Analyse und Dokumentation

BSc Psychologie SoSe 2025

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	Gruppe 1/2	Gruppe 3	Format	Thema
1	**Do, 10.04.**	**Fr, 11.04.**	**Seminar**	**(1) Quarto, Zotero, Tidyverse**
2	Do, 17.04.	Fr, 25.04.	Seminar	(2) Ethik und Ethische Formalitäten
3	Do, 24.04.	Fr, 02.05.	Seminar	(3) Wissenschaftliche Berichte
4	Mi, 30.04.	Fr, 09.05.	Seminar	(4) Offenheit und Transparenz
5	Do, 08.05.	Fr, 16.05.	Praxisseminar	Offene Übung
6	Do, 15.05.	Fr, 23.05.	Präsentationen	Einfache Lineare Regression
7	Mi, 21.05.	Fr, 30.05.	Präsentationen	Korrelation
8	Do, 05.06.	Fr, 06.06.	Präsentationen	Einstichproben-T-Test
9	Do, 12.06.	Fr, 13.06.	Präsentationen	Zweistichproben-T-Test
10	Do, 19.06.	Fr, 20.06.	Präsentationen	Einfaktorielle Varianzanalyse
11	Do, 26.06.	Fr, 27.06.	Präsentationen	Zweifaktorielle Varianzanalyse
12	Do, 03.07.	Fr, 04.07.	Präsentationen	Multipe Regression
13	Do, 10.07.	Fr, 11.07.	Präsentationen	Kovarianzanalyse
	Juli		Klausurtermin	

(1) Quarto, Zotero, Tidyverse

Quarto

Zotero

Tidyverse

Quarto

Zotero

Tidyverse

Quarto

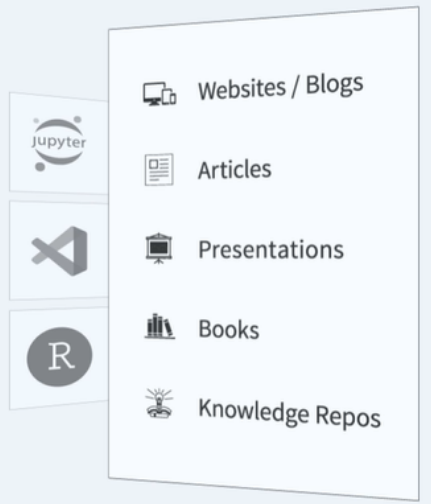
Welcome to Quarto

An open-source scientific and technical publishing system

- Author using Jupyter notebooks or with plain text markdown in your favorite editor.
- Create dynamic content with Python, R, Julia, and Observable.
- Publish reproducible, production quality articles, presentations, websites, blogs, and books in HTML, PDF, MS Word, ePub, and more.
- Share knowledge and insights organization-wide by publishing to Posit Connect, Confluence, or other publishing systems.
- Write using Pandoc markdown, including equations, citations, crossrefs, figure panels, callouts, advanced layout, and more.

Analyze. Share. Reproduce. You have a story to tell with data—tell it with Quarto.

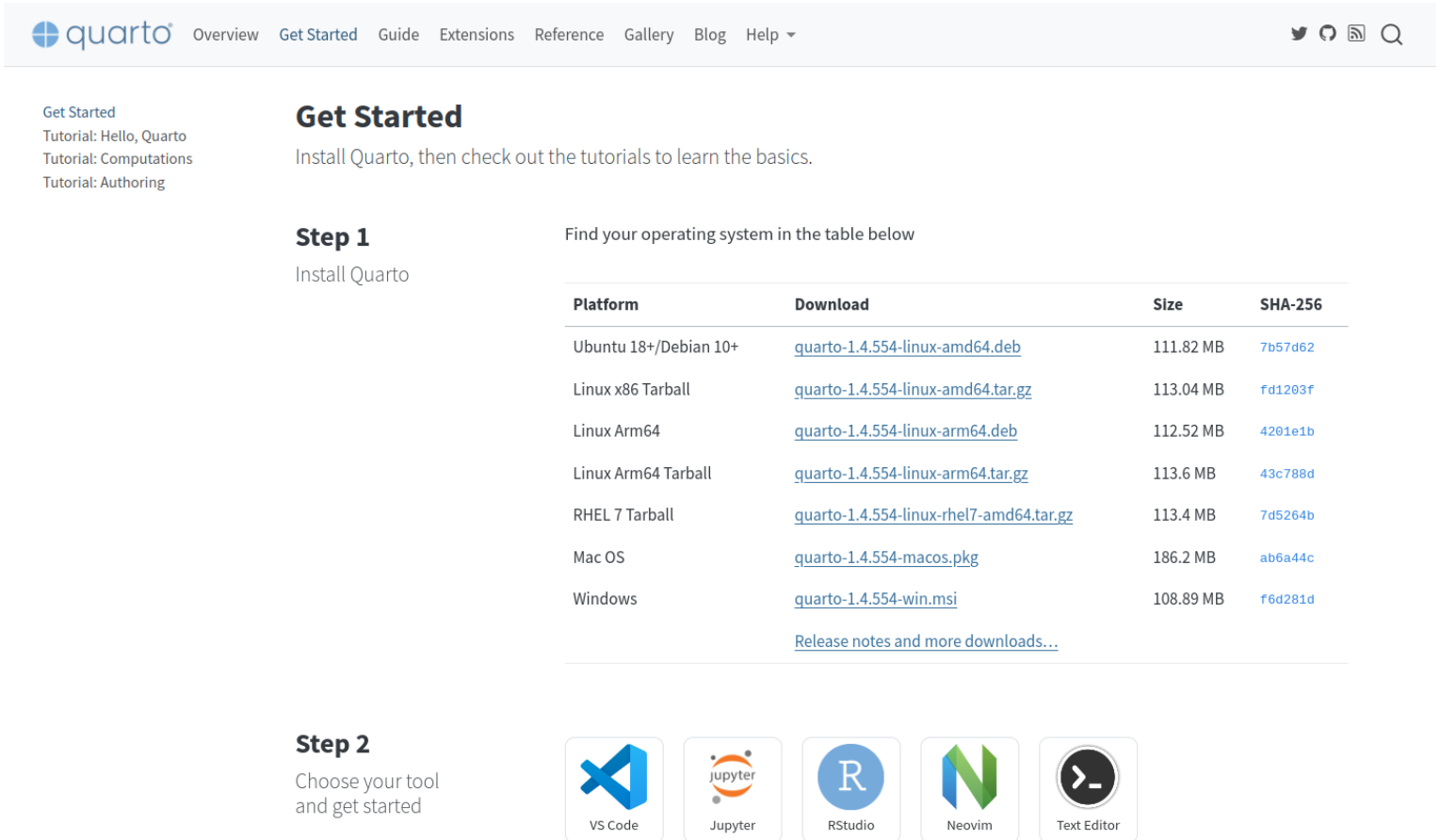
Get Started Guide



Was ist Quarto?

- Ein seit 2022 verfügbares freies wissenschaftlich-technisches Publikationssystem
- Eine Weiterentwicklung von RMarkdown und RBookdown durch Posit
- RMarkdown/RBookdown sind RStudio Adaptationen von Markdown und Jupyter Notebooks
- Allgemeines Ziel ist hier die einfache Integration von ausführbarem Programmiercode in ein ansprechendes Text-, Tabellen- und Abbildungslayout für Web- und Printdokumente.
- Quarto nutzt Markdown und Latex für Layoutprozesse.
- Quarto nutzt Pandoc für multiple Outputformate (.html, .docx, .pdf, etc.)
- Quarto läuft smoother und schneller als RMarkdown und RBookdown.

Quarto Installation



Quarto VSCode Tutorial

quarto Overview Get Started Guide Extensions Reference Gallery Blog Help

Get Started
Tutorial: Hello, Quarto
Tutorial: Computations
Tutorial: Authoring

Tutorial: Hello, Quarto

Choose your tool: VS Code | Jupyter | RStudio | Neovim | Editor

Overview

In this tutorial we'll show you how to use Quarto with VS Code. Before getting started, you should install the Quarto VS Code Extension, which includes many tools that enhance working with Quarto, including:

- Integrated render and preview for Quarto documents.
- Syntax highlighting for markdown and embedded languages
- Completion and diagnostics for YAML options
- Completion for embedded languages (e.g. Python, R, Julia, etc.)
- Commands and key-bindings for running cells and selected lines.

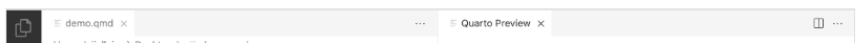
You can install the Quarto extension from within the **Extensions** tab in VS Code, from the Extension Marketplace, the Open VSX Registry or directly from a VISX extension file.

Note

This tutorial focuses on editing plain text Quarto `.qmd` files in VS Code. Depending on your preferences and the task at hand there are two other editing modes available for Quarto documents: the Visual Editor and the Notebook Editor. For the purposes of learning we recommend you work through this tutorial using the VS Code text editor, then after you've mastered the basics explore using the other editing modes.

Basic Workflow

Quarto `.qmd` files contain a combination of markdown and executable code cells. Here's what it might look like in VS Code to edit and preview a `.qmd` file:



On this page
- Overview
  - Basic Workflow
- Render and Preview
- YAML Options
- Markdown
- Code Cells
- External Preview
- Next Up

Edit this page
Report an issue

Was ist Markdown?

- Eine Markup Language (Auszeichnungssprache) zur Erzeugung formatierten Texts
- Eine HTML Alternative zur Erstellung von Webseiten etc. mithilfe einfacher Texteditoren
- Von John Gruber und Aaron Swartz 2004 mit dem Ziel hoher Lesbarkeit entwickelt

Text using Markdown syntax	Corresponding HTML produced by a Markdown processor	Text viewed in a browser
`Heading` `=======` `Sub-heading` `-----------` `# Alternative heading` `## Alternative sub-heading` `Paragraphs are separated` `by a blank line.` `Two spaces at the end of a line` `produce a line break.`	`<h1>Heading</h1>` `<h2>Sub-heading</h2>` `<h1>Alternative heading</h1>` `<h2>Alternative sub-heading</h2>` `<p>Paragraphs are separated` `by a blank line.</p>` `<p>Two spaces at the end of a` `line ` `produce a line break.</p>`	Heading Sub-heading Alternative heading Alternative sub-heading Paragraphs are separated by a blank line. Two spaces at the end of a line produce a line break.

`Text attributes _italic_, **bold**,`
`` `monospace` ``.
 	
`Horizontal rule:`
 	
`---`
	`<p>Text attributes <em>italic</em>,`
	`<strong>bold</strong>,`
	`<code>monospace</code>.</p>`
	
	`<p>Horizontal rule:</p>`
	
	`<hr />`
		Text attributes *italic*, **bold**, `monospace`.
		Horizontal rule:

Was ist Latex?

- Ein Softwarepaket zur Vereinfachung von TeX
- TeX ist ein von Donald Knuth ab 1977 entwickeltes Textsatzsystem mit Makrosprache
- LaTeX wurde von Leslie Lamport Anfang 1984 entwickelt
- LaTeX ist insbesondere für mathematische Berichte und Präsentationen (Beamer) nützlich

```
\footnotesize
\begin{theorem}[Datenverteilung des Allgemeinen Linearen Modells]
\justifying
\normalfont
Es sei
\begin{equation}
\upsilon = X\beta + \varepsilon \mbox{ mit } \varepsilon \sim N(0_n,\sigma^2I_n)
\end{equation}
das ALM. Dann gilt
\begin{equation}
\upsilon \sim N(\mu,\sigma^2I_n) \mbox{ mit } \mu := X\beta \in \mathbb{R}^n.
\end{equation}
\end{theorem}
```

Theorem (Datenverteilung des Allgemeinen Linearen Modells)

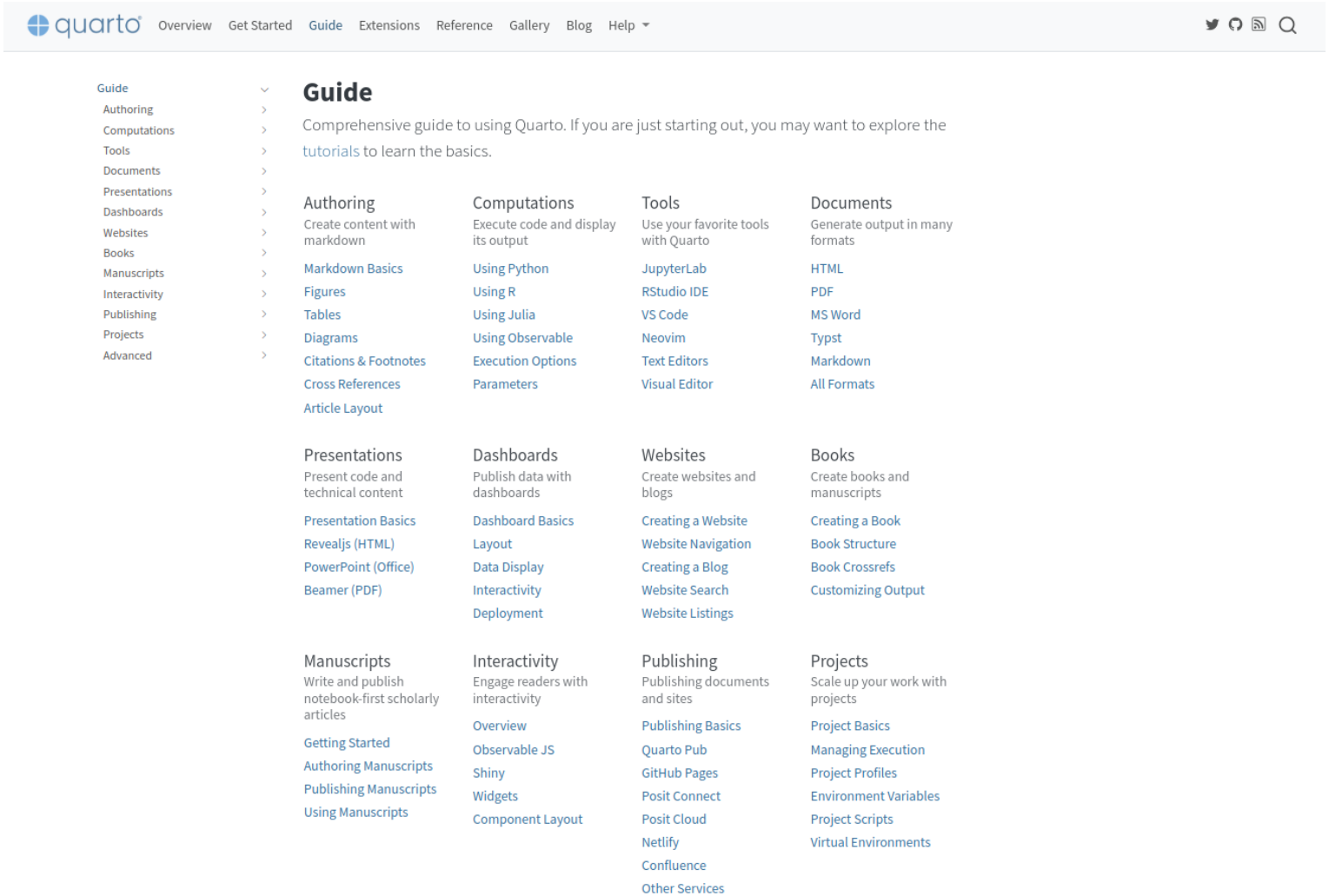
Es sei

$$\upsilon = X\beta + \varepsilon \text{ mit } \varepsilon \sim N(0_n, \sigma^2 I_n) \tag{7}$$

das ALM. Dann gilt

$$\upsilon \sim N(\mu, \sigma^2 I_n) \text{ mit } \mu := X\beta \in \mathbb{R}^n. \tag{8}$$

Quarto Guide



Quarto

```
---
title: "Quarto Demonstration"
author: "Toni Demo"
date: today
format: pdf
---

# Überschrift zu Kapitel 1.

Hier steht der Text für Kapitel 1. Darin könnte auch eine Abbildung enthalten sein.

![](../Abbildungen/otto.png){width="10%"}

## Überschrift zum Unterkapitel 1.1

Hier steht der Text für Unterkapitel 1.1. Manche Worte möchte ich **fett** und manche Worte _kursiv_, und Befehle
in `monospace` schreiben. Mögliche Farben möchte ich mit Stichpunkten auflisten.

* \textcolor{blue}{blau}
* \textcolor{green}{grün}
* \textcolor{red}{rot}
* \textcolor{gray}{grau}

Wenn wir mathematische Ausdrücke mit Dollarzeichen umrahmen, werden sie mithilfe von \LaTeX formatiert.
So können wir z.B. die Verteilung eines Zufallsvektors formal mit $\upsilon \sim N(\mu, \sigma^2 I_n)$ mit
$\mu := X\beta \in \mathbb{R}^n$ aufschreiben.
```

Quarto Demonstration

Toni Demo

2025-04-10

Überschrift zu Kapitel 1.

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Überschrift zum Unterkapitel 1.1

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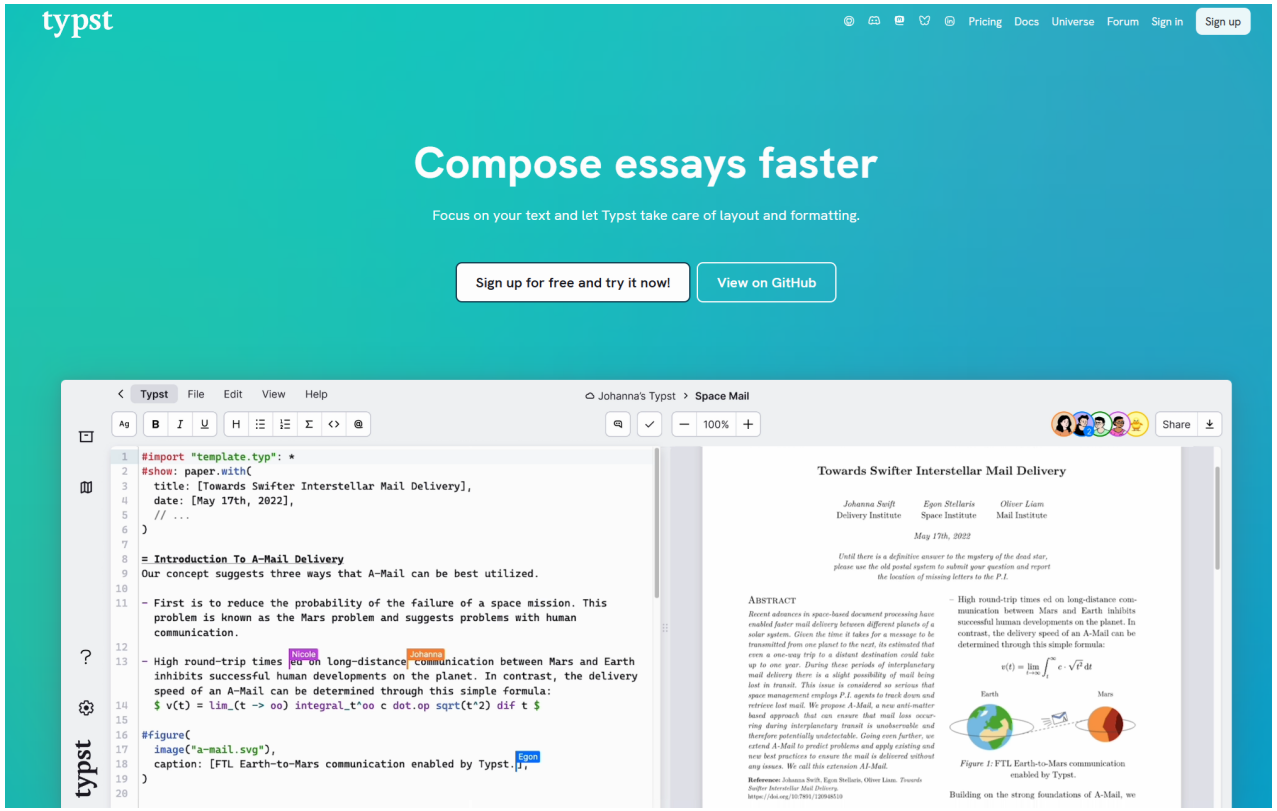
- blau
- grün
- rot
- grau

Wenn wir mathematische Ausdrücke mit Dollarzeichen umrahmen, werden sie mithilfe von LaTeXformatiert. So können wir z.B. die Verteilung eines Zufallsvektors formal mit $v \sim N(\mu, \sigma^2 I_n)$ mit $\mu := X\beta \in \mathbb{R}^n$ aufschreiben.

Beispielbericht

Beispielpräsentation

Typst


typst
Pricing
Docs
Universe
Forum
Sign in
Sign up
Compose essays faster
Focus on your text and let Typst take care of layout and formatting.
Sign up for free and try it now!
View on GitHub
Typst
File
Edit
View
Help
Johanna's Typst
Space Mail
100%
Share
#import "template.typ": *
#show: paper.with(
title: [Towards Swifter Interstellar Mail Delivery],
date: [May 17th, 2022],
// ...
)
= Introduction To A-Mail Delivery
Our concept suggests three ways that A-Mail can be best utilized.
- First is to reduce the probability of the failure of a space mission. This problem is known as the Mars problem and suggests problems with human communication.
- High round-trip times on long-distance communication between Mars and Earth inhibits successful human developments on the planet. In contrast, the delivery speed of an A-Mail can be determined through this simple formula:
$ v(t) = lim_(t -> oo) integral_t^oo c dot.op sqrt(t^2) dif t $
#figure(
image("a-mail.svg"),
caption: [FTL Earth-to-Mars communication enabled by Typst.],
)
Nicole
Johanna
Egon
Towards Swifter Interstellar Mail Delivery
Johanna Swift
Delivery Institute
Egon Stellaris
Space Institute
Oliver Liam
Mail Institute
May 17th, 2022
Until there is a definitive answer to the mystery of the dead star, please use the old postal system to submit your question and report the location of missing letters to the P.I.
Abstract
Recent advances in space-based document processing have enabled faster mail delivery between different planets of a solar system. Given the time it takes for a message to be transmitted from one planet to the next, its estimated that even a one-way trip to a distant destination could take up to one year. During these periods of interplanetary mail delivery there is a slight possibility of mail being lost in transit. This issue is considered so serious that space management employs P.I. agents to track down and retrieve lost mail. We propose A-Mail, a new anti-matter based approach that can ensure that mail loss occurring during interplanetary transit is unobservable and therefore potentially undetectable. Going even further, we extend A-Mail to predict problems and apply existing and new best practices to ensure the mail is delivered without any issues. We call this extension AI-Mail.
Reference: Johanna Swift, Egon Stellaris, Oliver Liam. Towards Swifter Interstellar Mail Delivery. https://doi.org/10.7891/1209-8510
– High round-trip times on long-distance communication between Mars and Earth inhibits successful human developments on the planet. In contrast, the delivery speed of an A-Mail can be determined through this simple formula:
$$v(t) = \lim_{t\to\infty} \int_t^\infty c \cdot \sqrt{t^2}\, dt$$
Earth
Mars
Figure 1: FTL Earth-to-Mars communication enabled by Typst.
Building on the strong foundations of A-Mail, we

Quarto Typst Integration

Typst Basics

Overview

Typst is a new open-source markup-based typesetting system that is designed to be as powerful as LaTeX while being much easier to learn and use. Typst creates beautiful PDF output with blazing fast render times.

Use the `typst` format to create a PDF document via Typst. For example:

hello-typst.qmd

```
---
title: "Hello Typst!"
format:
  typst:
    toc: true
    section-numbering: 1.1.a
    columns: 2
---
```

Rendering or previewing this document will invoke the Typst CLI to create `hello-typst.pdf`, a PDF file, from your markdown source file. Quarto includes the Typst CLI so no separate installation of Typst is required.

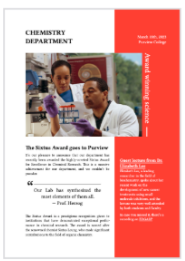
The above example highlights a few of the options available for Typst output. This document covers these and other options in detail. See the Typst format reference for a complete list of all available options.

One of the highlights of Typst is the ease of creating highly customized templates. For example, here are some Typst templates that you can use in Quarto as custom formats:

IEEE

Poster

Letter



Dept News

Learn more about how to use them, and how to create your own in Custom Formats.

Quarto

Zotero

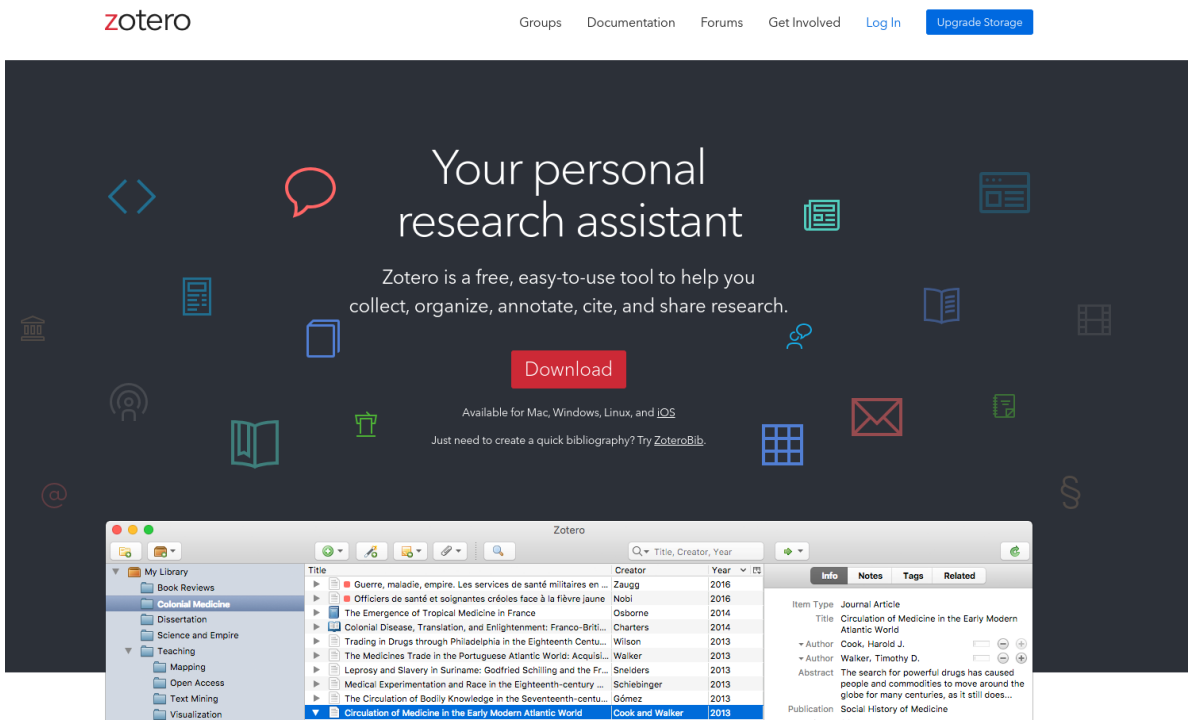
Tidyverse

Was ist ein Reference Manager?

- Reference Manager sind Literaturverwaltungsprogramme
- Reference Manager unterstützen Zitationen und das Erstellen von Literaturverzeichnissen
- Zitierstile können automatisch auf bestimmte Spezifikationen (z.B. APA) eingestellt werden
- Reference Manager dienen auch als digitale Bibliotheken
- Kommerzielle Reference Manager sind z.B. EndNote, Citavi, Mendeley und Papers
- Kostenlose/Freemium Reference Manager sind z.B. JabRef und Zotero
- Eine Integration in Quarto erlaubt z.B. der Export der eigenen Library in das BibTex Format.

Zotero Website

Zotero Documentation

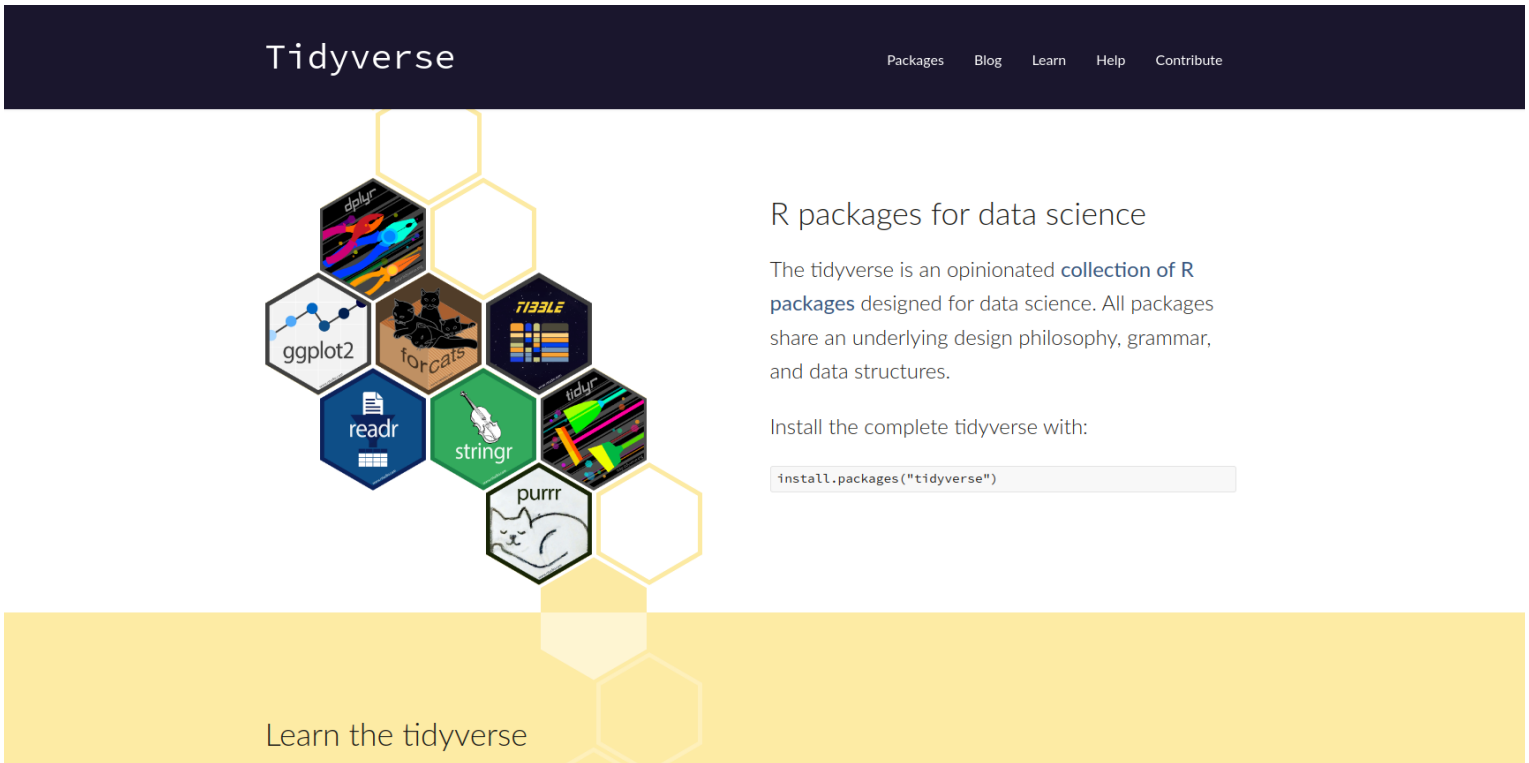


Quarto

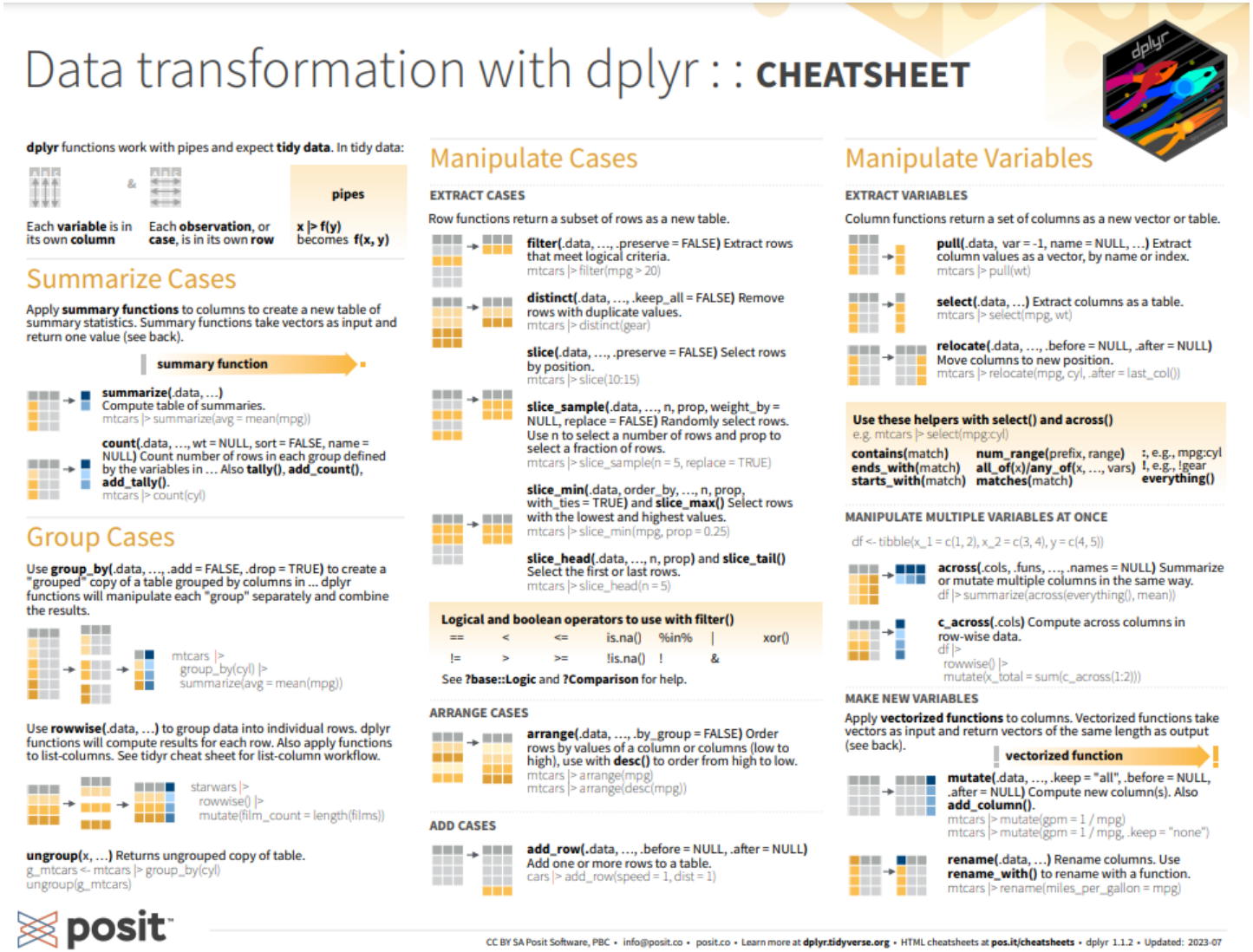
Zotero

Tidyverse

Tidyverse



Cheat Sheets



Data transformation with dplyr : : CHEATSHEET

dplyr functions work with pipes and expect **tidy data**. In tidy data:

Each **variable** is in its own **column** & Each **observation**, or **case**, is in its own **row**

pipes
x |> f(y) becomes **f(x, y)**

Summarize Cases

Apply **summary functions** to columns to create a new table of summary statistics. Summary functions take vectors as input and return one value (see back).

summary function

summarize(.data, …)
Compute table of summaries.
mtcars |> summarize(avg = mean(mpg))

count(.data, …, wt = NULL, sort = FALSE, name = NULL) Count number of rows in each group defined by the variables in … Also **tally()**, **add_count()**, **add_tally()**.
mtcars |> count(cyl)

Group Cases

Use **group_by**(.data, …, .add = FALSE, .drop = TRUE) to create a "grouped" copy of a table grouped by columns in ... dplyr functions will manipulate each "group" separately and combine the results.

```
mtcars |>
  group_by(cyl) |>
  summarize(avg = mean(mpg))
```

Use **rowwise**(.data, …) to group data into individual rows. dplyr functions will compute results for each row. Also apply functions to list-columns. See tidyr cheat sheet for list-column workflow.

```
starwars |>
  rowwise() |>
  mutate(film_count = length(films))
```

ungroup(x, …) Returns ungrouped copy of table.
g_mtcars <- mtcars |> group_by(cyl)
ungroup(g_mtcars)

Manipulate Cases

EXTRACT CASES

Row functions return a subset of rows as a new table.

filter(.data, …, .preserve = FALSE) Extract rows that meet logical criteria.
mtcars |> filter(mpg > 20)

distinct(.data, …, .keep_all = FALSE) Remove rows with duplicate values.
mtcars |> distinct(gear)

slice(.data, …, .preserve = FALSE) Select rows by position.
mtcars |> slice(10:15)

slice_sample(.data, …, n, prop, weight_by = NULL, replace = FALSE) Randomly select rows. Use n to select a number of rows and prop to select a fraction of rows.
mtcars |> slice_sample(n = 5, replace = TRUE)

slice_min(.data, order_by, …, n, prop, with_ties = TRUE) and **slice_max()** Select rows with the lowest and highest values.
mtcars |> slice_min(mpg, prop = 0.25)

slice_head(.data, …, n, prop) and **slice_tail()** Select the first or last rows.
mtcars |> slice_head(n = 5)

Logical and boolean operators to use with filter()

==	<	<=	is.na()	%in%	|	xor()
!=	>	>=	!is.na()	!	&	

See **?base::Logic** and **?Comparison** for help.

ARRANGE CASES

arrange(.data, …, .by_group = FALSE) Order rows by values of a column or columns (low to high), use with **desc()** to order from high to low.
mtcars |> arrange(mpg)
mtcars |> arrange(desc(mpg))

ADD CASES

add_row(.data, …, .before = NULL, .after = NULL) Add one or more rows to a table.
cars |> add_row(speed = 1, dist = 1)

Manipulate Variables

EXTRACT VARIABLES

Column functions return a set of columns as a new vector or table.

pull(.data, var = -1, name = NULL, …) Extract column values as a vector, by name or index.
mtcars |> pull(wt)

select(.data, …) Extract columns as a table.
mtcars |> select(mpg, wt)

relocate(.data, …, .before = NULL, .after = NULL) Move columns to new position.
mtcars |> relocate(mpg, cyl, .after = last_col())

Use these helpers with select() and across()
e.g. mtcars |> select(mpg:cyl)

contains(match) **num_range**(prefix, range) :, e.g., mpg:cyl
ends_with(match) **all_of**(x)/**any_of**(x, …, vars) !, e.g., !gear
starts_with(match) **matches**(match) **everything()**

MANIPULATE MULTIPLE VARIABLES AT ONCE

df <- tibble(x_1 = c(1, 2), x_2 = c(3, 4), y = c(4, 5))

across(.cols, .funs, …, .names = NULL) Summarize or mutate multiple columns in the same way.
df |> summarize(across(everything(), mean))

c_across(.cols) Compute across columns in row-wise data.
df |>
rowwise() |>
mutate(x_total = sum(c_across(1:2)))

MAKE NEW VARIABLES

Apply **vectorized functions** to columns. Vectorized functions take vectors as input and return vectors of the same length as output (see back).

vectorized function

mutate(.data, …, .keep = "all", .before = NULL, .after = NULL) Compute new column(s). Also **add_column()**.
mtcars |> mutate(gpm = 1 / mpg)
mtcars |> mutate(gpm = 1 / mpg, .keep = "none")

rename(.data, …) Rename columns. Use **rename_with()** to rename with a function.
mtcars |> rename(miles_per_gallon = mpg)

posit

dplyr Cheat Sheet

Tidyverse dplyr

```r
D <- read.table("./Daten/Daten_1.csv", sep = ",", header = TRUE)    # Daten einlesen
```

Variable_1	Variable_2	Variable_3
34.87	34.61	33.56
32.16	22.89	15.75
33.95	31.82	28.83
28.78	25.91	20.04
30.13	26.83	22.00
30.50	26.50	24.42
32.48	26.92	22.96
31.66	31.84	28.83
32.76	33.00	33.28
31.60	26.77	21.21
32.44	28.55	28.63
29.48	25.33	24.19
31.24	28.97	25.18
34.33	31.31	28.22
31.56	27.11	22.92
31.87	30.95	30.30
27.07	21.94	17.60
29.36	25.41	19.32
36.07	33.56	33.41
33.03	28.81	26.58
33.12	32.20	29.44

Tidyverse dplyr

Der Pipe operater %>% oder |> ermöglicht es, Funktionen in einer Reihe nacheinander auszuführen.

`mutate()` erlaubt das Erzeugen neuer Spalten als Funktionen bestehender Spalten

```
library(dplyr)
n <- nrow(D)                                                    # Anzahl Beobachtungen
D_processed <- D %>%                                            # D wird an nächste Funktion übergeben
  mutate(ID = seq(n)) %>%                                       # ID-Spalte hinzufügen
  mutate(Summe = Variable_1 + Variable_2 + Variable_3)          # Summen-Spalte hinzufügen
```

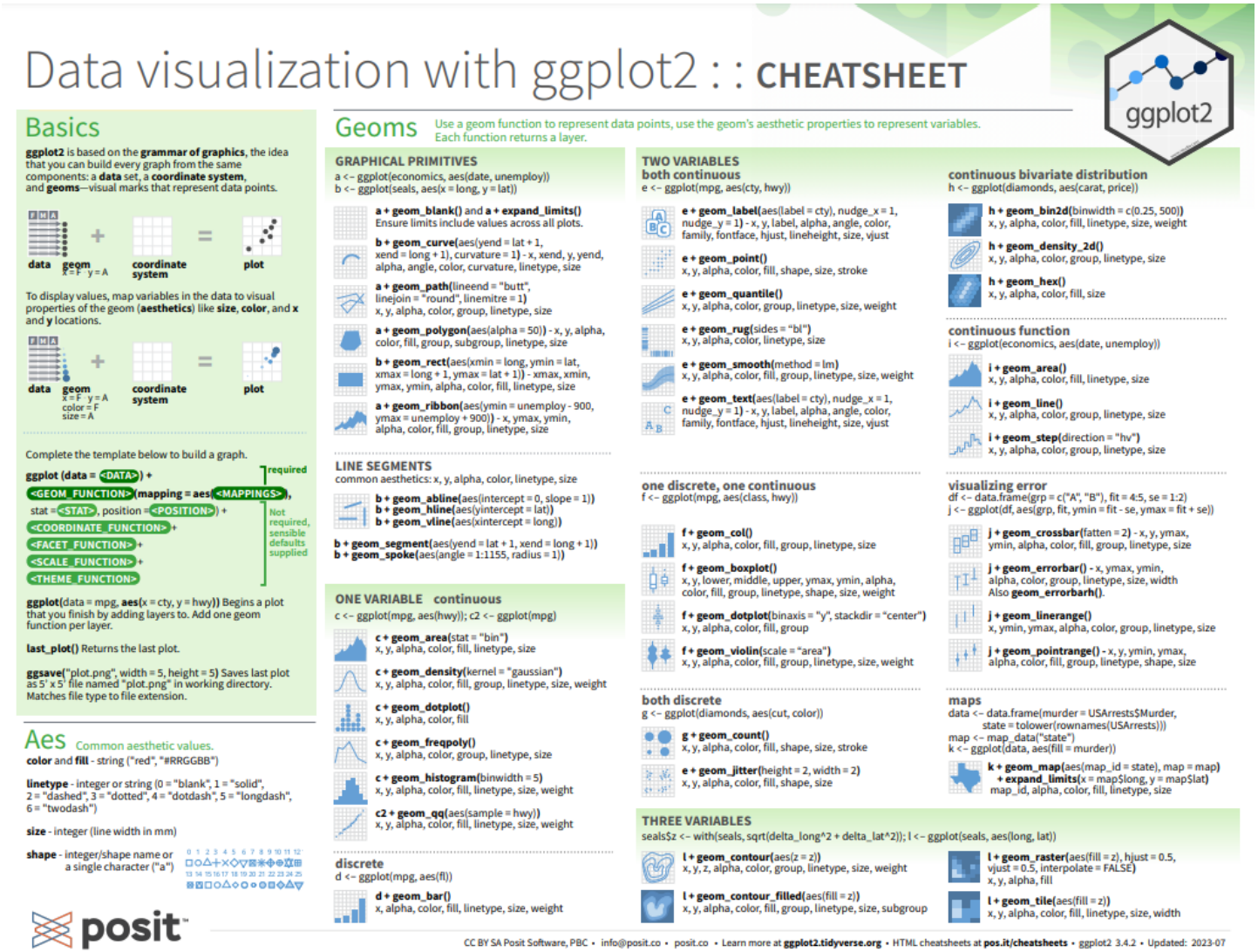
Variable_1	Variable_2	Variable_3	ID	Summe
34.87	34.61	33.56	1	103.04
32.16	22.89	15.75	2	70.79
33.95	31.82	28.83	3	94.60
28.78	25.91	20.04	4	74.74
30.13	26.83	22.00	5	78.96
30.50	26.50	24.42	6	81.42
32.48	26.92	22.96	7	82.37
31.66	31.84	28.83	8	92.34
32.76	33.00	33.28	9	99.05
31.60	26.77	21.21	10	79.58
32.44	28.55	28.63	11	89.62
29.48	25.33	24.19	12	79.00
31.24	28.97	25.18	13	85.40
34.33	31.31	28.22	14	93.86
31.56	27.11	22.92	15	81.59
31.87	30.95	30.30	16	93.12
27.07	21.94	17.60	17	66.61
29.36	25.41	19.32	18	74.09
36.07	33.56	33.41	19	103.04
33.03	28.81	26.58	20	88.42
33.12	32.20	29.44	21	94.75

Tidyverse `dplyr`

`filter()` erlaubt es, Zeilen gemäß bestimmten Bedingungen auswählen

```
D_selected <- D_processed %>%
  filter(ID %in% 1:10) %>%                    # Auswahl der IDs 1-10
  filter(Summe > 90)                          # Selektion der Beobachtungen mit Summe > 90
```

Variable_1	Variable_2	Variable_3	ID	Summe
34.87	34.61	33.56	1	103.04
33.95	31.82	28.83	3	94.60
31.66	31.84	28.83	8	92.34
32.76	33.00	33.28	9	99.05



Data visualization with ggplot2 : : CHEATSHEET

Basics

ggplot2 is based on the **grammar of graphics**, the idea that you can build every graph from the same components: a **data** set, a **coordinate system**, and **geoms**—visual marks that represent data points.

data + geom (x = F, y = A) = coordinate system + plot

To display values, map variables in the data to visual properties of the geom (**aesthetics**) like **size**, **color**, and **x** and **y** locations.

data + geom (x = F, y = A, color = F, size = A) = coordinate system + plot

Complete the template below to build a graph.

```
ggplot (data = <DATA>) +                                   required
<GEOM_FUNCTION> (mapping = aes(<MAPPINGS>),
stat = <STAT>, position = <POSITION>) +                    Not required, sensible defaults supplied
<COORDINATE_FUNCTION> +
<FACET_FUNCTION> +
<SCALE_FUNCTION> +
<THEME_FUNCTION>
```

ggplot(data = mpg, **aes**(x = cty, y = hwy)) Begins a plot that you finish by adding layers to. Add one geom function per layer.

last_plot() Returns the last plot.

ggsave("plot.png", width = 5, height = 5) Saves last plot as 5' x 5' file named "plot.png" in working directory. Matches file type to file extension.

Aes

Common aesthetic values.

color and **fill** - string ("red", "#RRGGBB")

linetype - integer or string (0 = "blank", 1 = "solid", 2 = "dashed", 3 = "dotted", 4 = "dotdash", 5 = "longdash", 6 = "twodash")

size - integer (line width in mm)

shape - integer/shape name or a single character ("a")

0 1 2 3 4 5 6 7 8 9 10 11 12
13 14 15 16 17 18 19 20 21 22 23 24 25

Geoms

Use a geom function to represent data points, use the geom's aesthetic properties to represent variables. Each function returns a layer.

GRAPHICAL PRIMITIVES

a <- ggplot(economics, aes(date, unemploy))
b <- ggplot(seals, aes(x = long, y = lat))

a + geom_blank() and **a + expand_limits()** Ensure limits include values across all plots.

b + geom_curve(aes(yend = lat + 1, xend = long + 1), curvature = 1) - x, xend, y, yend, alpha, angle, color, curvature, linetype, size

a + geom_path(lineend = "butt", linejoin = "round", linemitre = 1) x, y, alpha, color, group, linetype, size

a + geom_polygon(aes(alpha = 50)) - x, y, alpha, color, fill, group, subgroup, linetype, size

b + geom_rect(aes(xmin = long, ymin = lat, xmax = long + 1, ymax = lat + 1)) - xmax, xmin, ymax, ymin, alpha, color, fill, linetype, size

a + geom_ribbon(aes(ymin = unemploy - 900, ymax = unemploy + 900)) - x, ymax, ymin, alpha, color, fill, group, linetype, size

LINE SEGMENTS

common aesthetics: x, y, alpha, color, linetype, size

b + geom_abline(aes(intercept = 0, slope = 1))
b + geom_hline(aes(yintercept = lat))
b + geom_vline(aes(xintercept = long))

b + geom_segment(aes(yend = lat + 1, xend = long + 1))
b + geom_spoke(aes(angle = 1:1155, radius = 1))

ONE VARIABLE continuous

c <- ggplot(mpg, aes(hwy)); c2 <- ggplot(mpg)

c + geom_area(stat = "bin") x, y, alpha, color, fill, linetype, size

c + geom_density(kernel = "gaussian") x, y, alpha, color, fill, group, linetype, size, weight

c + geom_dotplot() x, y, alpha, color, fill

c + geom_freqpoly() x, y, alpha, color, group, linetype, size

c + geom_histogram(binwidth = 5) x, y, alpha, color, fill, linetype, size, weight

c2 + geom_qq(aes(sample = hwy)) x, y, alpha, color, fill, linetype, size, weight

discrete

d <- ggplot(mpg, aes(fl))

d + geom_bar() x, alpha, color, fill, linetype, size, weight

TWO VARIABLES

both continuous

e <- ggplot(mpg, aes(cty, hwy))

e + geom_label(aes(label = cty), nudge_x = 1, nudge_y = 1) - x, y, label, alpha, angle, color, family, fontface, hjust, lineheight, size, vjust

e + geom_point() x, y, alpha, color, fill, shape, size, stroke

e + geom_quantile() x, y, alpha, color, group, linetype, size, weight

e + geom_rug(sides = "bl") x, y, alpha, color, linetype, size

e + geom_smooth(method = lm) x, y, alpha, color, fill, group, linetype, size, weight

e + geom_text(aes(label = cty), nudge_x = 1, nudge_y = 1) - x, y, label, alpha, angle, color, family, fontface, hjust, lineheight, size, vjust

one discrete, one continuous

f <- ggplot(mpg, aes(class, hwy))

f + geom_col() x, y, alpha, color, fill, group, linetype, size

f + geom_boxplot() x, y, lower, middle, upper, ymax, ymin, alpha, color, fill, group, linetype, shape, size, weight

f + geom_dotplot(binaxis = "y", stackdir = "center") x, y, alpha, color, fill, group

f + geom_violin(scale = "area") x, y, alpha, color, fill, group, linetype, size, weight

both discrete

g <- ggplot(diamonds, aes(cut, color))

g + geom_count() x, y, alpha, color, fill, shape, size, stroke

e + geom_jitter(height = 2, width = 2) x, y, alpha, color, fill, shape, size

THREE VARIABLES

seals$z <- with(seals, sqrt(delta_long^2 + delta_lat^2)); l <- ggplot(seals, aes(long, lat))

l + geom_contour(aes(z = z)) x, y, z, alpha, color, group, linetype, size, weight

l + geom_contour_filled(aes(fill = z)) x, y, alpha, color, fill, group, linetype, size, subgroup

continuous bivariate distribution

h <- ggplot(diamonds, aes(carat, price))

h + geom_bin2d(binwidth = c(0.25, 500)) x, y, alpha, color, fill, linetype, size, weight

h + geom_density_2d() x, y, alpha, color, group, linetype, size

h + geom_hex() x, y, alpha, color, fill, size

continuous function

i <- ggplot(economics, aes(date, unemploy))

i + geom_area() x, y, alpha, color, fill, linetype, size

i + geom_line() x, y, alpha, color, group, linetype, size

i + geom_step(direction = "hv") x, y, alpha, color, group, linetype, size

visualizing error

df <- data.frame(grp = c("A", "B"), fit = 4:5, se = 1:2)
j <- ggplot(df, aes(grp, fit, ymin = fit - se, ymax = fit + se))

j + geom_crossbar(fatten = 2) - x, y, ymax, ymin, alpha, color, fill, group, linetype, size

j + geom_errorbar() - x, ymax, ymin, alpha, color, group, linetype, size, width Also **geom_errorbarh()**.

j + geom_linerange() x, ymin, ymax, alpha, color, group, linetype, size

j + geom_pointrange() - x, y, ymin, ymax, alpha, color, fill, group, linetype, shape, size

maps

data <- data.frame(murder = USArrests$Murder, state = tolower(rownames(USArrests)))
map <- map_data("state")
k <- ggplot(data, aes(fill = murder))

k + geom_map(aes(map_id = state), map = map) **+ expand_limits**(x = map$long, y = map$lat) map_id, alpha, color, fill, linetype, size

posit

ggplot2 Cheat Sheet

Beispieldatensatz

```r
library(dplyr)                                                    # Für Pipe (%>%), mutate()

# Daten vorbereiten
D <- read.table("./Daten/Daten_2.csv", sep = ",", header = TRUE)  # Daten einlesen
n_pat <- nrow(D)                                                  # Anzahl Patientinnen
D_processed <- D %>%                                              # PatientIn ID hinzufügen
  mutate(PatientIn = seq(n_pat))
```

Die ersten 12 Zeilen des Dataframes:

DUR	BDI	PatientIn
1.37	9	1
2.18	8	2
1.16	11	3
3.60	0	4
2.33	8	5
1.18	7	6
2.49	3	7
2.74	7	8
2.58	3	9
1.69	11	10
3.51	9	11
2.39	7	12

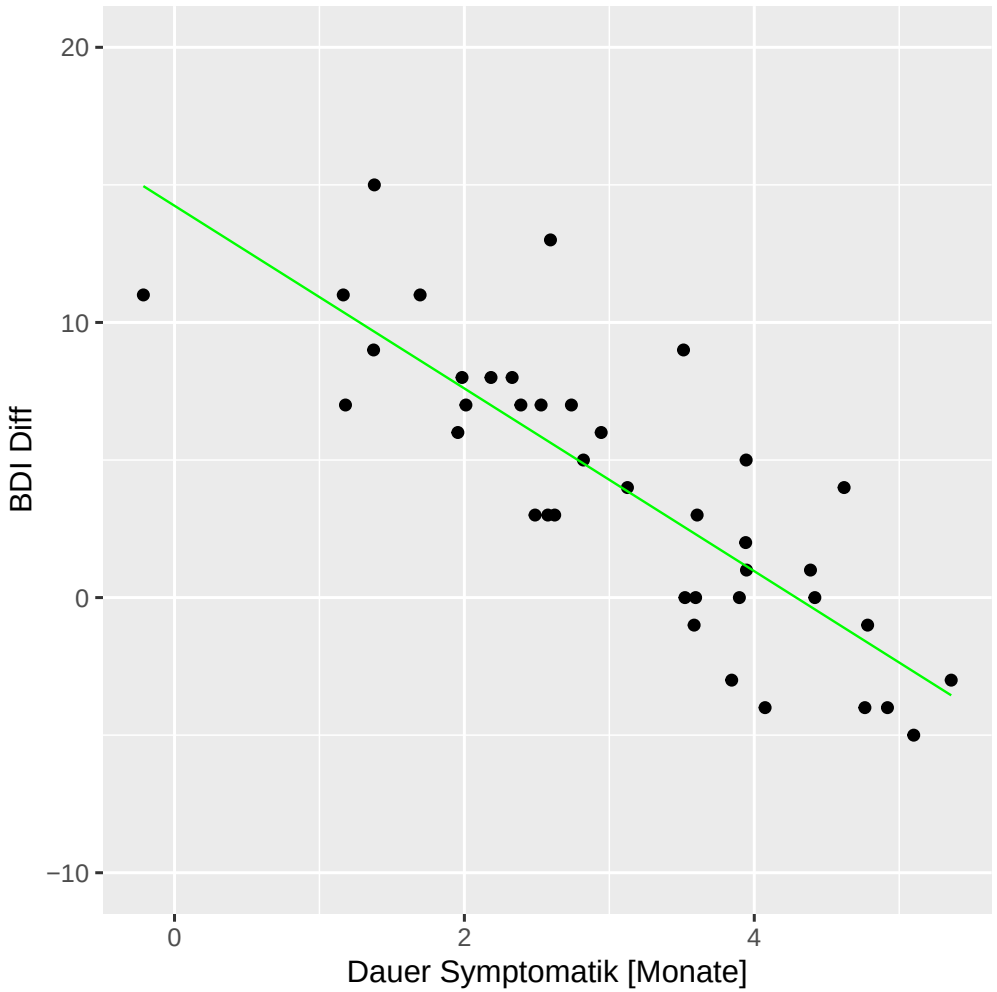
Tidyverse ggplot2

```r
library(ggplot2)                                          # Für ggplot()

# Visualisierung
ggplot(
  data = D_processed,                                     # Daten
  mapping = aes(x = DUR, y = BDI)                         # Daten-Axen-mapping
  ) +
  coord_cartesian(ylim = c(-10, 20)) +                    # y-limits anpassen
  geom_point() +                                          # Datenpunkte zeichnen
  geom_smooth(                                            # Ausgleichsgerade zeichnen
    method = "lm",
    color = "green", se = F, linewidth = 0.4
    ) +
  ylab("BDI Diff") + xlab("Dauer Symptomatik [Monate]")  # Achsenbeschriftung
graphics.off()                                            # Schließt browser

ggsave(                                                   # Abbildung speichern
  filename = "ggplot_beispiel.pdf",
  height = 5, width = 5
)
```

Tidyverse `ggplot2`



Quellen

VS Code Website

VS Code-R Wiki

R for Data Science (2e)

ggplot2: Elegant Graphics for Data Analysis (3e)