Bayesian Statistics and Hierarchical Bayesian Modeling for Psychological Science

Lecture 02

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https://github.com/lei-zhang/BayesCog_Wien

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Bayesian warm-up?

BASICS OF R PROGRAMMING

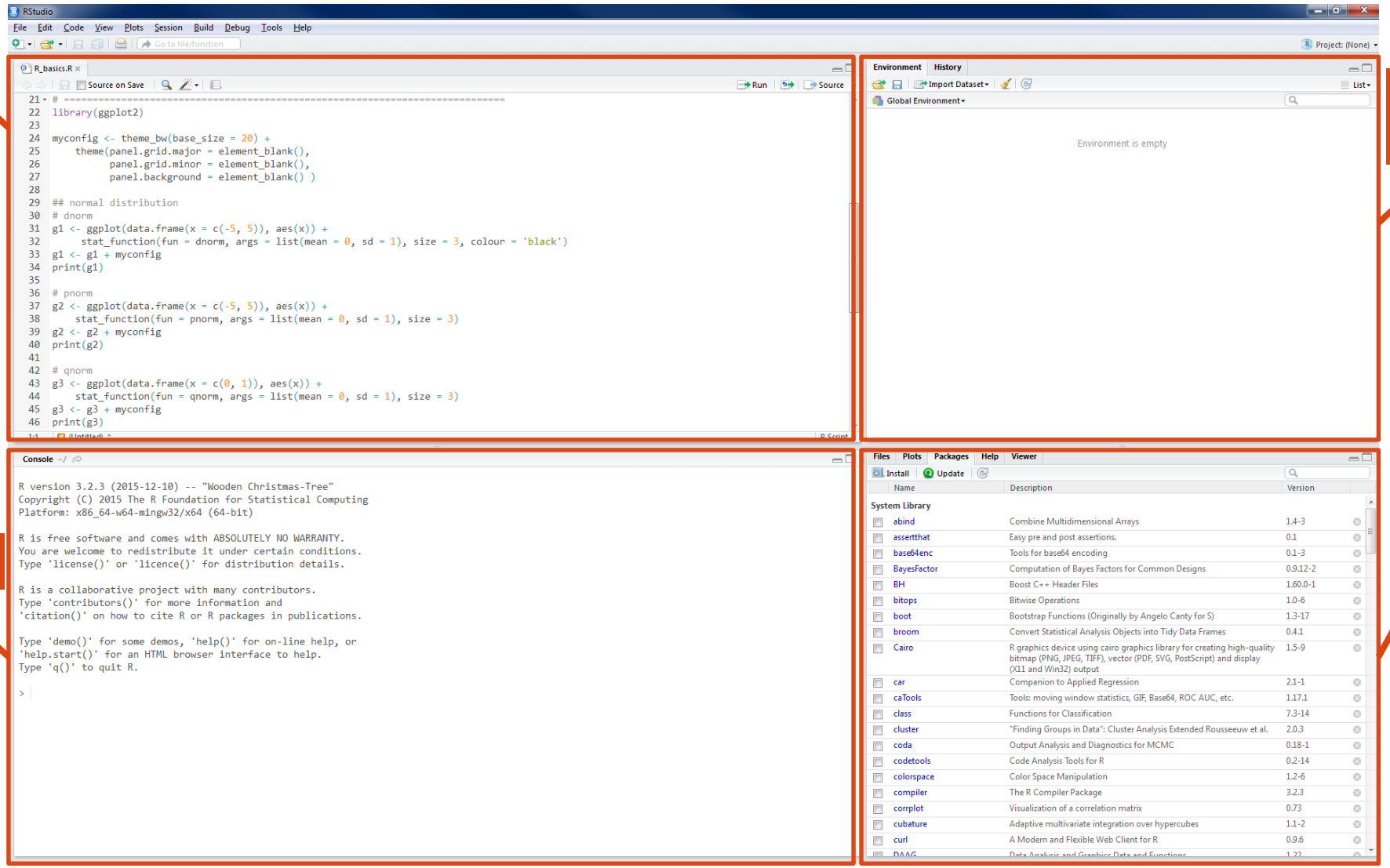
RStudio®

R Basics

- R
  - a programming language for statistical computing
  - R has its own user interface
  - freely available on Windows, Mac, and Linux

- R Studio
  - integrated development environment (IDE) for R
  - a more sophisticated R-friendly editor, with helpful syntax highlight

script editor



console

environment/
command history

file/pkg/img/
etc.

Know your R

```
>R.version

               _
platform       x86_64-w64-mingw32
arch           x86_64
os             mingw32
system         x86_64, mingw32
status
major          3
minor          5.1
year           2018
month          07
day            02
svn rev        74947
language       R
version.string R version 3.5.1 (2018-07-02)
nickname       Feather Spray
```

R Console as a Calculator

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Addition and Subtraction

```
> 3+2
[1] 5

> 3-2
[1] 1
```

Multiplication and Division

```
> 3*2
[1] 6

> 3/2
[1] 1.5
```

Exponents in R

```
> 3^2
[1] 9

> 2^3
[1] 8
```

Constants in R

```
> pi
[1] 3.141593

> exp(1)
[1] 2.718282
```

base of the natural logarithm

Special values

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Infinite Values

```
> Inf
[1] Inf

> 1+Inf
[1] Inf
```

Empty Values

```
> NULL
NULL

> 1+NULL
numeric(0)
```

Machine Epsilon

```
> .Machine$double.eps
[1] 2.220446e-16

> 0>.Machine$double.eps
[1] FALSE
```

Missing Values

```
> NA
[1] NA

> 1+NA
[1] NA
```

Storing and manipulating variables

Define objects `x` and `y` with values of 3 and 2, respectively:

```
> x=3
> y=2
```

Some calculations with the defined objects `x` and `y`:

```
> x+y
[1] 5

> x*y
[1] 6
```

Warning: R is case sensitve, so `x` and `X` are not the same object.

Basic R functions

Combine

```
> c(1,3,-2)
[1]  1  3 -2

> c("a","a","b","b","a")
[1] "a" "a" "b" "b" "a"
```

Variance and Std. Dev.

```
> var(c(1,3,-2))
[1] 6.333333

> sd(c(1,3,-2))
[1] 2.516611
```

Sum and Mean

```
> sum(c(1,3,-2))
[1] 2

> mean(c(1,3,-2))
[1] 0.6666667
```

Minimum and Maximum

```
> min(c(1,3,-2))
[1] -2

> max(c(1,3,-2))
[1] 3
```

Basic R functions (cont.)

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Define objects `x` and `y`:

```
> x=c(1,3,4,6,8)
> y=c(2,3,5,7,9)
```

Calculate the correlation:

```
> cor(x,y)
[1] 0.988765
```

Calculate the covariance:

```
> cov(x,y)
[1] 7.65
```

Combine as columns

```
> cbind(x,y)
     x y
[1,] 1 2
[2,] 3 3
[3,] 4 5
[4,] 6 7
[5,] 8 9
```

Combine as rows

```
> rbind(x,y)
  [,1] [,2] [,3] [,4] [,5]
x    1    3    4    6    8
y    2    3    5    7    9
```

Basic Commands

```
getwd()
setwd('E:/teaching/BayesCog_Wien/')
dir() # folders/files in the wd
ls()  # anything in the environment/workspace
print('Hello World!')
cat('Hello', 'World!')
paste0('C:/', 'Group1')
help(func)
? func # and Google!
a <- 5
a = 5
head(d) # first 6 entries
tail(d) # last 6 entries
save(varname, file = "pathname/varname.RData")
load("pathname/varname.RData")
rm(list = ls())
q()
```

RStudio - Shortcuts

Ctrl + L: clean console

Ctrl + Shift + N: create a new script

↑: command history

Ctrl(hold) + ↑: command history with certain starts

Ctrl + Enter: execute selected codes (in a script)

Editor (WIN general) - Shortcuts

Ctrl + home/Pos: go to the very top of a script

Ctrl + end/Ende: go to the very end of a script

Shift(hold) + ↑/↓: select line(s)

Ctrl(hold) + ←/→: select word(s)

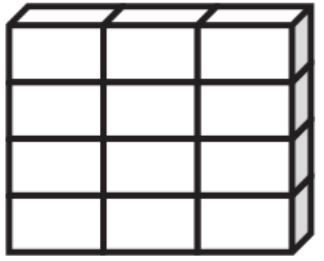
Data Classes


```
numeric: 1.1 2.0
integer: 1 2 3
character / string: "hello world!"
logical: TRUE FALSE
factors: "male" / "female"
(complex: 1+2i)
```

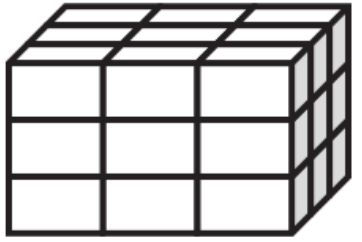
Data Types

(a) Vector

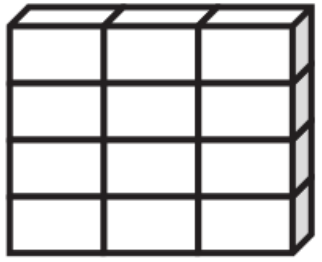
(b) Matrix



(c) Array



(d) Data frame



Columns can be different modes

(e) List

- Vectors
- Arrays
- Data frames
- Lists

Kabacoff (2015)

Exercise I

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…/01.R_basics/_scripts/R_basics.R

up to “Control Flow”

TASK: practise basic R commands and data type

TIP: `class()`, `str()`

Side note: folder structure

click this to start each exercise,
then no need to set directory