Introduction to R, Rstudio & Project Management

Berry Boessenkool, uni-potsdam.de, May 2017

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github.com/brry

swc-bb.github.io/2017-05-17-r-workshop

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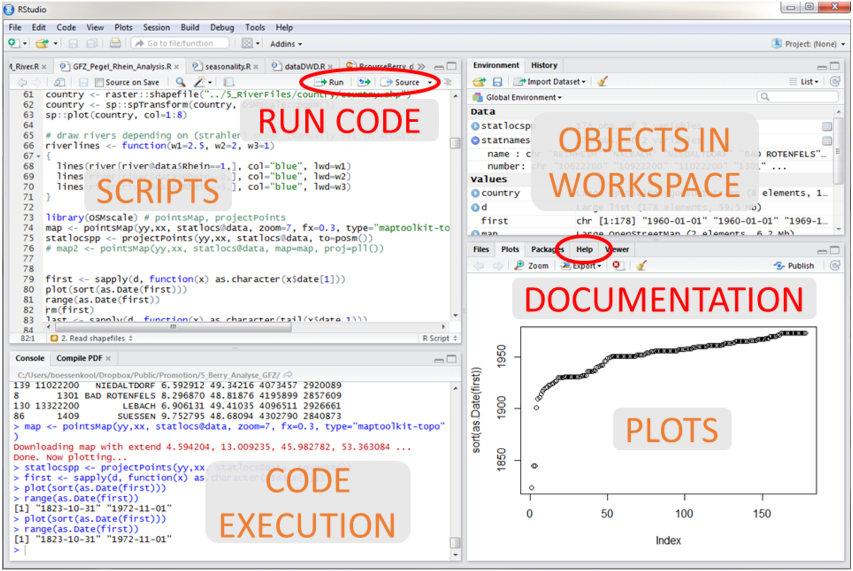
Survey

knowledge survey to determine focus for this session

bit.ly/knowR

RStudio



```
country <- raster::shapefile("../5_RiverFiles/country/country.shp")
country <- sp::spTransform(country, OSMscale::posm())
sp::plot(country, col=1:8)

# draw rivers depending on (strahler) order (manually set in ArcGIS)
riverlines <- function(w1=2.5, w2=2, w3=1)
{
  lines(river[river@data$Rhein==1,], col="blue", lwd=w1)
  lines(river[river@data$Rhein==2,], col="blue", lwd=w2)
  lines(river[river@data$Rhein==3,], col="blue", lwd=w3)
}

library(OSMscale) # pointsMap, projectPoints
map <- pointsMap(yy,xx, statlocs@data, zoom=7, fx=0.3, type="maptoolkit-to
statlocspp <- projectPoints(yy,xx, statlocs@data, to=posm())
# map2 <- pointsMap(yy,xx, statlocs@data, map=map, proj=pll())


first <- sapply(d, function(x) as.character(x$date[1]))
plot(sort(as.Date(first)))
range(as.Date(first))
rm(first)
last <- sapply(d, function(x) as.character(tail(x$date,1)))
```

```
C:/Users/boessenkool/Dropbox/Public/Promotion/5_Berry_Analyse_GFZ/
139 11022200   NIEDALTDORF 6.592912 49.34216 4073457 2920089
8       1301 BAD ROTENFELS 8.296870 48.81876 4195899 2857609
130 13322200        LEBACH 6.906131 49.41035 4096511 2926661
86      1409       SUESSEN 9.752795 48.68094 4302790 2840873
> map <- pointsMap(yy,xx, statlocs@data, zoom=7, fx=0.3, type="maptoolkit-topo"
)
Downloading map with extend 4.594204, 13.009235, 45.982782, 53.363084 ...
Done. Now plotting...
> statlocspp <- projectPoints(yy,xx, statlocs@data, to=posm())
> first <- sapply(d, function(x) as.character(x$date[1]))
> plot(sort(as.Date(first)))
> range(as.Date(first))
[1] "1823-10-31" "1972-11-01"
> plot(sort(as.Date(first)))
> range(as.Date(first))
[1] "1823-10-31" "1972-11-01"
> 
```

```
Data
statlocspp      178 obs. of 2 variables
statnames       178 obs. of 2 variables
  name : chr "REINHEIM" "NALBACH" "NIEDALTDORF" "BAD ROTENFELS"…
  number: chr "10622200" "10922200" "11022200" "1301" ...
Values
country         Large SpatialPolygonsDataFrame (8 elements, 1…
d               Large list (178 elements, 59.5 Mb)
first           chr [1:178] "1960-01-01" "1960-01-01" "1969-1…
map             Large OpenStreetMap (2 elements, 6.2 Mb)
```

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keyboard shortcuts (ALT+SHIFT+K)

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Recommended settings for reproducible research under
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Tools - Global Options - Code - Display
ON: Show margin (Margin column:80) *People hate horizontal scrolling!*

Tools - Global Options - Code - Saving
Line ending conversion: **Windows (CR/LF)**

Assignments

- objects: assignment with $<-$

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nstudents <- 15
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- comments: `# everything after a hashtag is not executed.`

Exercise

- Open Rstudio, start new script. Write comments about what you do, save the file in a useful place.
- Calculate 21+21 , 7*6 and $\frac{0{,}3}{4} * \sqrt{313600}$
- Is `0.5 - 0.2` equal to `0.3`? Is `0.4 - 0.1` equal to `0.3`?
- With the `c` command, create a vector with body sizes of people around you. You can also use the values 1.75, 1.76, 1.83, 1.84, 1.77, 1.76, 1.77, 1.66, 1.86, 1.76
- What does `3:6` create? What does `YourObject[3:6]` do?
- What does `YourObject[-4]` do?
- BONUS (for fast people): Analyze the descriptive statistics: `mean(YourObject), median, min, max, range, quantile`
- BONUS 2: Generate 150 random numbers from a normal distribution with $\mu = 170cm$ and $\sigma = 8cm$. Perform a Kolmogorov-Smirnov test for normality of that sample.

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```
treesize <- read.table(file="treesize.txt", header=TRUE)
```

Objects

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- To make sure your script is reproducible (you may rename objects, for example, and miss one occurrence):
  restart R (`CTRL` + `SHIFT` + `F10`) every once in a while (Make sure Rstudio settings are reproducible as shown on slide 4).

Overview: data types

In order of coercion (if mixed, TRUE is converted to 1, 3.14 to "3.14" etc)

Description	example	`typeof`	`class`
empty set	NULL	NULL	NULL
not available	NA	logical	logical
logical	c(T, F, FALSE, TRUE)	logical	logical
category	factor("left")	integer	**factor**
integer number	4:6	integer	integer
decimal	8.7	double	**numeric**
complex	5+3i	complex	complex
character string	"homer rocks"	character	character
time	Sys.time()	double	**POSIXct**
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Overview: Object types

Object	example	`typeof`	`class`
vector	*see data types*	...	...
matrix	matrix(9:15, ncol=2)	...	matrix
array	array(letters[1:24], dim=c(2,6,4))	...	array
data.frame	data.frame(C1=4:5, C2=c("a","b"))	list	data.frame
list	list(el1=7:15, el2="big")	list	list
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`as.matrix(Object)` converts the class of an object by force.

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- Rarely needed: `remove.packages("packagename")`

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- Briefly explain the `summary` of the linear model.

Objects: data.frames

- For tables with different data types (numbers, characters, categories, integers), R has the object type data.frame: `data.frame(count=c(2,6,5), type=c("a","k","k"))`
- `read.table` also returns a data.frame
- If we have the object `df`, we can subset with `df[rows,columns]`
- `df[1,2:4]; df[2, ]; df[ ,"name"]; df$name`
- Logical values: `vect[c(TRUE,TRUE,FALSE,FALSE,TRUE,FALSE)]`

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From the dataset `treesize` from the previous exercise, obtain:

- The first 5 values in column 2
- The maximum "Height" (the maximum of the values in that column)
- For each entry: is the measurement equal to (==) A?
- BONUS 1: The height entries for trees older than 23.5 years
- BONUS 2: All rows, excluding rows 3, 7,8,9,...,20