Quantitative Geography

GGM 201: Research Methods for Dissertations

[Dr. Dani Arribas-Bel]

October 6, 2014

Definition

Dictionary

Source: Oxford English Dictionary

Quantitative

- "That is, or may be, **measured** or assessed with respect to or on the basis of **quantity**; that may be expressed in terms of quantity; quantifiable."

Geography

- "The field of study concerned with the **physical features of the earth** and its atmosphere, and with **human activity** as it affects and is affected by these, including the **distribution** of populations and resources and political and economic activities; also as a subject of educational study or examination."

Academic

Fotheringham, Brunsdon, and Charlton (2000)

"One or more of the following activities:

- the analysis of numerical spatial data;
- the development of spatial theory;
- and the construction and testing of mathematical models of spatial processes"

Murray (2010)

"The collection of **methods** that are applied, or could/can be applied, by geographers and others to study **spatial** phenomena, issues and problems"

History

History

- As practice, origin is very old and hard to date
- As a *movement*, 1950s/60s/70s $\rightarrow$ **Quantitative Revolution**
  - Adoption of the **scientific method** in human geography
  - Focus on **quantification** and measurement
  - Strong association with particular **methods**: statistics, modeling...
  - Sprung out of a few epicenters (UW's "*space cadets*", Lund's T. Hagerstrand, also related to Isard's Regional Science)
- 1980s/90s $\rightarrow$ Cultural turn in Human Geography
- 1990s/00s $\rightarrow$ Spill over other disciplines (Economics, sociology, public health/policy...)
- **[My view]** Nowadays $\rightarrow$ Back in fashion? Big Data revolution, IoT, computational power...

Quantitative Geography today

Murray (2010)

(Spatial) methods that can be/have been applied to *human* and *physical* geography problems and issues. Broad categories:

- Geographic Information Systems (GISs)
- Airborne sensing
- Statistics and exploratory spatial data analysis (ESDA)
- Mathematics and optimization
- Regional analysis
- Computer science and simulation

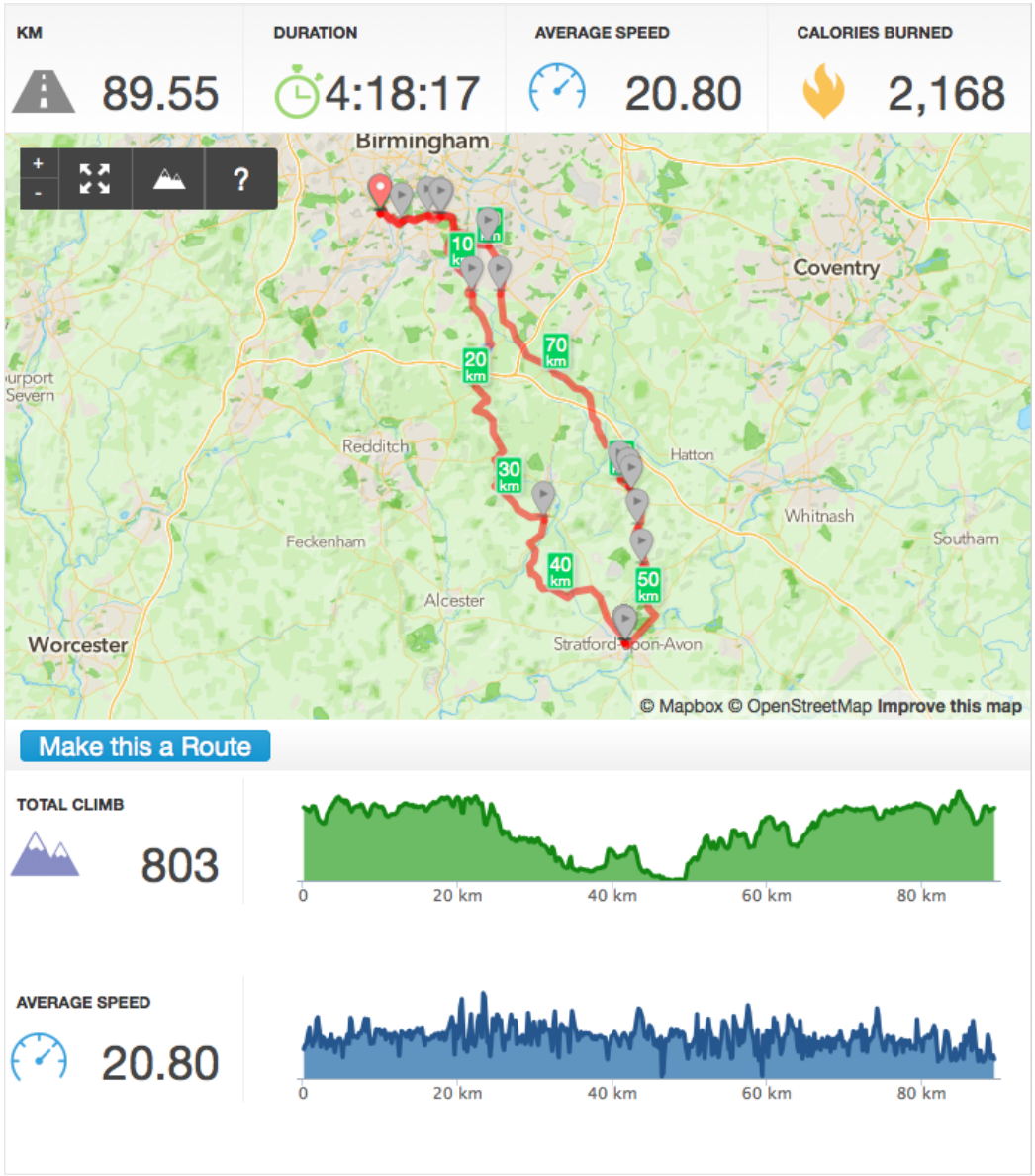
Geographic Information Systems (GISs)

"Collection of hardware, software, and associated procedures to support **spatial data**. . .

- acquisition,
- management,
- manipulation,
- analysis,
- and display"

Let's walk through each of them with an example. . .

GIS example: cycling tracking



Source: `http://www.runkeeper.com`

GIS example: cycling tracking

- **Acquisition**: collection of GPS traces (smartphone)
- **Management**: phone storage, transfer over server, orderly inserted into database
- **Manipulation**: transform traces (points) into an actual route (lines)
- **Analysis**: calculate distance, speed, climb, etc.
- **Display**: present information in an intuitive and efficient way

Other day-to-day examples of GIS?

Airborne sensing

"Geospatial sensing technologies that can be utilized for data collection and/or creation"

- Global position system (GPS)
- Photogrammetry
- Remote sensing

Share:

- (Not only) from geographers: engineering, geodetic and computer sciences
- Focus on **data collection**
- Importance of sensors (IoT)
- Need for techniques to derive spatial information from raw measurements

Airborne sensing

Global Positioning System

Systems (satellites, base stations and individual receivers) that enable determining **position** and **time**

Photogrammetry

- Capture, analysis and interpretation of aerial photographs that represent spatial information
- Camera on balloons, planes, helicopters, drones...

Remote sensing

- Hardware, software and techniques for semiautomated spatial data collection
- Detect electromagnetic radiation using microwave sensors
- Allows for collection of land cover, land uses, vegetation type...

Airborne sensing (source: WikiPedia)

Airborne sensing (source: WikiMedia)

Airborne sensing (source: WikiPedia)

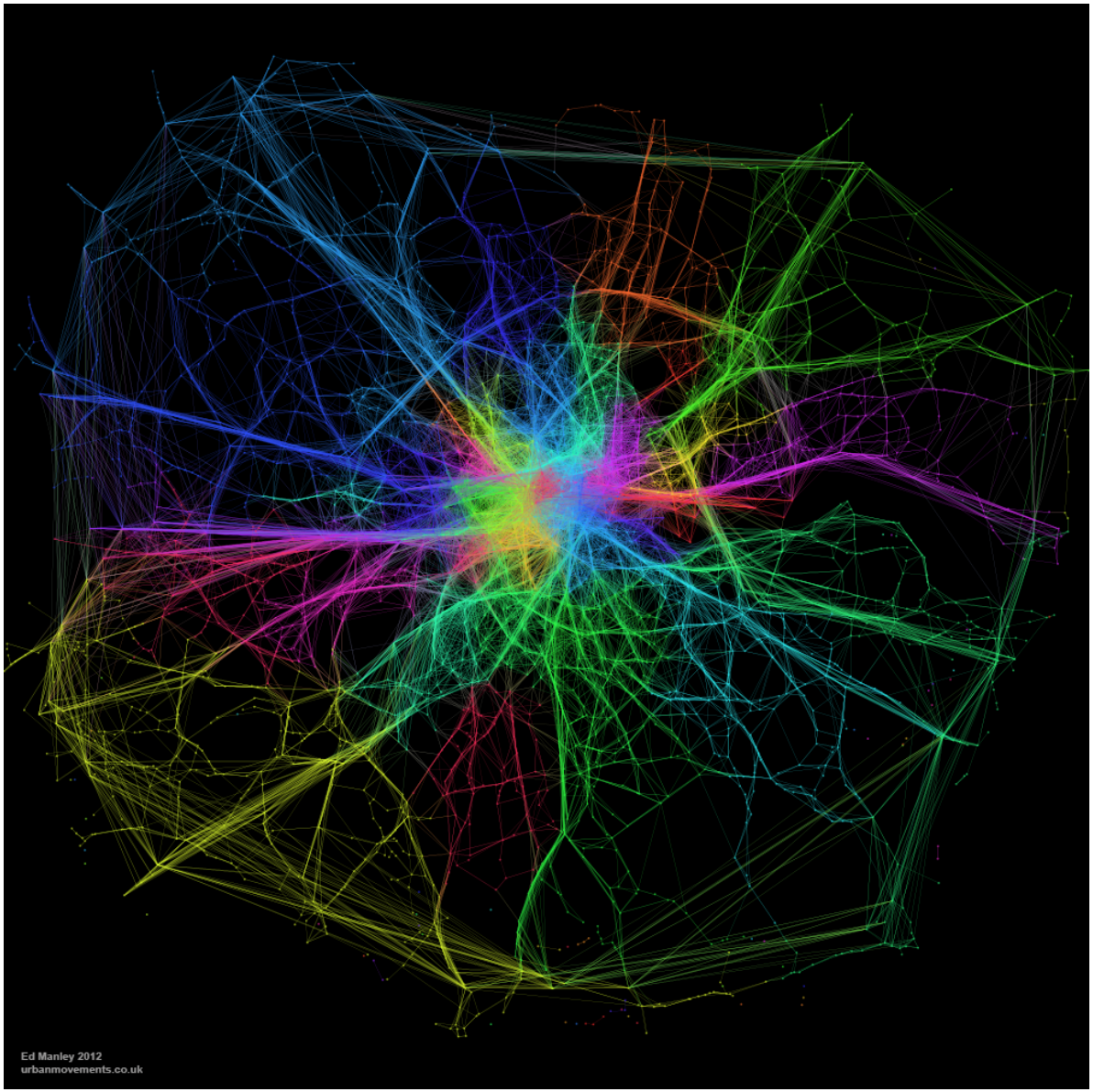
Mathematics and optimization

Algebra, geometry, calculus are at the core of much of Quantitative Geography.

Prominent Examples

- Spatial interaction models (trade, commuting, etc.)
- Spatial optimization (real world examples?)
- Network analysis (spatial networks: rivers, streets, the internet. . .)

Mathematics and optimization (source: Ed Manley)



Statistics and ESDA*

ESDA: **E**xploratory **S**patial **D**ata **A**nalysis

- One of the most extensive areas of Quantitative Geography
- Builds on non-spatial statistics, but incorporates **space** explicitly in that framework
- Main areas:
  - Surveying and sampling
  - Point pattern analysis
  - Spatial autocorrelation
  - Spatial statistics (regression, interpolation. . .)
  - Exploratory Spatial Data Analysis (ESDA) and interactive data exploration

Statistics and ESDA (source: WikiPedia)*

Regional analysis*

- Techniques to support the understanding of urban and regional economies in a quantitative manner
- Obtain insights about:
  - Industry interactions
  - Impacts on sectors of the economy and their channels
  - Regional interdependencies
- Intimately connected to economic geography, **Regional Science** and economics

Computer science and simulation*

- Traditionally *"the playground of non-geographers"*
- Recently, a much more balanced two-way relationship
- Using computating technology to create **spatial** knowledge
- Huge potential in taking advantage of future computing advances, distributed networks and parallel processing (hardware and software advances)
- Increasing in relevance as datasets grow and problems becomes more computational

Where to continue

Where to continue

If you like how all of this sounds, find more of it at GEES scattered in:

- [Y2] *Understanding neighborhood poverty*, by Dr. Lee
- [Y2] *Geomatics for Geographers* , by Dr. Chapman
- [Y2] *The Urban and Regional Economy* , by Dr. Tranos.
- [Y3] *Network Geographies*, by Dr. Tranos.
- [Y3] *Geocomputation* (coming soon!), by Dr. Arribas-Bel.

Or talk to:

- Dr. Tranos
- Dr. Arribas-Bel

Credits

Credits

This set of slides are heavily inspired by:

- Haggett, P. 2008. "The Local Shape of Revolution: Reflections on Quantitative Geography at Cambridge in the 1950s and 1960s," *Geographical Analysis*, 40, 336–352.
- Murray, A. T. 2010. "Quantitative Geography," *Journal of Regional Science*, 50, 1, 143-163.

Of course any mistakes and errors remain entirely of myself

License