



Analyse und Dokumentation

BSc Psychologie SoSe 2024

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Inhalte basieren teilweise auf Design, Analyse, Dokumentation von Dirk Ostwald, lizenziert unter CC BY-NC-SA 4.0

Datum	Einheit	Thema	Lehrperson
10.04.24	Seminar	(1) Ethik und Ethische Formalitäten	BF
17.04.24	Seminar	(2) Wissenschaftliche Berichte	BF
24.04.24	Seminar	(3) Offenheit und Transparenz	BF
01.05.24	Tag der Arbeit		
08.05.24	Seminar	(4) R, Quarto und Zotero	BF
15.05.24	Praxisseminar	Offene Übung	BF
22.05.24	Präsentationen	Einfache Lineare Regression	JS
29.05.24	Präsentationen	Korrelation	JS
05.06.24	Präsentationen	Einstichproben-T-Test	JS
12.06.24	Präsentationen	Zweistichproben-T-Test	JS
19.06.24	Präsentationen	Einfaktorielle Varianzanalyse	BF
26.06.24	Präsentationen	Zweifaktorielle Varianzanalyse	BF
03.07.24	Präsentationen	Multiple Regression	BF
10.07.24	Präsentationen	Kovarianzanalyse	BF
26.07.24	Klausurtermin		
Feb 2025	Klausurwiederholungstermin		

(4) R, Quarto und Zotero

R Tools

Quarto

Zotero

R Tools

Quarto

Zotero

Visual Studio Code (VS Code) Website

VS Code-R Wiki

R for Data Science (2e)

ggplot2: Elegant Graphics for Data Analysis (3e)

Wiederholung: R und VS Code

Visual Studio Code

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GET STARTED

USER GUIDE

SOURCE CONTROL

TERMINAL

GITHUB COPILOT

LANGUAGES

OVERVIEW

JAVASCRIPT

JSON

HTML

CSS, SCSS and LESS

Typescript

Markdown

PowerShell

C++

Java

R#P#P

Python

Julia

R

Ruby

Post

SQL

T-SQL

C#

.NET

Polyscript

NODEJS / JAVASCRIPT

TYPESCRIPT

PYTHON

JAVA

C++

C#

DOCKER

DATA SCIENCE

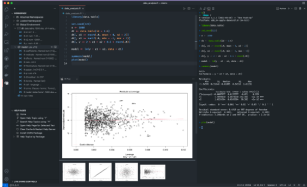
AI/ML

R in Visual Studio Code

EDIT

The **R programming language** is a dynamic language built for statistical computing and graphics. It is commonly used in statistical analysis, scientific computing, machine learning, and data visualization.

The **R extension** for Visual Studio Code supports extended syntax highlighting, code completion, linting, formatting, interacting with R terminals, viewing data, plots, workspace variables, help pages, managing packages and working with **R Markdown** documents.



The screenshot shows the Visual Studio Code interface with the R extension installed. The main editor displays R code for a scatter plot. The output console shows the plot, and the variable explorer shows the data frame used in the plot.

IN THIS ARTICLE

Getting started

Running R code

Code completion (IntelliSense)

Linting

Workspace viewer

Debugging

Next steps

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Getting started

1. **Install R** ($\geq 3.4.0$) for your platform. For Windows users, it is recommended to check **Save version number in registry** during installation so that the R extension can find the R executable automatically.
2. **Install `languageserver`** in R.

```
install.packages("languageserver")
```
3. **Install the R extension for Visual Studio Code.**
4. **Create an R file and start coding.**

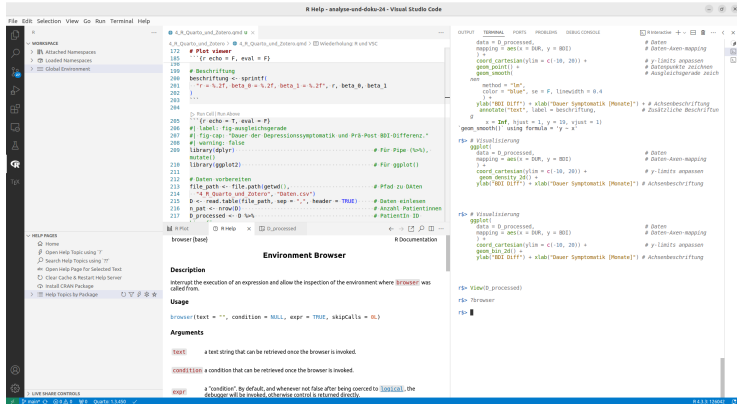
To enhance the experience of using R in VS Code, the following software and packages are recommended:

VS Code Website

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Wiederholung: R workspace und Interactive Viewer

Help Viewer



Mit dem Befehl `?funktionsname` über **HELP PAGES** öffnen.

VS Code Wiki - Interactive viewers

Wiederholung: R workspace und Interactive Viewer

Table Viewer

The screenshot shows the Visual Studio Code interface with an R script open in the editor. The script defines a function `plot_viewer` and processes data from a CSV file. The output of the script is displayed in the Table Viewer, which shows a table with 13 rows and 5 columns: (row), THP, DMR, BDI, and Patienten ID.

(row)	THP	DMR	BDI	Patienten ID
1	OST	1.9755	9	1
2	OST	2.1606	8	2
3	OST	1.1644	11	3
4	OST	3.9953	0	4
5	OST	2.3256	8	5
6	OST	1.1795	7	6
7	OST	2.4874	3	7
8	OST	2.7383	7	8
9	OST	2.5758	3	9
10	OST	1.6946	11	10
11	OST	3.5118	9	11
12	OST	2.3898	7	12
13	OST	1.3788	15	13

Mit dem Befehl `View()` oder im R **WORKSPACE** → **Global Environment** über das View Symbol  neben entsprechendem Objekt

[VS Code Wiki - Interactive viewers](#)

Wiederholung: R workspace und Interactive Viewer

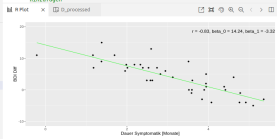
List Viewer

The screenshot displays the Visual Studio Code interface with the R extension. The left sidebar shows the 'R' workspace with a list of objects: 'D', 'D_processed', 'beta_0', 'beta_1', 'beta_2', 'beta_3', 'beta_4', 'beta_5', 'beta_6', 'beta_7', 'beta_8', 'beta_9', 'beta_10', 'beta_11', 'beta_12', 'beta_13', 'beta_14', 'beta_15', 'beta_16', 'beta_17', 'beta_18', 'beta_19', 'beta_20', 'beta_21', 'beta_22', 'beta_23', 'beta_24', 'beta_25', 'beta_26', 'beta_27', 'beta_28', 'beta_29', 'beta_30', 'beta_31', 'beta_32', 'beta_33', 'beta_34', 'beta_35', 'beta_36', 'beta_37', 'beta_38', 'beta_39', 'beta_40', 'beta_41', 'beta_42', 'beta_43', 'beta_44', 'beta_45', 'beta_46', 'beta_47', 'beta_48', 'beta_49', 'beta_50', 'beta_51', 'beta_52', 'beta_53', 'beta_54', 'beta_55', 'beta_56', 'beta_57', 'beta_58', 'beta_59', 'beta_60', 'beta_61', 'beta_62', 'beta_63', 'beta_64', 'beta_65', 'beta_66', 'beta_67', 'beta_68', 'beta_69', 'beta_70', 'beta_71', 'beta_72', 'beta_73', 'beta_74', 'beta_75', 'beta_76', 'beta_77', 'beta_78', 'beta_79', 'beta_80', 'beta_81', 'beta_82', 'beta_83', 'beta_84', 'beta_85', 'beta_86', 'beta_87', 'beta_88', 'beta_89', 'beta_90', 'beta_91', 'beta_92', 'beta_93', 'beta_94', 'beta_95', 'beta_96', 'beta_97', 'beta_98', 'beta_99', 'beta_100'. The main editor shows the R script 'lm_model - analyse-und-doku-24 - Visual Studio Code'. The script includes comments in German and R code for plotting a linear model. The right sidebar shows the 'OUTPUT' pane with the terminal output of the R script, which includes the plot command and the resulting plot. The plot shows a scatter plot of 'D' (Depressionssymptomatik) against 'D_processed' (Prä-Post BDI-Differenz) with a fitted line. The plot is titled 'D' and has axes labeled 'D' and 'D_processed'.

Mit dem Befehl `View()` oder im R **WORKSPACE** → **Global Environment** über das View Symbol  neben entsprechendem Objekt

[VS Code Wiki - Interactive viewers](#)

Plot Viewer



Nach Installation über `r.plot.useHttpgd` in VS Code Einstellungen freischalten.

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Debugging mit browser()

Die R base Funktion `browser()` erlaubt das Pausieren der Exekution eines Skripts und Inspektion der aktuellen *environment*.

Beispiel

```
# Variableninitiation
erste_variable <- 1
zweite_variable <- 3
ergebnis <- c()

# Inspektion des environments
browser()                # Pausiert Skript

# Mitte des Skripts
ergebnis <- erste_variable + zweite_variable
browser()
```

Über das Argument `expr` kann auch eine Bedingung als boolesche Operation spezifiziert werden.

Mit wird die Exekution fortgeführt.

Mit wird der browser beendet.

Tidyverse

[Packages](#) [Blog](#) [Learn](#) [Help](#) [Contribute](#)



R packages for data science

The tidyverse is an opinionated **collection of R packages** designed for data science. All packages share an underlying design philosophy, grammar, and data structures.

Install the complete tidyverse with:

```
install.packages("tidyverse")
```

Learn the 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

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

pipes

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).



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.



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

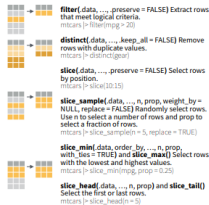


ungroup() (x, ...) Returns ungrouped copy of table.
g_mtcars = mtcars %>% group_by(cyl)
ungroup(g_mtcars)

Manipulate Cases

EXTRACT CASES

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



Logical and boolean operators to use with filter()

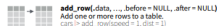
==	<	<=	is.na()	%in%		xor()
!=	>	>=	!is.na()	!	&	

See [7base::Logic](#) and [7base::Comparison](#) for help.

ARRANGE CASES



ADD CASES



Manipulate Variables

EXTRACT VARIABLES

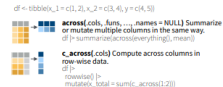
Column functions return a set of columns as a new vector or table.



Use these helpers with select() and across()

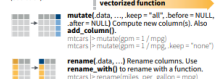
e.g. mtcars >-> select(mpg:cyl)
contains() **num_range()** **range()** **starts_with()** **ends_with()** **all_of()** **any_of()** **matches()** **everything()**
i.e. mpg:cyl
vars 1.e.g. log
mtcars >-> select(matches("mpg"), everything())

MANIPULATE MULTIPLE VARIABLES AT ONCE



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).



Datenvorverarbeitung mit dplyr

```
D <- read.table("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

Datenvorverarbeitung mit dplyr

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

Mit der R-Funktion mutate() können wir neue Spalten erzeugen (auch als Funktionen bestehender Spalten).

```
library(dplyr)
n <- nrow(D)
D_processed <- D %>%
  mutate(ID = seq(n)) %>%
  mutate(Summe = Variable_1 + Variable_2 + Variable_3)
```

Anzahl Beobachtungen
D wird an nächste Funktion übergeben
ID-Spalte hinzufügen
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

Datenvorverarbeitung mit dplyr

Mit der R-Funktion `filter()` können wir 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

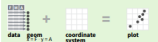
Plotten mit ggplot2

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.



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



Complete the template below to build a graph.

```
ggplot (data = DATA) +  
  GEOM FUNCTION (aes(mapping)) +  
  SCALE (geom, position = POSITION) +  
  COORDINATE FUNCTION +  
  THEME FUNCTION
```

ggplot(data = mpg, aes(x = cty, y = hwy)) Begins a plot that you finish by adding layers. 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", "RRRRGGG")
linetype - integer or string (0 = "blank", 1 = "solid", 2 = "dashed", 3 = "dotted", 4 = "longdash", 5 = "longdash", 6 = "twodash")

size - integer (line width in mm)

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



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(waals, aes(x = long, y = lat))

a = **geom_blank()** and a = **expand_limits()** ensure limits include values across all plots.

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

a = **geom_path()**(aes(x = long, y = lat, linetype = "round", linetype = 2))
x, y, alpha, color, group, linetype, size

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

b = **geom_rect()**(aes(xmin = long, ymin = lat, xmax = long + 2, ymax = lat + 2)) - xmin, ymin, ymax, xmin, 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))
x, y, alpha, color, fill, linetype, size

b = **geom_spoke()**(aes(angle = 1:155, radius = 1))
x, y, alpha, color, fill, group, linetype, size

ONE VARIABLE continuous

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

a = **geom_area()**(aes(x = long, y = lat))
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, fill, group, linetype, size

c = **geom_histogram()**(aes(x = long, y = lat))
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(class))

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

TWO VARIABLES both continuous

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

a = **geom_label()**(aes(label = cty, nudges = 1, nudges = 2)) - x, y, label, alpha, angle, color, family, fontface, hjust, linetype, 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()**(aes(x = "lat"))
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, nudges = 1, nudges = 2)) - x, y, label, alpha, angle, color, family, fontface, hjust, linetype, 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, xmin, alpha, color, fill, group, linetype, shape, size, weight

f = **geom_dotplot()**(aes(x = "cty", 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(carat, color))

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

g = **geom_jitter()**(width = 2, width = 2)
x, y, alpha, color, fill, shape, size

THREE VARIABLES

h <- ggplot(diamonds, aes(carat, log2(carat), lat2))
i <- ggplot(seals, aes(long, lat))

i = **geom_contour()**(aes(z = ct))
x, y, alpha, color, group, linetype, size, weight

i = **geom_contour_filled()**(aes(fill = ct))
x, y, alpha, color, fill, group, linetype, size, subgroup

continuous bivariate distribution

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

h = **geom_bin2d()**(binsize = 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 = "bw")
x, y, alpha, color, group, linetype, size

visualizing error

d <- data.frame(g = c("A", "B"), ft = 4.5, se = 1.2)
j <- ggplot(d, aes(g, ft, ymin = ft - se, ymax = ft + se))

j = **geom_cransford()** - x, y, ymax, xmin, alpha, color, fill, group, linetype, size

j = **geom_errorbar()** - x, ymax, xmin, alpha, color, group, linetype, size, width

j = **geom_errorbarh()** - x, ymax, xmin, alpha, color, group, linetype, size, width

j = **geom_linerange()**
x, ymin, xmin, 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(f1 = murder))

k = **geom_map()**(aes(map_id = state), map = map)

k = **geom_map()**(aes(fill = mapStat), map_id = alpha, color, fill, linetype, size)

Plotten mit ggplot

Beispieldatensatz

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

# Daten vorbereiten
D <- read.table("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

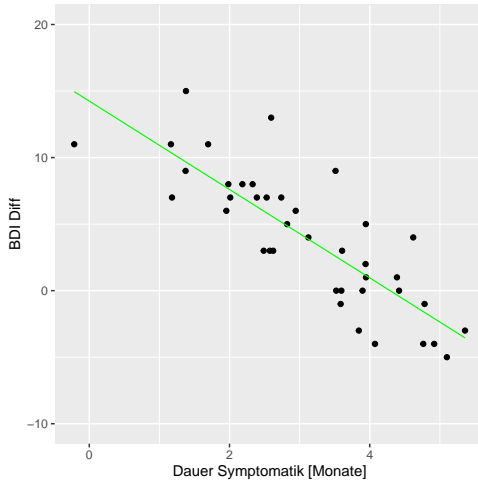
Plotten mit ggplot

```
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
)
```

Plotten mit ggplot



R Tools

Quarto

Zotero

Welcome to Quarto

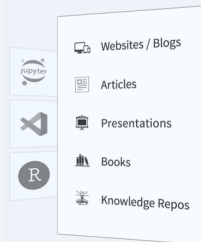
An open-source scientific and technical publishing system

- 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



[Quarto Website](#)

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.

Installation von Quarto

Get Started

Tutorial: Hello, Quarto
Tutorial: Computations
Tutorial: Authoring

Get Started

Install Quarto, then check out the tutorials to learn the basics.

Step 1

Install Quarto

Find your operating system in the table below


Platform	Download	Size	SHA-256
Ubuntu 18+/Debian 10+	quarto-1.4.554-linux-amd64.deb	111.82 MB	7b57d62
Linux x86 Tarball	quarto-1.4.554-linux-amd64.tar.gz	113.04 MB	f0d1283f
Linux Arm64	quarto-1.4.554-linux-arm64.deb	112.52 MB	4201e1b
Linux Arm64 Tarball	quarto-1.4.554-linux-arm64.tar.gz	113.6 MB	43c788d
RHEL 7 Tarball	quarto-1.4.554-linux-rhel7-amd64.tar.gz	113.4 MB	7d5264b
Mac OS	quarto-1.4.554-macos.pkg	186.2 MB	ab6a44c
Windows	quarto-1.4.554-win.msi	108.89 MB	f6d281d
Release notes and more downloads...			





Step 2

Choose your tool and get started



Quarto Website Installation


[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 [VSIX 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](#)

Quarto Website Tutorial: VS Code

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
<p>Heading *****</p> <p>Sub-heading -----</p> <p># Alternative heading</p> <p>## Alternative sub-heading</p> <p>Paragraphs are separated by a blank line.</p> <p>Two spaces at the end of a line produce a line break.</p>	<pre><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></pre>	<p>Heading</p> <p>Sub-heading</p> <p>Alternative heading</p> <p>Alternative sub-heading</p> <p>Paragraphs are separated by a blank line.</p> <p>Two spaces at the end of a line produce a line break.</p>
<p>Text attributes <i>_italic_</i>, **bold**, <code>'monospace'</code>.</p> <p>Horizontal rule:</p> <p>---</p>	<pre><p>Text attributes italic, bold, <code>monospace</code>.</p> <p>Horizontal rule:</p> <hr /></pre>	<p>Text attributes <i>italic</i>, bold, <code>monospace</code>.</p> <p>Horizontal rule:</p> <hr/>

- Ein Softwarepaket zur Vereinfachung von TeX
- TeX ist ein von Donald E. 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 \text{ mit } \varepsilon \sim N(0_n, \sigma^2 I_n)
\end{equation}
das ALM. Dann gilt
\begin{equation}
\upsilon \sim N(\mu, \sigma^2 I_n) \text{ mit } \mu := X\beta \in \mathbb{R}^n.
\end{equation}
\end{theorem}
```



Theorem (Datenverteilung des Allgemeinen Linearen Modells)

Es sei

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

das ALM. Dann gilt

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

- Pandoc ist eine kostenlose Document Conversion Software von John MacFarlane
- Pandoc ist in die Quarto Engine integriert
- Einige von Pandocs Konvertierungsoptionen sind im Folgenden aufgeführt

(← = conversion from; → = conversion to; ↔ = conversion from and to)

Lightweight markup formats

↔ Markdown (including CommonMark and
GitHub-flavored Markdown)
↔ reStructuredText
→ AsciiDoc
↔ Emacs Org-Mode
↔ Emacs Muse
→ Textile
→ Markua
→ txt2tags

HTML formats

↔ (X)HTML 4
↔ HTML5
→ Chunked HTML

Ebooks

↔ EPUB version 2 or 3
↔ FictionBook2

Documentation formats

→ GNU TexInfo
↔ Haddock markup

Roff formats

↔ roff man
→ roff ms

TeX formats

↔ LaTeX
→ ConTeXt

Word processor formats

→ Microsoft Word docx
→ Rich Text Format RTF
↔ OpenOffice/LibreOffice ODT

Interactive notebook formats

↔ Jupyter notebook (ipynb)

Page layout formats


→ InDesign ICML
→ Typst





Wiki markup formats

↔ MediaWiki markup
→ DokuWiki markup
→ TikiWiki markup
→ TWiki markup
↔ Vmwiki markup
→ XWiki markup
→ ZimWiki markup
↔ Jira wiki markup
→ Creole

Slide show formats

→ LaTeX Beamer
→ Microsoft PowerPoint
→ Slidy
→ reveal.js
→ Silex
→ S5
→ DZSlides

 Overview Get Started Guide Extensions Reference Gallery Blog Help



Guide

Authoring

Computations

Tools

Documents

Presentations

Dashboards

Websites

Books

Manuscripts

Interactivity

Publishing

Projects

Advanced

Guide

Comprehensive guide to using Quarto. If you are just starting out, you may want to explore the tutorials to learn the basics.

Authoring

Create content with markdown

Markdown Basics

Figures

Tables

Diagrams

Citations & Footnotes

Cross References

Article Layout

Computations

Execute code and display its output

Using Python

Using R

Using Julia

Using Observable

Execution Options

Parameters

Tools

Use your favorite tools with Quarto

JupyterLab

RStudio IDE

V5 Code

Neovim

Text Editors

Visual Editor

Documents

Generate output in many formats

HTML

PDF

MS Word

Typst

Markdown

All Formats

Presentations

Present code and technical content

Presentation Basics

Reveal.js (HTML)

PowerPoint (Office)

Beamer (PDF)

Dashboards

Publish data with dashboards

Dashboard Basics

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Data Display

Interactivity

Deployment

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Create websites and blogs

Creating a Website

Website Navigation

Creating a Blog

Website Search

Website Listings

Books

Create books and manuscripts

Creating a Book

Book Structure

Book Crossrefs

Customizing Output

Manuscripts

Write and publish notebook-first scholarly articles

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Authoring Manuscripts

Publishing Manuscripts

Using Manuscripts

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Engage readers with interactivity

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Component Layout

Publishing

Publishing documents and sites

Publishing Basics

Quarto Pub

GitHub Pages

Posit Connect

Posit Cloud

Netlify

Confluence

Other Services

Projects

Scale up your work with projects

Project Basics

Managing Execution

Project Profiles

Environment Variables

Project Scripts

Virtual Environments

Quarto Website Guide

Analyse und Dokumentation | © 2024 Belinda Fleischmann CC BY 4.0 | Folie 30

Quarto Beispiel

```
---
title: "Quarto Demonstration"
author: "Belinda Fleischmann"
date: today
format: pdf
---

# Überschrift zu Kapitel 1.

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

{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  $\epsilon \sim N(\mu, \sigma^2 I_n)$  mit
 $\mu := X\beta$  in  $\mathbb{R}^n$  aufschreiben.
```

Quarto Demonstration

Belinda Fleischmann

2024-05-02

Überschrift zu Kapitel 1.

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



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.

- blau
- grün
- rot
- 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 $v \sim N(\mu, \sigma^2 I_n)$ mit $\mu := X\beta \in \mathbb{R}^n$ aufschreiben.

Beispielbericht

Beispielpräsentation

R Tools

Quarto

Zotero

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.

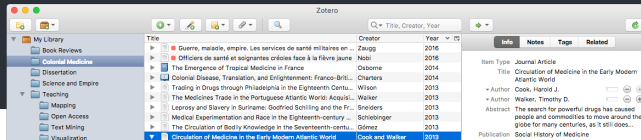
Your personal research assistant

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