GIS Basics: Computer Mapping Concepts & Options

Pratt Institute
PSPD – Fall 2014
GIS I Fundamentals
Computer mapping — a powerful tool

A geographic information system (GIS) is a sophisticated computer and database application that manages and analyzes data based on its location — a street address, ZIP Code, latitude/longitude, or other “geocode.”

GIS is used by many entities, such as:

- **government agencies**, to show exactly where toxic sites are located or to track land use changes;
- **utilities**, to expand their customer base and monitor power and phone lines;
- **real estate developers and retailers**, to plot demographic trends with precision; and
- **campaign consultants**, to analyze voting trends, polling results and contribution data down to the street address.
Conventional Information Systems

– Answer the following questions:
  • Who?
  • What?
  • When?
  • Why?
  • How?
GIS answers the following

- **Location**: Where is it?
- **Condition**: What’s nearby?
- **Trends**: How has this area changed since…?
- **Patterns**: Where are the concentrations?
- **Modeling**: What if…?
GIS: different than traditional mapping.

GIS maps are …

• … *dynamic*, based on relational databases (all maps are different);

• … *customizable* without redrawing by hand;

• … *interactive* – you can click on them to obtain more information;

• … *analyzed visually and statistically*; and

• … not necessarily maps, but better characterized as “*map layouts*”.
Real Madrid v Atlético Madrid: how the #UCL final played out on Twitter

Geotagged Tweets covering key terms for each team, CEST
Customizable...
Interactive...

Race/Ethnicity by Census Block:
2000   2010

Kings County
Tract 846.00 Block 1002
FIPS: 360470846001002

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2010</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>294</td>
<td>277</td>
<td>-17</td>
</tr>
<tr>
<td>White</td>
<td>3</td>
<td>2</td>
<td>-1</td>
</tr>
<tr>
<td>Black</td>
<td>267</td>
<td>242</td>
<td>-25</td>
</tr>
<tr>
<td>Hispanic</td>
<td>15</td>
<td>16</td>
<td>+1</td>
</tr>
<tr>
<td>Asian</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>All Other</td>
<td>9</td>
<td>17</td>
<td>+8</td>
</tr>
</tbody>
</table>


Data from US Census Bureau (PL94-171) analyzed and mapped by Center for Urban Research, CUNY Graduate Center.
Visual and statistical analysis ... (you may not need a map, but you need GIS)

How GIS Works

- Layers of information are combined to visualize reality.
- Allows you to look at several different features of an area at the same time.

Image from Hunter College Geography Department, CUNY. (www.geography.hunter.cuny.edu/~carsi/INDEX/CURRENTERAFFAIRS/exhibit/central_park_Layers.htm)
Key GIS concepts

- Geography separate from attributes
- Each row of a spatial database represents a single geographic feature
- Each database represents a “layer” of information – similar features grouped together
- The database’s geographic “object” enables you to query the database spatially
- If multiple databases/layers are accessed at the same time by a GIS, queries can be done across layers (and using information from one layer to query another)

» find me all census tracts (layer number 1) where most households have one car and that are within a mile of a public park (layer number 2)
Map layouts ... start with a blank slate, add layers, based on relational databases, enables spatial analysis.
How GIS is useful for urban planning …
Equity Analysis

- are projects distributed fairly based on population patterns

Map created by Lehman College Dept of Geology and Geography

Voting patterns

2013 Mayoral election
vote share & turnout for Bill de Blasio
De Blasio vote share, by Election District
(vs. Lhota & minor candidates)

75% or more
50 - 75%
25 - 50%
25% or less

Blocks won by candidate
Blocks lost by candidate

Turnout
Below Above avg. avg.
(Average 2013 turnout: 24% of registered voters)

Data sources:
unofficial 2013 results from Associated Press;
registered voter counts from NYC Board of Elections.

Blank areas: no votes and/or no population.

Brooklyn-Queens border
Airports

Map prepared by the Center for Urban Happort
at the Graduate Center/CUNY in partnership with:

2013 Mayoral Democratic primary
vote & turnout for Bill de Blasio
De Blasio vote share, by block
(vs. 8 other candidates)

75% or more
50 to 75%
50% or less
25 to 50%
25% or less

Blocks won by candidate
Blocks lost by candidate

Turnout
Below Above avg. avg.
(Average 2013 primary turnout: ~30% of registered Democrats)

2013 vote data from Associated Press.

Blank areas: no votes and/or no population.

Airports
Demographics and social services - targeting need throughout a region
Emergency management / response

No Evacuation Order Currently in Effect

Legend

- Evacuation Center
- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- Zone 6

Information on evacuation centers is subject to change. Please revisit this site for updated reports on building status and wheelchair accessibility features.

Find out more about the zones and preparing for a coastal storm: NYC Hazards - Coastal Storms & Hurricanes

Layer transparency
Emergency management / response

Median Household Income and Sandy Storm Surge: SE Queens

Created by: Pratt Center for Community Development
February 2013

ESRI Major Roads 2008, DCP Borough Boundaries 2012
GIS, online map “mashups”, and our location-aware mobile networked world

Google Maps (and others - Microsoft, Apple, etc)

Real-time data

Web services (ex: weather data integrated into online map)

3D views; mobile maps
Map galleries online:

- **cartoDB** [http://cartodb.com/gallery](http://cartodb.com/gallery)
- **MapBox** [https://www.mapbox.com/showcase/](https://www.mapbox.com/showcase/)
- **NYC** [http://www1.nyc.gov/nyc-resources/nyc-maps.page](http://www1.nyc.gov/nyc-resources/nyc-maps.page)
Maps may not answer all your questions… but:

- they enable you to know what questions to ask;
- and to ask those questions in an informed way.
ArcGIS basics