Utrecht University

Urban Geography
Research Day 2023

Geographic Information Systems (and Science) – (GIS)

How to measure and represent urban geographic space?

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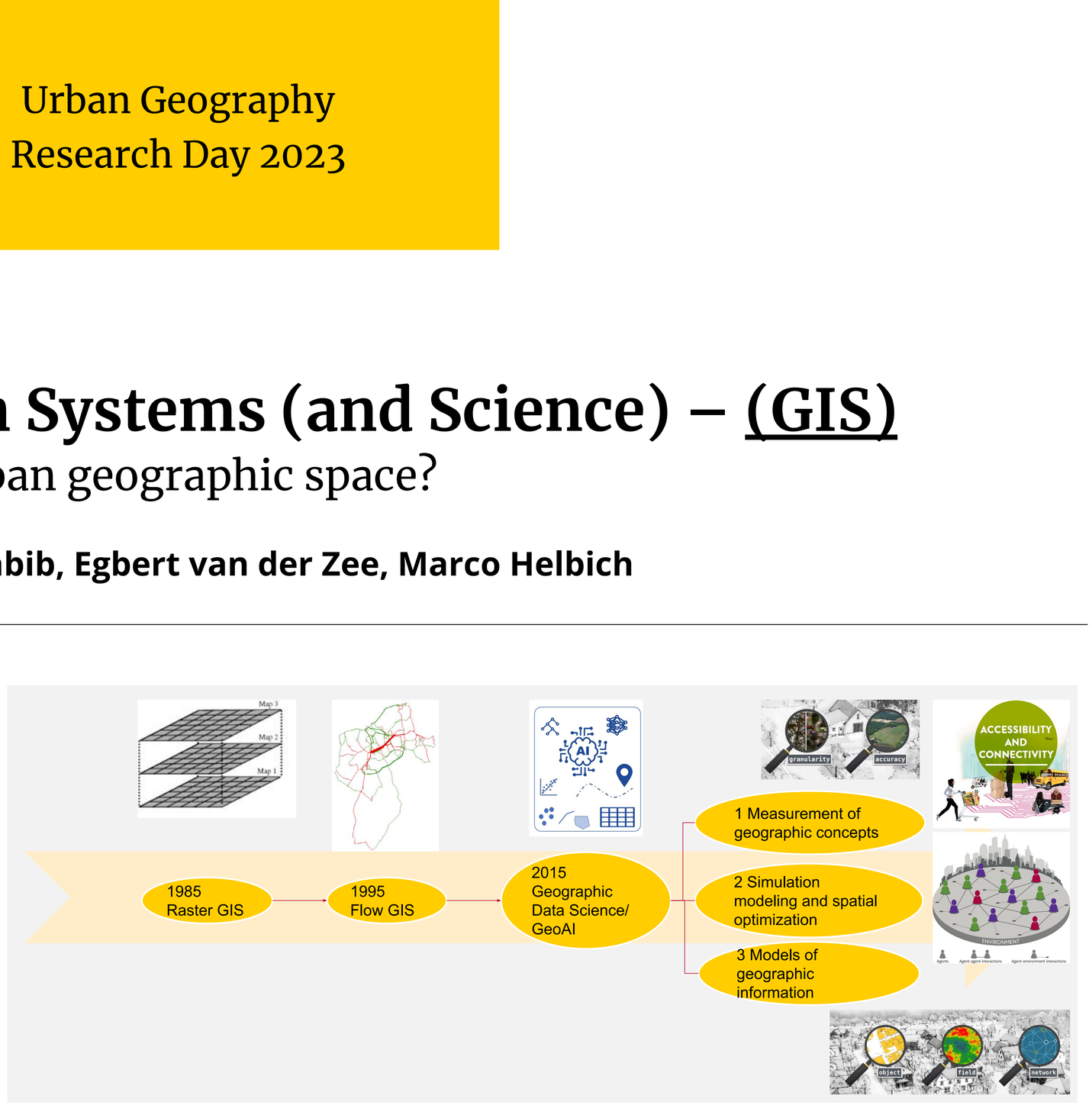
Research history

Geographic information science was invented in the 1980ies as a **science of spatial methods**. Geography@UU has a history of being among the first research groups to **develop GIS**.

1. 1985: The group of Prof. Peter Burrough developed one of the first **raster GIS** (PCRaster). Now hosted by Physical Geography.
2. 1995: Tom de Jong developed Flowmap, a software for **analysing transport flows over networks (vector).** The software is still in use in analysis and teaching.
3. Since 2015: With the advent of geospatial artificial intelligence (**geoAI**) and **geographic data science**, new methods are developed.



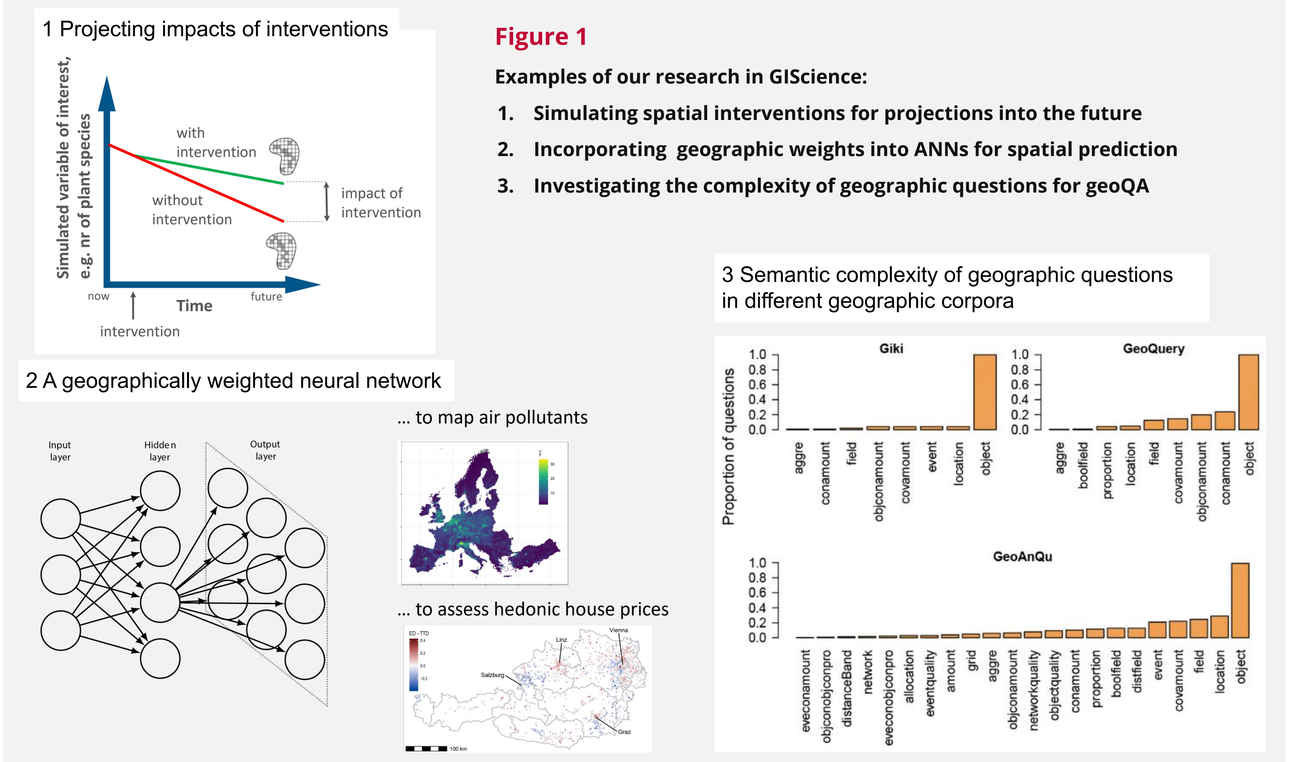


Figure 1

Examples of our research in GIScience:

1. **Simulating spatial interventions for projections into the future**
2. **Incorporating geographic weights into ANNs for spatial prediction**
3. **Investigating the complexity of geographic questions for geoQA**

Main research questions

GIScience is a **meta-science** (= a science about spatial information methods). Therefore, it is not about answering geographic questions, but about **how to** answer them:

1. *Measurement of geographic concepts*
   - How to model **mobility**, **accessibility**, **greenness** and **infrastructural qualities** of cities, e.g. with AI?
   - How can we model (the quality of) **geographic places** in cities using social media data?
   - What is the **role of time, space, scale** and **resolution** for geographic research (e.g. MAUP)?
2. *Simulation modeling and spatial optimization*
   - How to **project** the (health/environmental/societal) **impact** of potential urban interventions?
   - How to **explain historical geographic** developments?
   - How to **find optimal configurations** of space given multiple (health/environmental/societal) objectives?
3. *Models of geographic information in discourse about maps*
   - Which **theoretical concepts** are required for using **geographic maps**? And how can these be modeled?
   - How to automatically answer **geographic questions**?
   - How to read **geographic texts "from a distance"**?
   - What is the **perception and impact of maps** in public discourse (e.g. nitrogen maps)?

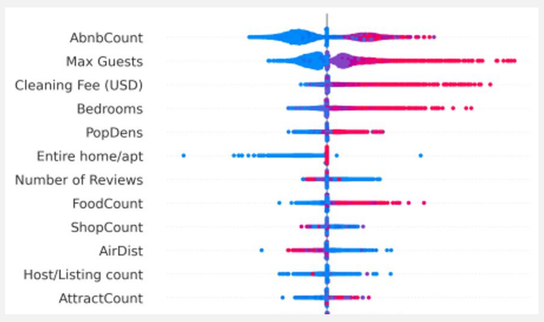
Contribution to urban geography

Methods for **modeling urban space** can be used to answer geographic questions of the following kinds (**Geography Bingo**; enter examples for … as you wish):

- What is the effect of … infrastructure on … behavior and health?
- What is the spatial distribution of topic … in social media?
- What is the impact of intervention … on … in city…?
- What are optimal configurations of … given the conflicting objectives of … ?
- What is the accessibility of amenity … in city …?
- What is the density of … for each area in …?
- What is the percentage of area covered by … in …?
- What is the spatial inequality of … within and across cities?
- What is the … quality of … places in city …?

Figure 2

4 Effect of infrastructure on Airbnb prices. Random Forest Regression with SHAP values (SHapley Additive exPlanations)
Blue = negative impact on the price
Red = positive impact on the price



5 Extraction of leisure (eating) potentials from social media posts using NLP topic models (Kernel density of topic occurrence in social media posts)