References

•  https://github.com/mtennekes/tmap
  Home page (README.md) contains installation instructions (Linux), links to vignettes, presentations, and blogs.

•  Tennekes, M. (2017) *tmap: Thematic Maps in R*. Forthcoming in the *Journal of Statistical Software*
  Paper not available yet, but all example sections are on github.
Grammar of Graphics applied to spatial data visualization

Alternative to ggplot2:
- Spatial objects (from `sp`, `raster`, and `sf` packages) can be used directly
- Layout optimized for maps (e.g. legend, map attributes)
- Another package to learn ...

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<td><code>geom_...(...) + scale_...(...) +</code></td>
<td><code>facet_wrap(...) +</code></td>
<td><code>theme(...)</code></td>
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<tr>
<td><code>tmap</code></td>
<td><code>tm_shape(...) +</code></td>
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<td><code>tm_facets(...) +</code></td>
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Implemented:
- `tm_polygons`, `tm_symbols`, `tm_lines`, `tm_raster`, `tm_text`, `tm_fill`, `tmBorders`, `tm_bubbles`, `tm_squares`, `tm_dots`, `tm_rgb`, `tm_markers`, `tm_iso`
Spatic plot and interactive view

- Switch between **plot** and **view** mode with `tmap_mode("plot")` or `tmap_mode("view")`
- Toggle between modes with `ttm()`

```r
# Example code

tm_shape(World) +
  tm_polygons("income_grp", ....) +
  tm_text("iso_a3", size = "AREA", ....) +
  tm_shape(metro) +
  tm_bubbles("pop2010", col = "growth", ....) +
  tm_format_World() +
  tm_style_gray()

qtm(World, fill = "income_grp", text = "iso_a3", text.size = "AREA") +
qtm(metro, symbols.size = "pop2010", symbols.col = "growth")

ttm()
last_map()
```
Map layout

- Attributes: compass, contribution text, grid lines, scale bar
- Styles, e.g. `tm_style_grey`, `tm_style_classic`.

```r
tm_shape(land) +
  tm_raster("elevation", ...) +

tm_shape(rivers) +
  tm_lines("lightblue", lwd = "strokelwd", ...) +

tm_shape(World, is.master = TRUE) +
  tmBorders("gray20", lwd = 0.5) +
  tm_grid(projection = "longlat", ...) +
  tm_text("name", size = "AREA") +

tm_compass(...) +
  tm_credits("Eckert IV projection", ...) +
  tm_style_classic()

qtm(land, raster = "elevation") +
qtm(World, fill=NULL)
```
Map insets

- Map insets are set using the **viewport** function of the **grid** package
- Alaska and Hawaii are plotted as insets:
Small multiples can be defined in 3 ways:
1. By assigning multiple variables for one aesthetic
2. By specifying the **by** argument of `tm_facets`
3. By using `tmap_arrange`

```r
tm_shape(london_osm) +
  tm_rgb() +
tm_shape(crimes_city) +
  tm_dots(size = 0.2) +
tm_facets(by = "Crime.type")
```
# load cartogram package (thanks to Sebastian Jeworutzki)
library(cartogram)

# load shape of Dutch provinces
data(NLD_prov)

# create cartogram shape
NLD_prov_pop <- cartogram(NLD_prov, "population")

# plot it
qtm(NLD_prov_pop, fill = "pop_65plus")

# export to png
save_tmap(filename = "cartogram.png", height=5)
**tmaptools**: package with helper functions

`tmaptools` contains useful helper functions, e.g.

- `bb` creates or modifies a bounding box
- `append_data` appends data.frame to spatial object (including feedback on over- and under coverage)
- `geocode_OSM` and `rev_geocode_OSM` query OpenStreetMap nominatim
- `palette_explorer` starts an interactive tool to explore ColorBrewer palettes
Related packages

Used packages:

- sp, raster, rgdal, rgeos, classInt, RColorBrewer
- graphics:
  - grid for static plots
  - leaflet for interactive plots (and some functions from mapview)

Alternatives packages:

Static:
- sp, raster
- ggplot (and ggmap),
- choroplethr, GISTools, cartography, rworldmap, maps

Interactive:
- leaflet
- mapview
- plotGoogleMaps
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