Geographic Data

Lecture Week 5

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Overview

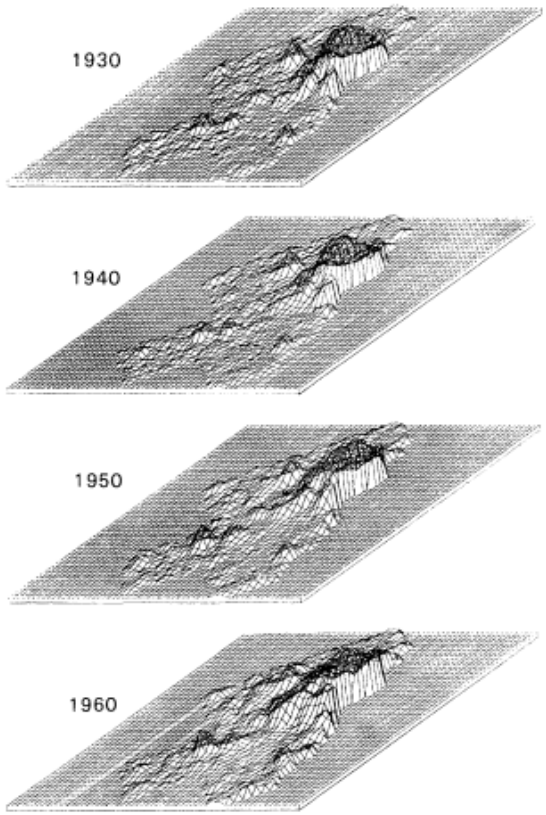
1. What is “distance”?
2. How is geography used in politics research?
3. Challenges of geographic data

Overview

Tobler's Law (1970)

The First Law of Geography:

"Everything is related to everything else, but near things are more related than distant things."



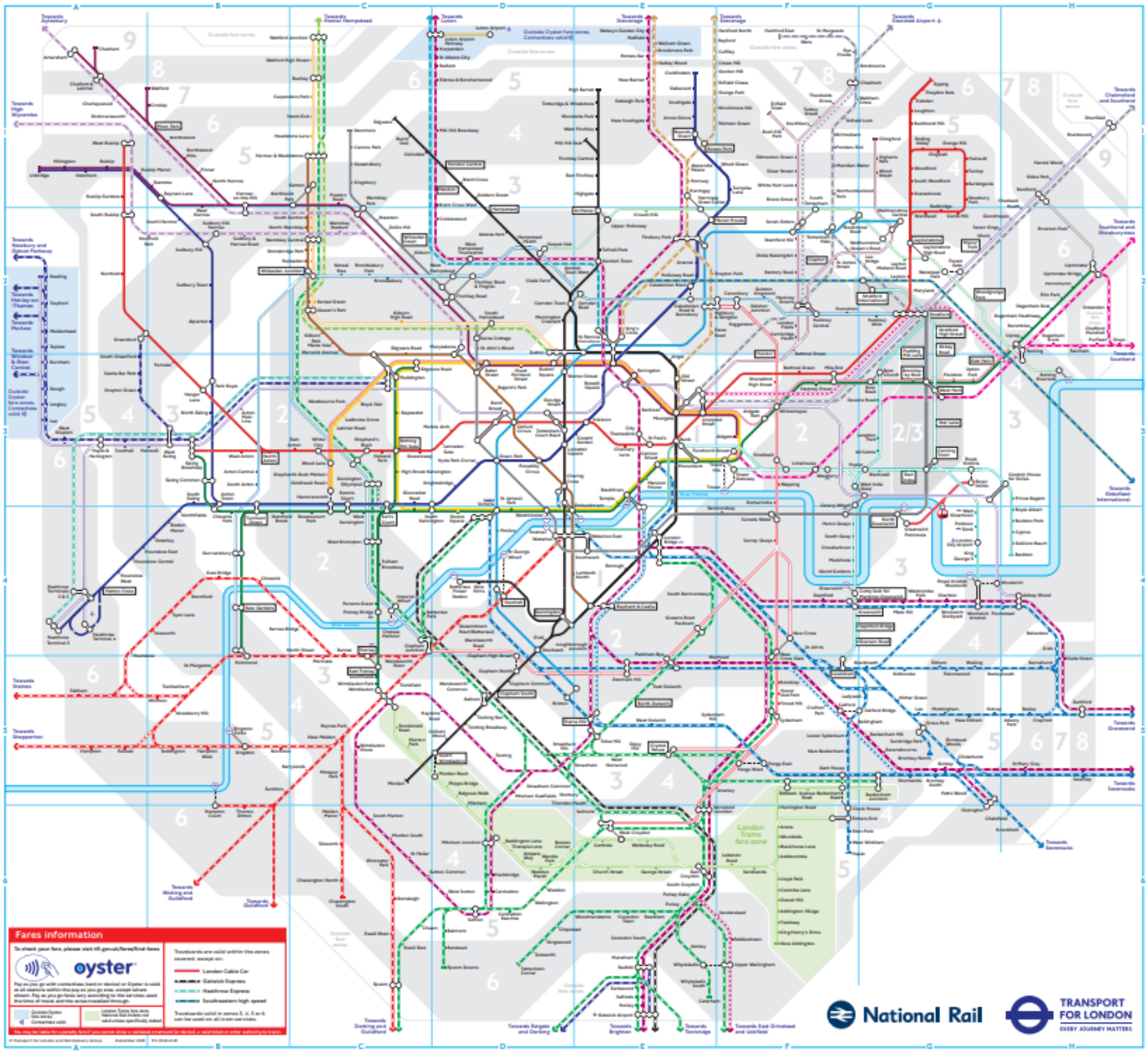
Actual population growth, Detroit Region (non-linear vertical scale).

Physical distance

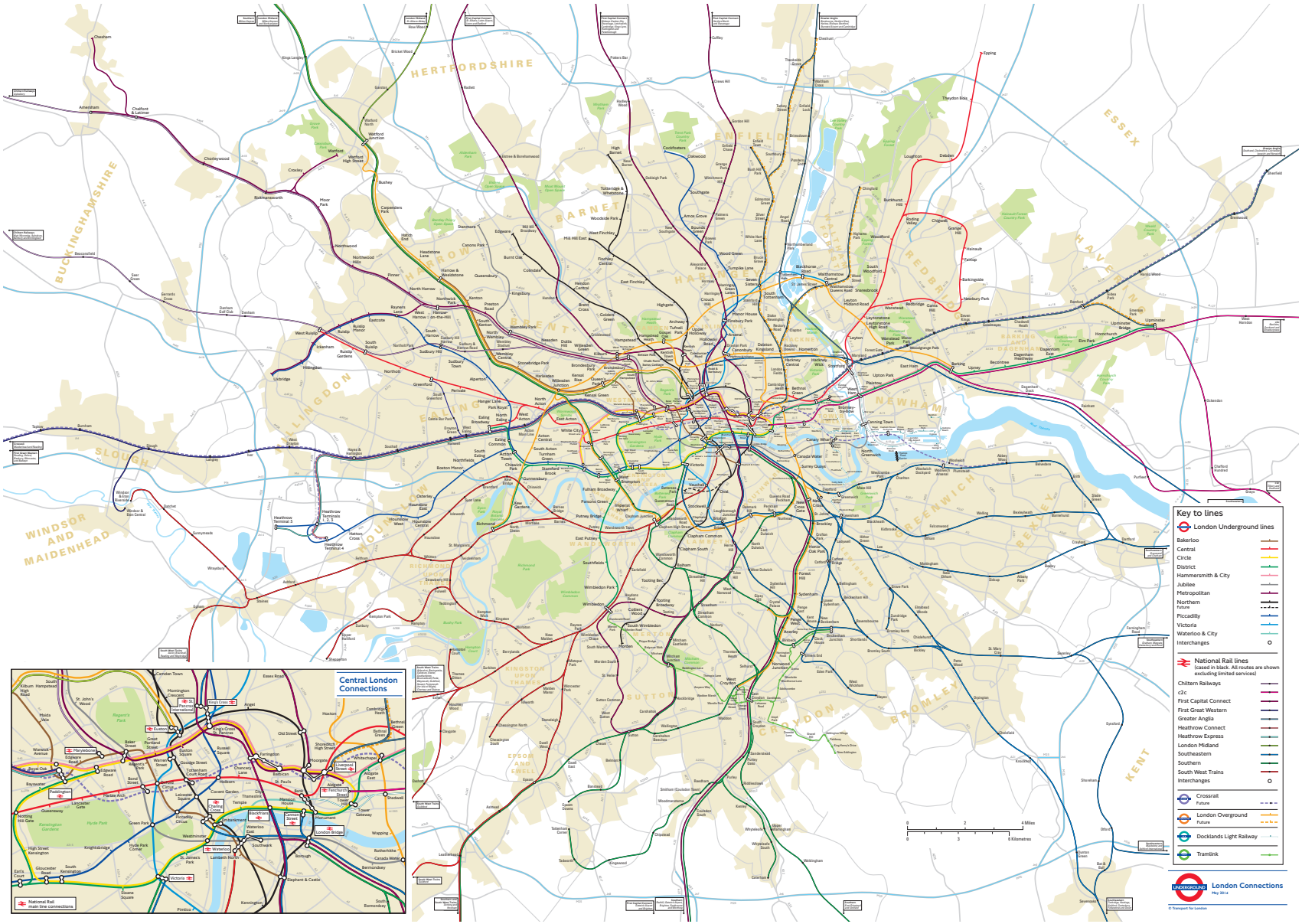
- Euclidean distance
  - Straight-line distance, based on Pythagorean Theorem
  - What does this represent? Exposure? Access?

Distance as dimension reduction

Distance as dimension reduction



Distance as dimension reduction



Distance as dimension reduction

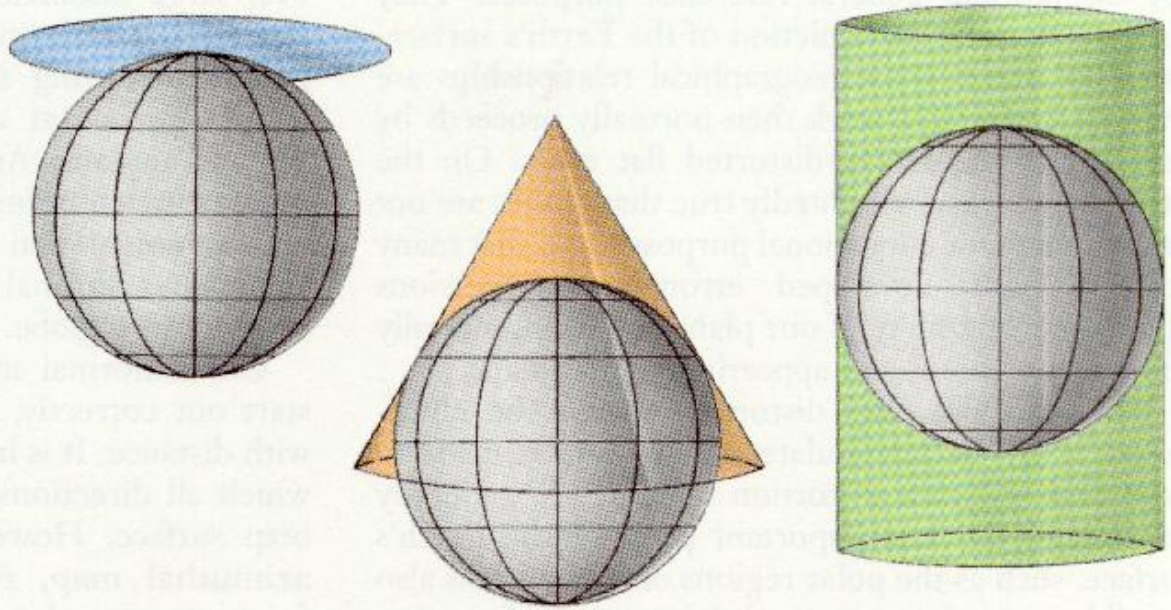


FIGURE 3.2 The projection principles for plane, conic, and cylindrical map projections. To envision how the projections are accomplished, imagine a light placed at the centers of each of the globes projecting the outlines of the Earth features onto the three geometrical surfaces.

Source: `https://faculty.kutztown.edu/courtney/blackboard/Physical/05Project/project.html`

Physical distance

- Euclidean distance
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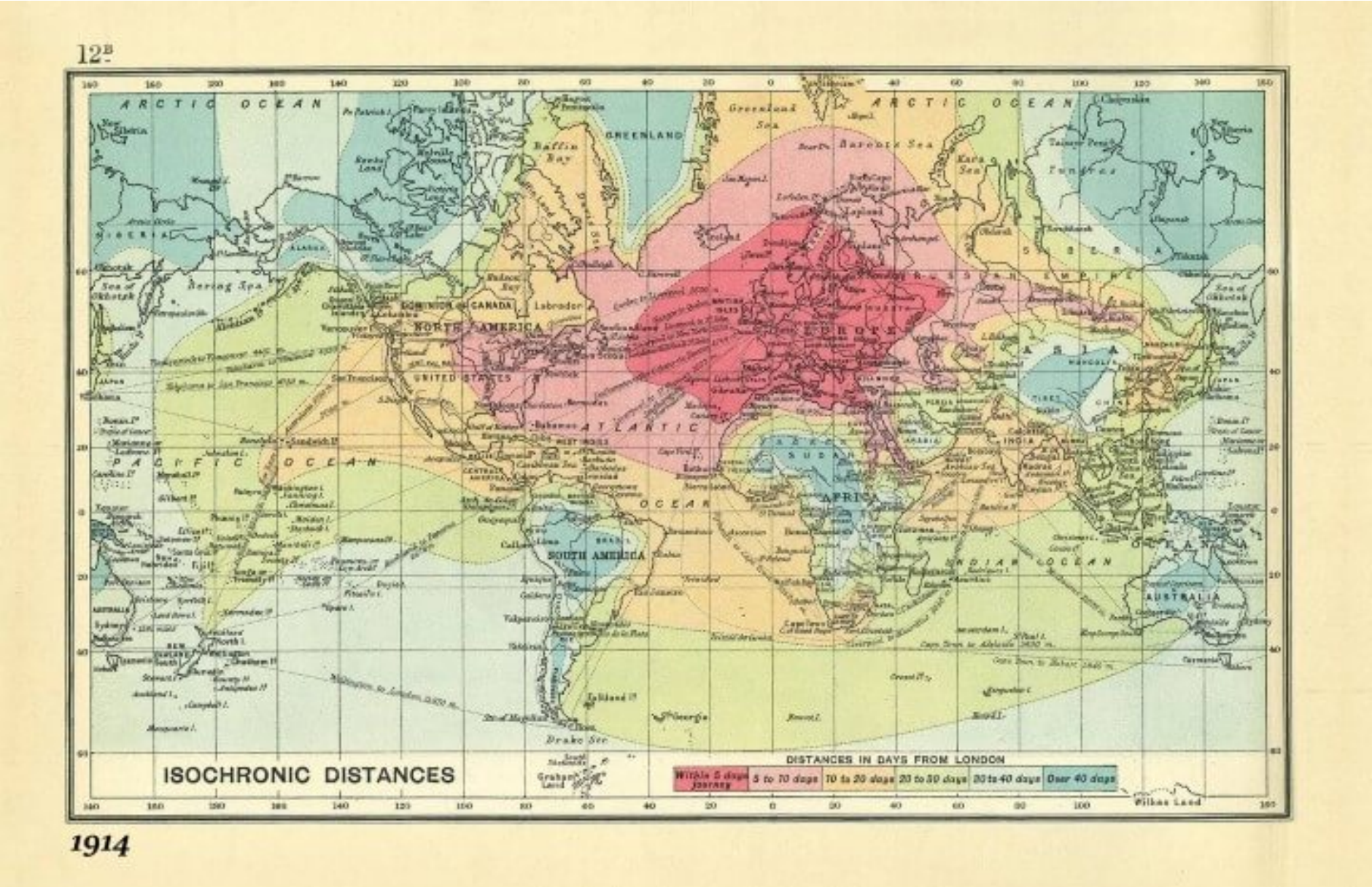
  - What does this represent? Exposure? Access?
- Travel distance or routing distance
  - Usually based on given mode of transit
  - Isochrone maps

Isochrone maps



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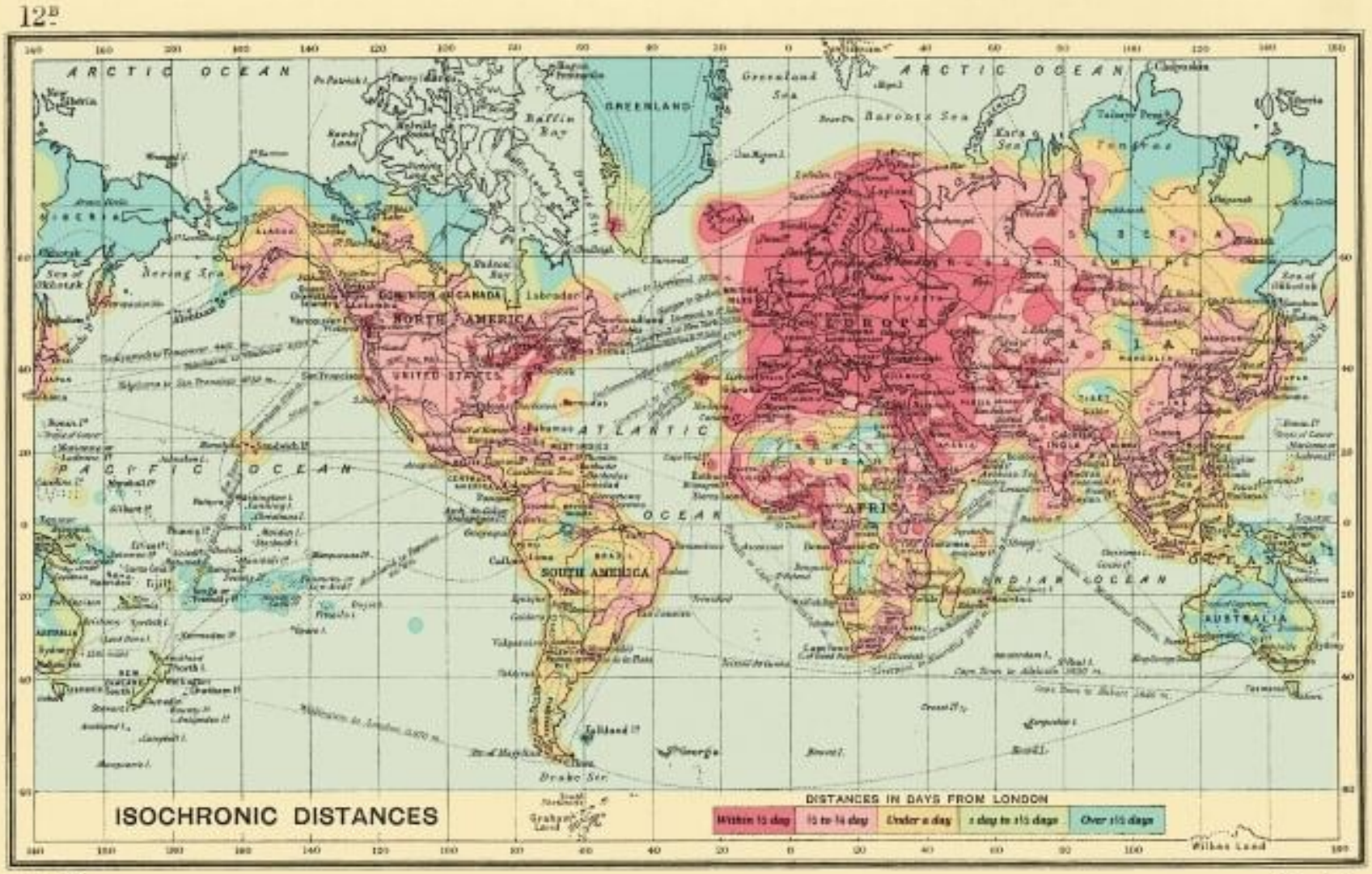

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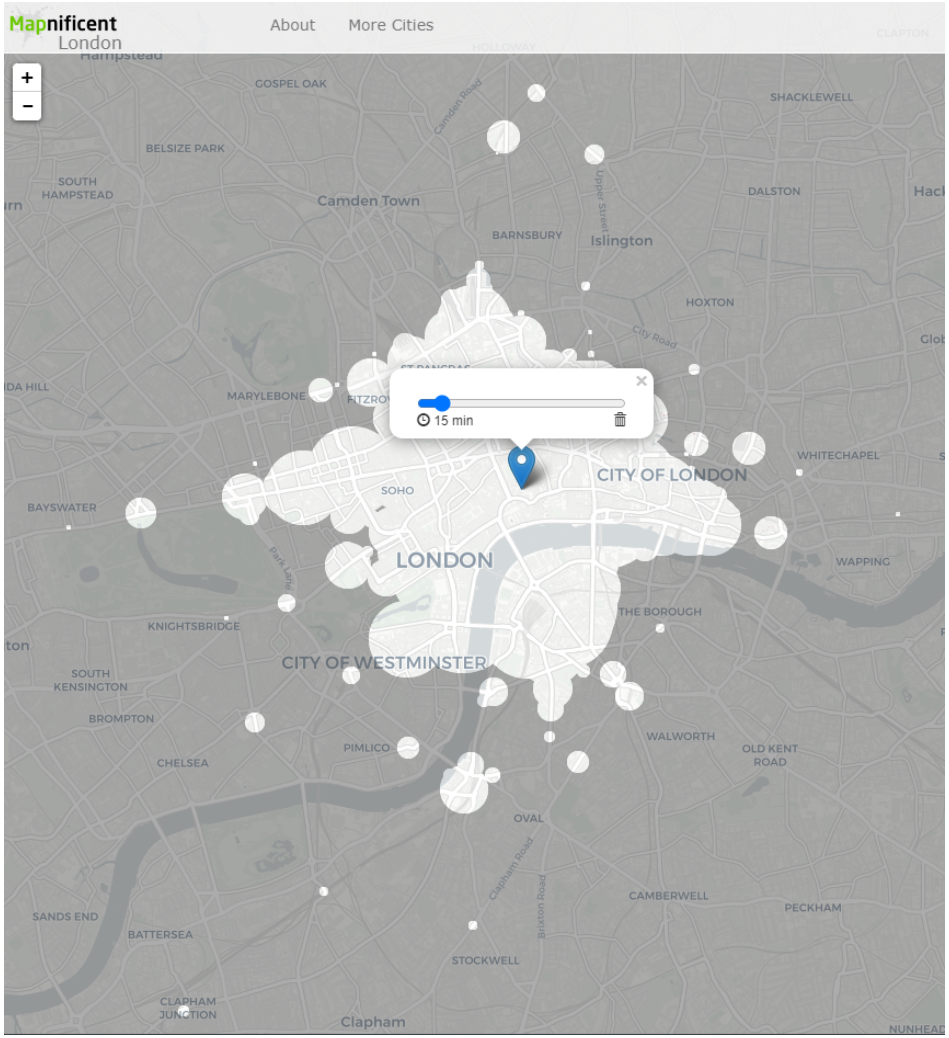

Source: `https://www.mapnificent.net/`

Maps affect our perceptions of space

People often trust the transit map more than they trust themselves!

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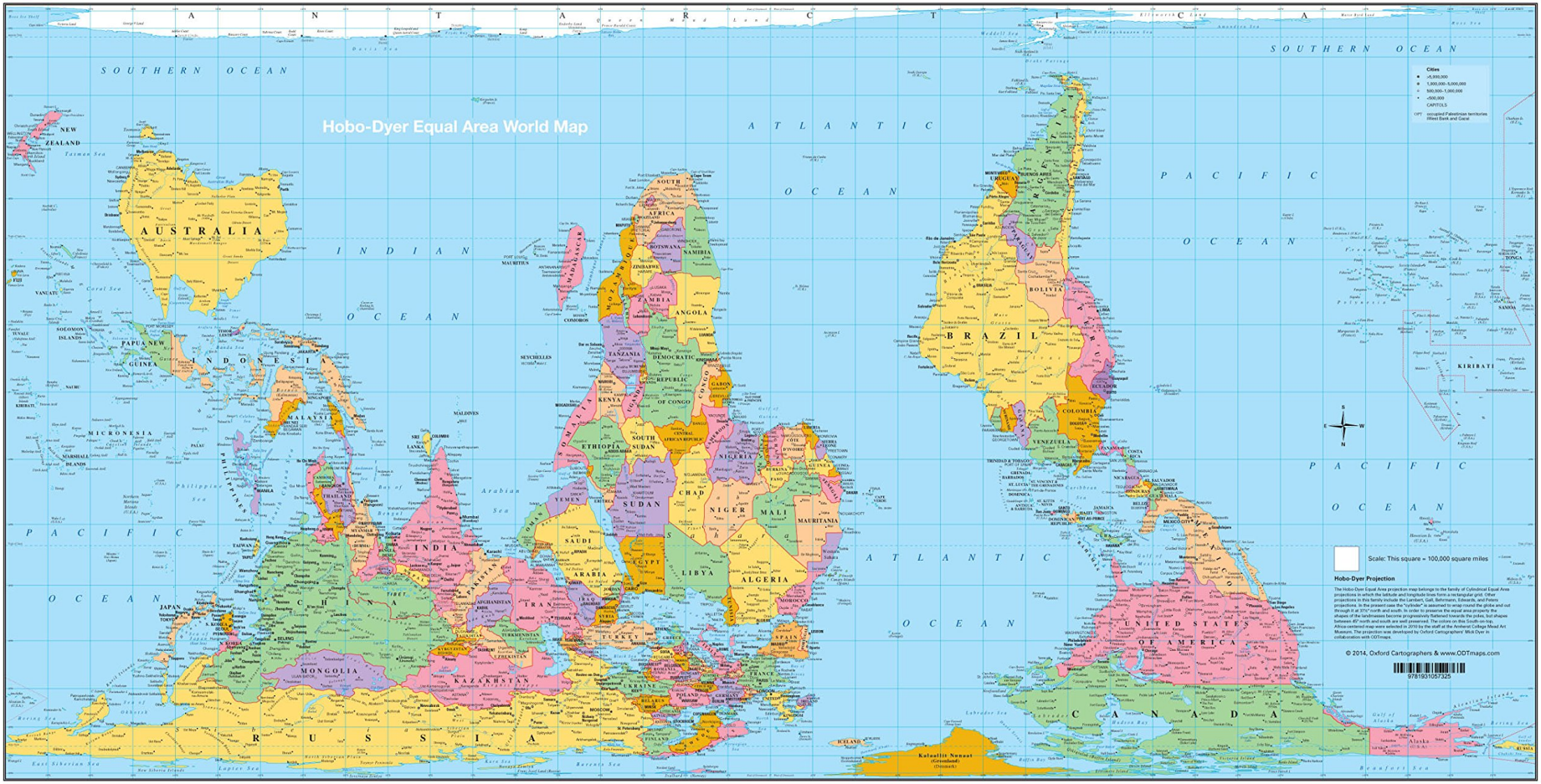

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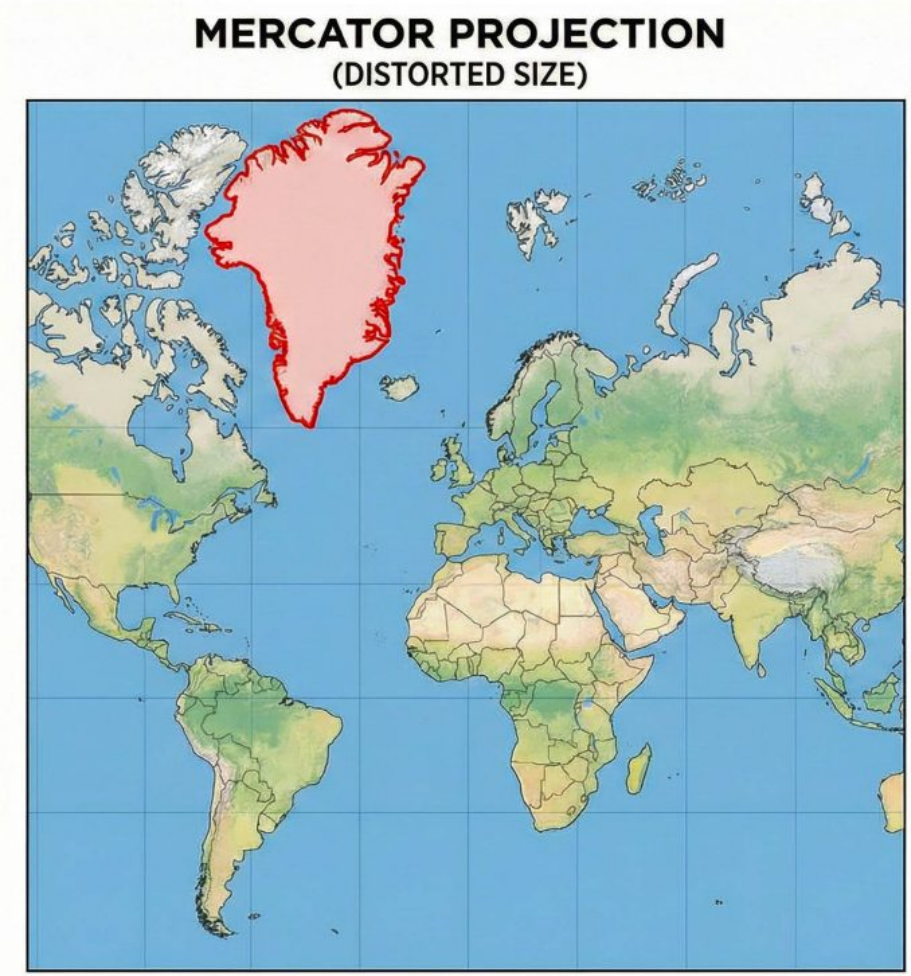

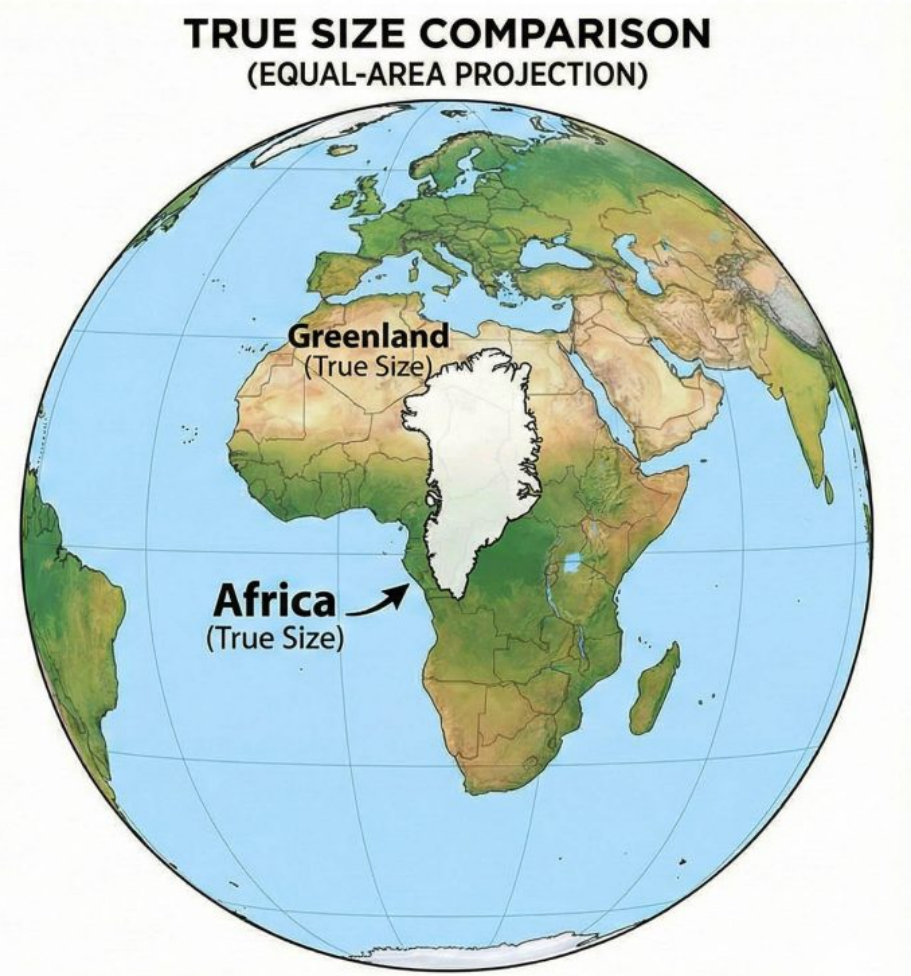

Maps are political! (Sometimes really political)

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- Multi-dimensionality and transformations
  - Distance is a one-dimensional summary of many dimensions
  - Non-linearities in distance?

Psychological distance

- **Psychological or cognitive distance**: "judgments we make about spatial separation of objects that cannot be seen directly" (Gatrell 1983)
  - e.g., temporal distance, spatial distance, social (or interpersonal) distance, hypothetical distance
  - Implications for language, memory, inferences we draw about other people and about ourselves, decision-making.
- **Construal Level Theory** (Trope & Lieberman 2003)
  - Objects or events that are more distant in time or space are thought of in more abstract terms (higher level of construal), while those that are closer in time or space are thought of in more concrete terms (lower level of construal).
  - Goes both ways
- Political implications?
- Still relevant today?

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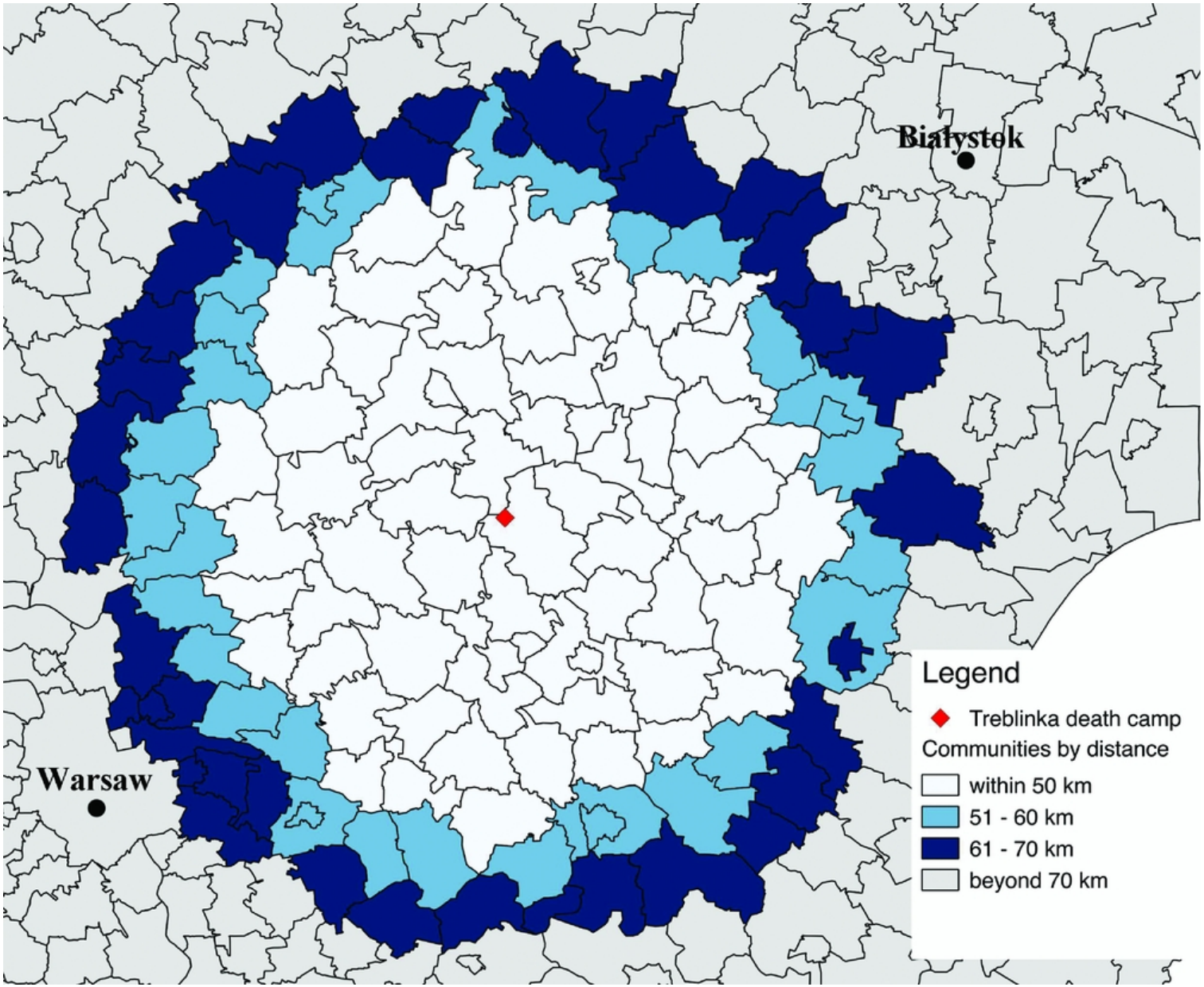
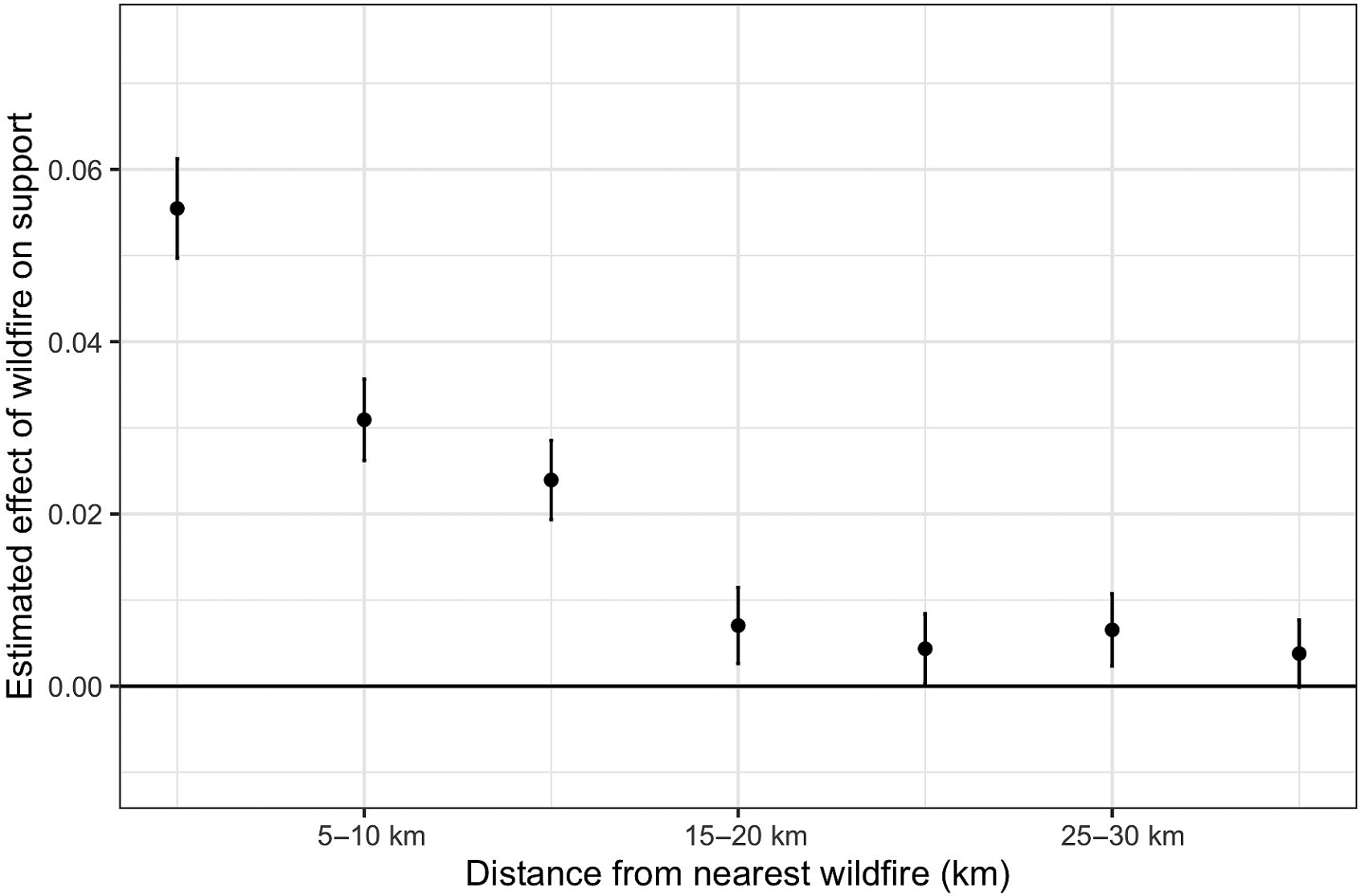
How is geography used in politics research?

- As explanatory variable, e.g.,
  - Distance from Mexico-US border (Dube, Dube, & Garcia-Ponce 2013)
  - Missile range from Gaza (Getmansky & Zeitzoff 2014)
  - Proximity to Nazi death camp (Charnysh & Finkel 2017)
  - Proximity to wildfires (Hazlett & Mildenberger 2020)

Charnysh & Finkel 2017



Hazlett & Mildenberger 2020



Hazlett, C., & Mildenberger, M. (2020). Wildfire exposure increases pro-environment voting within Democratic but not Republican areas. *American Political Science Review*, 114(4), 1359-1365.

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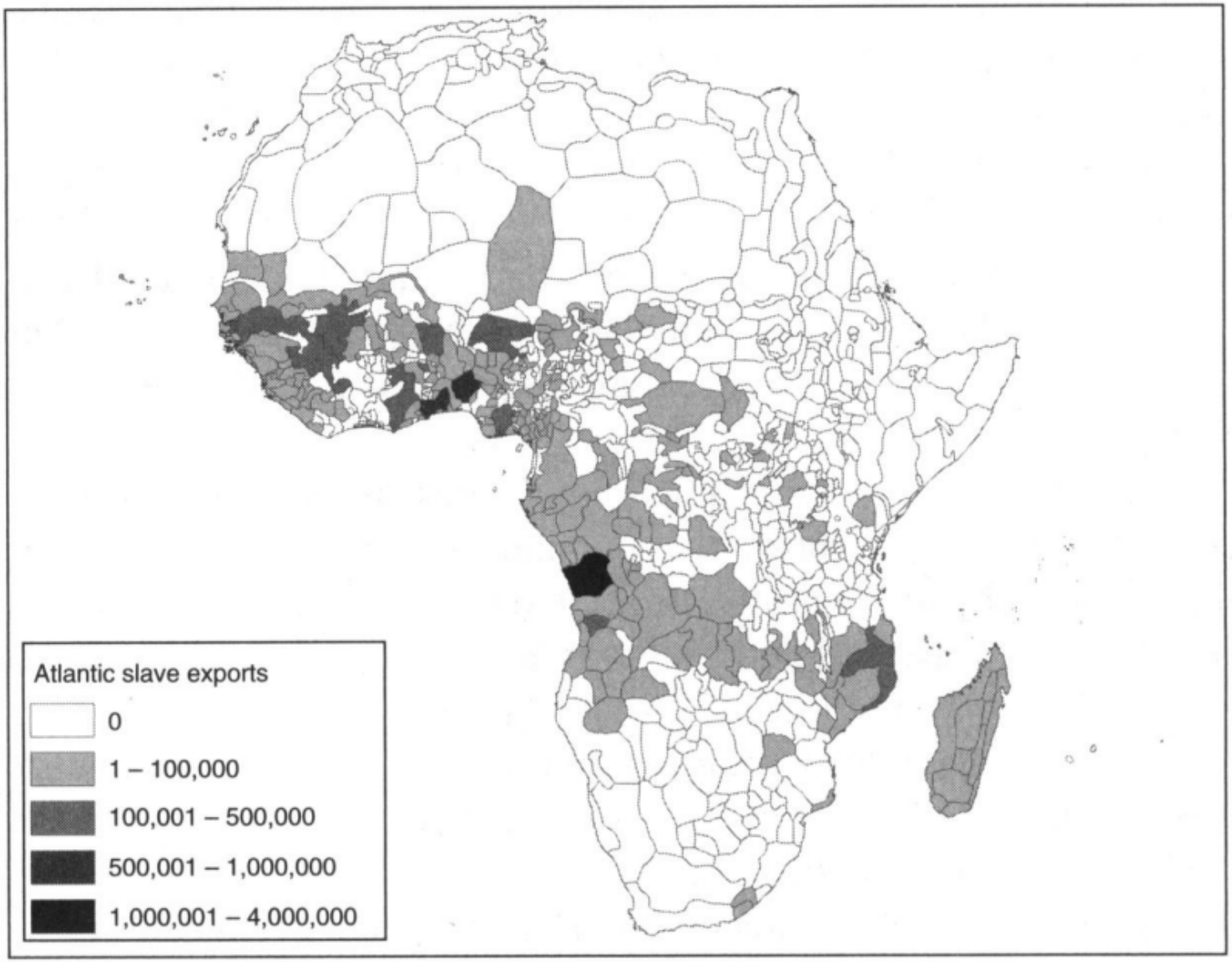
- As assignment variable (Geo-RDD or Geo-IV), e.g.,
  - RDD: Distance to Potosi (Dell 2010)
  - RDD: Distance from colonial border (Lee & Schulz 2011)
  - IV: Distance from site of invention of written language (Laitin & Ramachandran 2016)
  - IV: Distance from coast (Nunn & Wantchekon 2011)
  - IV: Distance from railway network (Rozenas, Schutte, & Zhukov 2017)

Nunn & Wantchekon 2011

Panel A. Transatlantic slave trade



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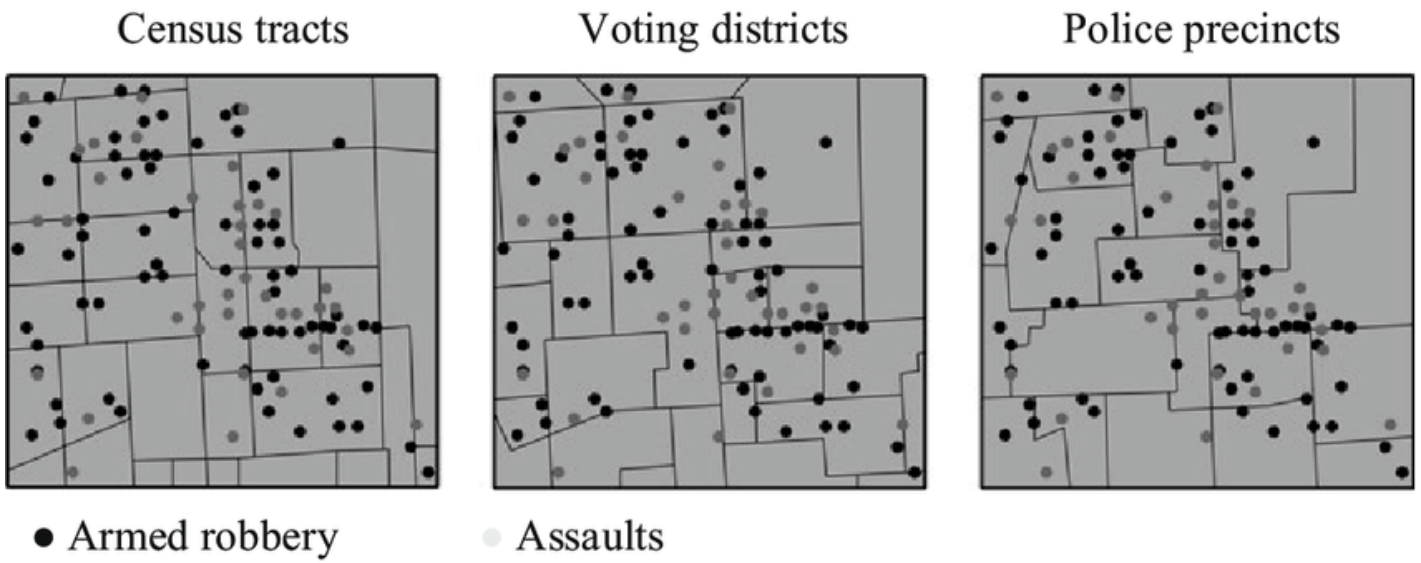
- As mediating variable, e.g.,
  - Distance to polling station (Brady & McNulty 2011)
- As control variable

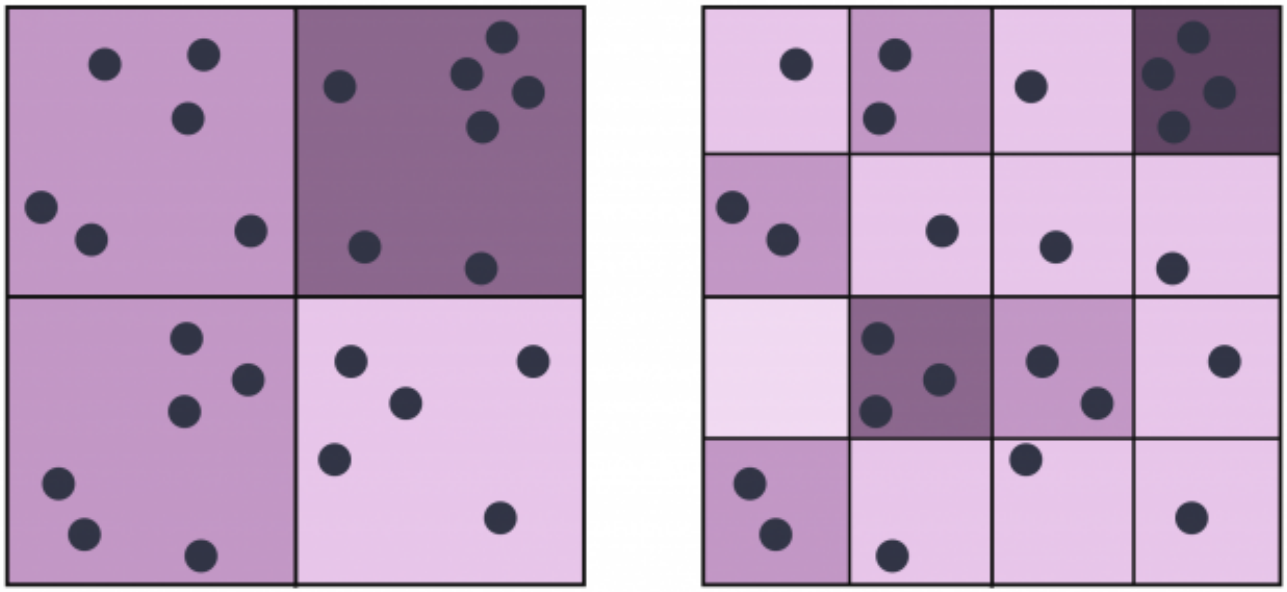
Overview

Challenges of geographic data

1. Operationalisation and measurement
   - Distance? Exposure? Geographic unit?
2. Modifiable Areal Unit Problem (MAUP)
   - Summary values are influenced by both the shape and scale of the aggregation unit

Modifiable Areal Unit Problem





Wong et al 2020

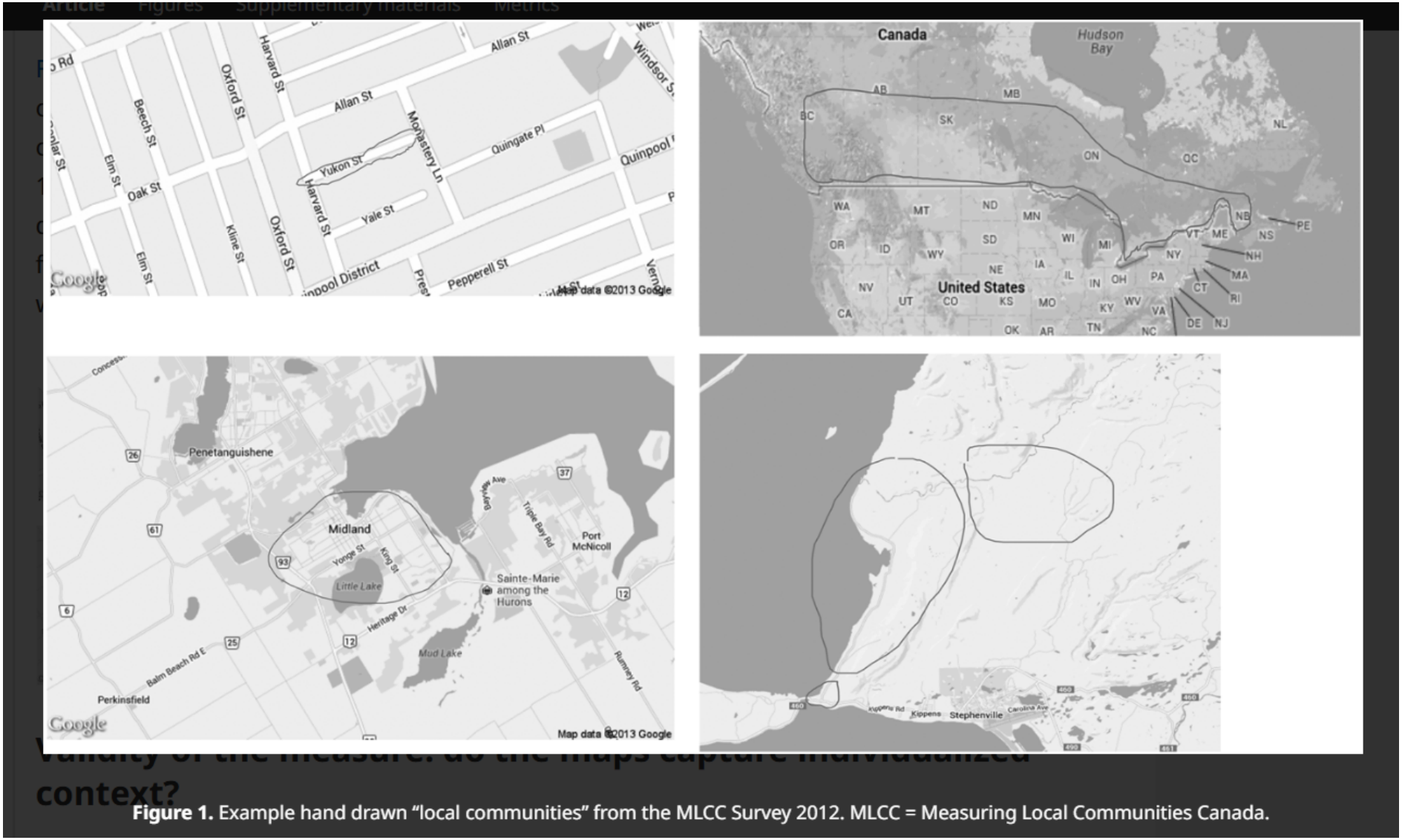


Figure 1. Example hand drawn "local communities" from the MLCC Survey 2012. MLCC = Measuring Local Communities Canada.

Wong, C., Bowers, J., Rubenson, D., Fredrickson, M., & Rundlett, A. (2020). Maps in people's heads: Assessing a new measure of context. *Political Science Research and Methods*, 8(1), 160-168.

Moore & Reeves 2020

Figure 1. The paths of two individuals in Los Angeles County. Person 1 (△) is concentrated in West Los Angeles and Person 2 (◯) in La Crescenta-Montrose.

Moore & Reeves 2020

Figure 5. Examples of racial experiences in select metropolitan counties. Individuals living in the same county have disparate racial experiences. Panels show the distribution of the racial and ethnic composition of the census blocks that individuals travel through, grouped by modal county. The *x*-axis is the percent non-white; densities farther to the right indicate more diverse (less white) racial and ethnic contexts. Vertical lines represent the percent of the county population that is non-white.

Challenges of geographic data

1. Operationalisation and measurement
   - Distance? Exposure? Geographic unit?
2. Modifiable Areal Unit Problem (MAUP)
   - Summary values are influenced by both the shape and scale of the aggregation unit
3. Measurement and data problems
   - non-matching coordinate reference system (CRS) and projections
   - polygons vs. points; centroids
   - unit boundaries don't match, or change over time
4. Distance/geography for causal inference
   - Geo-IVs (plausibility? Tobler...)
   - Geo-RDD (see Keele & Titiunik, 2015)
   - Spatial diff-in-diff

Hankinson, Magazinnik, & Sands (2026)

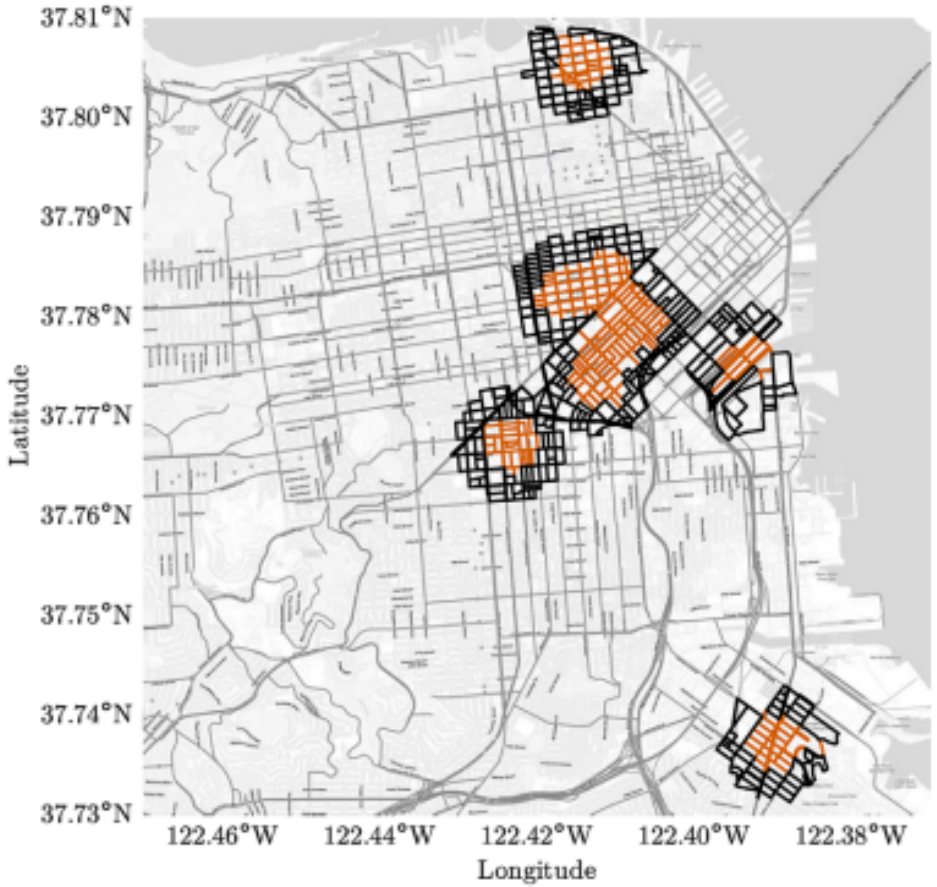


FIGURE 2 Visualization of the near-far design. *Notes:* Treated blocks—those that are near Low-Income Housing Tax Credit (LIHTC) developments built in 2003–2006—are orange, and control blocks—those that are just farther from LIHTC developments built in 2003–2006—are black.

Hankinson, Magazinnik, & Sands (2026)

FIGURE 3 Visualization of near-near design. *Notes:* Treated blocks—those that receive Low-Income Housing Tax Credit (LIHTC) developments in 2003–2006—are orange, and control blocks—those that receive LIHTC developments in 2007–2010—are black.

Hankinson, Magazinnik, & Sands (2026)

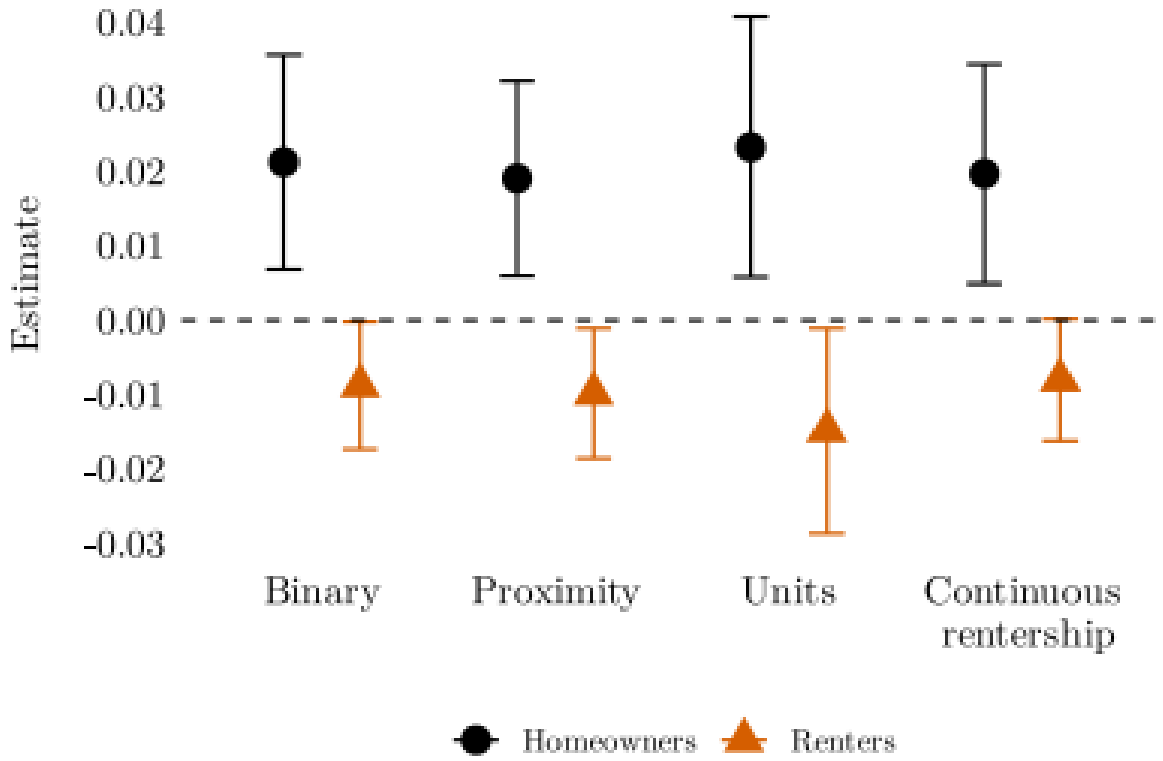


FIGURE 4 Effect of new, nearby Low-Income Housing Tax Credit developments on change in support for housing bonds, near-far design. *Notes:* Error bars represent 95% confidence intervals adjusted for multiple hypothesis testing. Sample size for "Binary" ($n = 6{,}000$), "Proximity" ($n = 6{,}000$), "Units" ($n = 6{,}000$), and "Continuous rentership" ($n = 9{,}292$).

Hankinson, Magazinnik, & Sands (2026)

(a) Prior to LIHTC housing (2016)

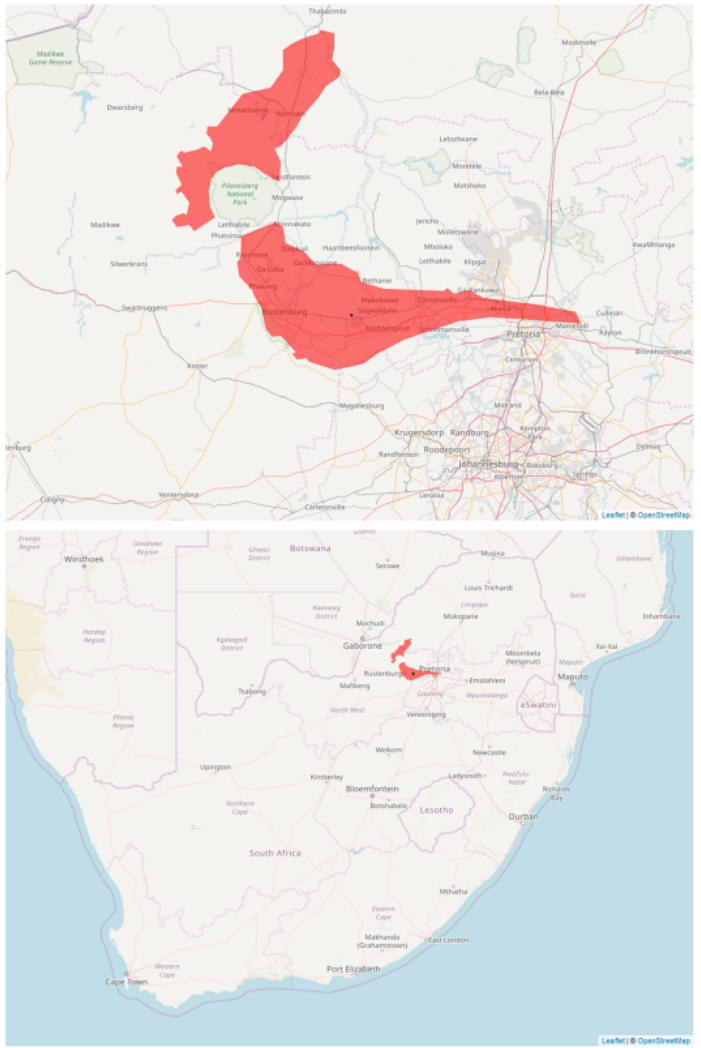
(b) With LIHTC housing (2019)

tl;dr: Publicly-funded affordable housing causes increased support for more affordable housing among nearby homeowners, likely due to neighborhood improvements

Hankinson, M., Magazinnik, A., & Sands, M. (2026). The policy adjacent: How affordable housing generates policy feedback among neighboring residents. *American Journal of Political Science*.

de Kadt, Johnson-Kanu, & Sands (2024)

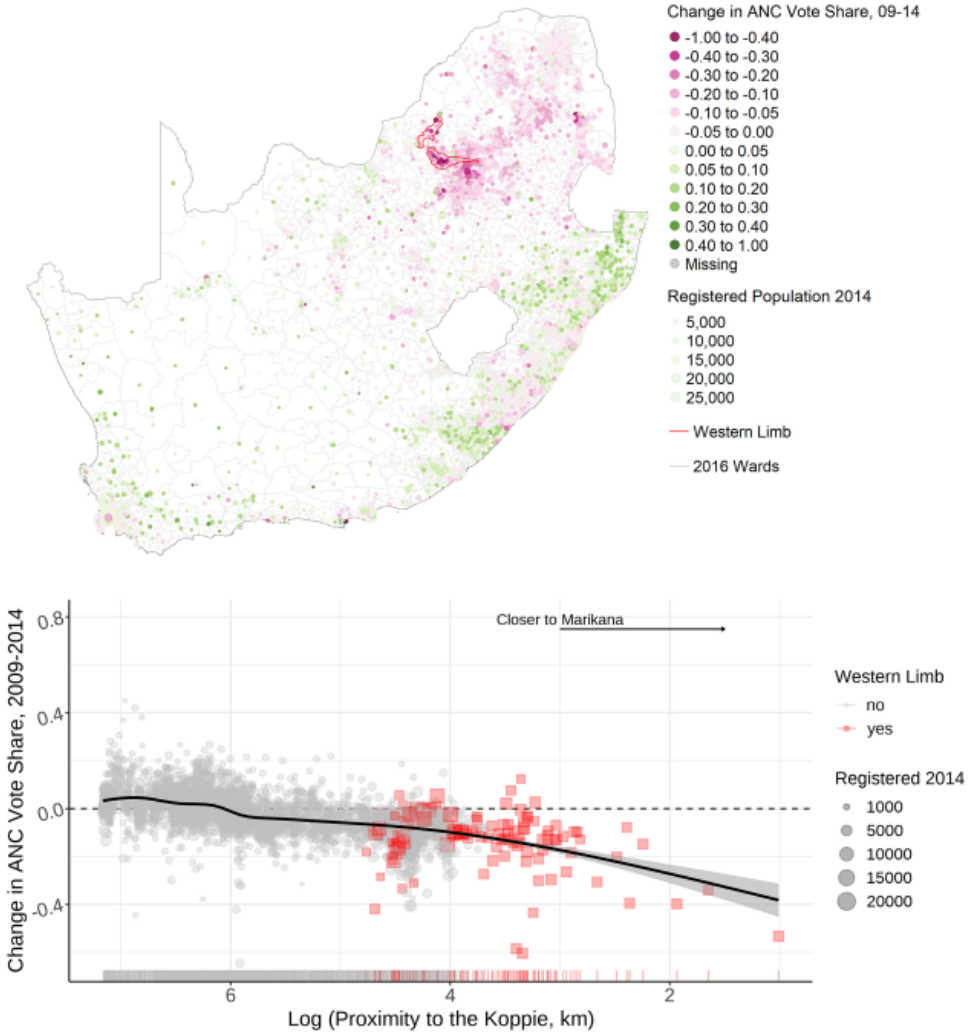
FIGURE 1. The Western Limb and the Koppie, the Site of the Marikana Massacre



Note: The upper panel shows the site of the Marikana Massacre (the black dot) and the extent of the Western Limb communities (red polygons) in the local geographic context. The lower panel shows the same but in a broader context. The Western Limb polygons were hand drawn by the authors in GIS, following Godfrey (2018) and Kinnaird (2005). The massacre occurred at two different scenes; the black dot shows the Koppie from which the strike was organized, which lies equidistant between them, 250m from either scene.

de Kadt, Johnson-Kanu, & Sands (2024)

FIGURE 5. Visualizing the Electoral Effect of the Massacre



Note: Each ward in the country is represented by a point on both the upper panel (map) and the lower panel (graph). In the upper panel, each point is located at the ward's centroid. The outline of Western Limb is shown in red in the upper panel and those same "treated" wards are highlighted in red in the lower panel.