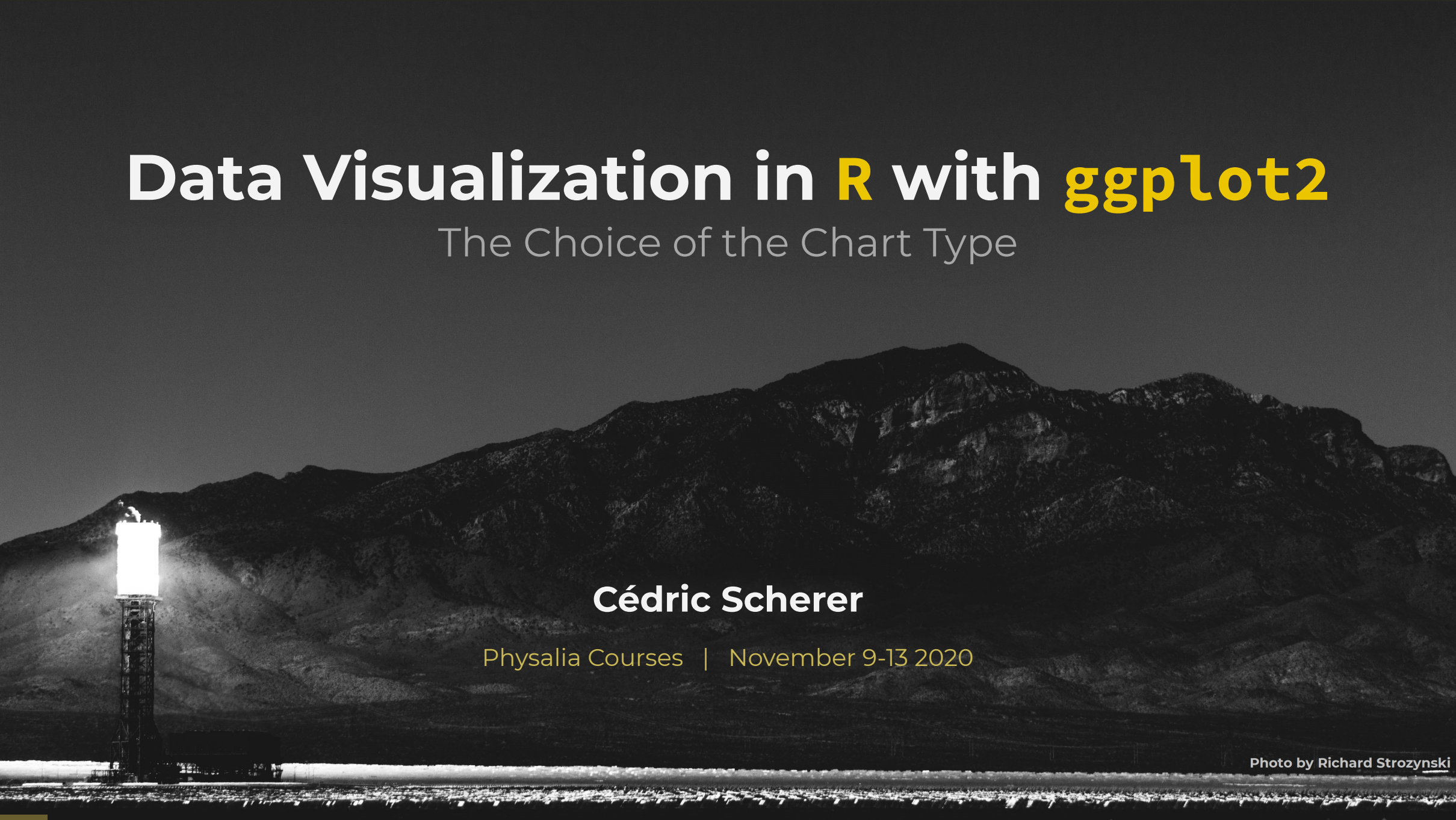
Data Visualization in R with ggplot2

The Choice of the Chart Type

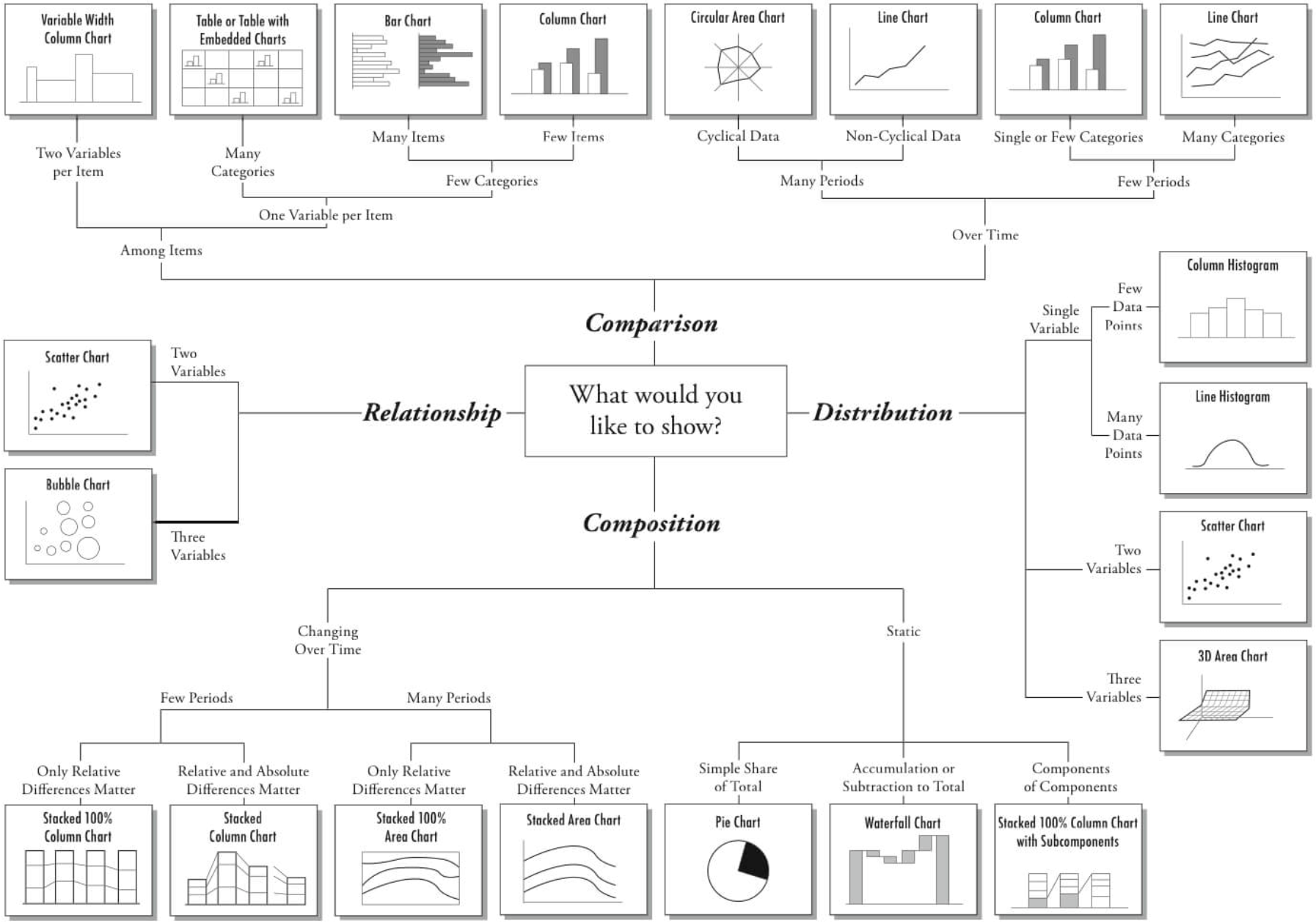


Cédric Scherer

Physalia Courses | November 9-13 2020

Photo by Richard Strozynski

Chart Suggestions—A Thought-Starter



from Data to Viz

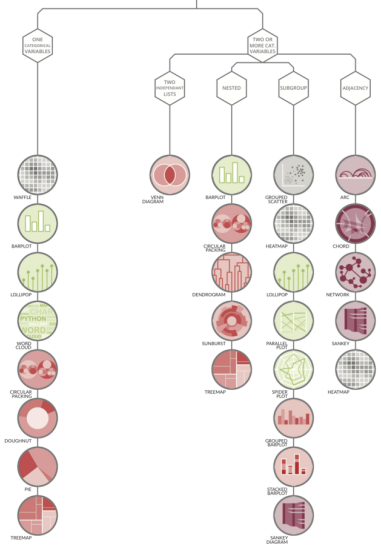
'From Data to Viz' is a classification of chart types based on input data format. It will help you find the perfect chart in three simple steps :

1. Identify what type of data you have.
2. Go to the corresponding decision tree and follow it down to a set of possible charts.
3. Choose the chart from the set that will suit your data and your needs best.

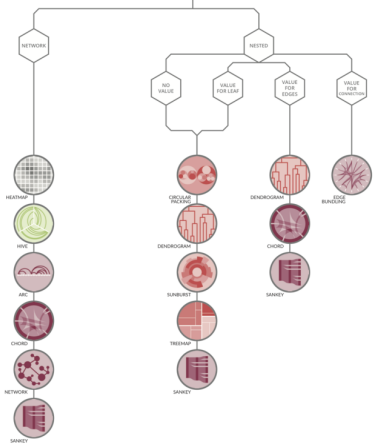
Dataviz is a world with endless possibilities and this project does not claim to be exhaustive. However it should provide you with a good starting point. For an interactive version and much more, visit:

data-to-viz.com

CATEGORIC

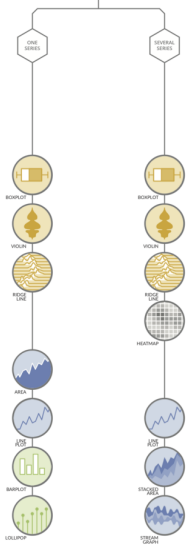


RELATIONAL



MAP

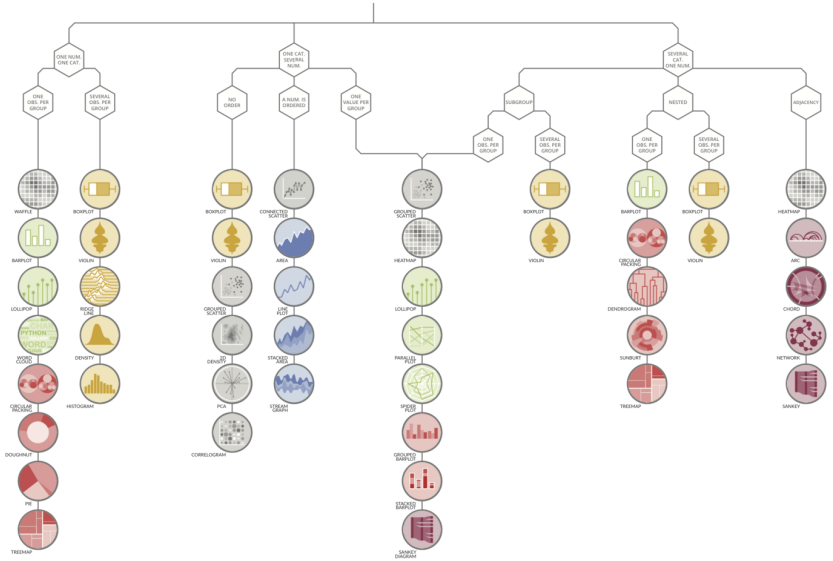
TIME SERIES



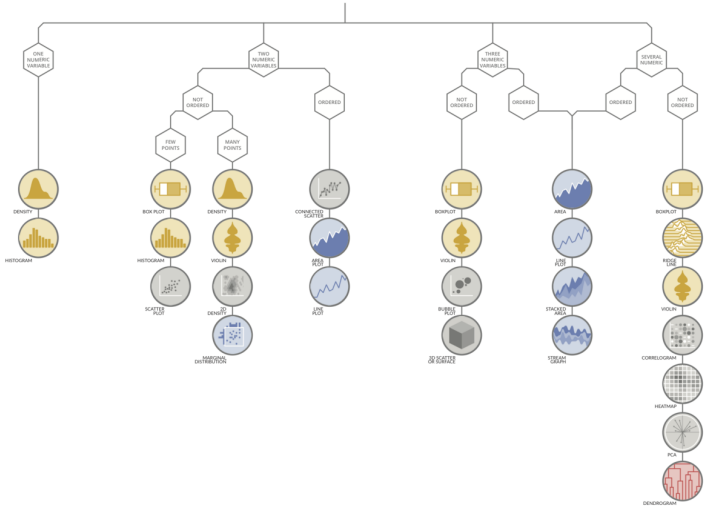
WHAT DO YOU WANT TO SHOW ?

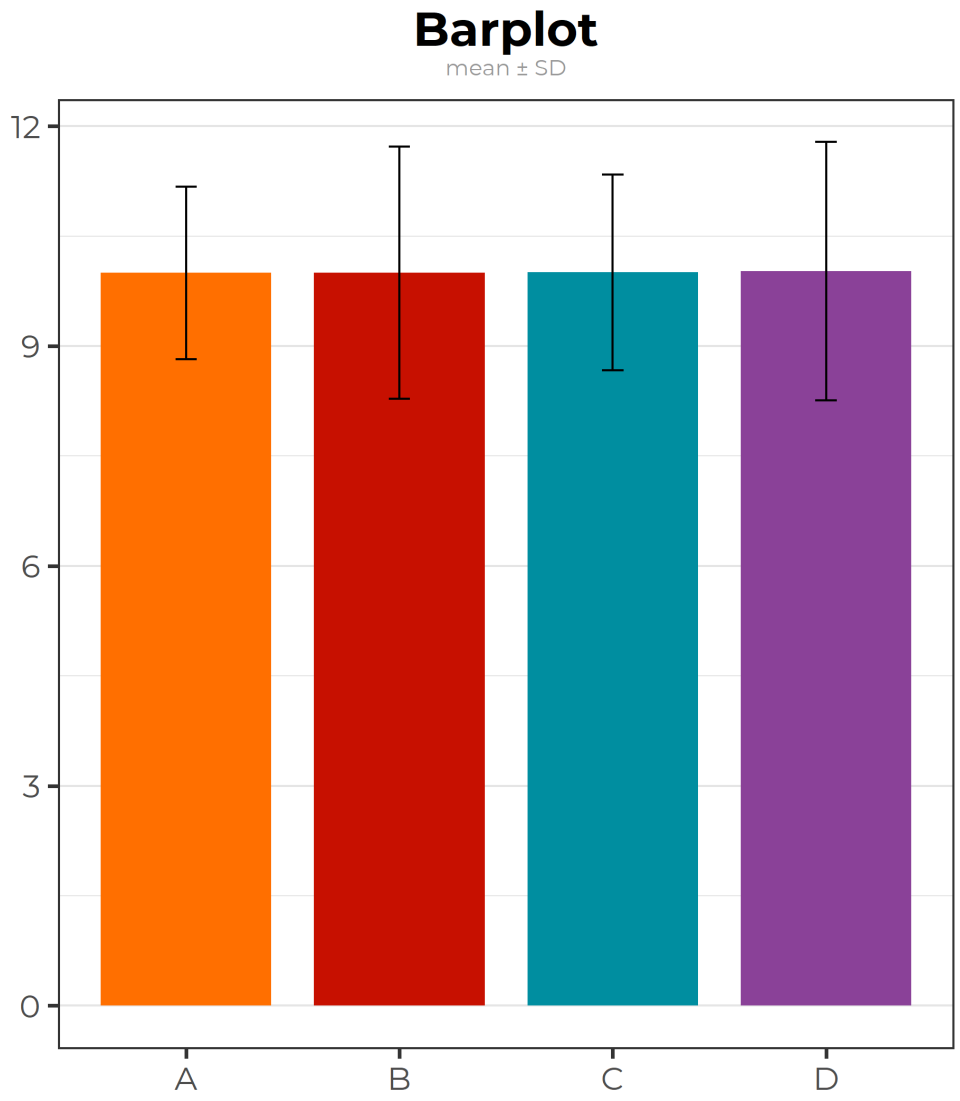
- Distribution
- Correlation
- Ranking
- Part of a whole
- Evolution
- Maps
- Flow

CATEGORIC AND NUMERIC

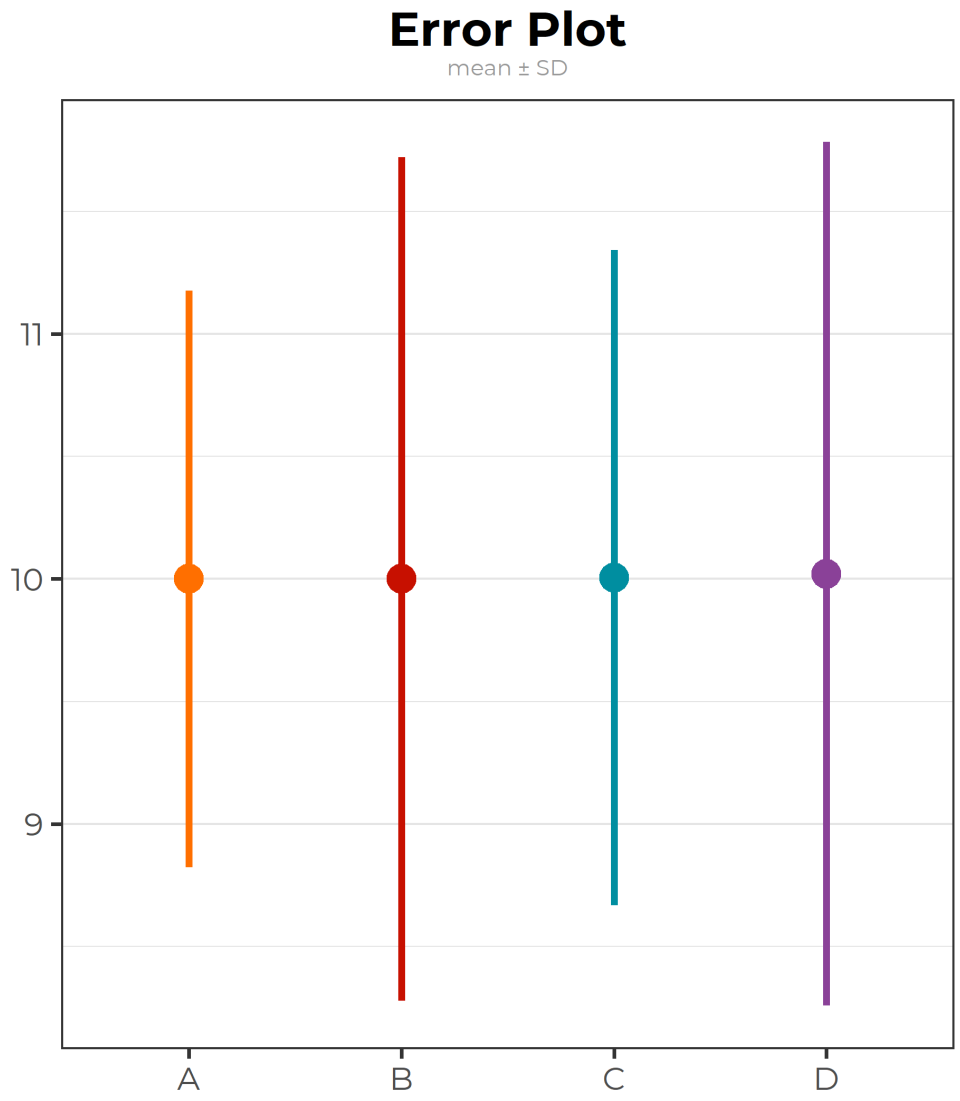


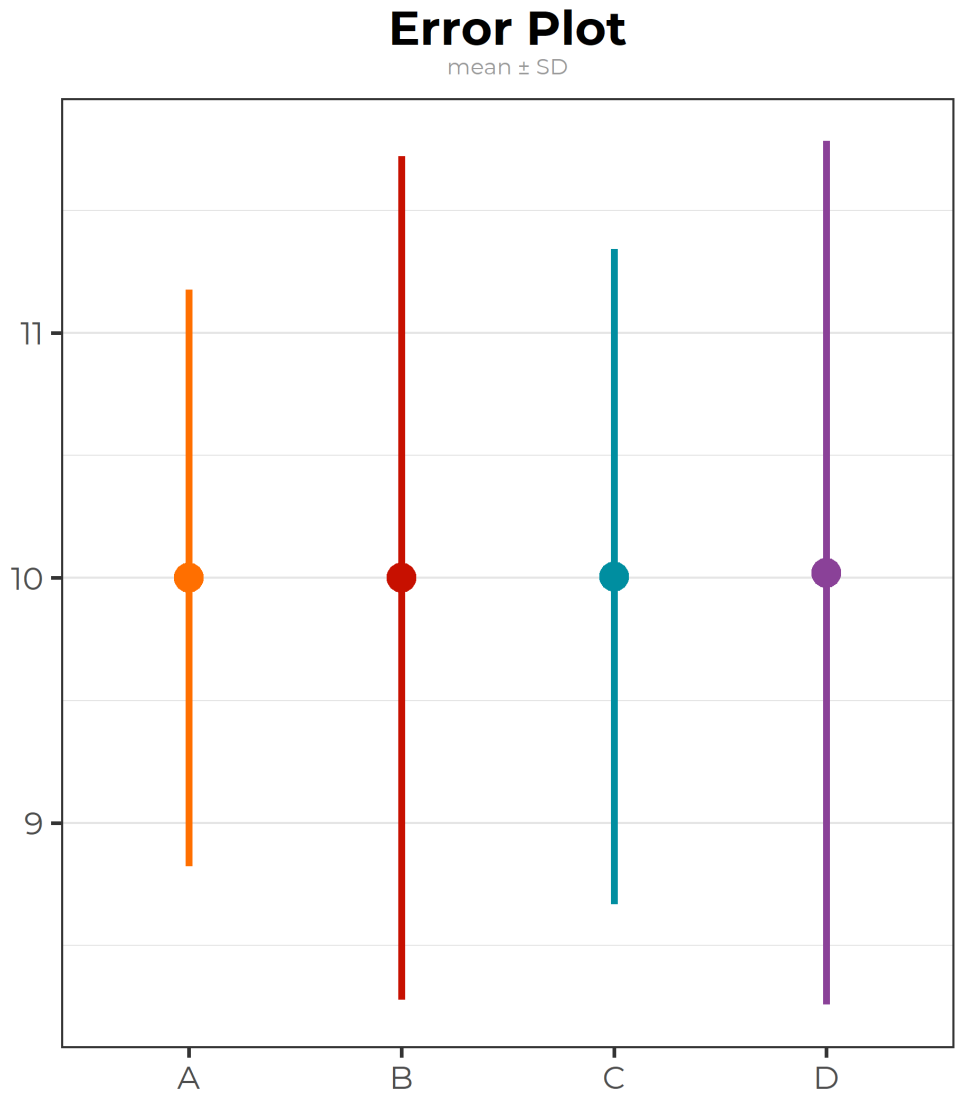
NUMERIC



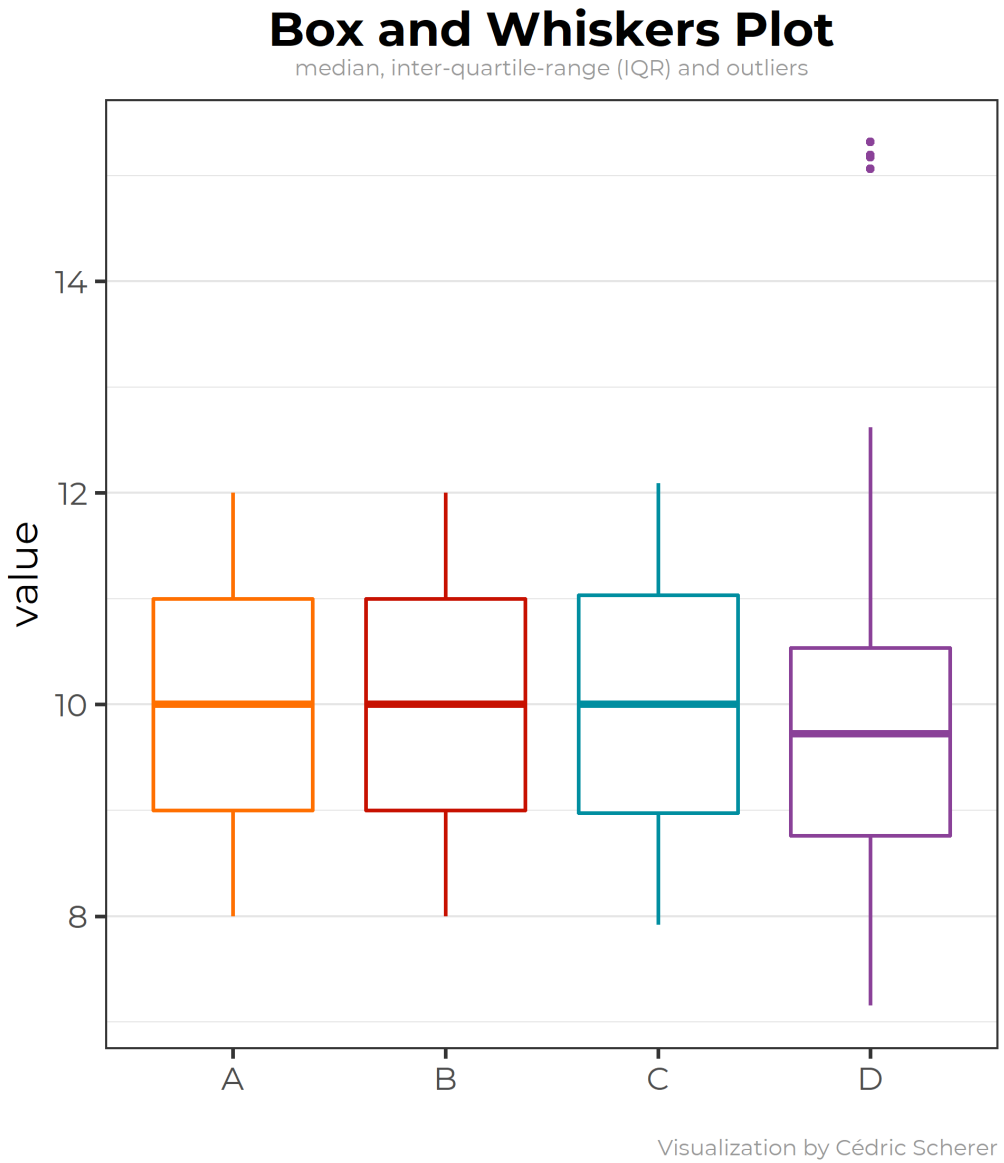


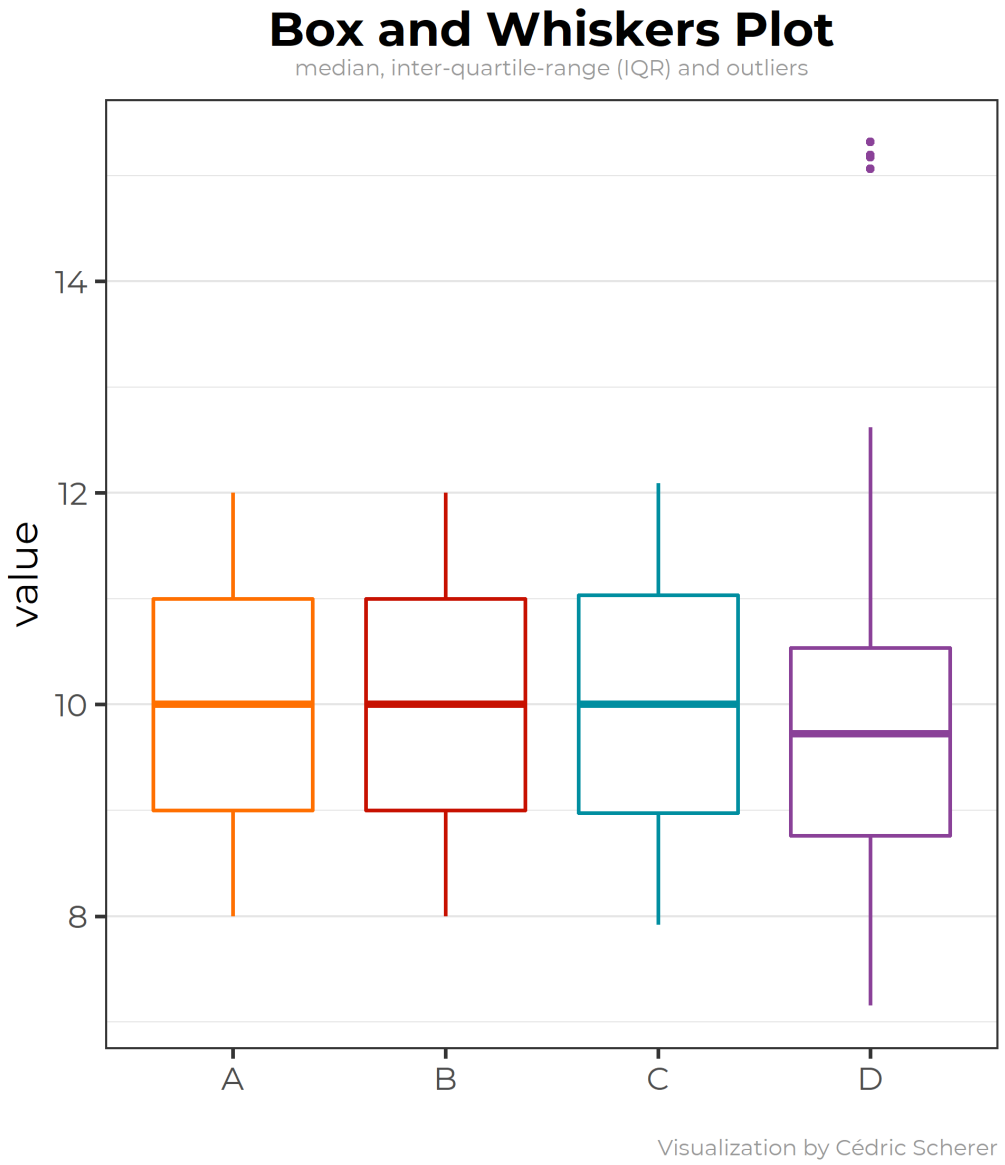
- Boring
- Not accurate
- Lots of useless space


Error Plot
mean ± SD
11
10
9
A
B
C
D
Visualization by Cédric Scherer

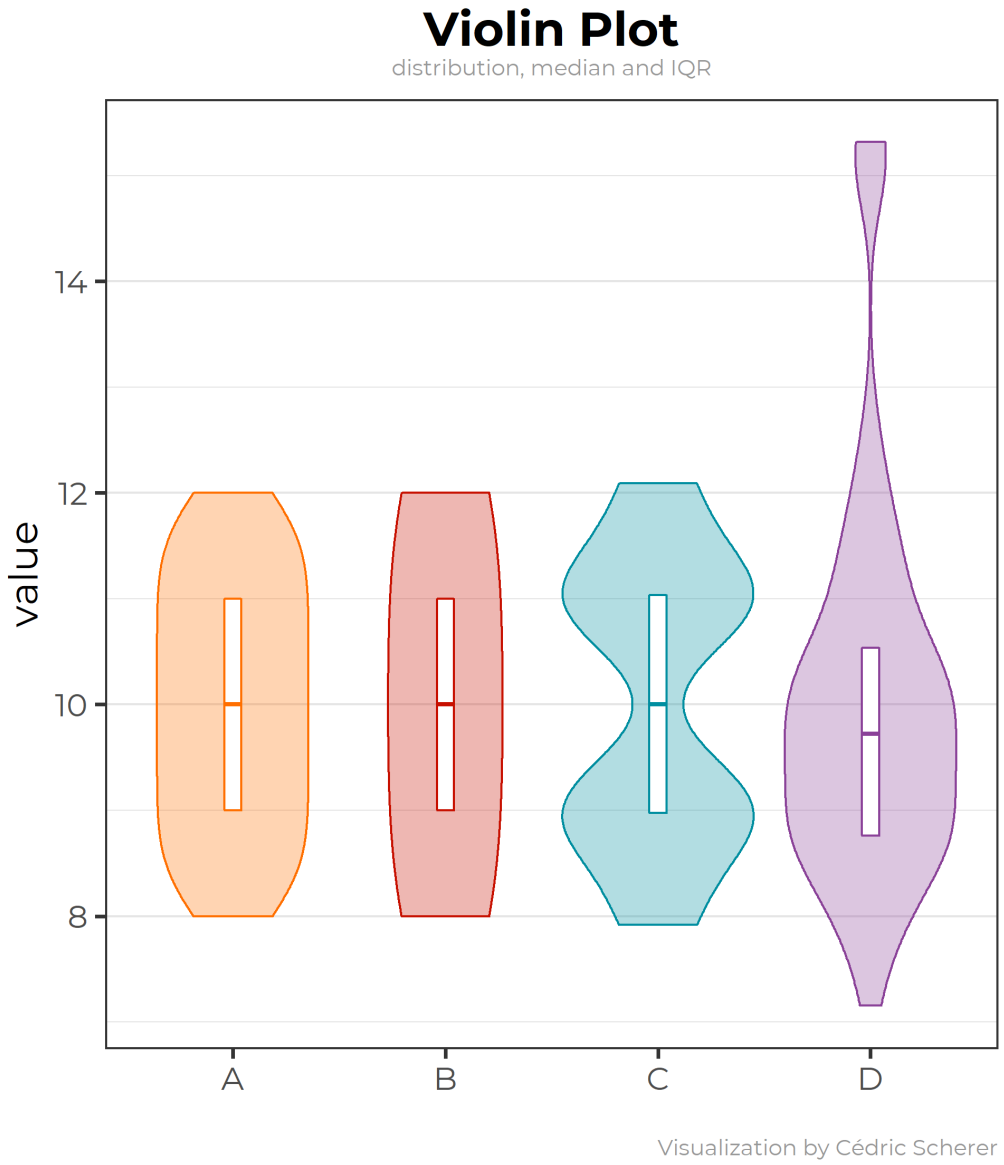


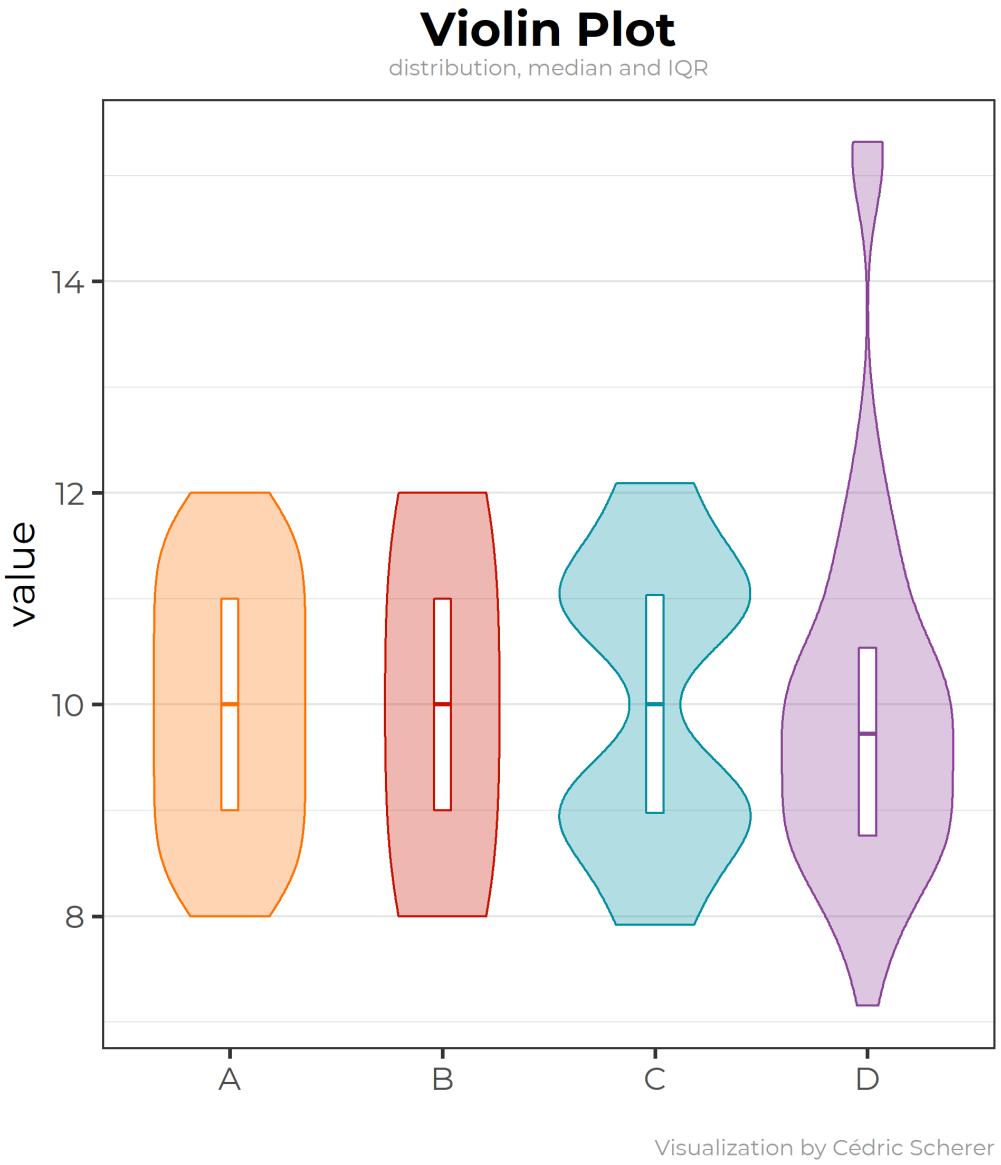
- Good: More accurate than a bar plot
- Good: Better data-ink ratio
- But: unclear what's shown


Box and Whiskers Plot
median, inter-quartile-range (IQR) and outliers
value
14
12
10
8
A
B
C
D
Visualization by Cédric Scherer

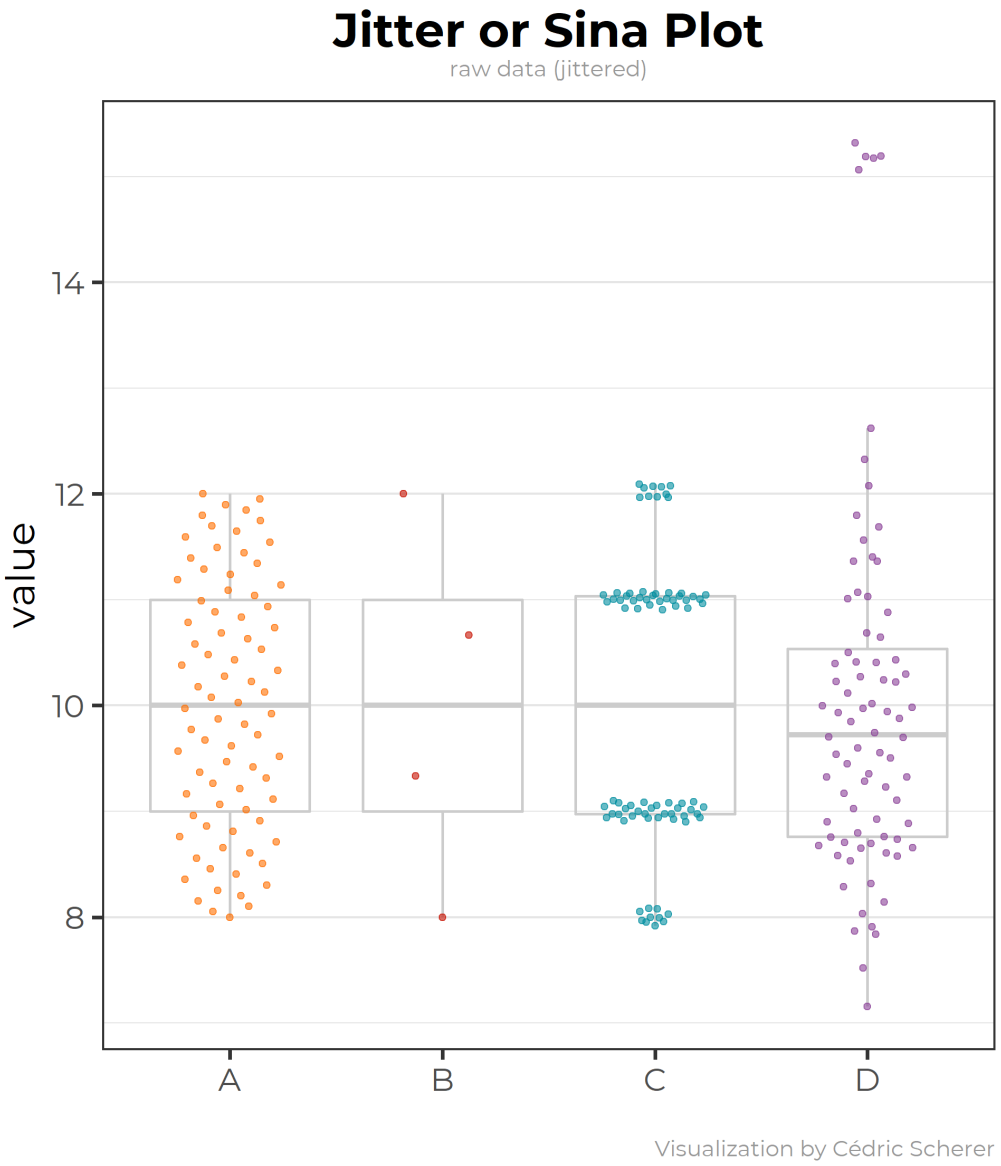


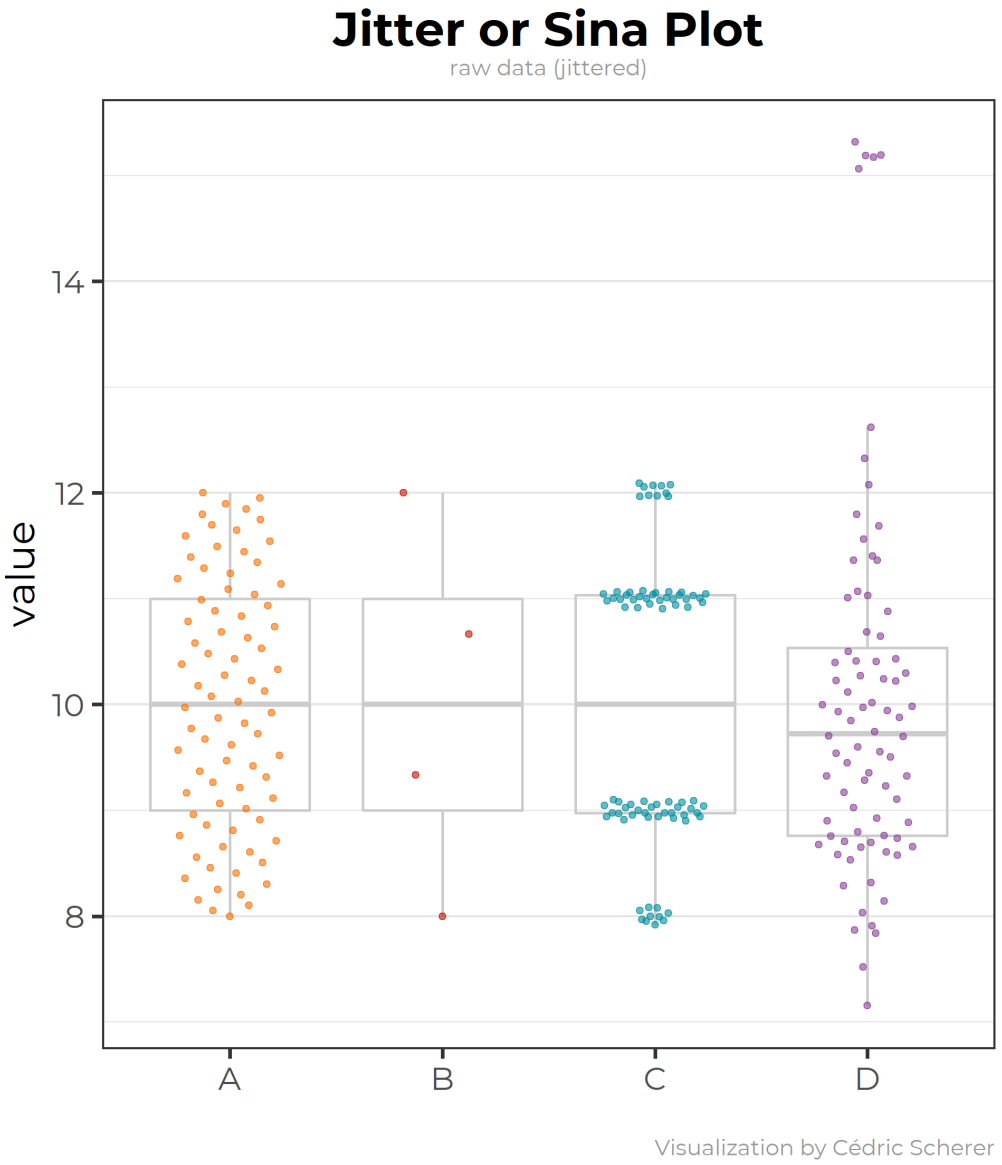
- Good: shows important summary stats
- Looks "scientifically"
- But: no info on sample size
- But: hard to grasp for broad audience


Violin Plot
distribution, median and IQR
value
14
12
10
8
A
B
C
D
Visualization by Cédric Scherer

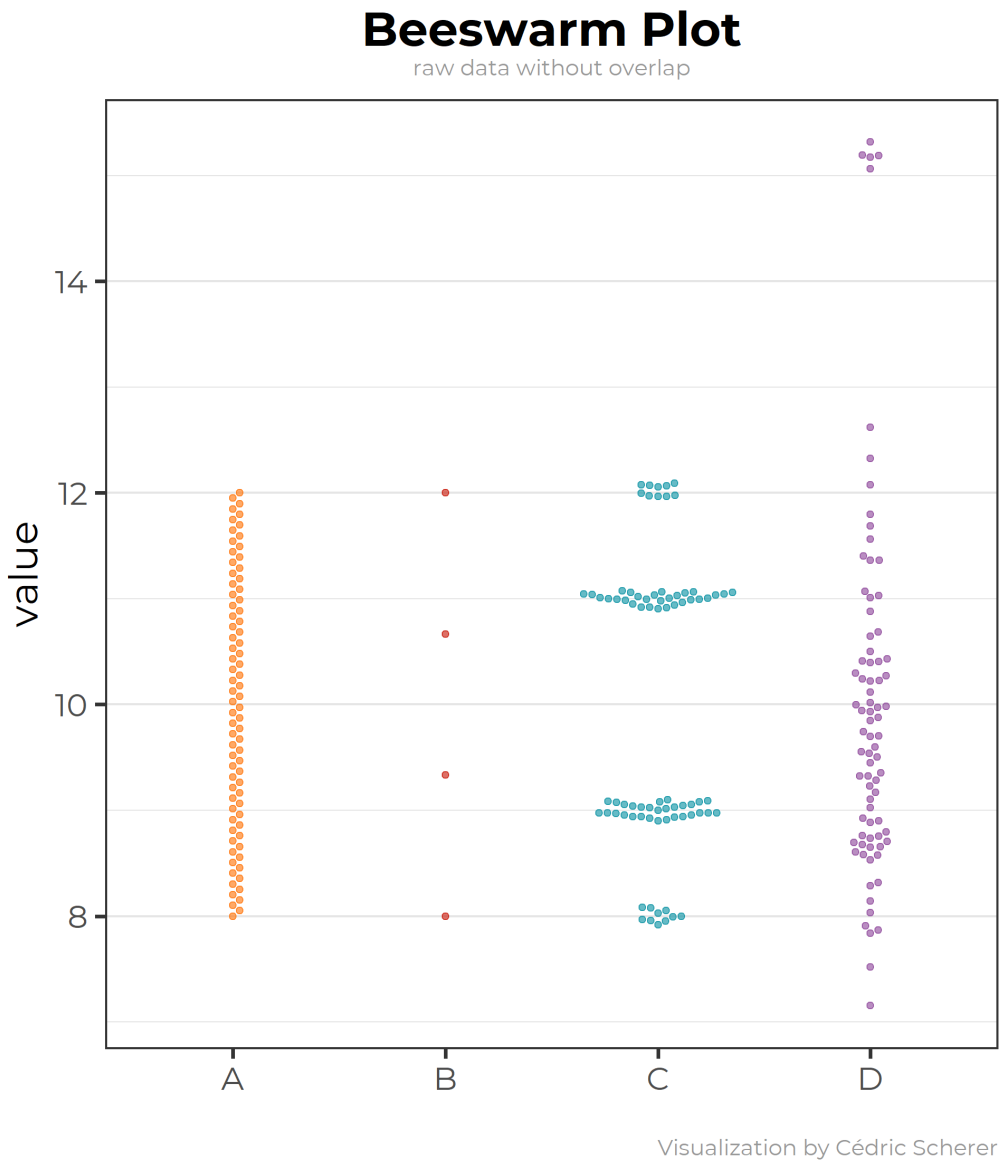


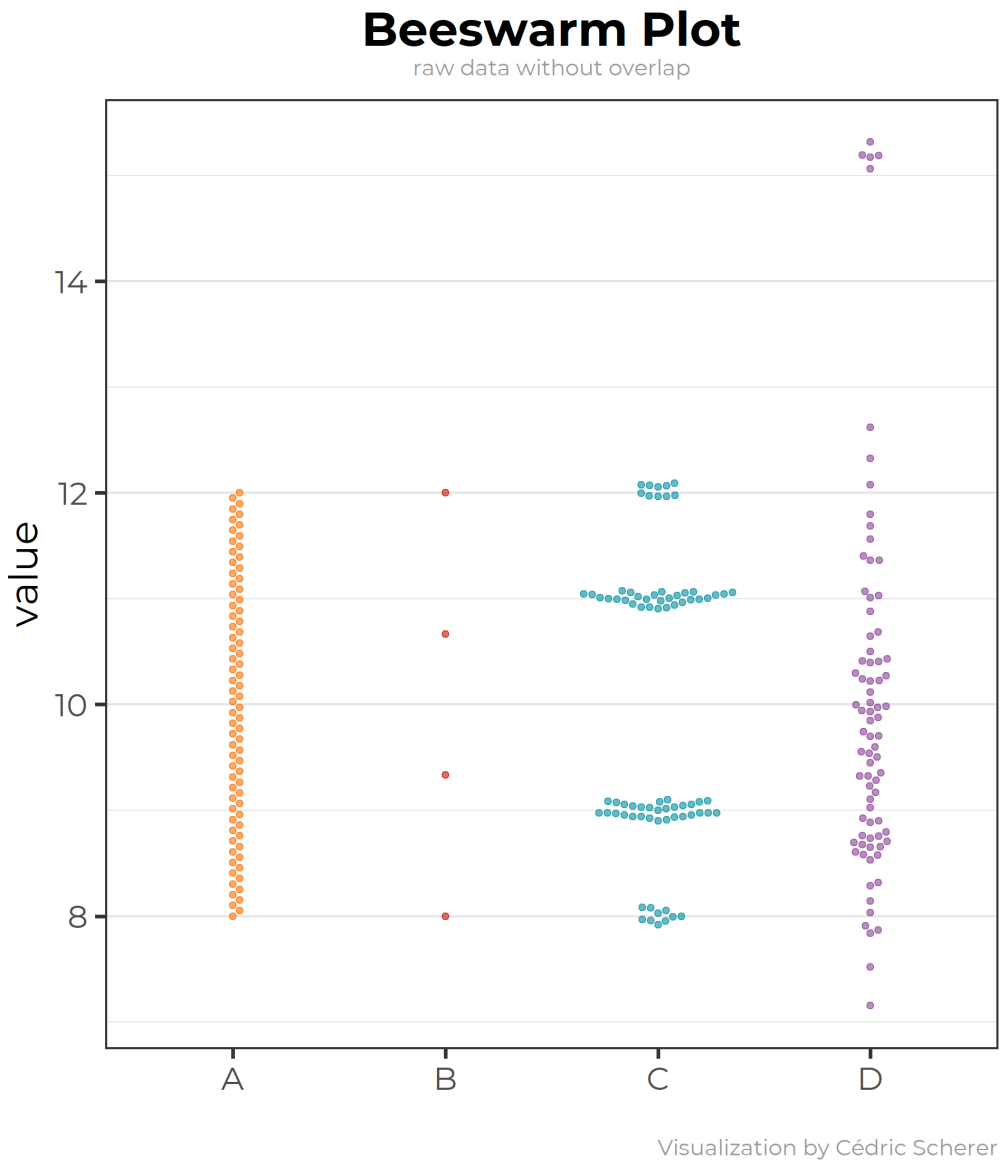
- Good: shows distribution + sample size
- But: sample size hard to estimate


Jitter or Sina Plot
raw data (jittered)
value
14
12
10
8
A
B
C
D
Visualization by Cédric Scherer

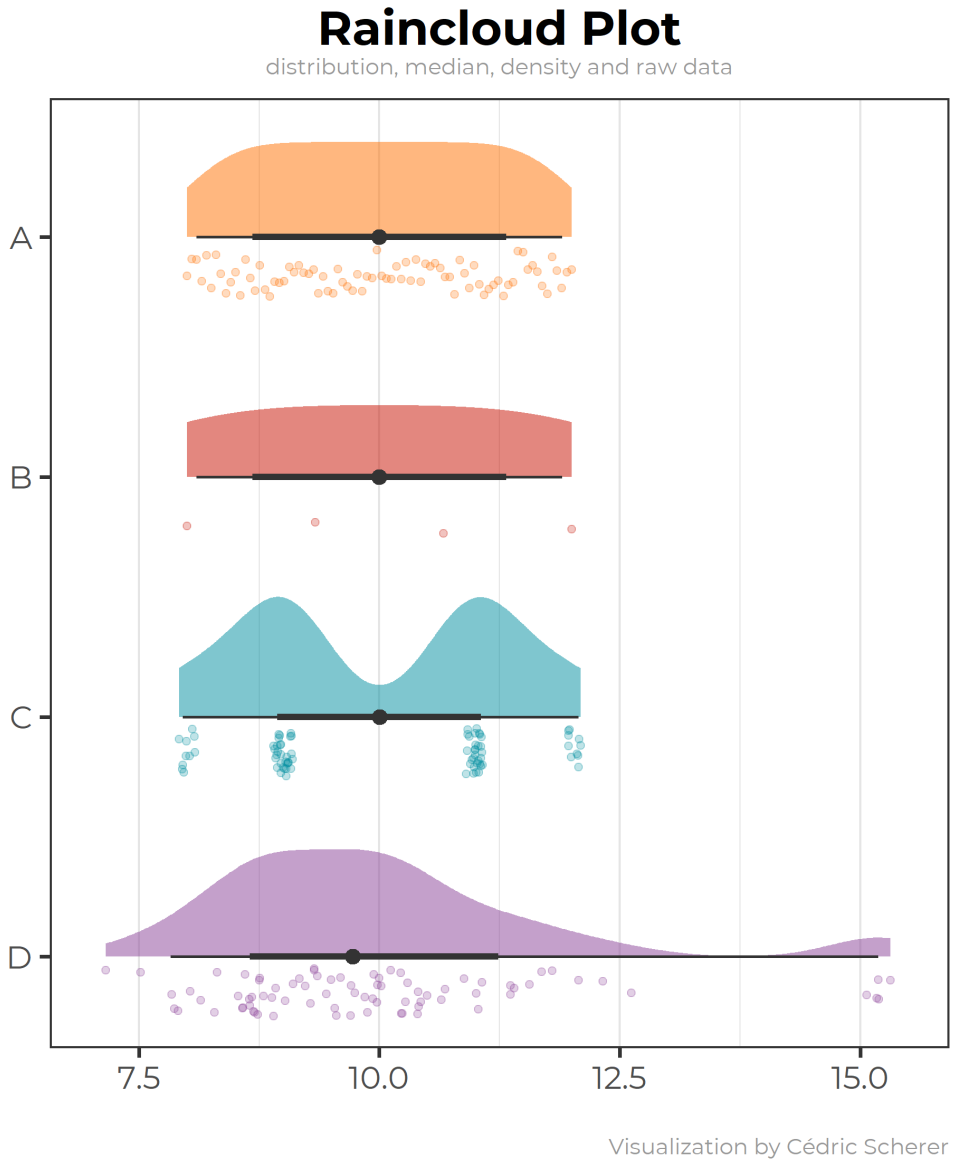


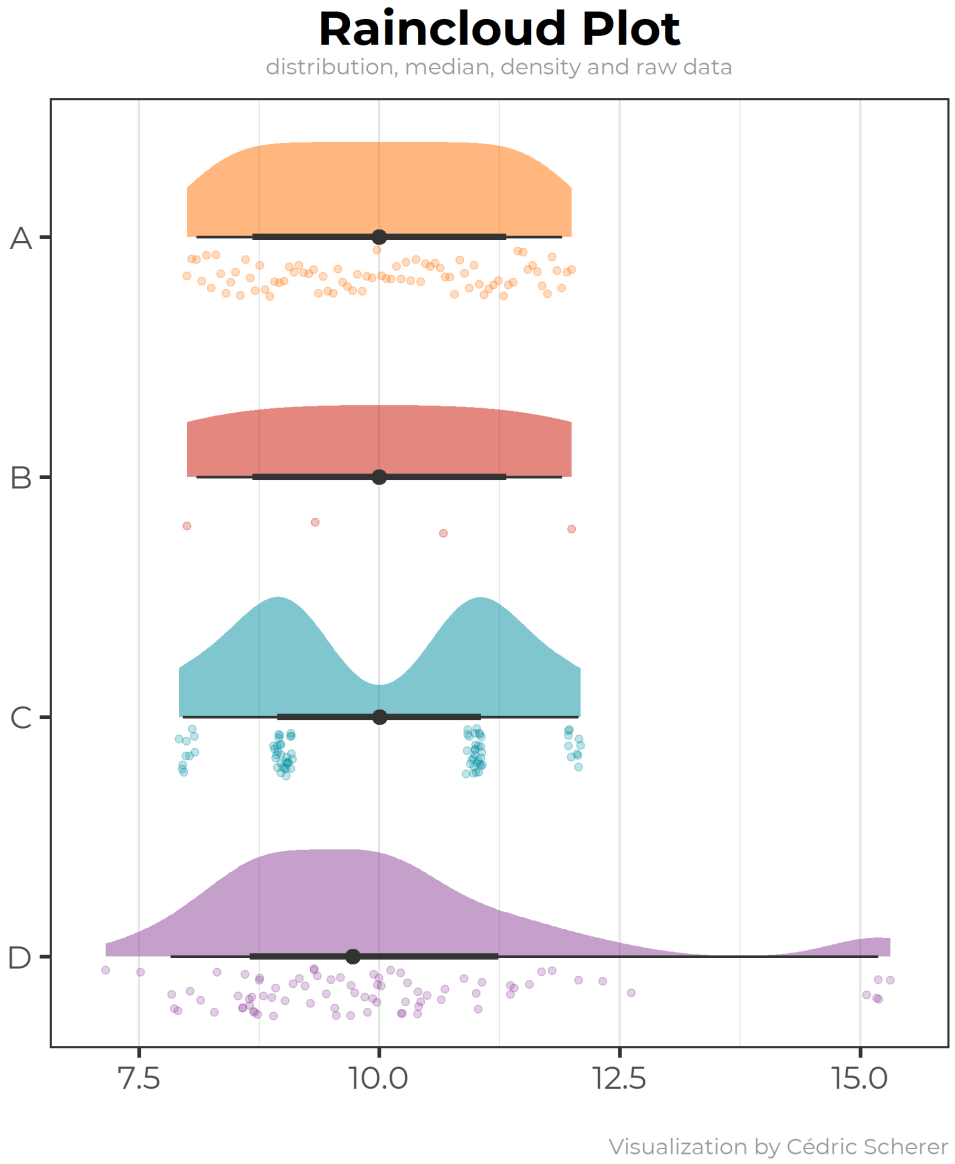
- Good: shows sample size + distribution
- But: difficult with large sample sizes


Beeswarm Plot
raw data without overlap
value
14
12
10
8
A
B
C
D
Visualization by Cédric Scherer

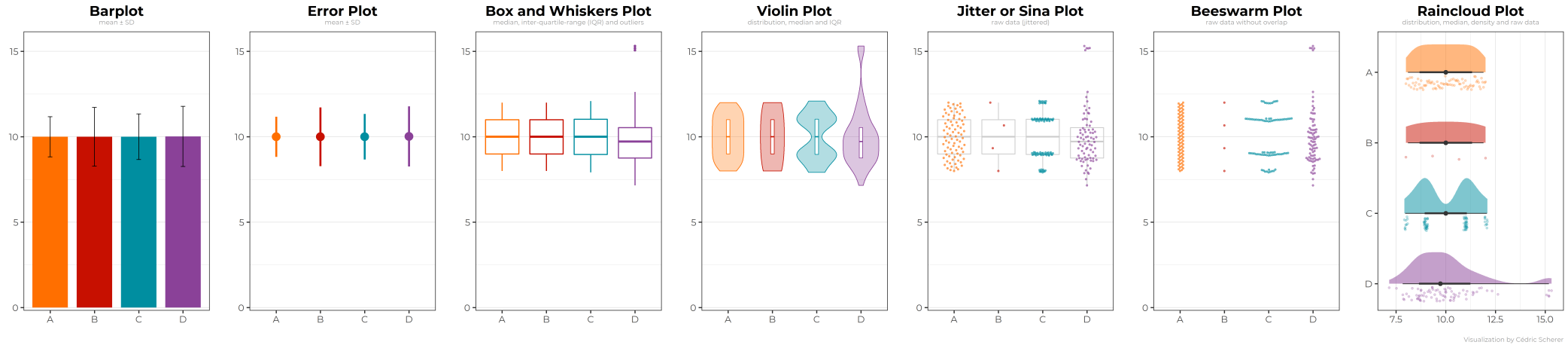


- Good: shows raw data + distribution
- Good: avoids overplotting
- But: difficult with large sample sizes

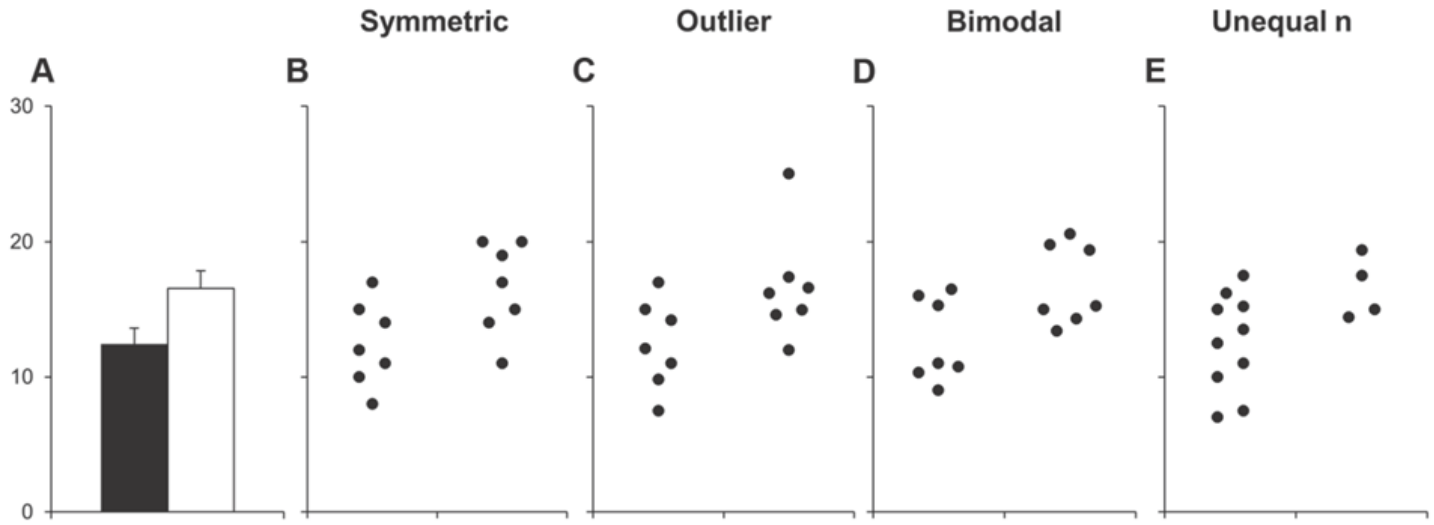

Raincloud Plot
distribution, median, density and raw data
A
B
C
D
7.5
10.0
12.5
15.0
Visualization by Cédric Scherer



- Good: shows raw data + distribution
- Good: shows important summary stats
- But: needs more space



- Always check raw data and sample size
- Try several chart types
- Be open to combine chart types
- Choose chart type with your audience in mind



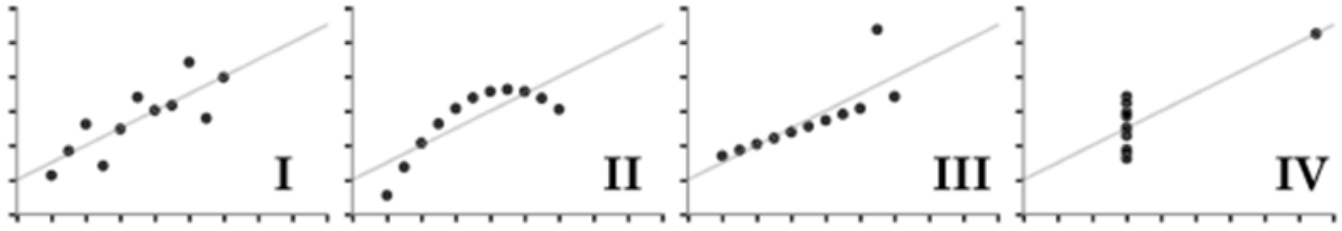
Test		p value		
T-test: Equal var.	0.035	0.050	0.026	0.063
T-test: Unequal var.	0.035	0.050	0.026	0.035
Wilcoxon	0.054	0.073	0.128	0.103

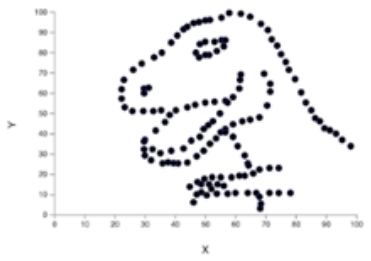
Same Stats, Different Graphs: Generating Datasets with Varied Appearance and Identical Statistics through Simulated Annealing

Justin Matejka and George Fitzmaurice
Autodesk Research, Toronto Ontario Canada

"The Datasaurus Dozen"

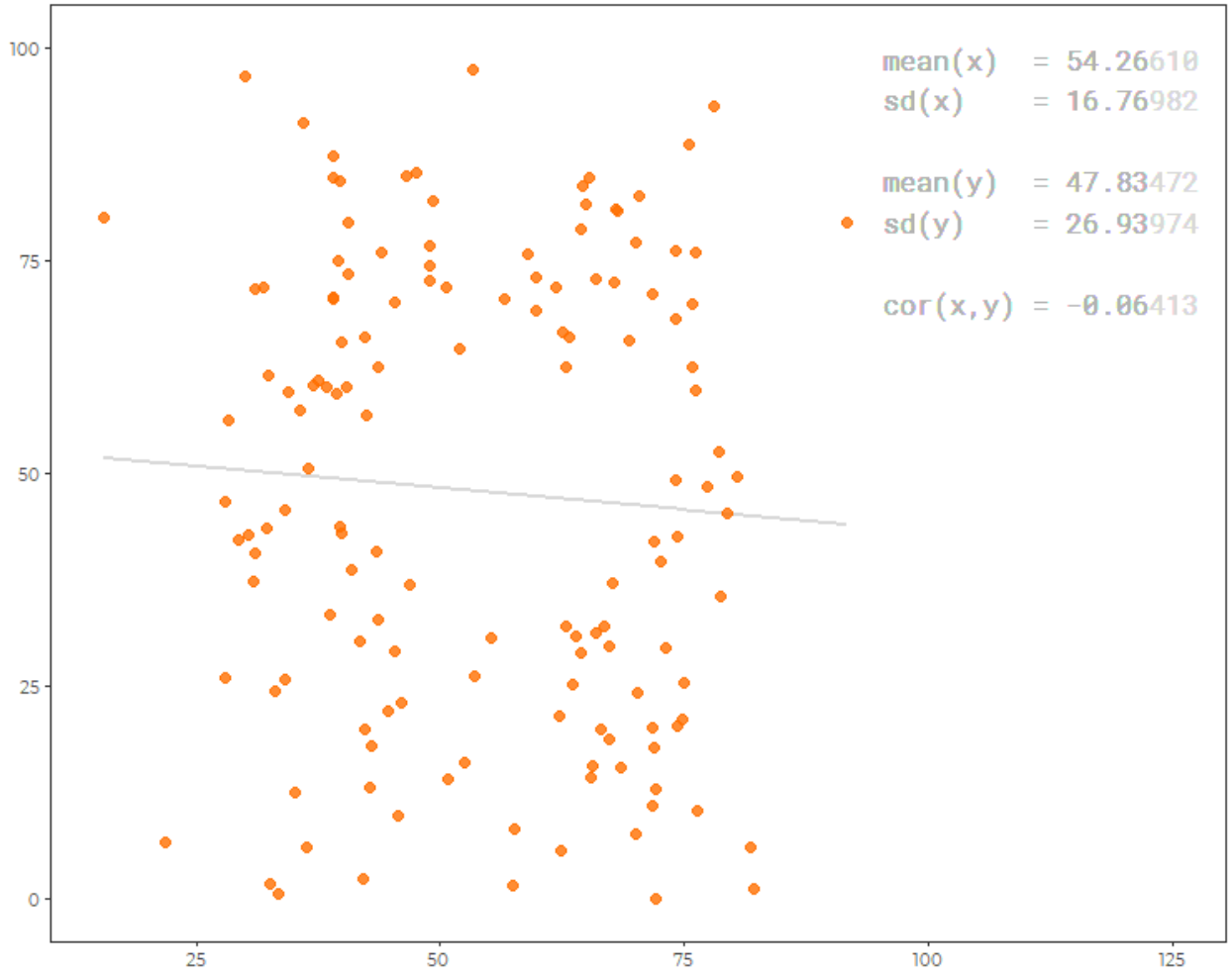
based on Anscombe's Quarter and Alberto Cairo's "Datasaurus" (or "Anscombosaurus")



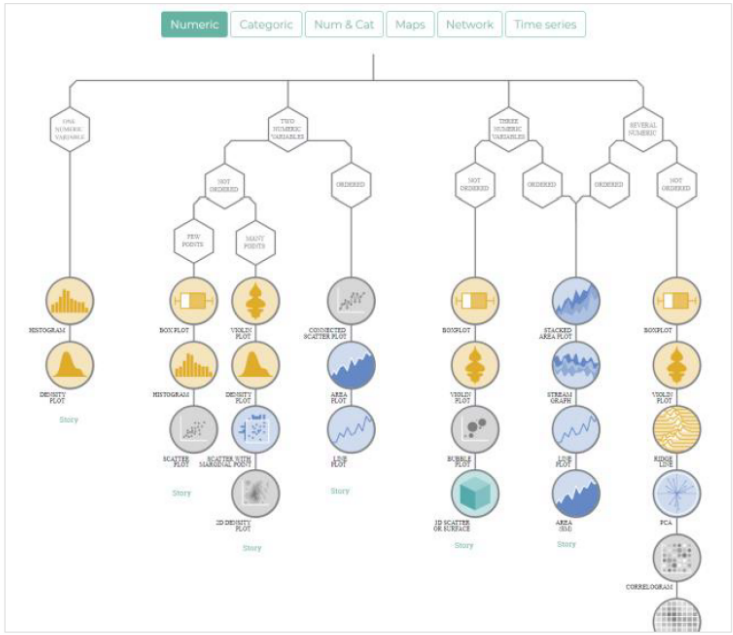


The Datasaurus Dozen

Different datasets – nigh-identical summary statistics

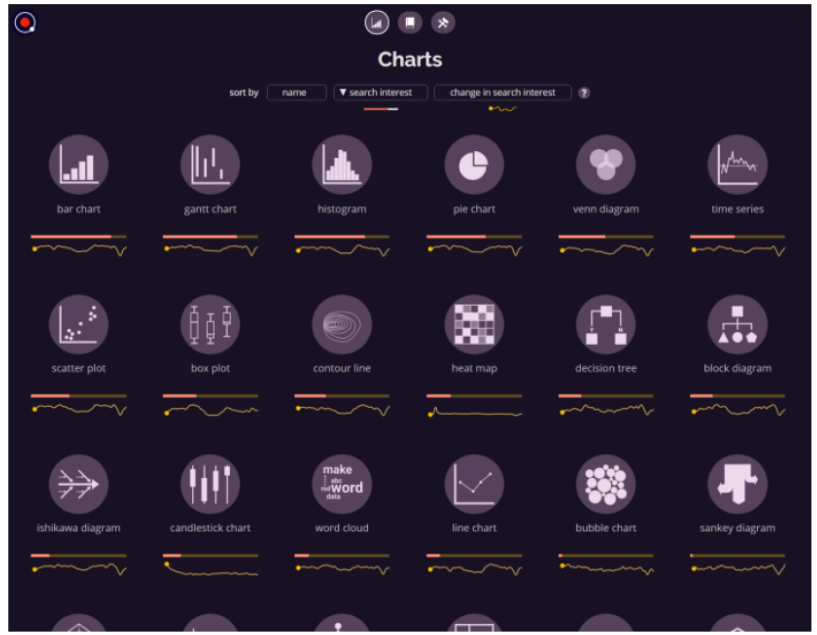


Idea by Alberto Cairo, Justin Matejka & George Fitzmaurice
Visualization by Tom Westlake & Cédric Scherer

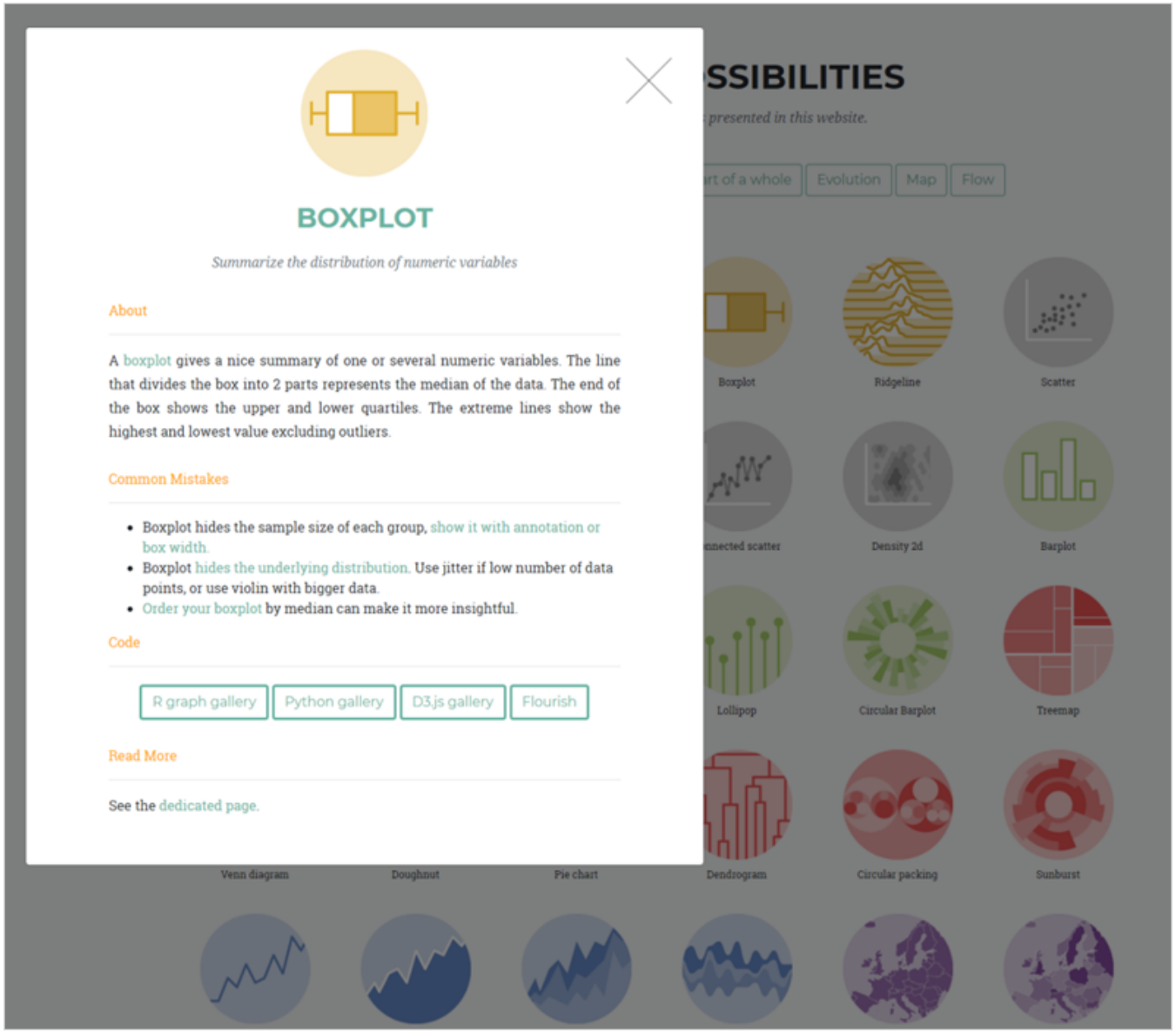


data-to-viz.com

datavizproject.com



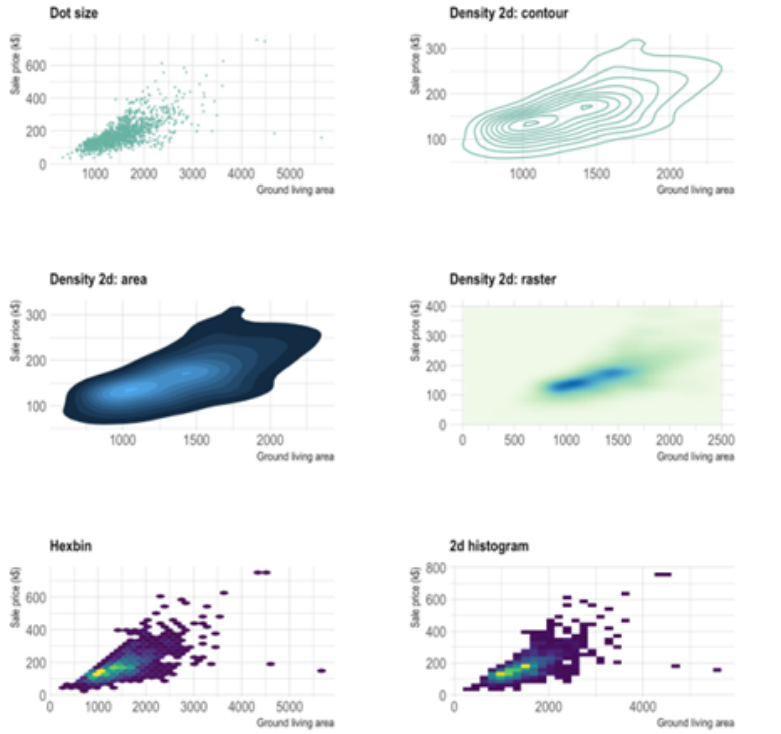
visualizationuniverse.com/charts


BOXPLOT
Summarize the distribution of numeric variables
About
A boxplot gives a nice summary of one or several numeric variables. The line that divides the box into 2 parts represents the median of the data. The end of the box shows the upper and lower quartiles. The extreme lines show the highest and lowest value excluding outliers.
Common Mistakes
Boxplot hides the sample size of each group, show it with annotation or box width.
Boxplot hides the underlying distribution. Use jitter if low number of data points, or use violin with bigger data.
Order your boxplot by median can make it more insightful.
Code
R graph gallery
Python gallery
D3.js gallery
Flourish
Read More
See the dedicated page.
SSIBILITIES
presented in this website.
rt of a whole
Evolution
Map
Flow
Boxplot
Ridgeline
Scatter
nnected scatter
Density 2d
Barplot
Lollipop
Circular Barplot
Treemap
Venn diagram
Doughnut
Pie chart
Dendrogram
Circular packing
Sunburst

Overplotting

The most common pitfall with scatterplot is overplotting: when the sample size gets big, dots are plotted on top of each other what makes the chart unreadable. There are several work around to avoid this issue as describe in this specific post. Here is a summary of the different offered techniques:

CODE

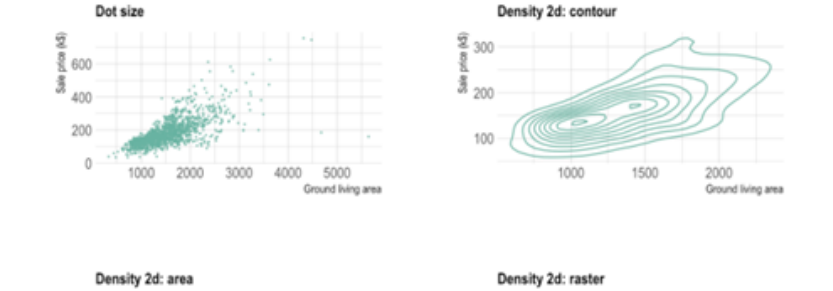


Going further

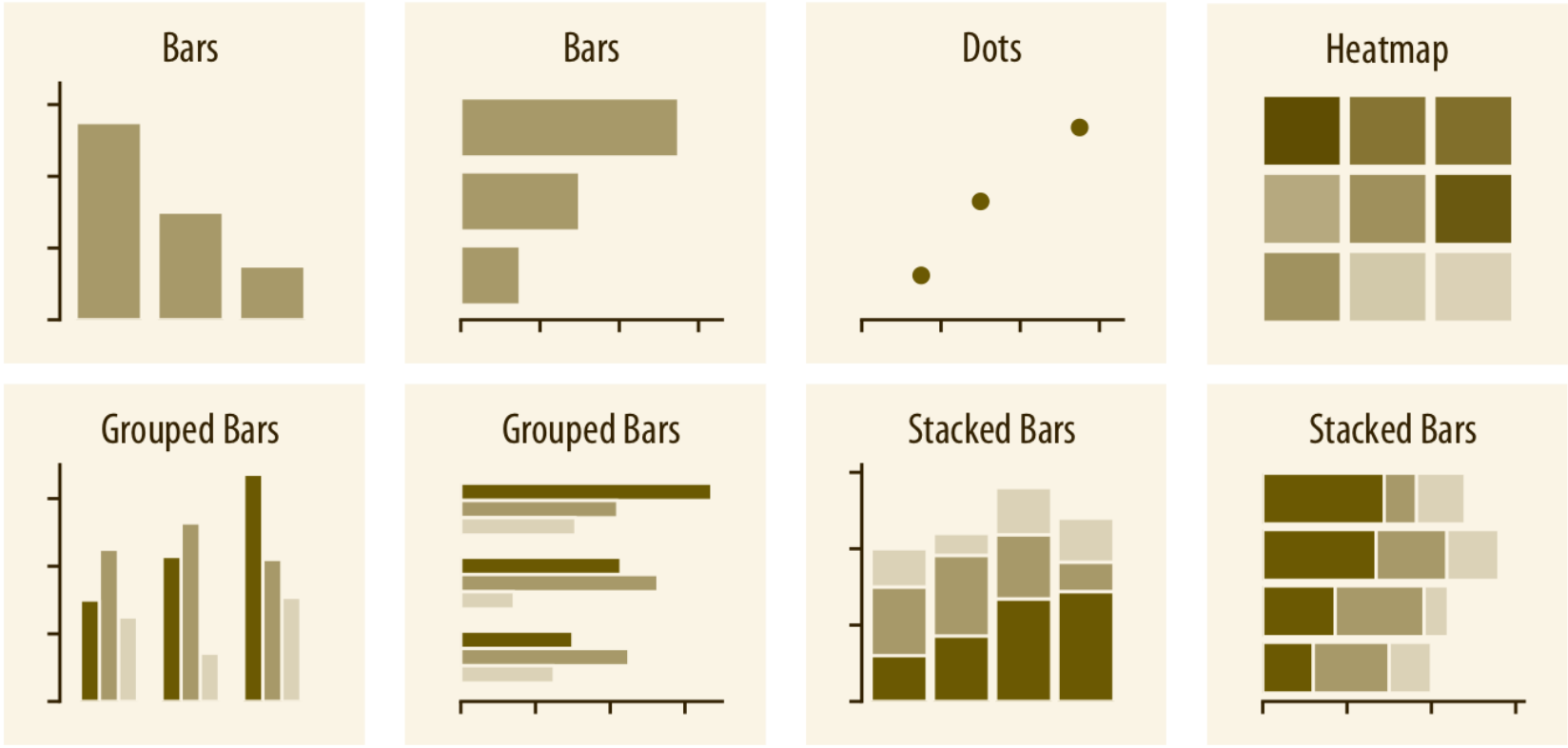
You can learn more about each type of graphic presented in this story in the dedicated

HIDE

```
# code for all graphics:
p <- data %>%
  ggplot( aes(x=GrLivArea, y=SalePrice/1000)) +
    theme_ipsum() +
    theme(
      plot.title = element_text(size=12)
    ) +
    ylab('Sale price (k$)') +
    xlab('Ground living area')

# Reduce dot size
p1 <- p + geom_point(color="#69b3a2", alpha=0.8, size=0.2) + ggtitle("Dot size")

# Use density estimate
p2 <- p + geom_density2d(color="#69b3a2") + ggtitle("Density 2d: contour")

# Use density estimate (area)
p3 <- p + stat_density_2d(aes(fill = ..level..), geom = "polygon") + ggtitle("Density 2d: area") + theme(legend.positio
n="none")

# With raster
p4 <- p +
  stat_density_2d(aes(fill = ..density..), geom = "raster", contour = FALSE) +
  scale_fill_distiller(palette=4, direction=1) +
  scale_x_continuous(expand = c(0, 0)) +
  scale_y_continuous(expand = c(0, 0)) +
  theme(
    legend.position='none'
  ) +
  ggtitle("Density 2d: raster") +
  xlim(0,2500) +
  ylim(0,400)

# Hexbin
p5 <- p + geom_hex() +
    scale_fill_viridis() +
    theme(legend.position="none") +
    ggtitle("Hexbin")

# 2d histogram
p6 <- p + geom_bin2d( ) +
    scale_fill_viridis( ) +
    theme(legend.position="none")  +
    ggtitle("2d histogram")

p1 + p2 + p3 + p4 + p5 + p6 + plot_layout(ncol = 2)
```

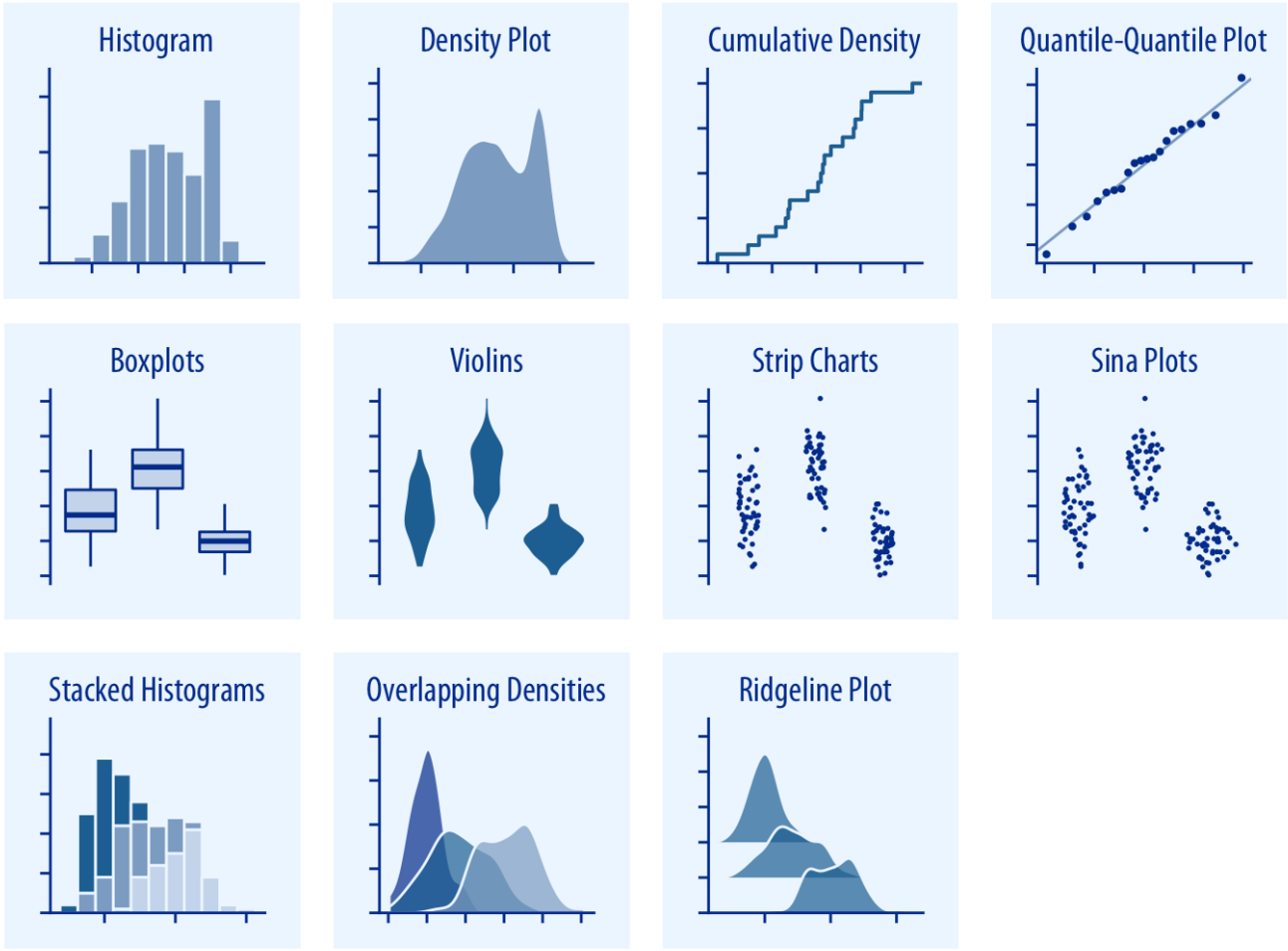


Charts to Visualize Amounts



Source: "Fundamentals of Data Visualization" by Claus Wilke

Charts to Visualize Distributions

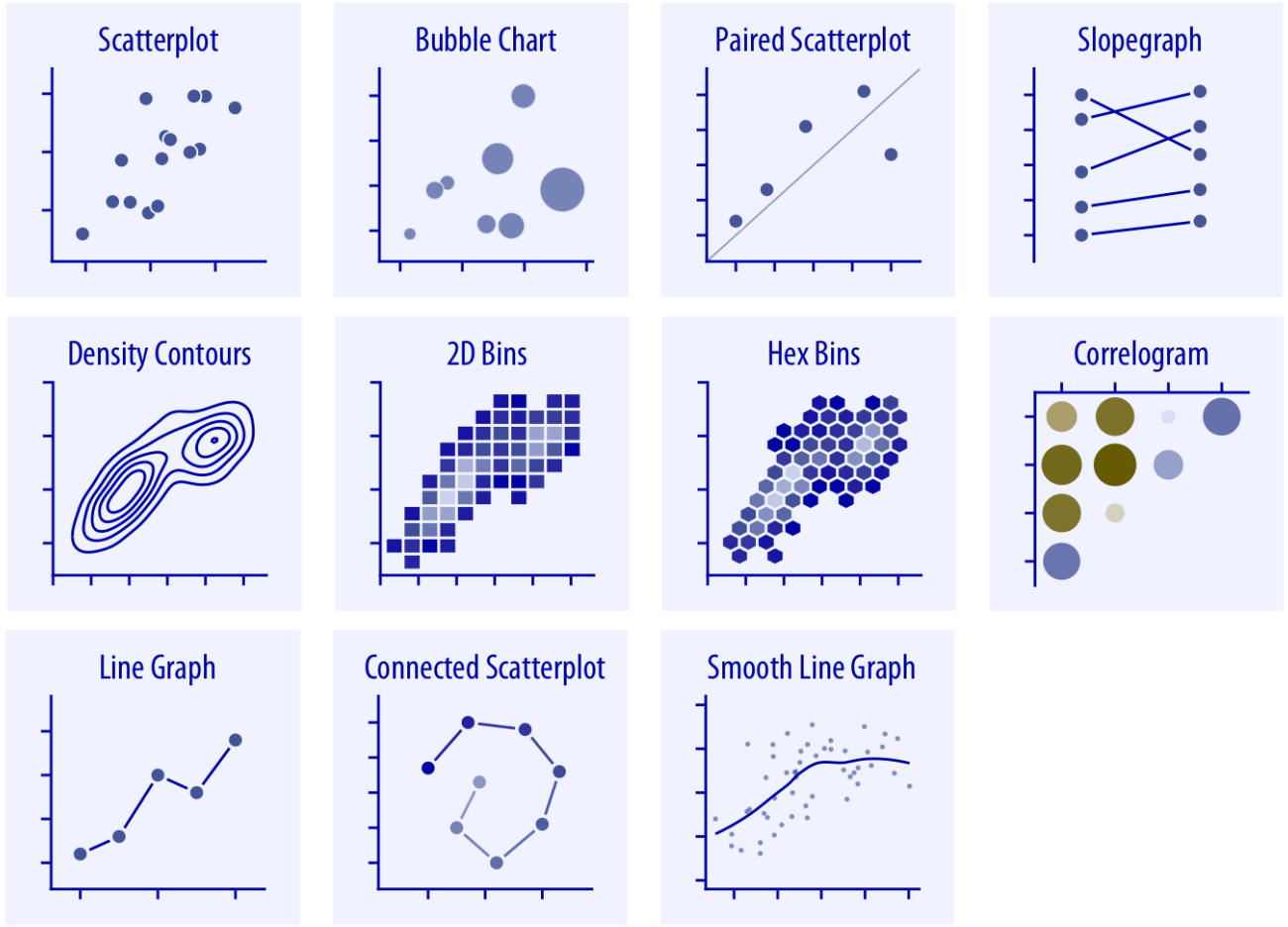


Source: "Fundamentals of Data Visualization" by Claus Wilke

Charts to Visualize Proportions

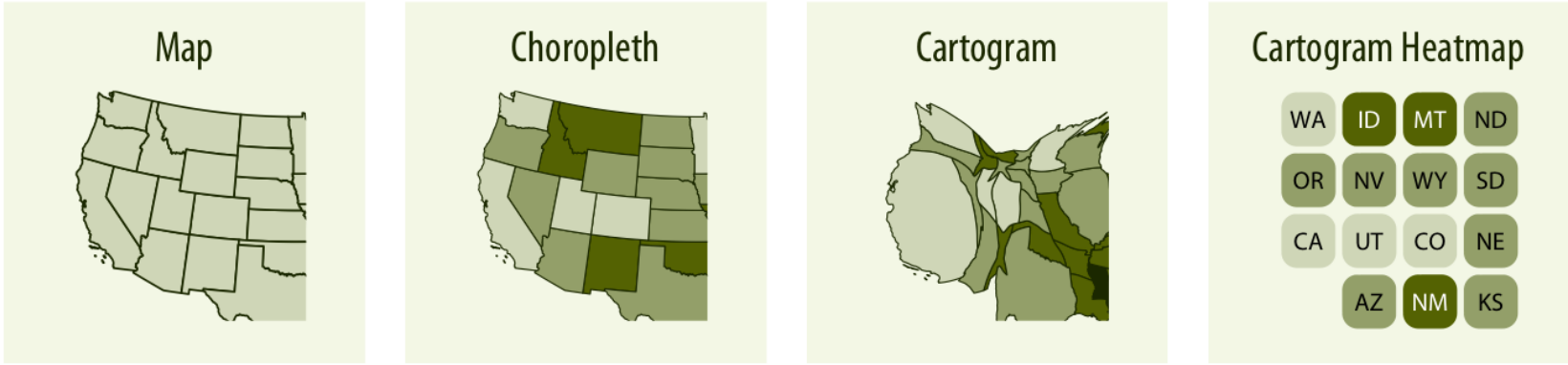
Source: "Fundamentals of Data Visualization" by Claus Wilke

Charts to Visualize x–y Relationships



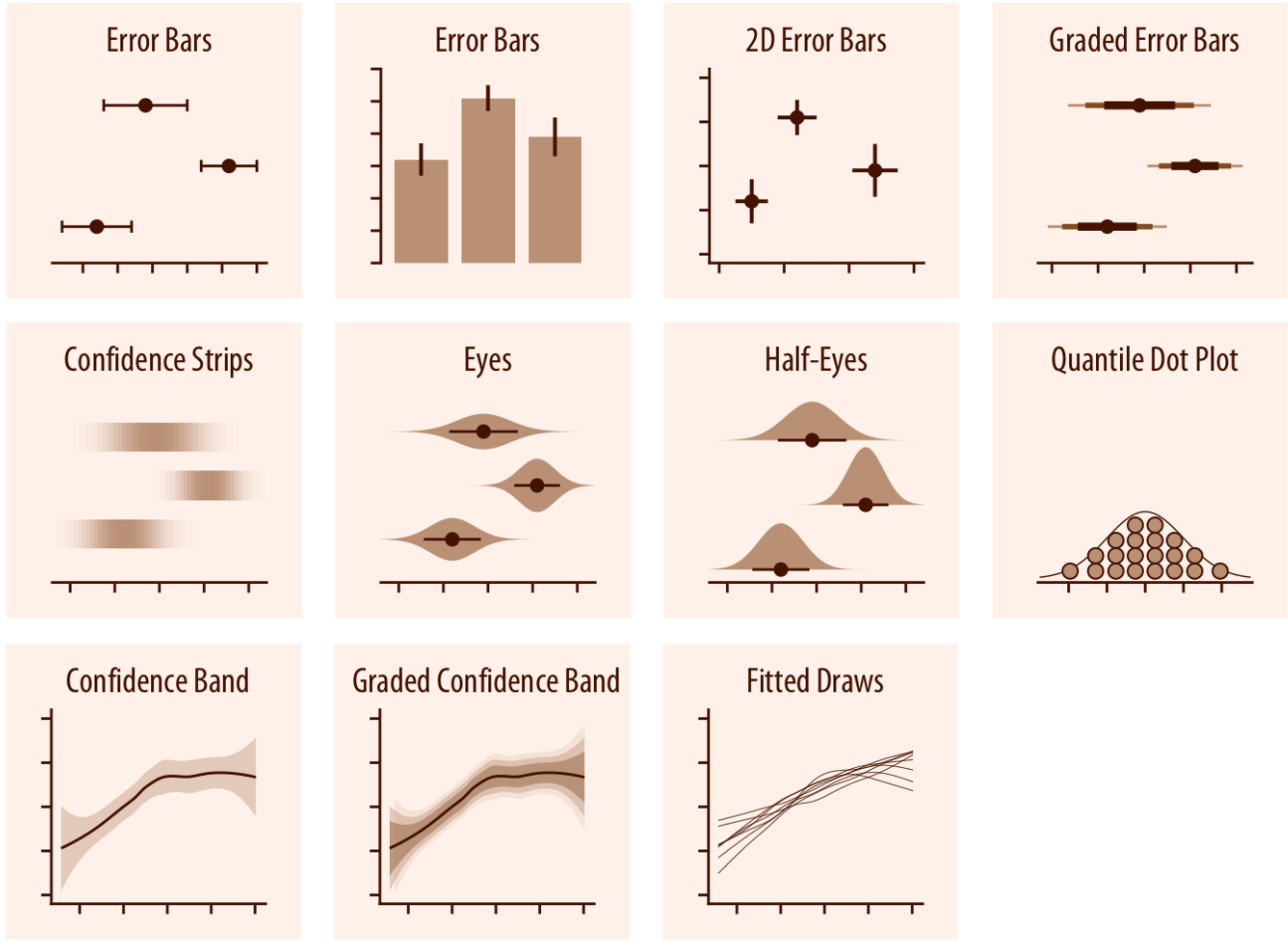
Source: "Fundamentals of Data Visualization" by Claus Wilke

Charts to Visualize Geospatial Data



Source: "Fundamentals of Data Visualization" by Claus Wilke

Charts to Visualize Uncertainty



Source: "Fundamentals of Data Visualization" by Claus Wilke

Your Turn!