Visualisation

Applied Data Science using R, Session 6

Prof. Dr. Claudius Gräbner-Radkowitsch
Europa-University Flensburg, Department of Pluralist Economics
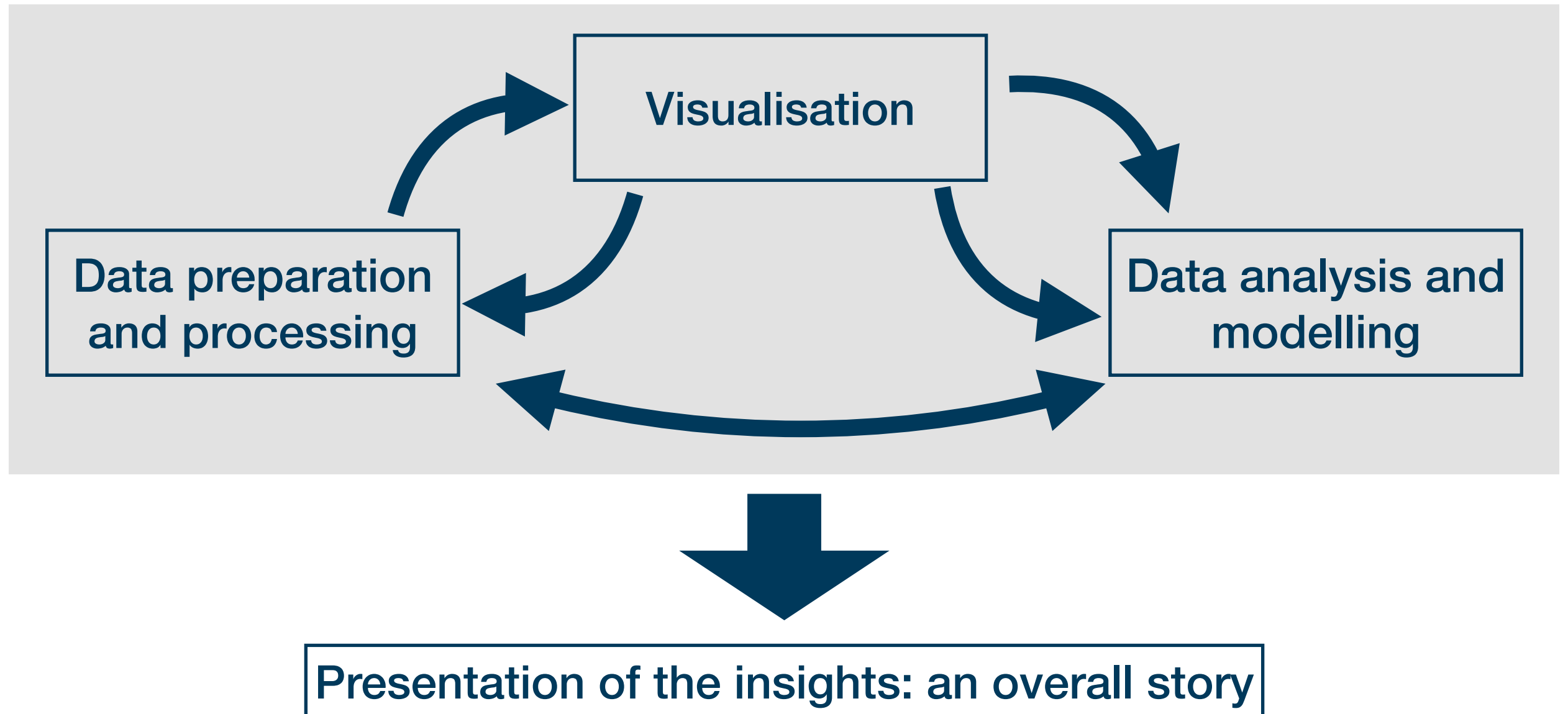www.claudius-graebner.com | @ClaudiusGraebner | claudius@claudius-graebner.com

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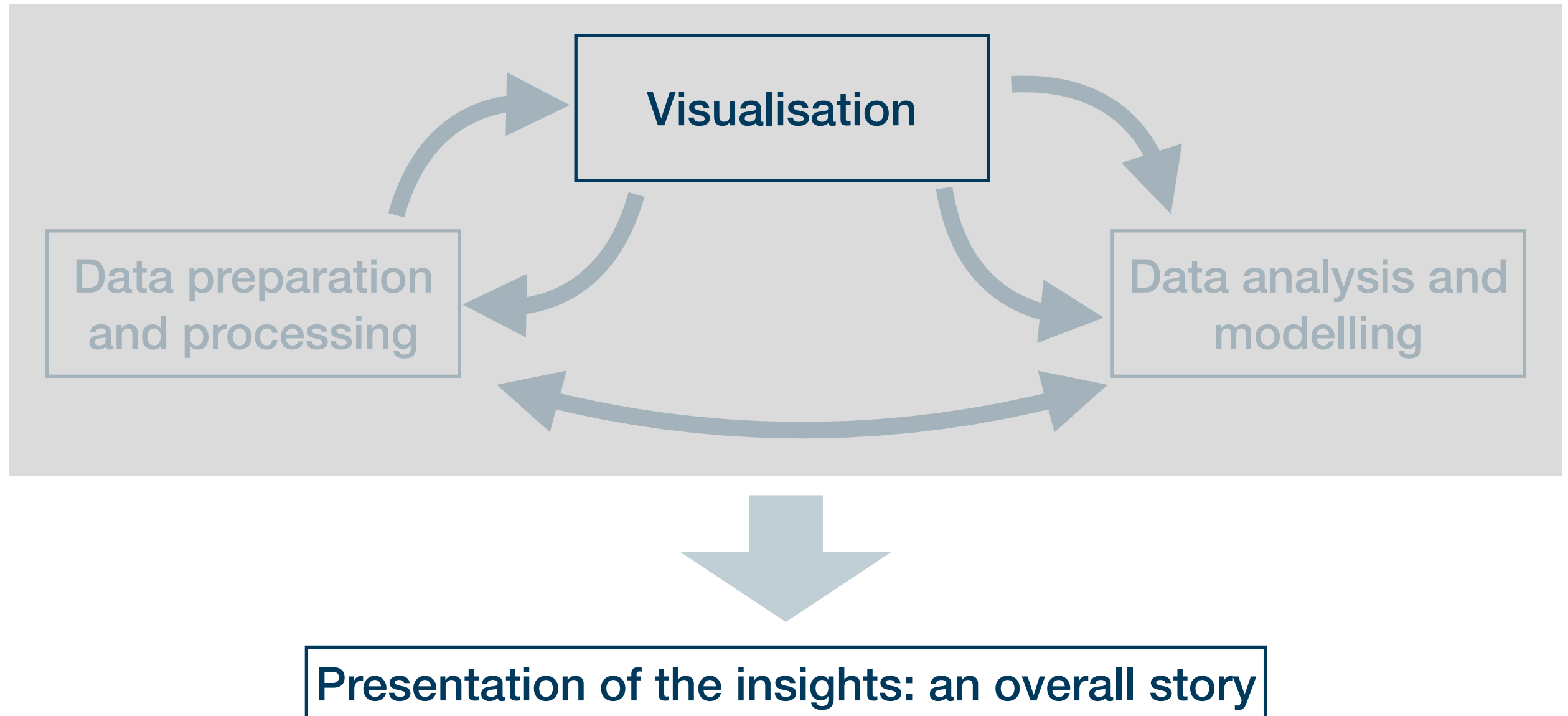Department of Pluralist Economics

Goals for today

I. Understand how plots are created layer-wise via the `ggplot2` package

II. Learn how to map variables in data frames to visual aspects of a plot

III. Figure out how you can re-use code across different visualisation tasks

Basics of visualization

# The role of visualisation in data science

The role of visualisation in data science

Visualisation

Data preparation and processing

Data analysis and modelling

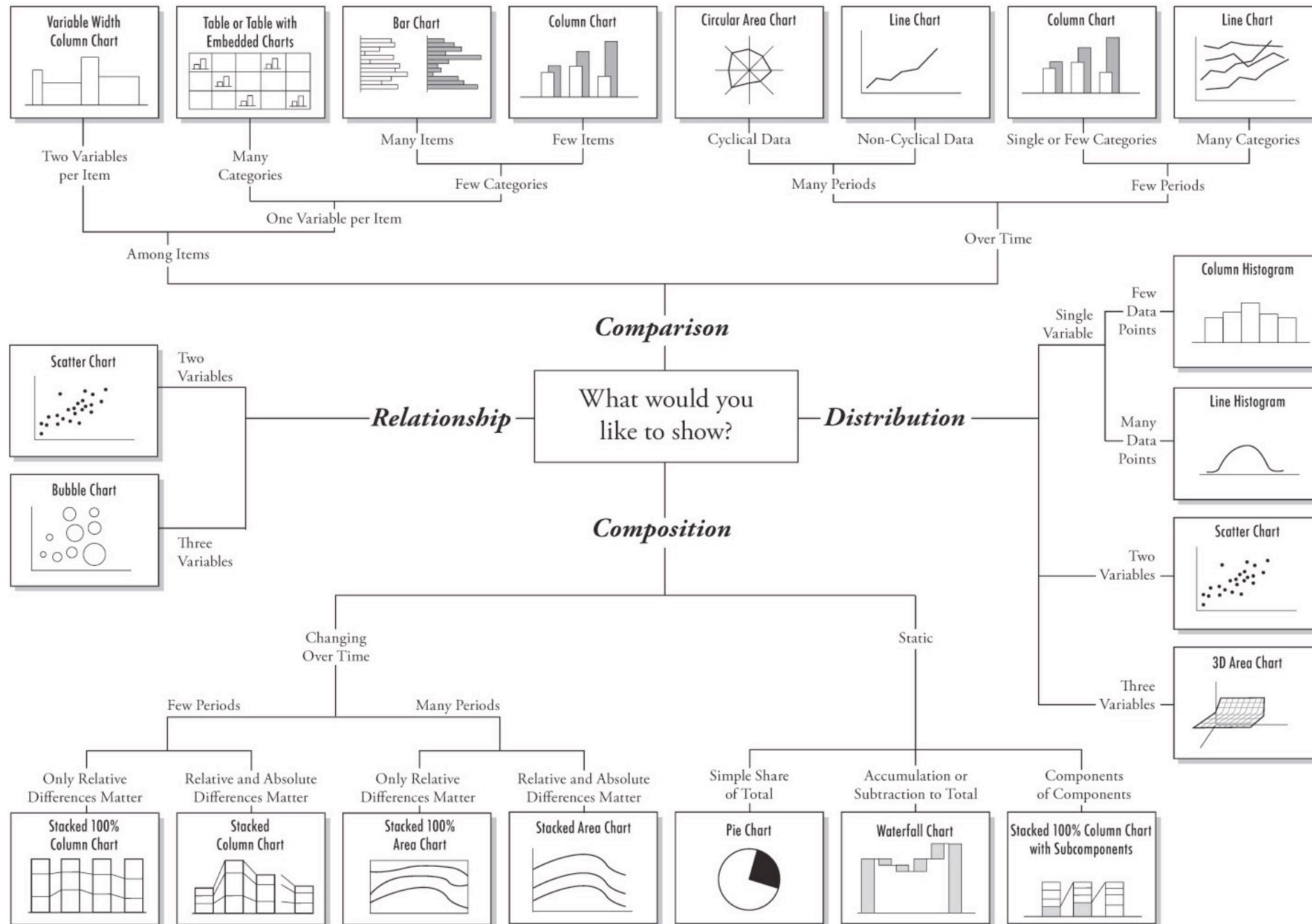Presentation of the insights: an overall story

About visualisations

- Visualisations can be used for many purposes

  - **Exploratory data analysis** → understand your data → prepare/refine models

  - **Communication** → inform others about your results

  - **Manipulation** → convince others or recognise others convincing you

- Here we will learn about how to create visualisations using the package `ggplot2`

- An easy-to-read, widely-used and powerful visualisation engine

- Many great extensions, e.g. for animated GIFs, control charts, and many more…
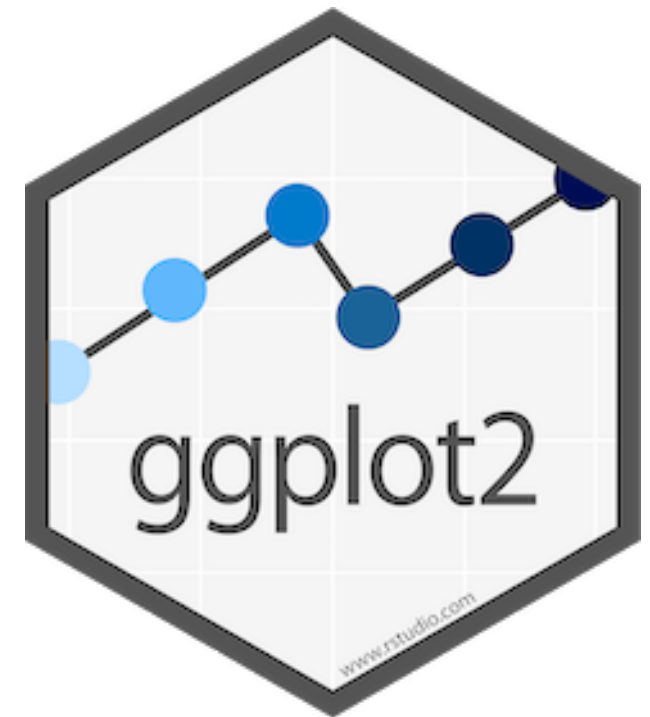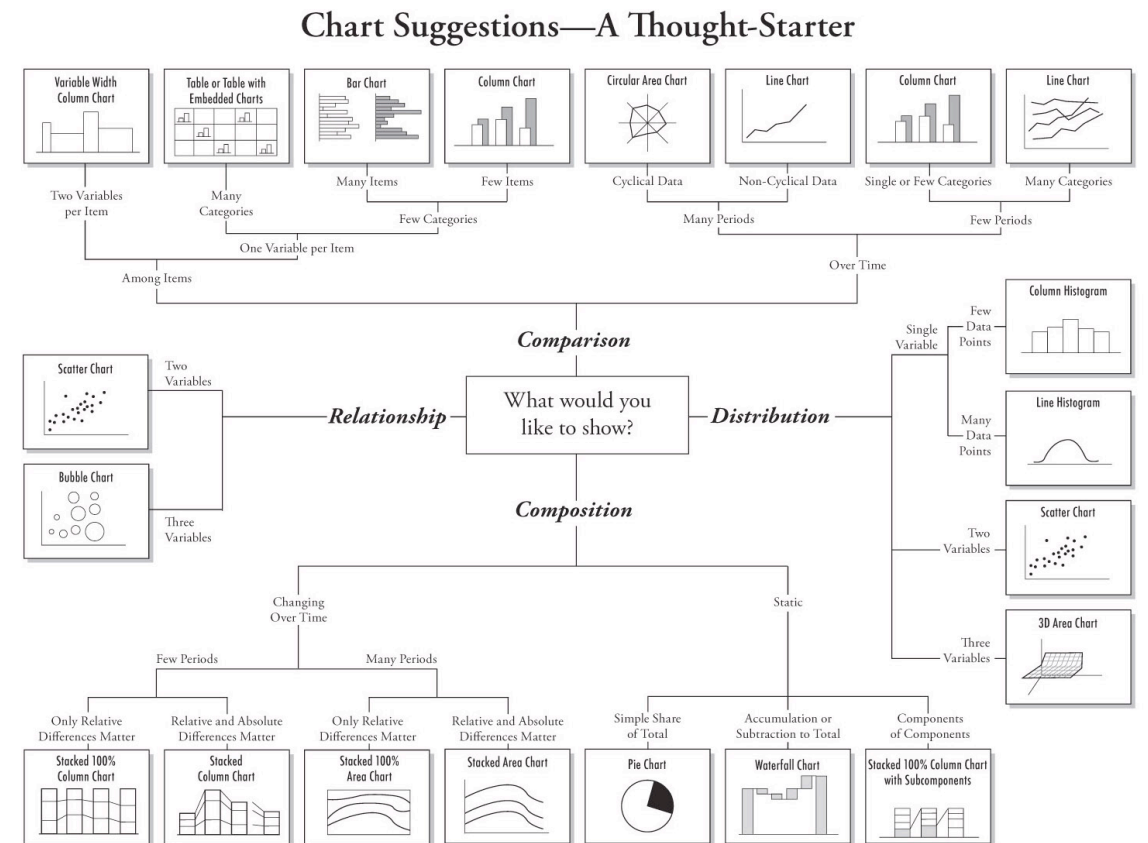
What kind of plot do you want?

Chart Suggestions—A Thought-Starter

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Chart Suggestions—A Thought-Starter
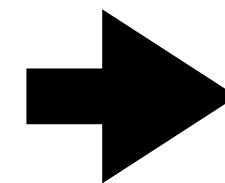
- Visualisation always involves prior thinking and theory

- The great thing about `ggplot2` is that the syntax is the same for all graphs

- During our lecture we focus on 2 examples:

  - The scatterplot/bubble chart from session 1
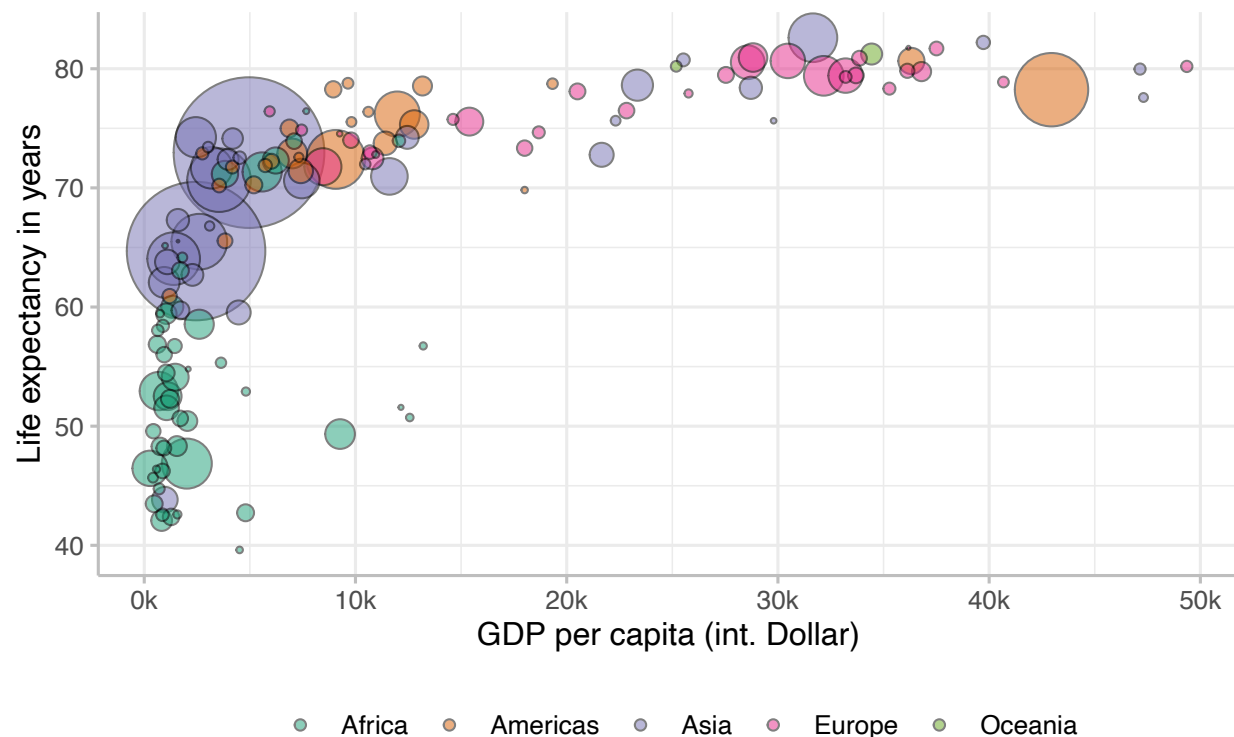
  - A line chart

 Readings provide first generalisation

The practical workflow

Where we want to go:

- Today we want to get started with visualisations and produce the following two plots:

Life expectancy and income per capita

Note: size of bubbles represents population. Data: Gapminder

The divergence of income per capita
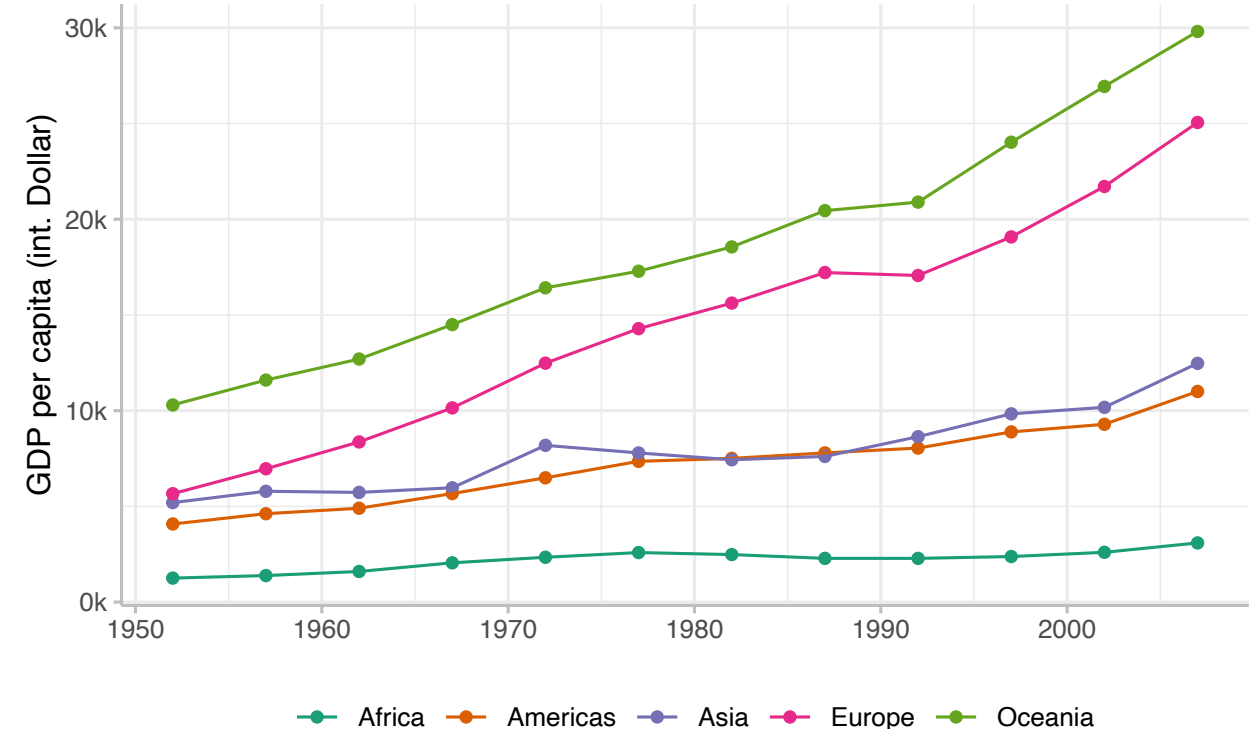
Note: country data averaged over continants. Data: Gapminder

- We will see that the mechanics are very similar for different plots

  - Based on the readings you will be able to make even much more plots already now!

The general idea

- Every plot in `ggplot2` is generated in two major steps

  - You describe the plot in all its details via a list ← This is where all the work gets done 😅

  - You call the list and R renders the plot for you ← This is where errors become apparent 🤬

- To create the list-like description, `ggplot2` offers you a ton of helper functions

- You always start with an empty plot, then add layers above this empty plot, adjust details and that's it!

- Lets illustrate this using a subset of the gapminder data set only containing data for the year 2017

  - Readymade available to you via the DataScienceExercises package as `DataScienceExercises::gdplifexp2007`

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Developing a ggplot - the general workflow

- Since we are working on the graph development interactively, see my **lecture notes** for documentation purposes

Summary & outlook

Summary

- Visualisations serve many purposes, including the exploration of your data and the communication of your results

- We learned how to visualise data stored in data frames via `ggplot2`

- While there are many different plot variants, their syntax is very similar

```
ggplot() +
    <GEOM_FUNCTION>(
        data = <DATA>
        mapping =aes(<MAPPINGS>),
        stat = <STAT>,
        position = <POSITION>
        ) +
    <COORDINATE_FUNCTION> +
    <FACET_FUNCTION> +
    <THEME ADJUSTMENTS>
```

The geometric forms used to represent the data (points, lines, shades,…)

The data to be visualized

The mapping of the variables in data to the plot aesthetics (x/y-axis, size, form,…)

May be set as defaults within `ggplot()`, or separately for each geom

Adjustment to look, labels, etc.

Summary

- Code for different plots differs mainly by the aesthetic mappings and the geoms used → allows you to re-use a lot of coding heuristics

  - We produced two beautiful plots: a bubble plot and a line graph

- The readings introduce you to other types of plots, which you can easily make more beautiful using the techniques you learned today

  - A great way to learn how to plot is to replicate examples from the internet, and adjust them to your own data:

from Data to Viz

The R Graph Gallery

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Outlook

- Next session: how to organise an R project and import data into R

  - This allows us in a next step to transform it into a format we can use for visualisation (and, later, modelling)

  - Up till know we only worked with readymade data sets but in reality, the data you get will be messy → learn to produce data as you have already learned use will open many doors

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Tasks until next session:

1. Fill in the **quick feedback survey** on Moodle
2. Do the **readings** posted on the course page → they generalise what you have learned to new plot types
3. Have a look at my lecture notes and redo the plot creation of today
4. Do the **exercises** provided on the course page and **discuss problems** and difficulties via the Moodle forum

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