

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

# Quick high quality maps with R

Jan-Philipp Kolb

July 7 2021

# Motivation

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb



**Jan-Philipp Kolb** @JanPhilippKolb · 9. Nov. 2020

...

My Day9 #30daymapchallenge. A monochrome map of #Trier in Germany. I made this map with the #rstats #osmplotr package.



23



# About the tutorial

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Organisation

- Four sections with each 20 min presentation and 10 minutes testing time for you

## Sections

- ① Focus on quick maps - some classics
- ② Data sources and structures
- ③ Openstreetmap
- ④ OSM maps with R

# Hello World

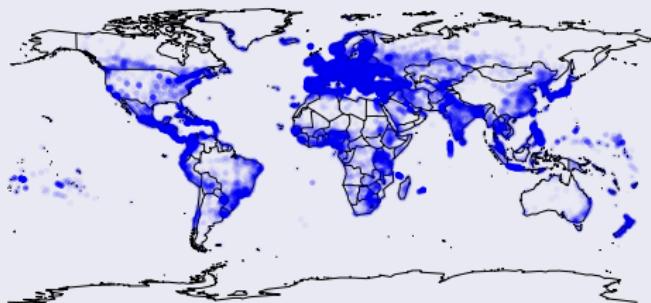
Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## A classic - the `maps` package

- `maps` package by Richard A. Becker, Allan R. Wilks and Ray Brownrigg

```
library(maps)
data(world.cities)
map()
map.cities(world.cities, col=rgb(0,0,1,.05), cex=2,
           pch=20)
```

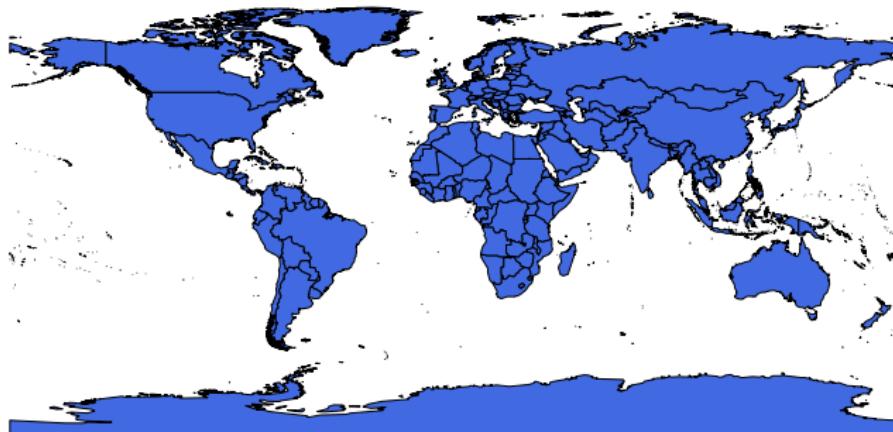


## A second classic - maptools package

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

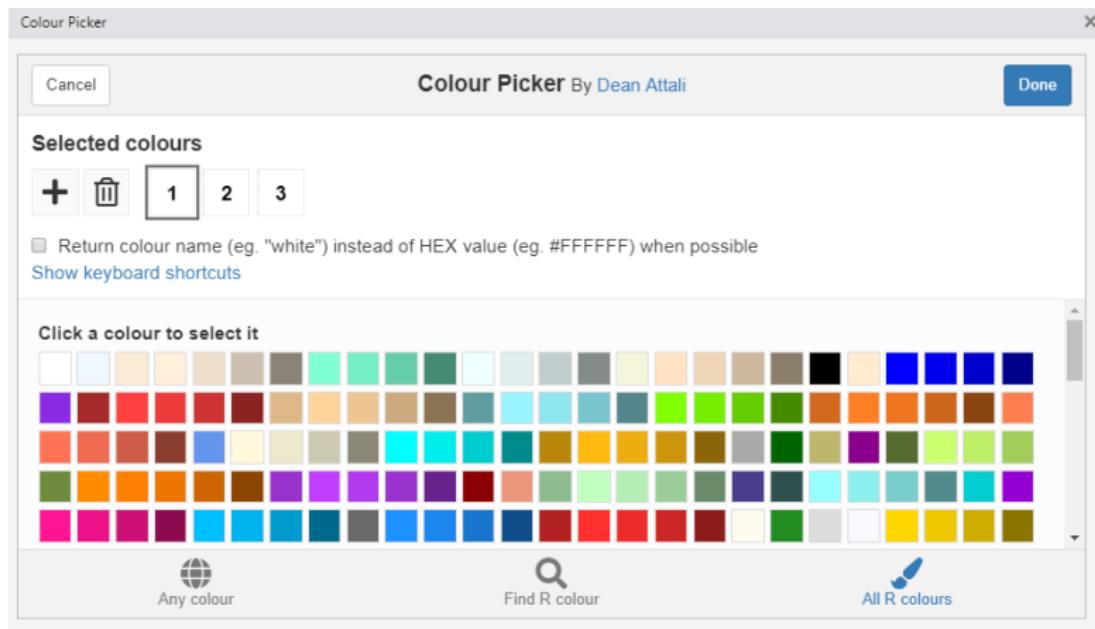
```
library(maptools)
data("wrld_simpl")
plot(wrld_simpl,col="royalblue")
```



# Colour picker

Quick high quality maps with R

Jan-Philipp Kolb

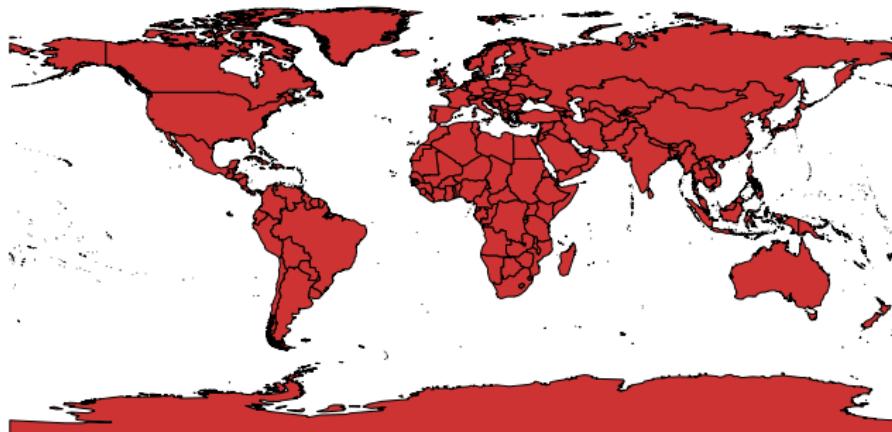


## A second classic - maptools package

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
library(maptools)
data("wrld_simpl")
plot(wrld_simpl,col=c("#CD3333"))
```



# The maptools package

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## wrld\_simpl data

```
head(wrld_simpl@data)
```

Rpubs by RStudio

Show 10 entries

Search:

FIPS	ISO2	ISO3	UN	NAME	AREA	POP2005	REGION	SUBREGION	LON	LAT
ATG	AC	AG	ATG	28 Antigua and Barbuda	44	83039	19	29	-61.783	17.078
DZA	AG	DZ	DZA	12 Algeria	238174	32854159	2	15	2.632	28.163
AZE	AJ	AZ	AZE	31 Azerbaijan	8260	8352021	142	145	47.395	40.43
ALB	AL	AL	ALB	8 Albania	2740	3153731	150	39	20.068	41.143
ARM	AM	AM	ARM	51 Armenia	2820	3017661	142	145	44.563	40.534
AGO	AO	AO	AGO	24 Angola	124670	16095214	2	17	17.544	-12.296
ASM	AQ	AS	ASM	16 American Samoa	20	64051	9	61	-170.73	-14.318

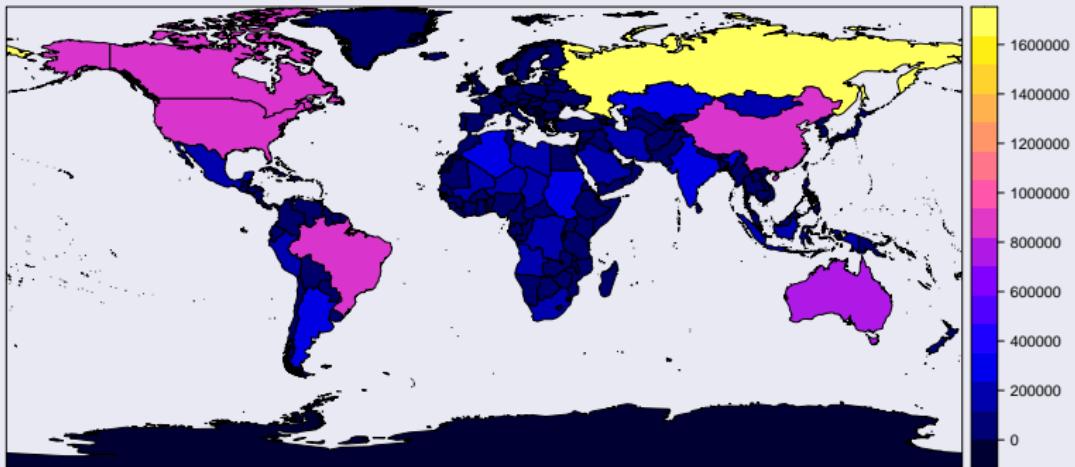
# The sp package

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Classes and Methods for Spatial Data

```
sp::spplot(wrld_simpl, "AREA")
```



# The `qtm` command from the `tmap` package

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Fast thematic map

- With `qtm` you can create a fast thematic map
- Example from the **Vignette** for the `tmap` package

```
library(tmap)  
data(World)  
qtm(World)
```



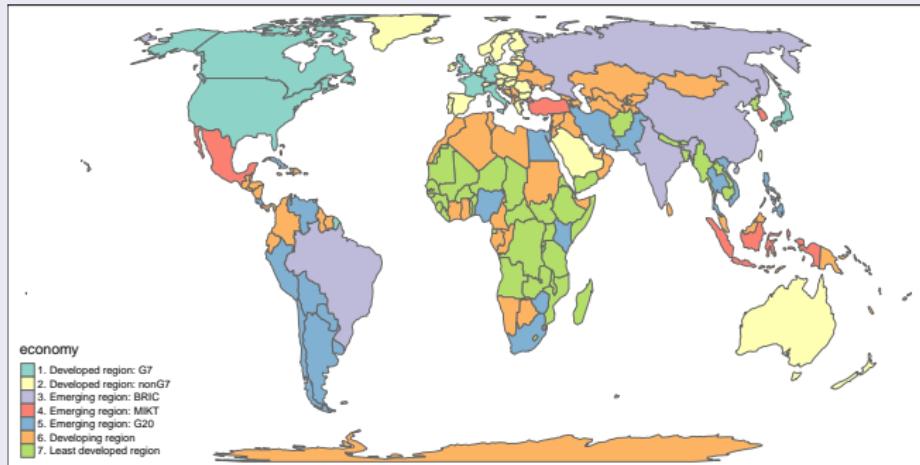
# To get more color in the map

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Economic development status

```
library(tmap)
data(World)
qtm(World, fill="economy")
```



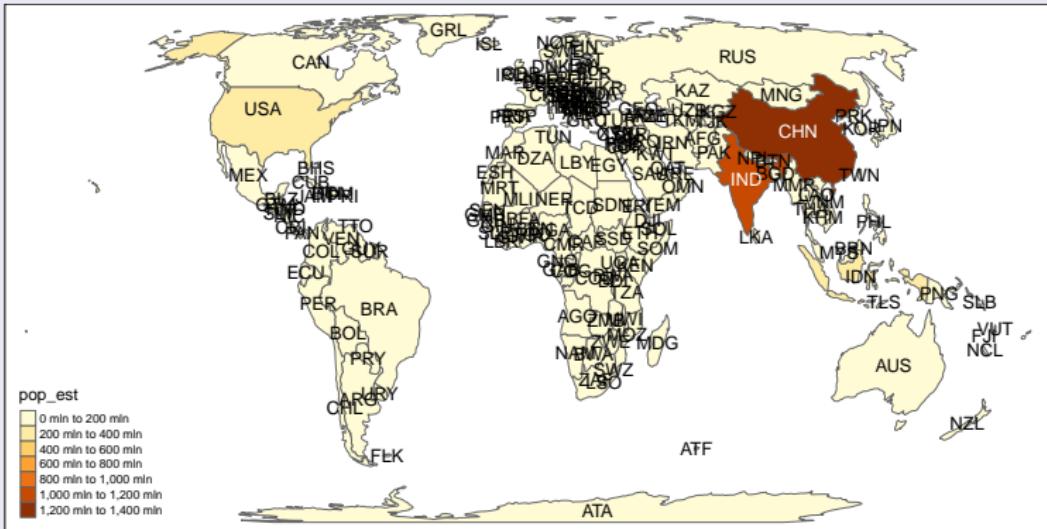
# A map with text

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Population

```
qtm(World, fill="pop_est", text="iso_a3")
```



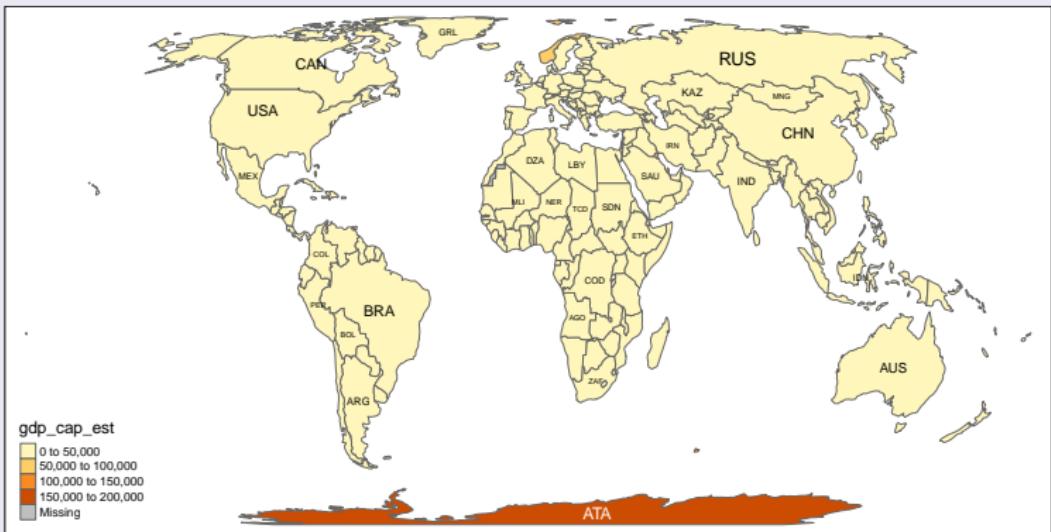
# This Scheme is better:

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## GDP per capita

```
qtm(World, fill="gdp_cap_est", text="iso_a3",  
text.size="AREA")
```

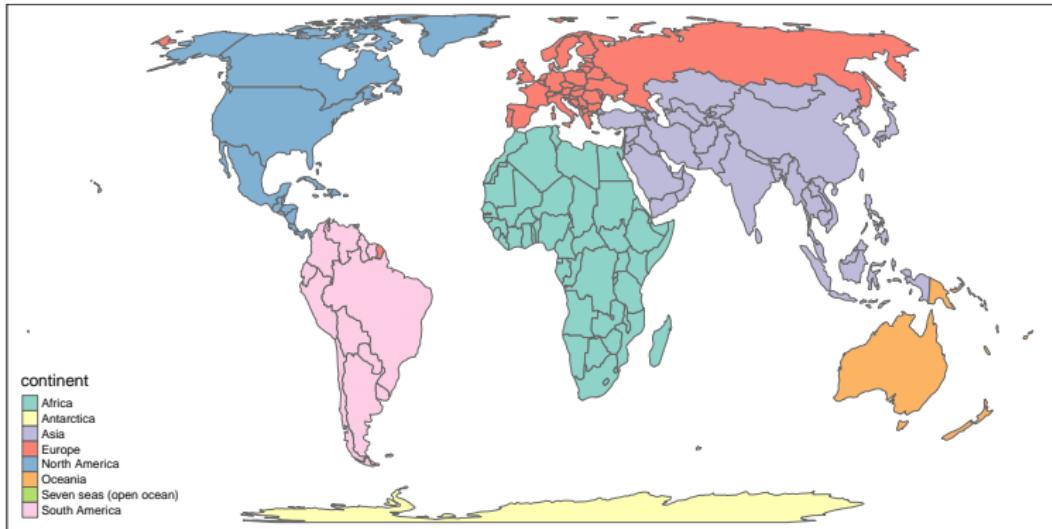


# The variable continent

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
qtm(World, fill="continent")
```

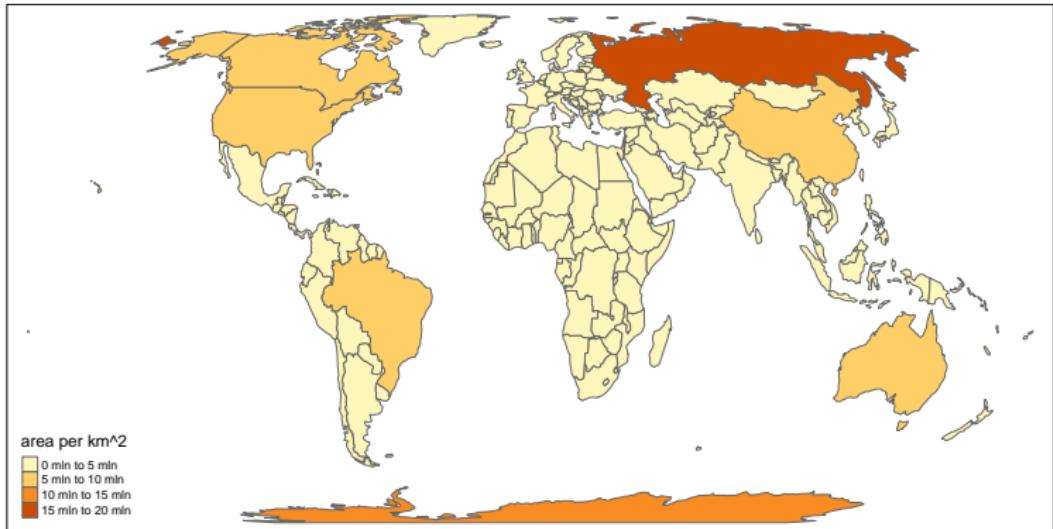


# The variable area

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
qtm(World, fill="area") # Russia is huge
```

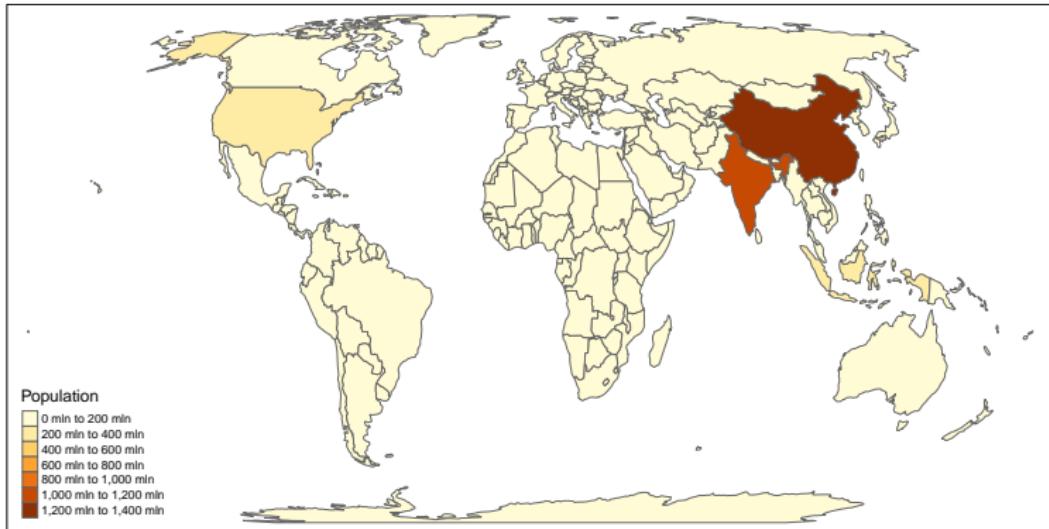


# Population

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
qtm(World, fill="pop_est",fill.title="Population")
```



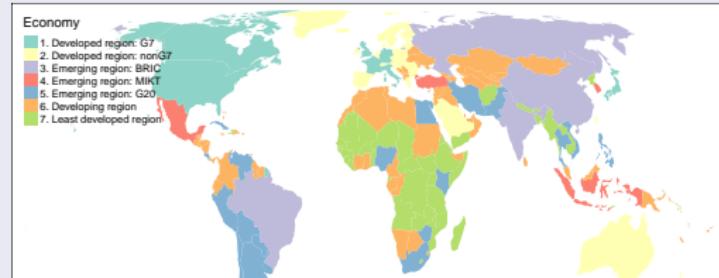
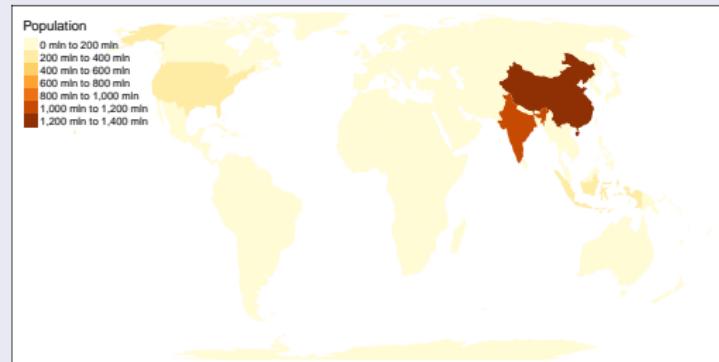
# Two maps

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Population and level of development

```
tm_shape(World) + tm_fill(c("pop_est", "economy"),  
                           title=c("Population", "Economy"))
```

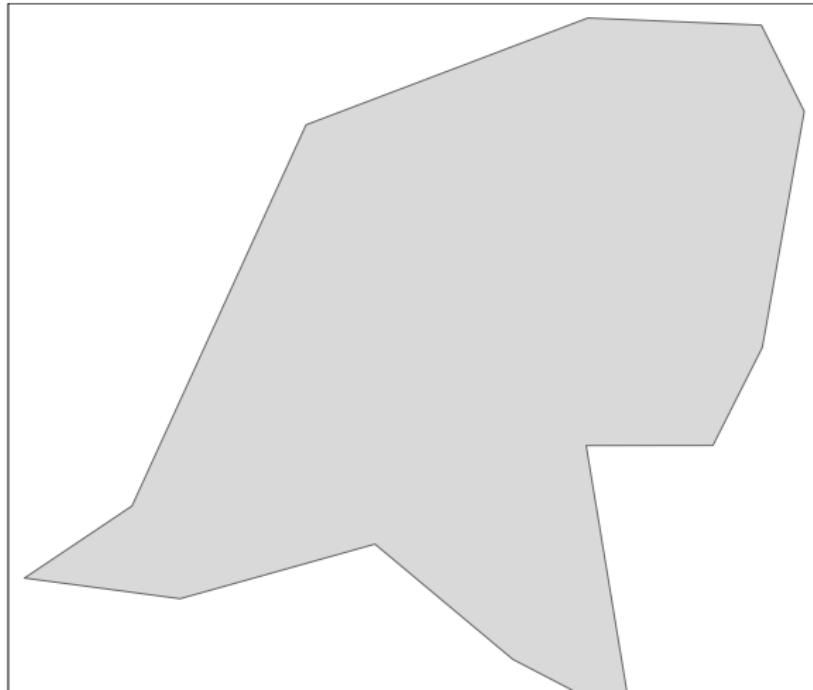


# Map for only one country

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
tm_shape(World[World$name=="Netherlands", ]) +  
  tm_polygons()
```

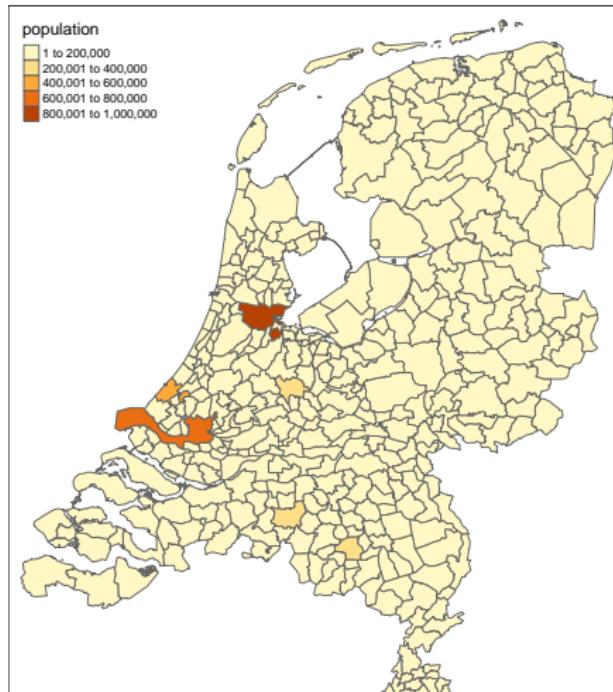


# Population in Dutch municipalities

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
data(NLD_muni)  
qtm(NLD_muni, "population")
```



# About the World dataset

Quick high quality maps with R

Jan-Philipp Kolb

## Natural Earth

- Dataset contains information from **Natural Earth**

```
data(World, package="tmap")
```



# Natural Earth

Free vector and raster map data at  
1:10m, 1:50m, and 1:110m scales

 Search[Home](#)[Features](#)[Downloads](#)[Blog](#)[Forums](#)[Corrections](#)[About](#)

Natural Earth is a public domain map dataset available at 1:10m, 1:50m, and 1:110 million scales. Featuring tightly integrated vector and raster data, with Natural Earth you can make a variety of visually pleasing, well-crafted maps with cartography or GIS software.

# Topics of the World dataset

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Available variables in the data set

- ISO classification
- country name
- Area, population, population density,
- Gross Domestic Product
- Gross domestic product at purchasing power parities
- Economy, income group

## Variables of the World Dataset

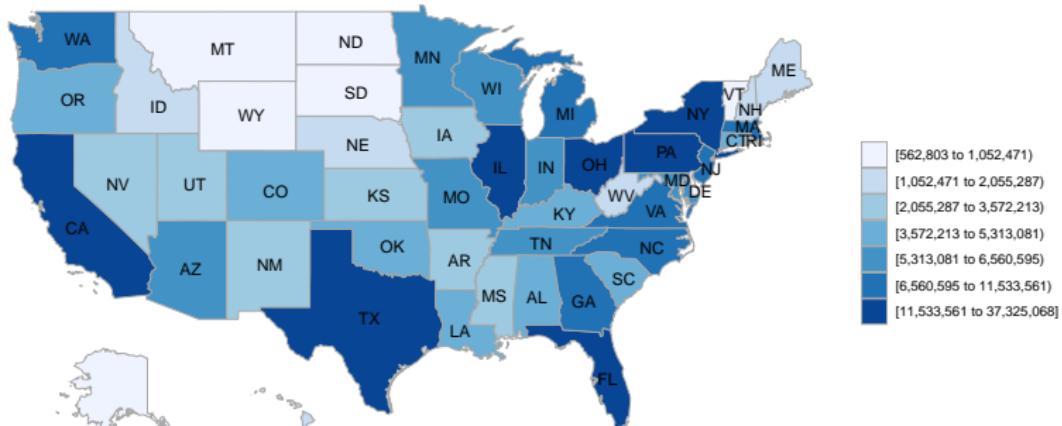
	economy	income_grp	gdp_cap_est	life_exp	well_being	footprint	inequality	HPI
1	7. Least developed region	5. Low income	784.1549	59.668	3.8	0.79	0.4265574	20.22535
2	7. Least developed region	3. Upper middle income	8617.6635	NA	NA	NA	NA	NA
3	6. Developing region	4. Lower middle income	5992.6588	77.347	5.5	2.21	0.1651337	36.76687
4	6. Developing region	2. High income: nonOECD	38407.9078	NA	NA	NA	NA	NA
	geometry							
1	MULTIPOLYGON (((5310471 451...							
2	MULTIPOLYGON (((1531585 -77...							
3	MULTIPOLYGON (((1729835 521...							
4	MULTIPOLYGON (((4675864 313...							

# The package choroplethrMaps

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
library("choroletchr")
library("choroletchrMaps")
data(df_pop_state)
state_choroletch(df_pop_state)
```

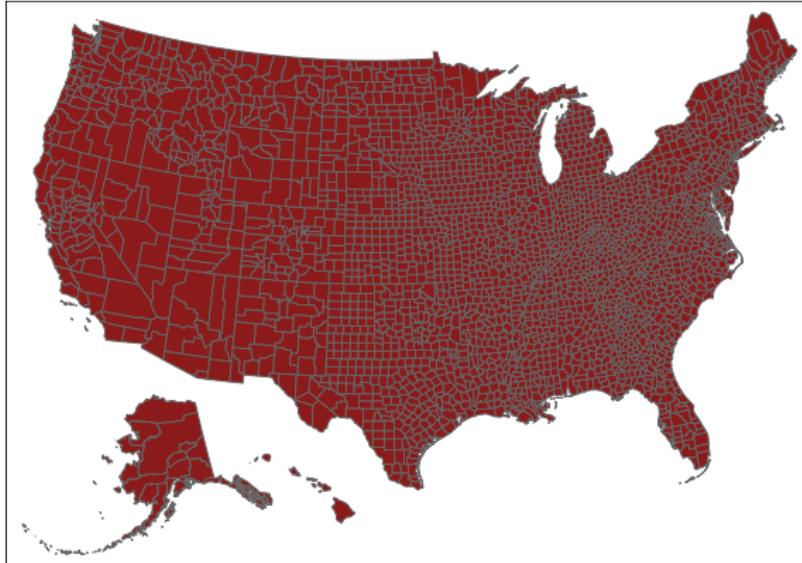


# The package `tidycensus`

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
library(tidycensus)  
data(county_laea)  
  
qtm(county_laea, fill=c("#8B1A1A"))
```

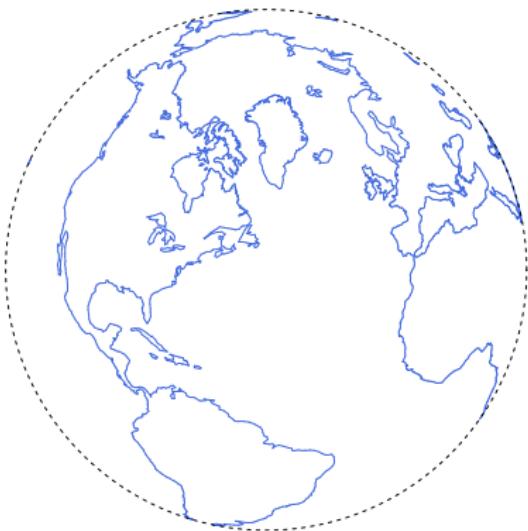


# Coming back to the world

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
library(globe)  
globeearth(eye=place("titanic"), col="royalblue")
```



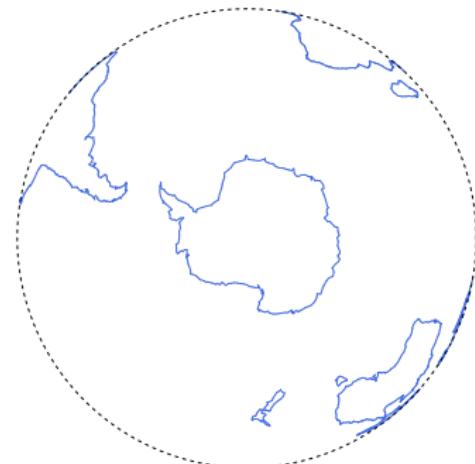
# Available places for globeearth

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

'nedlands', 'curtin', 'perth', 'northpole', 'southpole', 'casey',  
'mawson', 'madrid', 'aarhus', 'aalborg', 'newyorkcity', 'titanic',  
'pyongyang', 'everest', 'kilimanjaro'

```
globeearth(eye=place("southpole"), col="royalblue")
```



# Section 2: Data sources and structures

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Simple Features

`library(sf)`



# Eurostat Data

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
library(dplyr)  
library(ggplot2)
```

## Tools for Eurostat Open Data

```
library(eurostat)
```

```
# Download Geospatial Data from GISCO:  
df60 <- get_eurostat_geospatial(resolution = 60)  
# Same data - less detailed:  
df1 <- get_eurostat_geospatial(resolution = 1)
```

## The dataset

	<a href="#">id</a>	<a href="#">CNTR_CODE</a>	<a href="#">NUTS_NAME</a>	<a href="#">LEVL_CODE</a>	<a href="#">FID</a>	<a href="#">NUTS_ID</a>	<a href="#">geometry</a>	<a href="#">geo</a>
1	BG	BG	БЪЛГАРИЯ	0	BG	BG	[object Object]	BG
2	CH	CH	SCHWEIZ/SUISSE/SVIZZERA	0	CH	CH	[object Object]	CH
3	CY	CY	КУПРОС	0	CY	CY	[object Object]	CY

# A more detailed map of the Netherlands

```
plot(df60[df60$LEVL_CODE == 0 &  
          df60$CNTR_CODE == "NL",1])
```

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb



# NUTS2 of the Netherland

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
CE.sf <- df60 %>%
  filter(LEVL_CODE == 2 &
CNTR_CODE %in% c("NL")) %>%
  select(NUTS_ID)
plot(CE.sf,col=1:12)
```



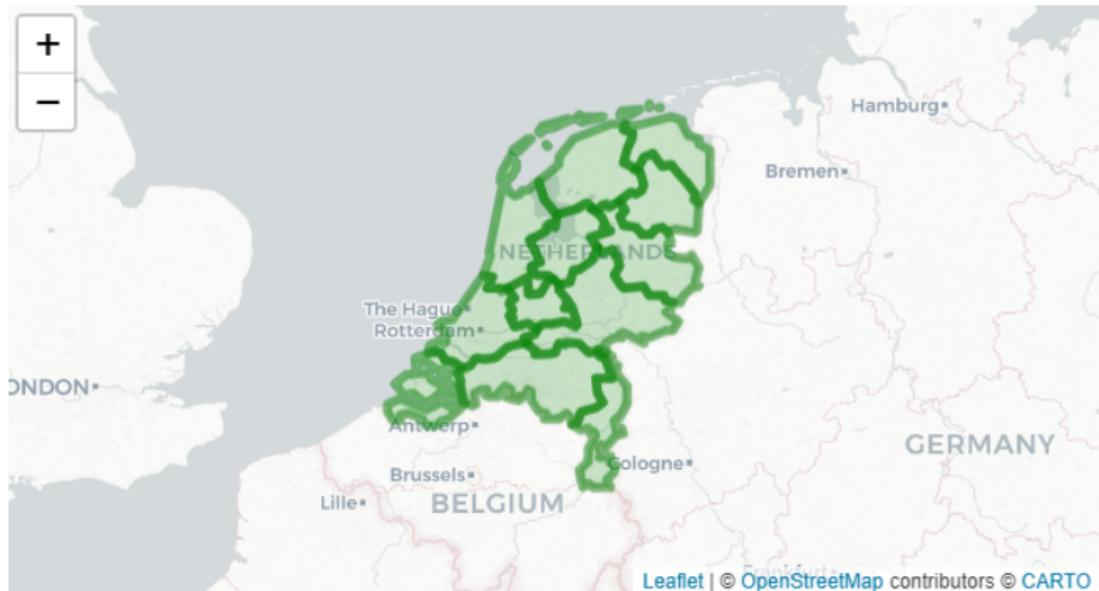
- NUTS 3 is the limit

# An interactive map of the Netherlands

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
library(leaflet)  
leaflet(CE.sf) %>%  
  addProviderTiles("CartoDB.Positron") %>%  
  addPolygons(color = "green")
```



# Simple Feature collection: multipolygon

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Data Structures of df60

```
Simple feature collection with 6 features and 7 fields
geometry type: MULTIPOLYGON
dimension: XY
bbox: xmin: 2.54601 ymin: 34.56908 xmax: 34.56859 ymax: 51.50246
geographic CRS: WGS 84
id CTR_CODE NUTS_NAME LEVL_CODE FID NUTS_ID geometry geo
1 BG BG <U+0411><U+042A><U+041B><U+0413><U+0410><U+0420><U+0418><U+042F> 0 BG BG MULTIPOLYGON (((22.99717 43... BG
2 CH CH SCHWEIZ/SUISSE/SVIZZERA 0 CH CH MULTIPOLYGON (((8.61383 47.... CH
3 CY CY <U+039A><U+03A5><U+03A0><U+03A1><U+039F>S 0 CY CY MULTIPOLYGON (((33.75237 34... CY
4 AL AL SHQIPERIA 0 AL AL MULTIPOLYGON (((19.831 42.4... AL
5 CZ CZ CESKA REPUBLIKA 0 CZ CZ MULTIPOLYGON (((14.49122 51... CZ
6 BE BE BELGIQUE-BELGIE 0 BE BE MULTIPOLYGON (((5.10218 51... BE
```

# Simple Features

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb



```
class(World)
```

```
## [1] "sf"           "data.frame"
```

- **Vignette of the sf package**

# Simple feature collection

Quick high quality maps with R

Jan-Philipp Kolb

## Attribute values and an abridged version of the geometry

```
## Simple feature collection with 100 features and 6 fields
## geometry type: MULTIPOLYGON
## dimension: XY
## bbox: xmin: -84.32385 ymin: 33.88199 xmax: -75.45698 ymax: 36.58965
## epsg (SRID): 4267
## proj4string: +proj=longlat +datum=NAD27 +no_defs
## precision: double (default; no precision model)
## First 3 features:
##   BIR74 SID74 NWBIR74 BIR79 SID79 NWBIR79
## 1 1091 1 10 1364 0 19 MULTIPOLYGON((( -81.47275543...
## 2 487 0 10 542 3 12 MULTIPOLYGON((( -81.23989105...
## 3 3188 5 208 3616 6 260 MULTIPOLYGON((( -80.45634460...
```

						geom
##	1	1091	1	10	1364	0 19 MULTIPOLYGON((( -81.47275543...
##	2	487	0	10	542	3 12 MULTIPOLYGON((( -81.23989105...
##	3	3188	5	208	3616	6 260 MULTIPOLYGON((( -80.45634460...

Simple feature

Simple feature geometry list-column (sf)

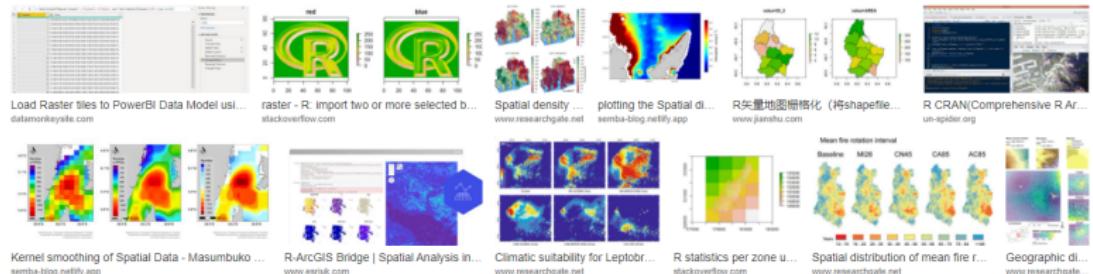
Simple feature geometry (sfg)

->

# raster - Geographic Data Analysis and Modeling

Quick high quality maps with R

Jan-Philipp Kolb



## Description:

Reading, writing, manipulating, analyzing and modeling of spatial data. The package implements basic and high-level functions for raster data and for vector data operations such as intersections.

## Author and contributors:

Robert J. Hijmans [cre, aut], Jacob van Etten [ctb], Michael Sumner [ctb], Joe Cheng [ctb], Dan Baston [ctb], Andrew Bevan [ctb], Roger Bivand [ctb], and many more

# Global Administrative Boundaries

Quick high quality maps with R

Jan-Philipp Kolb

## Get the data

```
FRA4 <- raster:::getData('GADM', country='FRA',  
                           level=4)
```

## Overview of the data

Rpubs by RStudio

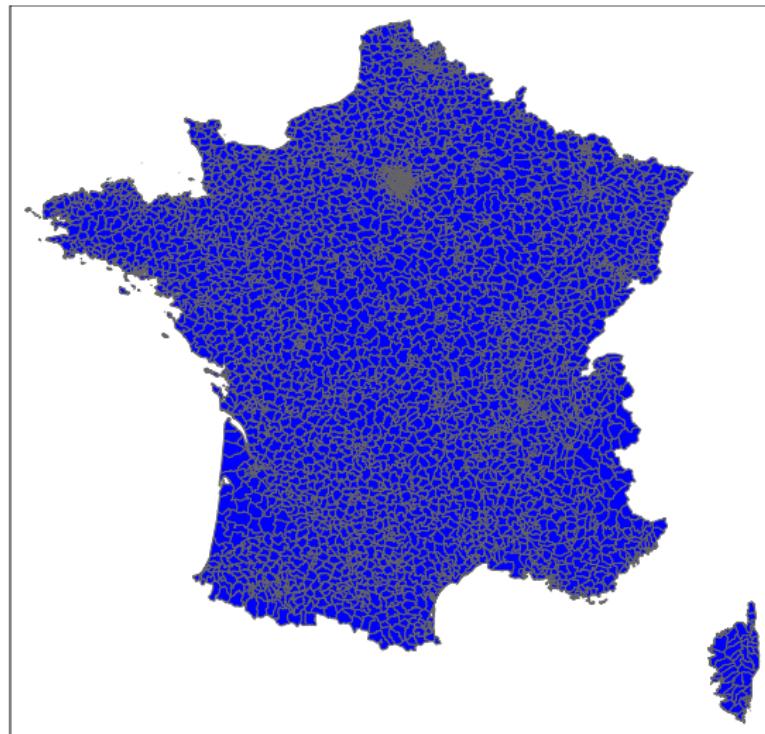
Show 10 entries											Search: <input type="text"/>
	GID_0	NAME_0	GID_1	NAME_1	GID_2	NAME_2	GID_3	NAME_3	GID_4	NAME_4	
1	FRA	France	FRA.1_1	Auvergne-Rhône-Alpes	FRA.1.1_1	Ain	FRA.1.1.1_1	Belley	FRA.1.1.1.1_1	Ambérieu-en-Bugey	
2	FRA	France	FRA.1_1	Auvergne-Rhône-Alpes	FRA.1.1_1	Ain	FRA.1.1.1_1	Belley	FRA.1.1.1.2_1	Belley	
3	FRA	France	FRA.1_1	Auvergne-Rhône-Alpes	FRA.1.1_1	Ain	FRA.1.1.1_1	Belley	FRA.1.1.1.3_1	Champagne-en-Valromey	
4	FRA	France	FRA.1_1	Auvergne-Rhône-Alpes	FRA.1.1_1	Ain	FRA.1.1.1_1	Belley	FRA.1.1.1.4_1	Hauteville-Lompnes	
5	FRA	France	FRA.1_1	Auvergne-Rhône-Alpes	FRA.1.1_1	Ain	FRA.1.1.1_1	Belley	FRA.1.1.1.5_1	Lagnieu	
6	FRA	France	FRA.1_1	Auvergne-Rhône-Alpes	FRA.1.1_1	Ain	FRA.1.1.1_1	Belley	FRA.1.1.1.6_1	Lhuis	

# Plot the map

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
qtm(FRA4, fill="blue")
```

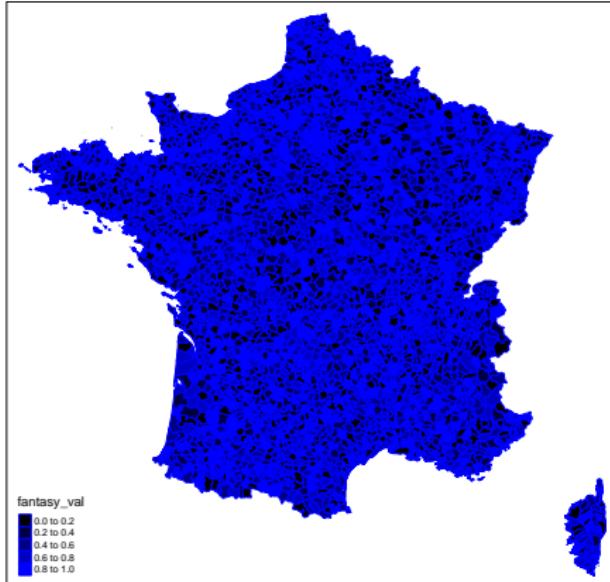


# Create colour gradation

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
FRA4$fantasy_val <- runif(nrow(FRA4))  
qtm(FRA4, "fantasy_val",  
    fill.palette = rgb(0,0,seq(0,1,.1),0),  
    borders = "blue")
```



## Section 3 - Openstreetmap data

Quick high  
quality maps  
with R

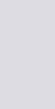
Jan-Philipp  
Kolb



# Openstreetmap map features

Quick high quality maps with R

Jan-Philipp Kolb

Key	Value	Element	Description	Map rendering	Image	Count
aeroway	aerodrome	 	An aerodrome, airport or airfield			25 299 <input checked="" type="checkbox"/> 17 772 <input type="checkbox"/> 971 <input type="checkbox"/>
aeroway	apron		An area of an airport where planes are parked, unloaded or loaded, refueled, or boarded			50 <input checked="" type="checkbox"/> 34 520 <input type="checkbox"/> 632 <input type="checkbox"/>
aeroway	gate		The bounded space, inside the airport terminal, where passengers wait before boarding their flight			16 329 <input checked="" type="checkbox"/> 45 <input type="checkbox"/> 1 <input type="checkbox"/>

# Example: Overpass API

Quick high quality maps with R

Jan-Philipp Kolb

<https://overpass-turbo.eu/>

The screenshot shows the Overpass Turbo web application interface. At the top, there is a navigation bar with links for "Ausführen", "Teilen", "Export", "Wizard", "Speichern", "Laden", "Einstellungen", "Hilfe", and "overpass turbo". Below the navigation bar is a search bar and a toolbar with various icons. The main area displays a map of the Rhine-Neckar region, specifically around Mannheim and Ludwigshafen. Numerous blue circles with yellow outlines are scattered across the map, representing playground locations. The map includes labels for many towns and roads, such as Ludwigshafen, Mannheim, and various local streets and highways like A6, A67, and B9. On the left side of the map, there is a code editor window containing an Overpass query:

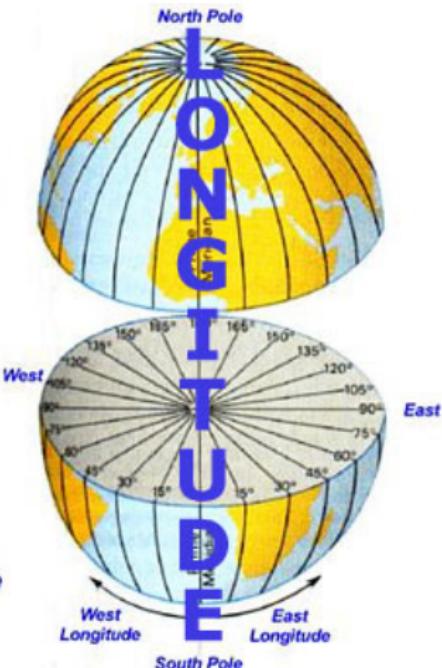
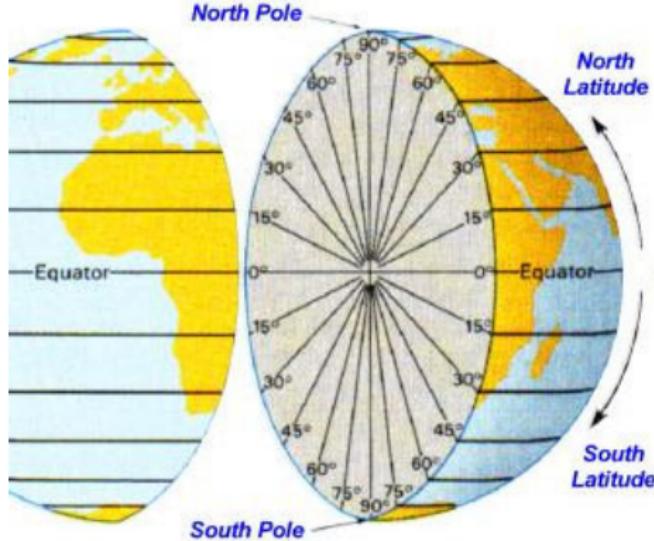
```
/*
This is an example Overpass query.
Try it out by pressing the Run button above!
You can find more examples with the Load tool.
*/
node
[leisure=playground]
((bbox););
out;
```

# Longitude and Latitude

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## LATITUDE



Source: Traveling across time

# tmaptools - Thematic Map Tools

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
library(tmaptools)
```

Author: Martijn Tennekes

```
citation("tmaptools")
```

## Description

Set of tools for reading and processing spatial data. The aim is to supply the workflow to create thematic maps. This package also facilitates 'tmap', the package for visualizing thematic maps.

# Geocoordinates

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Get geocodes

```
(gc_z <- geocode_OSM("Zürich"))

## $query
## [1] "Zürich"
##
## $coords
##           x             y
## 8.541042 47.374449
##
## $bbox
##           xmin         ymin         xmax         ymax
## 8.448006 47.320220 8.625441 47.434666
```

# Get more information

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## More details

```
gc_z <- geocode_OSM("Zürich",details = T)
names(gc_z)

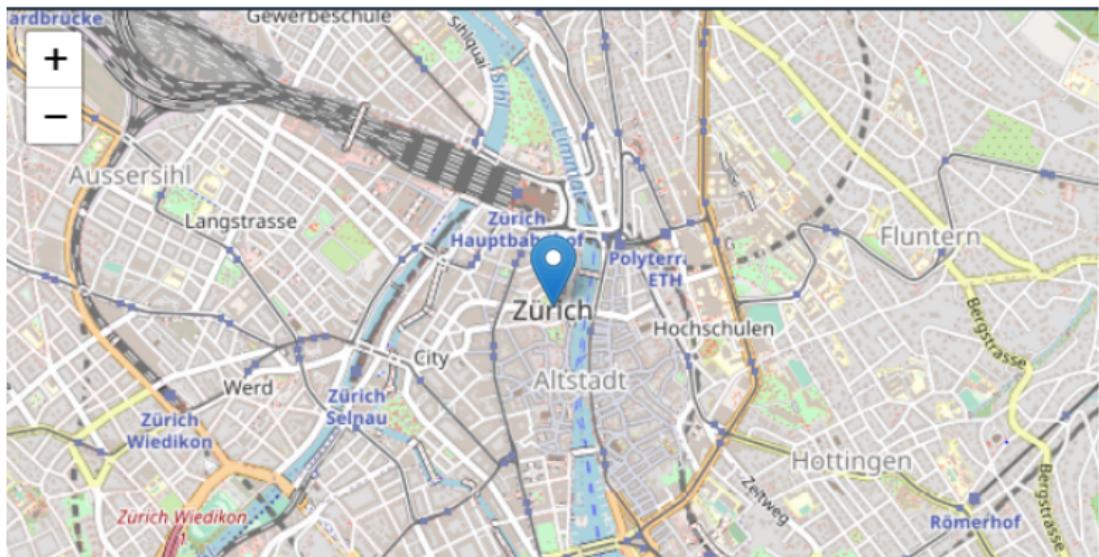
## [1] "query"          "coords"        "bbox"
## [6] "osm_id"         "place_rank"     "display_name"
## [11] "importance"     "icon"
```

# An interactive map with a popup

Quick high quality maps with R

Jan-Philipp Kolb

```
library(leaflet)
gcz <- geocode_OSM("Zürich")
leaflet() %>% addTiles() %>%
  addMarkers(lng=gcz$coords[1] , lat=gcz$coords[2] ,
             popup="The conference place")
```



# Section 4: OSM maps with R

Quick high quality maps with R

Jan-Philipp Kolb

## A package to get Openstreetmap data

Author: Mark Padgham

```
library(osmplotr)
```

```
citation("osmplotr")
```

The screenshot shows a search results page with several items:

- Meinst du: komplott**: A link to a user's profile.
- Creating continuous coloured maps with osmplotr ...**: A link to a blog post by mascardus.be.
- ropensci/osmplotr**: A GitHub repository for the package, with 14 stars, 1 maintainer, 133 commits, and 21 forks.
- Bespoke Images of OpenStreetMap Data ...**: A link to the documentation on docs.ropensci.org.
- osmplotr**: A link to a GitHub repository for the package, with 1 star, 1 maintainer, 1 commit, and 1 fork.
- osmplotr: Mara Averick into Twitter: 'Making ave...'**: A link to a tweet from Mara Averick (@MaraAverick) on Twitter.
- cran/osmplotr**: A GitHub mirror of the package, with 1 star, 1 maintainer, 1 commit, and 1 fork.
- Data Maps - OpenSci: osmplotr**: A link to the documentation on docs.ropensci.org.
- osmplotr hashtag on Twitter**: A link to the Twitter hashtag page for osmplotr.
- Bespoke Images of OpenStreetMap Data - OpenSci: osmplotr**: A link to the documentation on docs.ropensci.org.
- Create custom maps from openstreetmap - REC... gis.stackexchange.com**: A link to a question on GIS Stack Exchange.

# Buildings within a bounding box

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
bbox <- get_bbox (c(8.4539 , 49.4805 ,  
                    8.4774 , 49.4943 ))  
dat_M <- extract_osm_objects (key = 'building',  
                                bbox = bbox)  
  
qtm(dat_M,fill=c("purple"),borders="black")
```



# The package osmdata

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Install and load osmdata

```
install.packages("osmdata")
```

```
library(osmdata)
```

## Get a bounding box for a city

```
bbox <- getbb("Berlin")
```

# Streets of Berlin

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## OSM Map Feature key=highway value=primary

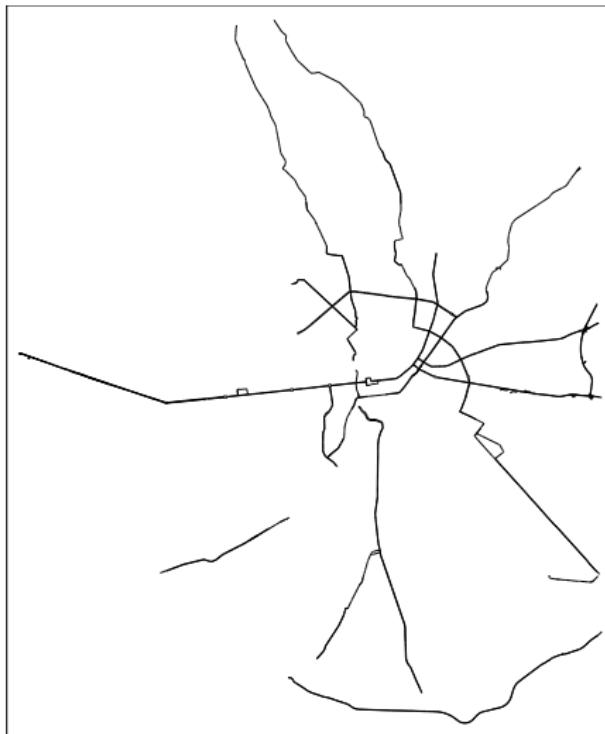
<b>highway</b>	primary	<input checked="" type="checkbox"/>	The next most important roads in a country's system.. (Often link larger towns.)	 
----------------	---------	-------------------------------------	--	--

## Get data with package osmdata

```
dat <- extract_osm_objects(key = 'highway',  
                           value = "primary",  
                           bbox = bbox)
```

# A quick map for the primary streets in Berlin

`qtm(dat)`



# Get data for secondary roads in Berlin

Quick high quality maps with R

Jan-Philipp Kolb

## OSM map feature

highway	secondary	<input type="checkbox"/>	The next most important roads in a country's system. (Often link towns.)		
---------	-----------	--------------------------	--	---	---

## New Information - same bounding box

```
dat_s <- extract_osm_objects(key = 'highway',  
                           value = "secondary",  
                           bbox = bbox)
```

# Plot the map

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
map <- osm_basemap(bbox = bbox, bg = "#F5F5DC")
map <- add_osm_objects(map, dat, col = "#00008B")
map <- add_osm_objects(map, dat_s, col = "purple")
print_osm_map(map)
```

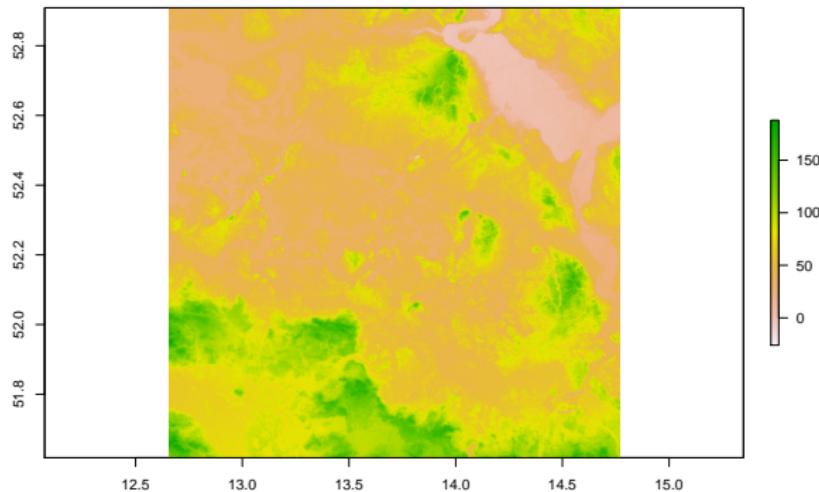


# The elevatr package

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

```
library(elevatr)
elevation <- get_elev_raster(dat, z = 9)
plot(elevation)
```



# Mapping is fun

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb



## Topi Tjukanov

@tjukanov

Makes maps. Started #30DayMapChallenge. Works at @GispoFinland

[Biografie übersetzen](#)

⌚ Helsinki, Suomi ⌐ [tjukanov.org](http://tjukanov.org) 📅 Seit November 2013 bei Twitter

**2.475** Folge ich    **13.078** Follower



Gefolgt von #30DayChartChallenge, Anat Zohar und 70 weiteren Personen, denen du folgst

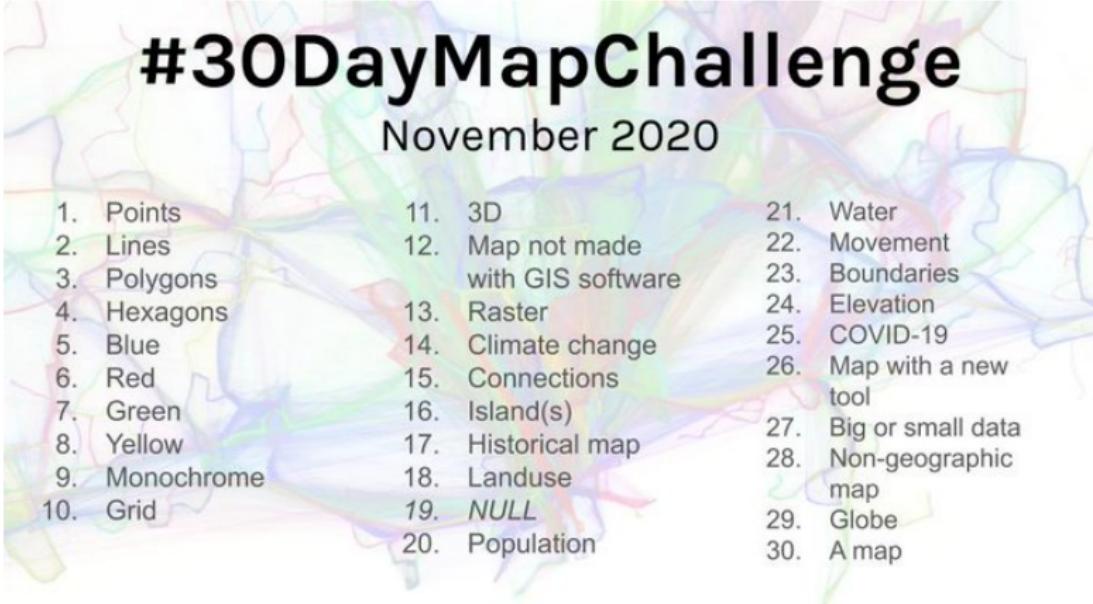
# #30daymapchallenge

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

# #30DayMapChallenge

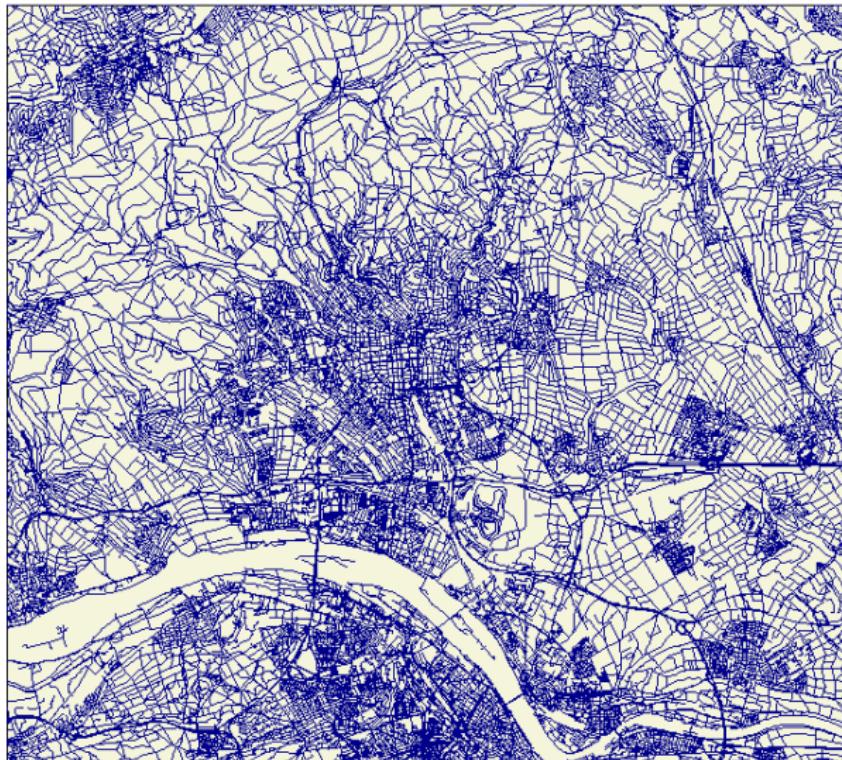
November 2020

- 
1. Points
  2. Lines
  3. Polygons
  4. Hexagons
  5. Blue
  6. Red
  7. Green
  8. Yellow
  9. Monochrome
  10. Grid
  11. 3D
  12. Map not made with GIS software
  13. Raster
  14. Climate change
  15. Connections
  16. Island(s)
  17. Historical map
  18. Landuse
  19. *NULL*
  20. Population
  21. Water
  22. Movement
  23. Boundaries
  24. Elevation
  25. COVID-19
  26. Map with a new tool
  27. Big or small data
  28. Non-geographic map
  29. Globe
  30. A map

# Exercise: Create a monochrome map

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb



# Resources

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

## Package osmplotr

- Github repo on osmplotr at [ropensci](#)
- Intro to the package
- Spatial Data Science

## Data sources

- Covid 19 datahub

# Further resources

Quick high  
quality maps  
with R

Jan-Philipp  
Kolb

- Tips for working with images in Rmd files