

# Einführung in R und RStudio

## [Termine 5 & 6]

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▶ **Termin 1 & 2**

- ▶ Grundlagen
- ▶ Datentypen

▶ **Termin 3 & 4**

- ▶ Objekten
- ▶ Lesen und Schreiben

▶ **Termin 5 & 6**

- ▶ Statistiken
- ▶ Grafiken

▶ **Termin 7 & 8**

- ▶ Fortgeschrittenes Programmieren
- ▶ Erstellen von Dokumenten
- ▶ Abschluss

## Funktion

```
foo(par1 = arg1, ..., parn =  
argn)
```

Funktionen und Argumente (Parameter)  
werden dokumentiert.

Achte auf Standardeinstellungen (default  
values).

```
A <- c(1, NA, 3, 5)
```

```
mean(A)
```

```
## [1] NA
```

```
mean(A, na.rm = TRUE)
```

```
## [1] 3
```

## Matrix

- ▶ Typ von Inhalt (mode()).
- ▶ Zwei Dimensionen.

```
M <- matrix(1:20, nrow = 4)
```

```
M
```

```
##      [,1] [,2] [,3] [,4] [,5]  
## [1,]    1    5    9   13   17  
## [2,]    2    6   10   14   18  
## [3,]    3    7   11   15   19  
## [4,]    4    8   12   16   20
```

```
class(M)
```

```
## [1] "matrix" "array"
```

```
mode(M)
```

```
## [1] "numeric"
```

```
length(M)
```

```
## [1] 20
```

```
dim(M)
```

```
## [1] 4 5
```

## Datensatz

Spaltenorientierte Tabelle  
(data.frame)

```
head(iris)
```

```
##   Sepal.Length Sepal.Width Petal.Length Petal.Width
## 1         5.1         3.5         1.4         0.2
## 2         4.9         3.0         1.4         0.2
## 3         4.7         3.2         1.3         0.2
## 4         4.6         3.1         1.5         0.2
## 5         5.0         3.6         1.4         0.2
## 6         5.4         3.9         1.7         0.2
```

```
str(iris)
```

```
## 'data.frame':    150 obs. of  5 variables:
## $ Sepal.Length: num  5.1 4.9 4.7 4.6 5 5.4
## $ Sepal.Width : num  3.5 3 3.2 3.1 3.6 3.9
## $ Petal.Length: num  1.4 1.4 1.3 1.5 1.4 1.7
## $ Petal.Width : num  0.2 0.2 0.2 0.2 0.2 0.2
## $ Species     : Factor w/ 3 levels "setosa"
```

## Liste

Liste (Sammlung) von Objekten, inklusive Listen.

Achte, dass `data.frame` eine spezielle Form von `list` ist.

```
MeineListe <- list(  
  A = 1:10,  
  B = matrix(1:10, nrow = 2),  
  C = "Dies ist eine Liste")  
MeineListe  
  
## $A  
## [1] 1 2 3 4 5 6 7 8 9 10  
##  
## $B  
##      [,1] [,2] [,3] [,4] [,5]  
## [1,]    1    3    5    7    9  
## [2,]    2    4    6    8   10  
##  
## $C  
## [1] "Dies ist eine Liste"
```

# CRAN

(Comprehensive R Archive Network)

- ▶ `install.packages()`
- ▶ `update.packages()`

```
install.packages("ade4")
update.packages(ask = FALSE)
```

<https://cran.r-project.org/>

Available CRAN Packages By Name

ABCDEFGHIJKLMNOPQRSTUVWXYZ

A3  
AATools  
ABACUS  
abbreviate  
abbyyR  
abc  
abc.data  
ABC.RAP  
abcADM  
ABCanalysis  
abclass  
ABCoptim  
ABCP2  
abcrf  
abcrda  
abctools  
abd  
abdiv  
abe  
abess  
abglasso  
ABHgenotypeR  
abind  
abjData  
abjutils  
abmR  
abn  
abnormality  
abodOutlier  
ABPS  
abstr  
abstractr  
abtest  
abundant  
Ac3net  
ACA  
academictwitterR

Accurate, Adaptable, and Accessible Error Metrics for Predictive Models  
Reliability and Scoring Routines for the Approach-Avoidance Task  
Apps Based Activities for Communicating and Understanding Statistics  
Readable String Abbreviation  
Access to Abbyy Optical Character Recognition (OCR) API  
Tools for Approximate Bayesian Computation (ABC)  
Data Only: Tools for Approximate Bayesian Computation (ABC)  
Array Based CpG Region Analysis Pipeline  
Fit Accumulated Damage Models and Estimate Reliability using ABC  
Computed ABC Analysis  
Angle-Based Large-Margin Classifiers  
Implementation of Artificial Bee Colony (ABC) Optimization  
Approximate Bayesian Computational Model for Estimating P2  
Approximate Bayesian Computation via Random Forests  
Asymptotically Bias-Corrected Regularized Linear Discriminant Analysis  
Tools for ABC Analyses  
The Analysis of Biological Data  
Alpha and Beta Diversity Measures  
Augmented Backward Elimination  
Fast Best Subset Selection  
Adaptive Bayesian Graphical Lasso  
Easy Visualization of ABH Genotypes  
Combine Multidimensional Arrays  
Databases Used Routinely by the Brazilian Jurimetrics Association  
Useful Tools for Jurimetrical Analysis Used by the Brazilian Jurimetrics Association  
Agent-Based Models in R  
Modelling Multivariate Data with Additive Bayesian Networks  
Measure a Subject's Abnormality with Respect to a Reference Population  
Angle-Based Outlier Detection  
The Abnormal Blood Profile Score to Detect Blood Doping  
R Interface to the A/B Street Transport System Simulation Software  
An R-Shiny Application for Creating Visual Abstracts  
Bayesian A/B Testing  
High-Dimensional Principal Fitted Components and Abundant Regression  
Inferring Directional Conservative Causal Core Gene Networks  
Abrupt Change-Point or Aberration Detection in Point Series  
Access the Twitter Academic Research Product Track V2 API Endpoint

## devtools

- ▶ `install()`
- ▶ `install_github()`

<https://ropensci.org/>

devtools 2.4.5   Reference   Articles ▼   News ▼



devtools

The aim of devtools is to make package development easier by providing R functions that simplify and expedite common tasks. [R Packages](#) is a book based around this workflow.

### Installation

```
# Install devtools from CRAN
install.packages("devtools")

# Or the development version from GitHub:
install.packages("devtools")
devtools::install_github("r-lib/devtools")
```



- ▶ readLines()
- ▶ read.table()
  - ▶ read.csv()
  - ▶ read.csv2()

```
Bonn2021 <- read.csv("Bevoelkerung-2021.csv")  
str(Bonn2021)
```

```
## 'data.frame':    67 obs. of  13 variables:  
## $ BezirkNr      : int  110 111 112 113 114 115 1  
## $ BezirkName    : chr  "Zentrum-Rheinviertel" "Z  
## $ Gesamt        : int  2343 3161 6768 8906 5157  
## $ DichteKm2     : int  6508 6585 11874 16193 433  
## $ Maenner       : int  1166 1537 3189 4575 2481  
## $ MaennerProzent : num  49.8 48.6 47.1 51.4 48.1  
## $ Frauen        : int  1177 1624 3579 4331 2675  
## $ FrauenProzent  : num  50.2 51.4 52.9 48.6 51.9  
## $ Zuwanderer    : int  753 1092 1762 2732 1873 2  
## $ ZuwandererProzent : num  32.1 34.5 26 30.7 36.3 35  
## $ Auslaender    : int  494 813 1145 2010 1235 12  
## $ AuslaenderProzent : num  65.6 74.5 65 73.6 65.9 55  
## $ AuslaenderProzent2: logi  NA NA NA NA NA NA ...
```

- ▶ readLines()
- ▶ read.table()
  - ▶ read.csv()
  - ▶ read.csv2()
  
- ▶ write.table()
  - ▶ write.csv()
  - ▶ write.csv2()

```
write.csv(iris, file = "iris.csv")  
write.csv2(iris, file = "iris2.csv")
```

Pakete können eigene Funktionen für Importieren und Exportieren anbieten.

### ▶ **xlsx**

- ▶ `read.xlsx()`
- ▶ `write.xlsx()`

### ▶ **readODS**

- ▶ `read_ods()`
- ▶ `write_ods()`

## R Data Import/Export

This is a guide to importing and exporting data to and from R.

This manual is for R, version 4.3.0 Under development (2022-10-23).

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## R-Images

- ▶ Workspace
  - ▶ `save()`
  - ▶ `load()`
  - ▶ Dateierweiterung **.rda** oder **.RData**
- ▶ Einzelnes Objekt
  - ▶ `saveRDS()`
  - ▶ `readRDS()`
  - ▶ Dateierweiterung **.rds**

# Vielen Dank!

```
library(fortunes)  
fortune(10)
```

```
##  
## Overall, SAS is about 11 years behind R and S-Plus in statistical capabilities  
## (last year it was about 10 years behind) in my estimation.  
## -- Frank Harrell (SAS User, 1969-1991)  
## R-help (September 2003)
```