

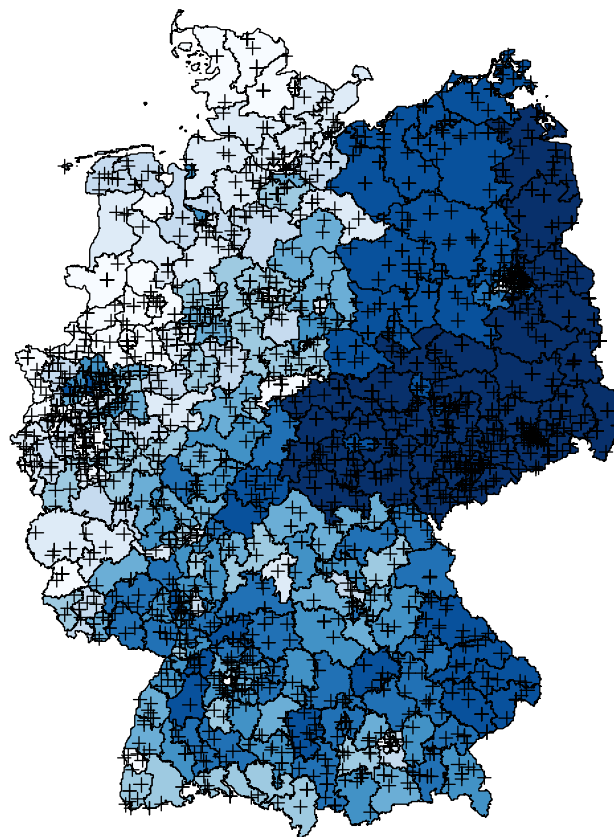
# Spatial Analysis of Geographic Data

CDSS Course, Spring 2018, MET, 4 ECTS

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The first law of geography states that “everything is related to everything else, but near things are more related than distant things” (Tobler 1970: 236).<sup>1</sup> In the Social Sciences, geographic data and spatial analyses offer rich insights into a variety of relevant research questions (Franzese and Hays 2008). The course covers crucial concepts involved in spatial analysis, introduces a toolbox of statistical models and pays particular attention to the accessible implementation of spatial analysis in free software (working with R and packages for spatial analysis). The course material is available via <https://github.com/julianbernauer/geospat>.



*Figure: Come to class and learn what you see! Yes it's Germany.*

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<sup>1</sup> Tobler, W. R. (1970): A Computer Movie Simulating Urban Growth in the Detroit Region. *Economic Geography* 46(Suppl.): 234-340.

## Sessions

*All sessions Tuesday, 8:30-11:45, room 212/13 in B6, 30-32*

### February 20: Concepts

*What you will learn:*

- Concepts involved in the spatial analysis of geographic data
- Conceptions of neighbourhood
- Meet W, the connectivity matrix which defines spatial dependencies
- Geo-referencing data
- Introducing the running example: AfD vote and attacks on refugees
- Exercise: mysterious Mannheim map

*Readings:*

- Relevance: Franzese, Robert J. and Jude C. Hays (2008): Interdependence in Comparative Politics. Substance, Theory, Empirics, Substance. *Comparative Political Studies* 41(4/5): 742-780.
- Basics: Fischer, Manfred M. and Jinfeng Wang (2011): *Spatial Data Analysis. Models, Methods and Techniques*. Berlin: Springer. Chapters 1 and 2. [Available as pdf via library.]
- More basics: Haining, Robert P. (2003): *Spatial Data Analysis: Theory and Practice*. Cambridge: Cambridge University Press. Chapters 1 and 2.
- Background on W: Neumayer, Eric and Thomas Plümper (2016): W. *Political Science Research and Methods* 4(1): 175-193.
- For the running example: Jäckle, Sebastian and Pascal D. König (2017): The Dark Side of the German ‘Welcome Culture’: Investigating the Causes behind Attacks on Refugees in 2015. *West European Politics* (40)2: 223-251.

### February 27: Models

*What you will learn:*

- Spatial correlation: Moran’s I and friends
- From linear to spatial regression, or, from spatial to linear regression
- Durbin model
- Spatial lag model
- Spatial error model
- Other varieties
- Varying outcomes: categorical, count, duration
- Space and time
- Exercise: running example

*Readings:*

- Nice primer: Selb, Peter (2006). Räumliche Regressionsmodelle. In Joachim Behnke et al. (eds), *Methoden der Politikwissenschaft: Neuere qualitative und quantitative Analyseverfahren*. Baden-Baden: Nomos, pp. 297-308.

- More detail: Fischer, Manfred M. and Jinfeng Wang (2011): *Spatial Data Analysis. Models, Methods and Techniques*. Berlin: Springer. Chapter 3. [Available as pdf via library.]
- Advanced: Schabenberger, Oliver and Carol A. Gotway (2005): *Statistical Methods for Spatial Data Analysis*. Boca Raton: Chapman & Hall/CRC. Chapters 6 and 9.

## March 6: Implementation

*What you will learn:*

- Delving into open-ended spatial analysis in R
- A tour of R packages for spatial analysis such as *spdep*
- Exercises: a few of the latest fads such as integrating Google Maps information, Economist-style graphs... based on the running example
- Focus on models and visualization

*Readings:*

- On Geodata and R: Bivand, Roger S., Edzer Pebesma and Virgilio Gómez-Rubio (2013): *Applied Spatial Data Analysis with R* (2<sup>nd</sup> Edition). New York: Springer. [Available as pdf via library.]
- Visualization and data management generally: Wickham, Hadley and Garrett Grolemund (2017): *R for Data Science. Import, Tidy, Transform, Visualize and Model Data*. Sebastopol: O'Reilly. Chapter 1. [Available as pdf via library.]
- A useful package: Bivand, Roger et al. (2017): Package 'spdep', <https://cran.r-project.org/web/packages/spdep/spdep.pdf>.

## March 20: Applications

*What you will learn:*

- Summary of the previous sessions, collecting elements
- Bayesian freestyle: implementing spatial analysis, integration multilevel structure...
- Example 1: Taking W to the APSR (Böhmelet et al. 2016)
- Example 2: Taking W to PA (Selb and Munzert 2011)
- Exercise: AfD vote and attacks in a Bayesian setting
- Workshop on paper project: short sketches and pitches

*Readings:*

- Geodata and Bayes: Scattered across Haining (2003), Schabenberger and Gotway (2005) and Bivand et al. (2013)
- Example 1: Böhmelet, Tobias, Lawrence Ezrow, Roni Lehrer and Hugh Ward (2016): Party Policy Diffusion. *American Political Science Review* 110(2): 397-410.
- Example 2: Selb, Peter and Simon Munzert. (2011): Estimating Constituency Preferences from Sparse Survey Data Using Auxiliary Geographic Information. *Political Analysis* 19(4): 455-470.

#### April 24: Presentations

- Discussion of the paper proposals of the participants
- Provide brief sketch: about 2-3 pages, research question, relevance, existing literature, theoretical argument, empirical strategy (based on geodata) and list of open questions
- Presentations of max. 10 min, use of visualizations and media encouraged, show preliminary results

#### **Assessment**

Active participation, exercises, presentation with preliminary analysis, paper on spatial analysis of geographic data (4000-5000 words). Please contact me anytime if you have any questions on the course.