Approaches to Spatial Analysis

Flora Vale, Linda Beale, Mark Harrower, Clint Brown
Esri Redlands
**Analysis** *(noun)*

Detailed examination of the elements or structure of something, as a basis for discussion, interpretation, and action.
Two Key Methods for Spatial Analysis

• Spatial Data Exploration

• Spatial Problem Solving
Spatial Data Exploration

Working with Maps and Graphs

- Smart Mapping enables you to explore and interact with your data ...
Spatial Data Exploration
Working with Maps and Graphs

- Interactive Charting and Graphing your Tabular Data and Real-time Feeds
Data Science
Approach To Spatial Problem Solving

Modeling accompanied by Exploration and Interpretation

… followed by Map-based Communication

1. Ask
2. Compute
3. Interpret
4. Decide
5. Share
1. Pose a Question
Scope and frame your question

- Explore your data

- Scope the problem and frame your question

- Examples:
  - Identify the best path for a wildlife corridor
  - Is there a difference in Medicare expenditures per capita across the country? Where?
  - Is there a pattern in these crime data? By location? By time?
2. Model and Compute

Compute with data. Apply a logical sequence of spatial processing operations to generate a desired set of results
2. Model and Compute
Compute with data. Apply a tool to transform existing data into new results

- GIS Tool

Apply an operation to your data to generate a result
Geoprocessing
String tools together to create your own “programs”

• Feed the results of one tool into another tool

• Program your ideas with Python, Model Builder, Insights, …
3. Explore and Interpret

Often a Missing Step

• Express your results as information products
  - Maps
  - Reports
  - Information Popups
  - Charts and Graphs
  - Etc.

• Explore, examine, and interpret these results

The Analysis Step
4. Make a Decision

- Draw your conclusions and document your results
5. Communicate and Share

- Present your results

- Communicate with Maps, Summaries, Charts and Graphs, Workbooks, and Narratives

- Share your conclusions and understanding with others as useful map-based information products

*Storymaps*
Two Key Methods in Action

- Spatial Data Exploration
- Spatial Problem Solving
Exploratory Data Analysis

Health (Medicare) data and crime incidents

Flora Vale
Spatial Analyst, Esri
Spatial Analysis

what society thinks I do
what my friends think I do
what my mom thinks I do
what I think I do
what I actually do
Charts in ArcGIS Pro

Distributions
HISTOGRAM – group numbers into bins to visualize distribution

Relationships
SCATTER PLOT – plot two numeric variables to visualize their relationship

Categories
BAR CHART – compare amounts across different categories

Change
LINE CHART – visualize change over a continuous range, such as time or distance
Data exploration can lead to insights and be fun
Reflections and Future Directions

• Interactive visualization and analysis go hand-in-hand (not either or)

• Smart defaults will help, but no magic bullets, need to ask good questions & expertise

• Introduce the power of analytics to new audiences

• Spatio-temporal is a major focus – people interested in processes, not static states.

  Lots of good time series methods (e.g., emerging hotspots) AND richer data available.

• June release ArcGIS Online great new temporal visualizations = formulate hypothesis
Highlight a Specific Point in Time

Sometimes, you want to see how things were different before and after a point in time.

This map shows buildings in Rotterdam, Netherlands. Rotterdam suffered intense bombing in World War II, drastically altering the structure of the city. The Rotterdam Blitz of May 14, 1940 destroyed many structures in the city. This map highlights buildings that were built before, during, and after the war. The dark blue buildings were built around 1967 or earlier. The light yellow buildings were built around 1949. The dark red buildings were built after 1974.

This map uses the Before and After theme, which spreads the colors across a range of dates, but is centered on a key date.

Show Time and Magnitude

Sometimes, we want to show where something happened, the magnitude of it, and how recently it occurred.

The Color and Size (Age) map style allows you to map time and magnitude together.

This map shows where migrants have gone missing during recent years. The color represents how many months ago the event occurred, while the size shows how many migrants went missing.
Summary
1. Pose a Question
   Explore, Frame, Scope

2. Model and Compute
   Assemble a logical sequence of GIS operations to derive new information

3. Explore and Interpret Results
   Map, Summarize, Graph, Compare

4. Decide
   Make decisions, Document your results, Determine Next Steps

5. Share Your Results
   Communicate as Useful Maps and Information Products, Tell Your Story
Spatial Problem Solving Often Leads to New Questions

A Repeatable, Iterative Process

1. Ask Again
2. Compute
3. Interpret
4. Decide
5. Share
Learn by doing
Please complete your session survey. Thanks!