Mapping Criminal Justice Data with ArcGIS

Elizabeth Groff, Ph.D.

Presented by
Justice Research and Statistics Association

6/15/2017
Mapping Criminal Justice Data with ArcGIS

Elizabeth R. Groff
Outline

- Advantages of mapping
- Conceptual overview of GIS/ArcGIS
- Example of mapping UCR data
- Problem-solving tips
Advantages of spatial analysis - 1
Section 1: Identify where things are located

- Where are the XXXX?
- Subways stations, bars, parks, after-school programs, halfway houses
Section 1: Combine spatial data

- Answer questions like ....
  - Which neighborhoods have the most access to public transportation?
    - Use neighborhood boundaries and locations of subway stations
    - Use neighborhood boundaries and locations of bus routes
  - Which neighborhoods get more after-school programming dollars?
    - Use neighborhood boundaries and locations of after-school program locations
Section 1: Identify where things are clustered

- Concentrations/hot spots of ...
  - retail outlets, bars, crime events, drug overdoses

- Areas with high levels ...
  - Clusters of neighborhoods with high violent crime levels
Section 1: Identify where things are changing

- Counties with declining property crime levels
- Neighborhoods with increasing numbers of formerly incarcerated people
Section 1: Integrate different data sets based on where

- Not tied to common field
- Location can be used
- Each layer (grouping of similar features) can be overlaid to identify where features are in common
- Ex.
So how do you get started?

- Many different mapping applications available
- Free
  - QGIS (Quantum GIS)
  - GRASS (Geographic Resources Analysis Support System)
  - [https://www.gislounge.com/open-source-gis-applications/](https://www.gislounge.com/open-source-gis-applications/)
- $$$$
  - Maptitude
  - MapInfo
  - Esri – ArcGIS – largest professional GIS firm for analytics
Conceptual overview of ArcGIS - 2
Some basic vocabulary

- **Features**
  - Geographic component of data
  - Simplified representation of one aspect of the real world
    - Streets
    - Buildings
    - Fire hydrants
    - Streams
    - Parcels
    - Land use

- **Attributes**
  - Tabular component of data
  - Characteristics of features
    - Street type, name, direction, length, address range, speed limit
A GIS simplifies features in the real world into three different data types:

- Points
  - Location described by single X,Y pair – (2, 7)

- Lines
  - Features with length. Described by a series of X, Y pairs.

- Polygons
  - Features with length and width. Areas.
  - (2,4)(2,5)(3,6)(4,5)(2,4)
ArcGIS Desktop

- Refers to a suite of products
- Three most frequently used are:
  - ArcMap
  - ArcCatalog
  - ArcToolbox
- All examples in today’s webinar use version 10.4
ArcMap

- Spend most of your time here
  - Add and inspect data files (both tabular and spatial)
  - Join spatial data and flat tables (attribute files)
  - Symbolize spatial data layers
  - Conduct spatial analysis
  - Create maps
  - Export data

- Can access both ArcCatalog and ArcToolbox from the ArcMap interface
ArcMap interface
ArcCatalog

- Use when organizing, creating and looking for geographic and tabular data
  - Add and inspect data files (both tabular and spatial)
  - Rename shapefiles easily
  - Create geodatabases
  - Export data
  - Set your home directory
  - Use ‘Connect to Folder’ button if you do not see your data
ArcCatalog data storage formats

- **Shapefile**
  - A set of files that have the same root name but different extensions
  - Three are required to use a shape file in ArcGIS
    - XXX.shp
    - XXX.shx
    - XXX.dbf

- **Geodatabase - File based**
  - Much more robust, recommended native format
  - A file geodatabase is a file folder that holds its dataset files
  - No limit on file size (see documentation for caveats)
ArcToolbox

- Contains all the geoprocessing tools for analyzing and manipulating geographic data
- Some tools for manipulating tabular data (but not a strength)
- Tip – manipulate data prior to importing it into ArcMap
ArcMap demo 1

- Orientation to the interface
- Accessing ArcCatalog
- Accessing ArcToolbox
- Creating an ArcMap project
- Setting the home directory
Working with spatial data - 3
Getting started -- Data basics

- File that is geographically enabled
  - Boundary file – counties, school districts, police districts, cities, census tracts, drug markets
  - Line file – streets, routes (school bus, public transit)
  - Point file – Transit stations, stadiums, other facility types

- File that has attribute information
  - Excel, Text (tab or comma delimited), .dbf, etc.

- Join the two files into a single file

- OR obtain a file that is geographically enabled and contains the attribute data
Example

- Geography of counties in a state

- Spreadsheet with county names

<table>
<thead>
<tr>
<th>County</th>
<th>Murder</th>
<th>Rape</th>
<th>Rob</th>
<th>Agg Aslt</th>
<th>Simple As: Burg</th>
<th>Lar</th>
<th>MVT</th>
<th>Vio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appling</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>70</td>
<td>54</td>
<td>114</td>
<td>275</td>
<td>6</td>
</tr>
<tr>
<td>Atkinson</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>4</td>
<td>16</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>Bacon</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>100</td>
<td>86</td>
<td>45</td>
<td>158</td>
<td>5</td>
</tr>
<tr>
<td>Baldwin</td>
<td>2</td>
<td>11</td>
<td>31</td>
<td>632</td>
<td>390</td>
<td>442</td>
<td>1133</td>
<td>54</td>
</tr>
<tr>
<td>Banks</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>147</td>
<td>135</td>
<td>103</td>
<td>384</td>
<td>20</td>
</tr>
<tr>
<td>Barrow</td>
<td>2</td>
<td>33</td>
<td>18</td>
<td>1042</td>
<td>741</td>
<td>547</td>
<td>1573</td>
<td>139</td>
</tr>
</tbody>
</table>
Joining data

- Tabular join
  - Requires one field that is in common between the two tables

- Spatial join
  - Use the geographic location to join two or more spatial data layers
Example of tabular join

- Table of geographic data layer
- Spreadsheet with state names
Example of a spatial join

- Associate points and polygons
  - EMS calls with school districts
- Associate points and lines
  - Bar locations and street segments
- Associate points and points
  - Possible but used less often
ArcMap: Creating subsets of data

- Attribute queries in ArcMap
  - Use a field in the table
  - Ex. Select all the street robberies

- Spatial queries in ArcMap
  - Use a spatial relationship
  - Select all the motor vehicle thefts within a block of a CCTV camera
Simplified workflow

Step 1 Identify spatial data
- Boundary layers
- Event layers
- Streets
- Other

Step 2 Identify attribute data
- Variables
- Coding

Step 3 Link spatial and attribute data
- Attribute join
- Spatial join

Step 4 Analysis and mapping
- Appropriate to question
ArcMap demo 2: Mapping UCR data

- Open a new ArcMap window
- Find spatial data
- Add spatial data to your ArcMap project
- Save your project
- Set the default directory
- Add tabular UCR data to your ArcMap project
- Use an attribute join

Many thanks to Stefanie Lopez-Howard, Director of the Georgia Statistical Analysis Center for the sharing the UCR data.
Improving your map - 5
Finding data

- Internet resources
  - Search terms to find spatial data
    - Geospatial repository
    - Open data

- Examples
  - ArcGIS,
  - PASDA - Pennsylvania Spatial Data Access,
    http://www.pasda.psu.edu/
  - Georgia Open Data -
    http://data-georgiagio.opendata.arcgis.com/
Open your ArcMap project

Calculate a new field with violent crime rate per 1,000 population
  - Choropleth maps based upon total numbers are easy to misinterpret
Making a presentation quality map

- Five elements
  - Map
  - Title
  - Legend
  - Scale bar
  - North arrow

- Export map
  - Graphic
  - Print
Problem-solving - 6
Help with issues

- Use your favorite search engine
  - Key words to use
    - Software
    - Challenge you are encountering

- Use software websites (more targeted approach)

- Stack exchange
  - https://stackexchange.com/
Thank-you!

Questions?