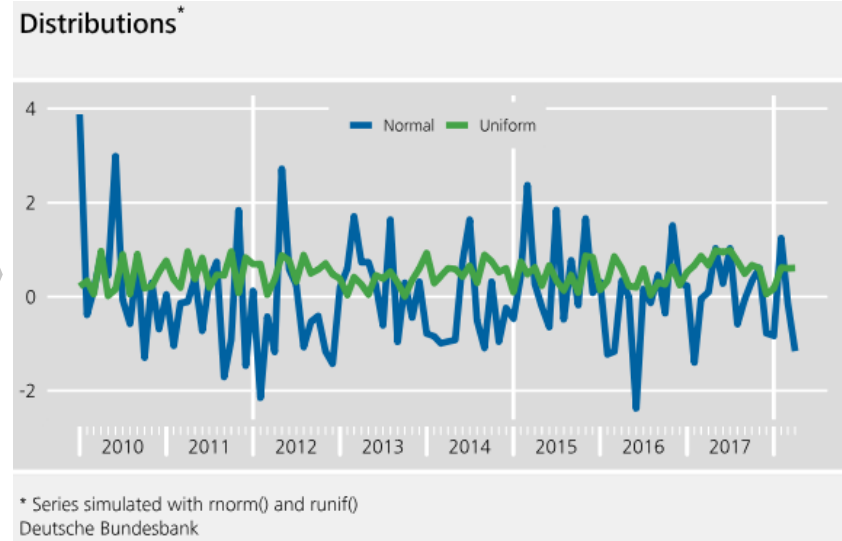
Deutsche Bundesbank

Usage

```
x <- xts::xts(rnorm(100), seq.Date(as.Date("2010-01-01"), length.out=100, by="months"))
y <- xts::xts(runif(100), seq.Date(as.Date("2010-01-01"), length.out=100, by="months"))

tsplot(merge(x,y), names = c("Normal", "Uniform"), source = "* Series simulated with rnorm() and runif()", include_source = FALSE, main = bquote("Distributions"^^"*"), legend_position = c(0.5, 0.9), color = c("blue", "green"))
```

Specialised function for time series (note the x-axis ticks and labels)



Usage

```
# (1) create plot 1-4
```

-
-
-

```
# (2) Combine plot 1-4
```

```
my_grob <- gridExtra::arrangeGrob(in_1, in_2, in_3, in_4, nrow=2)
```

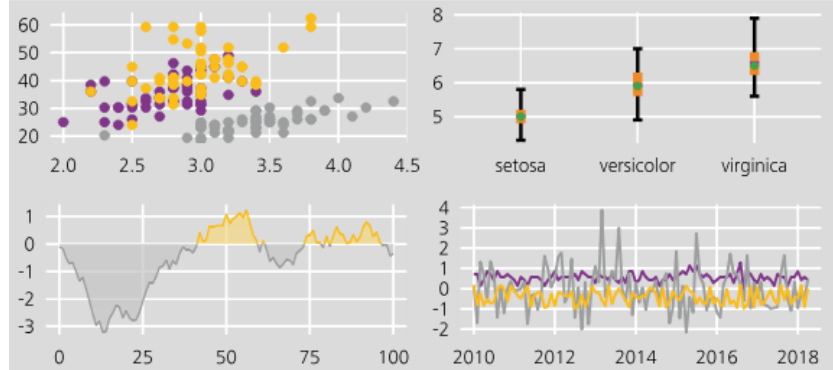
```
# (3) convert to Bundesbank design
```

```
bbkplot(my_grob, title = "BBkplot", subtitle = "Graphic examples", source = "Iris data", add_theme_bbk = FALSE)
```

Capability to create complex plots by combining multiple grid plots

BBkplot

Graphic examples



Source: Iris data
Deutsche Bundesbank

How to leverage bbkplot? – A workflow pipeline



R-MARKDOWN

```
239+ [[[r bbkplot_plot, fig.show = "hold", fig.cap="Scatterplot converted to bbkplot", echo=FALSE,  
240+ fig.pos="h"  
241+ # show the constructed scatterplot and its conversion to Bbk design  
242+ bbkplot(p)  
243+ ]]  
244+ ]]  
245+ ]]  
246+ [[[r example_2, fig.show = "hold", fig.cap="Scatterplot", echo=TRUE, fig.pos="H",  
247+ message=FALSE, warnings=FALSE]  
248+ p <- ggplot(mtcars, aes(mpg, wt)) +  
249+   geom_point(aes(color = factor(cyl))) +  
250+   labs(title = "Fast") +  
251+   theme(legend.position = c(.95, .95),  
252+         legend.justification = c("right", "top"),  
253+         legend.box.just = "right",  
254+         legend.margin = margin(6, 6, 6, 6))  
255+ ]]  
256+ bbkplot(p, title = "A scatterplot with mtcars in R",  
257+         subtitle = "Legend in plot area",  
258+         legend_below = FALSE)  
259+ ]]  
260+ ]]  
261+ ## Histogram  
262+ A Histogram is a visualisation of the frequency distribution of grouped data (Diaz-Bone,  
263+ 2006). While the height of the bars in barplots correspond to the number of observations in  
264+ each group, for histograms the area of each bar is equal to the frequency density. It is  
265+ therefore often used to inspect the empirical distribution of continuous data. Sometimes  
266+ parametric density estimates are added to histograms.  
267+ Histograms are easily created in ggplots. Here, we present an example of a histogram, where  
268+ two subgroups are highlighted in colour. We draw data from two normal distributions with  
269+ different mean and then plot these data using "ggplot()":  
270+ ]]  
271+ [[[r example_3, fig.show = "hold", fig.cap="Histogram", echo=TRUE, fig.pos="H",  
272+ message=FALSE, warnings=FALSE]  
273+ set.seed(1234)  
274+ # Generate artificial data  
275+ df <- data.frame(  
276+   Object_Type = factor(rep(c("A", "B"), each=200)),  
277+   Weight = round(c(rnorm(200, mean=50, sd=2),  
278+                   rnorm(200, mean=65, sd=2))))  
279+ # Create histograms with bins  
280+ p2 <- ggplot(df, aes(x = Weight, fill = Object_Type)) +  
281+   geom_histogram(bins = 25 ) +
```

OUTPUT

Publication-ready pdf in corporate design



bbkplot

Deutsche Bundesbank Corporate Design in R

Package version 1.10
Available in Bundesbank environment

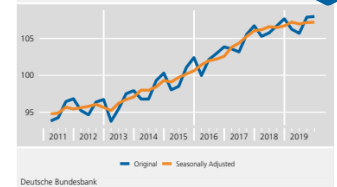
Deutsche Bundesbank, Research Data and Service Centre

Hendrik Christian Doll
Daniel Ollsch
Frederik Hering
Sidharth Manya



GDP Germany, chain-linked

2015=100



Deutsche Bundesbank
Figure 7: Time series plot

A single call to `tsplot()` that includes the time series object suffices to create a Bundesbank style plot. This can of course be augmented by including title, subtitle and specific names for the time series.

4.6 Tables

In addition to plots, the `bbkplot` package allows creating Bundesbank style tables using `bbktable()`. This function takes a pre-defined data set (such as a data frame) as an input. The resulting table can be tweaked by adding a title, numbering or changing the text size (see figure 8):

```
d <- head(iris[,1:3])  
bbktable(d,  
  title = "Title of the table",  
  footer_label = NULL,  
  subtitle = "Subtitle",  
  source = "Iris dataset",  
  font_size = 15,  
  number = "Table 1")
```

* Gomolka (2018)

Challenges and how we overcame them



CHALLENGE



SOLUTION

- Corporate design guide demands specifications not possible in `ggplot2`
 - Various possibilities for text in header and footer
 - Legend on plot or in footer



- Relying on `grid` graphics
 - Create separate `grobs*` and combine them in `bbkplot` function
 - Extracting legend and store in `grid` `grob` to flexibly use

- Non-standard axis ticks



- `ggplot2` is surprisingly flexible, the challenge lies in identifying the right tick position in each scenario

- Including non-standard font on all machines



- `sysfonts` package to load fonts, enable fallback options

* Graphical objects

Key Take-Aways



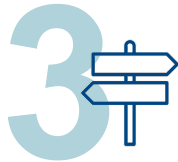
FLEXIBILITY

Any complex design guidelines can be implemented in R to streamline corporate design graphic production



QUALITY

For standard graphics, users can efficiently and reliably produce high-quality output



THE FUTURE

Enable further interactive input formats while keeping user-friendly design



References

- Arnold, J.B, Daroczi, G., Werth, B., Weitzner, B., Kunst, J., Auguie, B. Rudis, B., Wickham, H., Talbot, J., and J. London (2020). ggthemes: Extra Themes, Scales and Geoms for ggplot2. <https://CRAN.R-project.org/package=ggthemes>
- Doll, H. C., Ollech, D., Hering, F. & S. Marya (2020). bbkplot. Deutsche Bundesbank Corporate Design in R, Technical Report 2020-03, Deutsche Bundesbank, Frankfurt a.M. <https://www.bundesbank.de/resource/blob/831408/20861a1d419d93a1b2eba25ee829eae1/mL/2020-03-bbkplot-data.pdf>
- Gomolka, M. (2018). DataReportR. uRos 2018, Conference proceedings. http://r-project.ro/conference2018/presentations/Mattias_Gomolka_DataReportR.pdf
- Klein M. and S. Wagner (2018). ggCorpldent: INWTlab wrapper for ggplot2 to create plots matching a corporate identity. INWT Statistics GmbH. <https://github.com/INWTlab/ggCorpldent>
- Neth, H. and N. Gradwohl (2023). *unikn: Graphical elements of the University of Konstanz's corporate design*. University of Konstanz <https://CRAN.R-project.org/package=unikn>



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🌐 <https://www.bundesbank.de/en/bundesbank/research/rdsc>

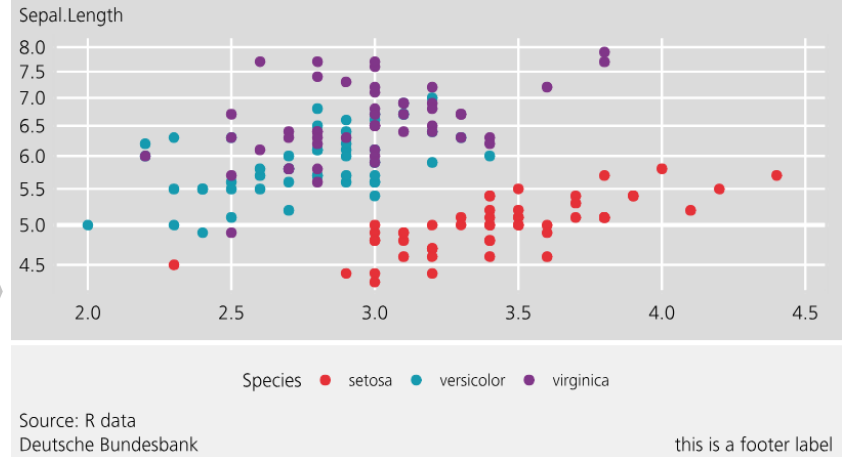
Usage

```
bbk_a <- bbkplot(  
  a,  
  title = "Iris data in a different view",  
  
  subtitle = "A more fancy comparison of t  
hree flower types",  
  source = "R data",  
  number = "Figure 2",  
  footer_label = "this is a footer label",  
  log_y = 10,  
  horizontal_line = 5,  
  n_breaks = 8,  
  expand_x_axis = TRUE,  
  y_title_direction = "top",  
  color = c("red", "petrol", "violet"))  
bbk_a
```

Iris data in a different view

Figure 2

A more fancy comparison of three flower types



Many modifications within the design guidelines are enabled

Usage

```
# (1) data to put into table
d <- head(iris[,1:3])

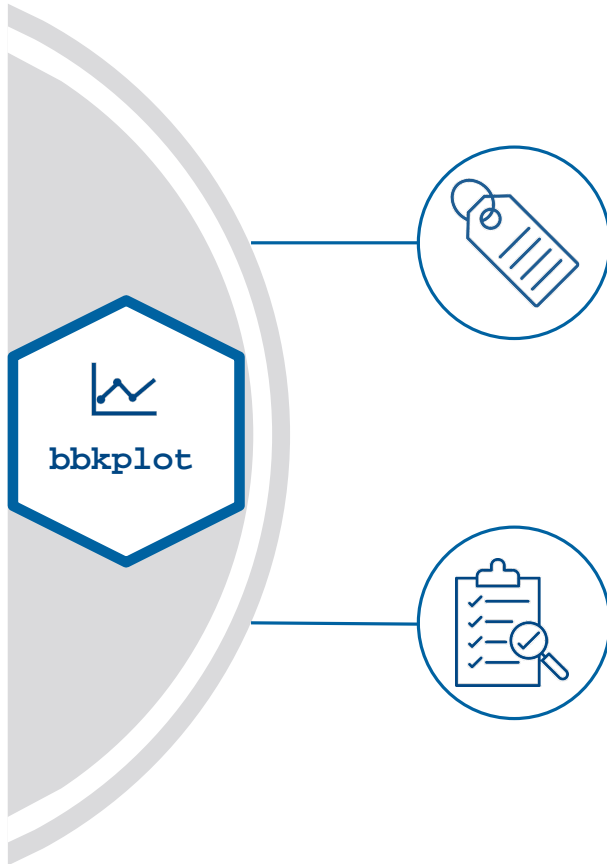
# (2) convert table into Bundesbank design
bbktable(d, title = "Title", subtitle = "Subtitle", source = "Iris dataset")
```

bbktable allows easy table creation from data.frames

Title			
Subtitle			
	Sepal.Length	Sepal.Width	Petal.Length
1	5.1	3.5	1.4
2	4.9	3	1.4
3	4.7	3.2	1.3
4	4.6	3.1	1.5
5	5	3.6	1.4
6	5.4	3.9	1.7

Source: Iris dataset
Deutsche Bundesbank

Introducing bbkplot in the organisation



EASY START

- Usage facilitated by many examples in vignette
- 2-day introductory class offered by package authors „Corporate Design in R“

RESULT

- Source code on internal R package repository
- Internal users across many business areas