

Creating Critical Thinkers in GIS Workshops

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**MIT
Libraries**

The image features a complex network of thin lines in three colors: light blue, red, and green. These lines are interconnected to form a series of overlapping triangles and polygons, creating a web-like or geometric pattern that spans across the lower half of the slide. The lines are thin and have a slight transparency, allowing overlapping shapes to appear darker.

Outline

- **About MIT & GIS Services**
- **Introduction to GIS workshop**
- **Workshop development process**
- **Teaching methods and theories**
- **Workshop content**
- **Future plans & tips**

MIT



GIS Services

- GIS lab
- Data purchasing
- GIS data repository, GeoWeb
- One-on-one help
- Workshops



Introduction to GIS workshop

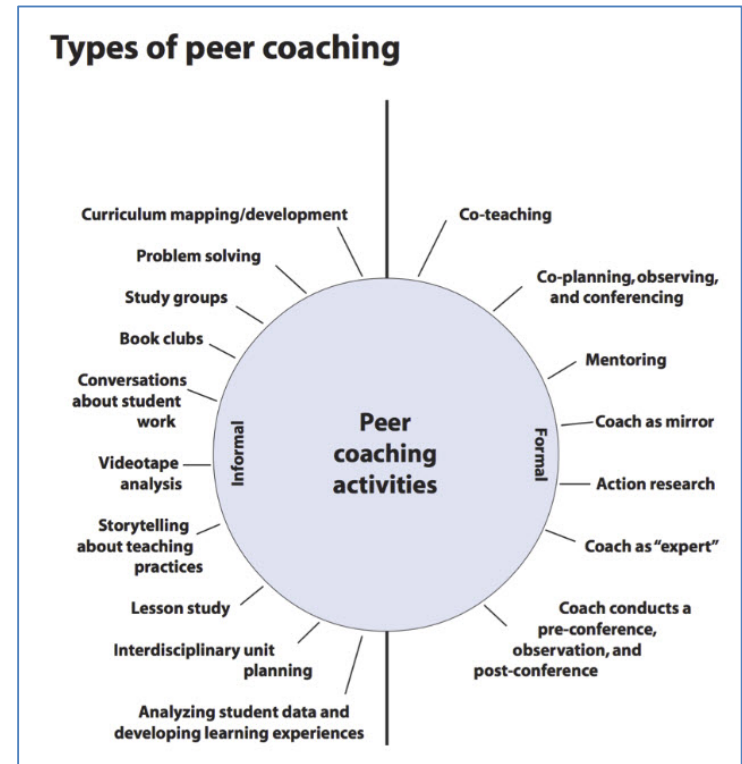
- **Held in the summer, fall, and winter**
- **2 ½ to 3 hours**
- **Open to entire MIT community**

Why revise it?

- **Increase understanding of GIS concepts and provide more transferable skills**
- **Align with Libraries-wide DISJ goals**
- **Work toward the strategic plan for the Libraries**

Workshop Development Process

- Peer coaching model
- Literature review & sharing
- Identify learning goals & skills
- Brainstorm lecture topics & activities
- Construct the workshop
- Lots of practice



From: <http://acrlog.org/2017/06/19/peer-coaching-for-professional-learning/>

Goals

Attendees will:

- **Evaluate maps and data critically in order to understand potential biases caused by the creator, collection method, visualization techniques, etc.**
- **Document their research processes so that others clearly understand and interpret the methods, tools and data used.**
- **Learn the technical skills necessary to choose the appropriate software and use it to accomplish their task.**

Teaching Methods & Theories

Scaffolding

- Break task into smaller parts
- Focus on prior knowledge

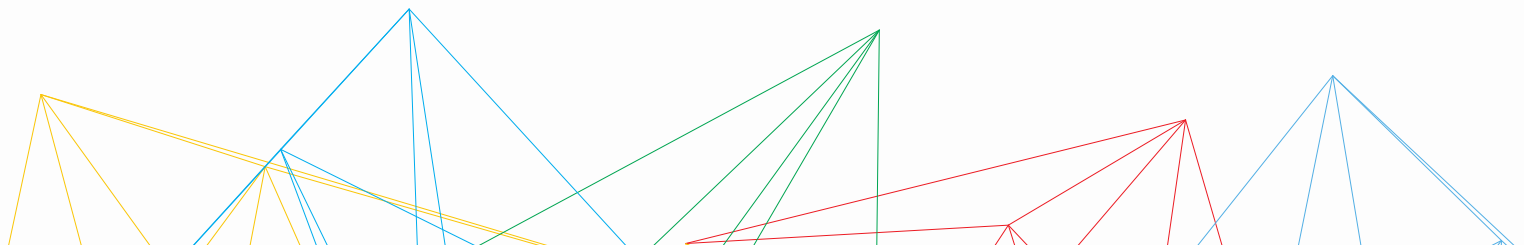
Segmented learning & retrieval

- Short activity or quiz after each section

Self-paced learning

- Hands-on tutorials

Use software to teach critical thinking skills



Workshop Content

- **Overview of GIS & applications**
- **Understanding Maps & Data**
- **Designing Maps**
- **Software**
- **Exercise**
- **Discussion**

Overview of GIS

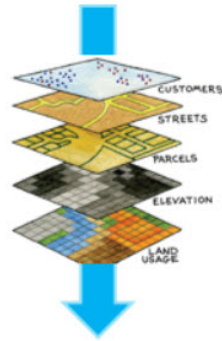
Theoretical Overview

GIS takes real world spatial data

and treats different spatial features as individual "layers"

which can be assembled in any number or combination

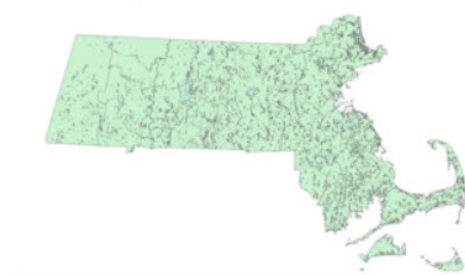
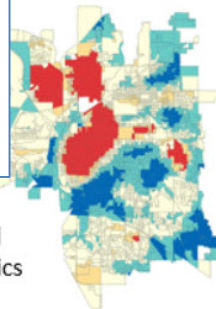
and overlaid for analysis



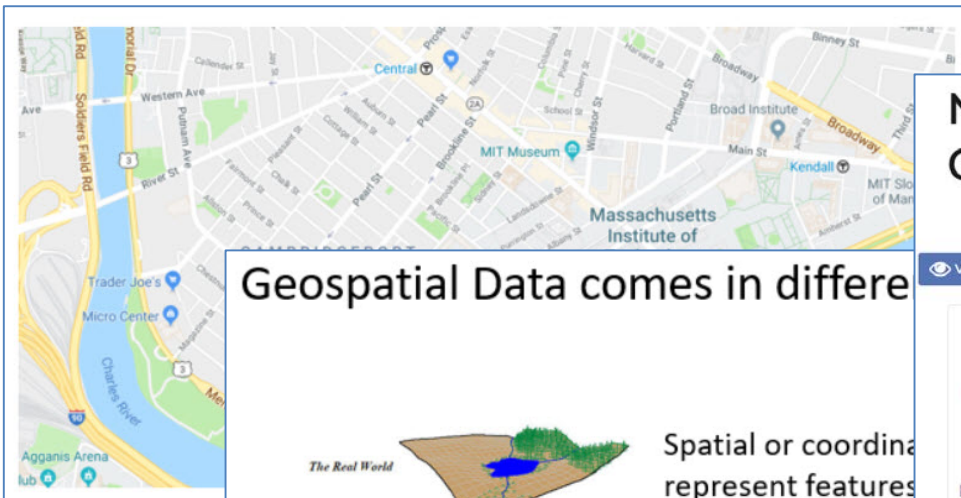
Create Maps



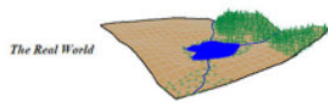
Conduct Analyses



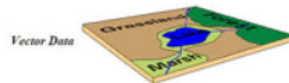
Understanding Maps & Data



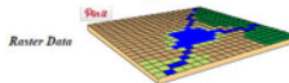
Geospatial Data comes in different



Spatial or coordinate
represent features
a known location of



Vector:
Points, lines, and



Raster:
Row and column matrix

MassGIS Data: Licensed Google Ortho Imagery

[View](#) [Revisions](#)



MassGIS (Bureau of
Geographic
Information)

MassGIS maintains a
comprehensive,
statewide database of

MassGIS Data: Licensed Google Ortho Imagery

December 2017

Google Imagery available as a web service for all Massachusetts state government agencies, and to the public in OLIVER and other MassGIS web maps.

[View Imagery and Index](#)

This is a licensed product with limited availability to non-government users.

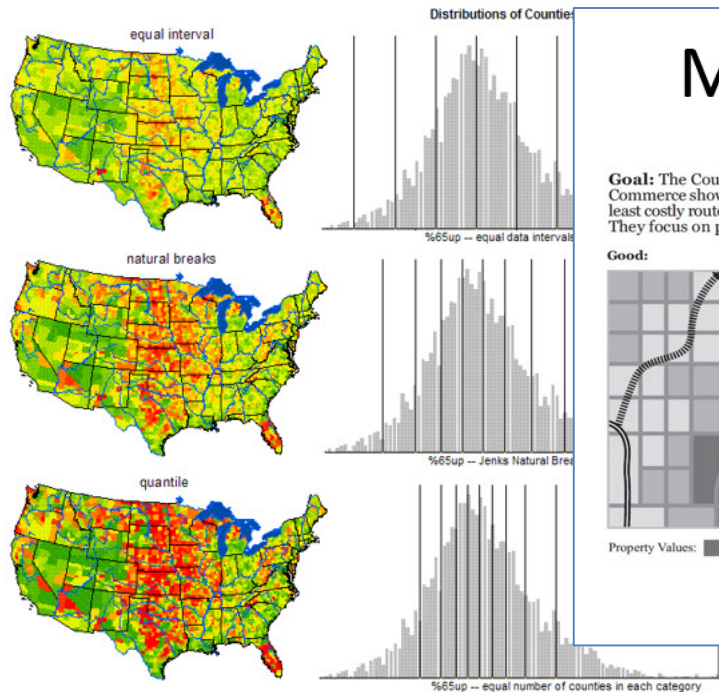
New! (12/12/17) -- Spring and summer 2017 imagery for the Cape Cod, Boston, Worcester and Springfield areas

Understanding Maps & Data

Concept	Activity
Data layers	Examine Google Maps, Use data layers in ArcMap
Characteristics and types of spatial data	Identify types of data layers in ArcMap
Tips for finding spatial data and metadata	Look at examples of metadata on websites, metadata “quiz”

Designing Maps

COMPARISON OF CLASSIFICATION METHODS
Percentage of US Population Age 65 or Older, by County



Making Great Maps

Goal: The County Chamber of Commerce shows the shortest and least costly route for the connector. They focus on property values:

Good:



Property Values: ■ high ■ med. ■ low

Goal: A community group contends the connector will devastate the African American community by cutting it in half:

Good:



% African Amer: ■ high ■ med. ■ low

Goal: A historical preservation group shows that historical properties in a historical district will be adversely affected:

Good:



% Historical Buildings: ■ high ■ med. ■ low

Goal: The Oberlin Business Association argues the proposed road will siphon traffic and thus business away from their members:

Good:



Density of Businesses: ■ high ■ med. ■ low

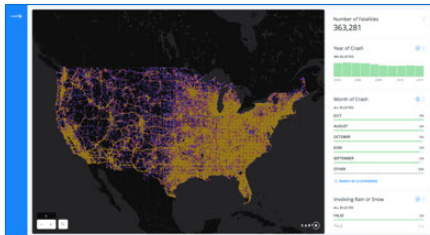
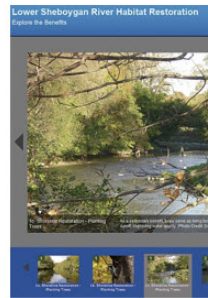
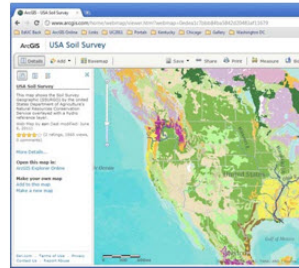
From: *Making Maps: A Visual Guide to Map Design for GIS* by John Krygier and Denis Wood - makingmaps.owu.edu

Software

Web-based

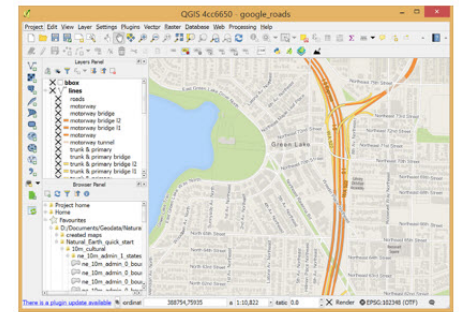
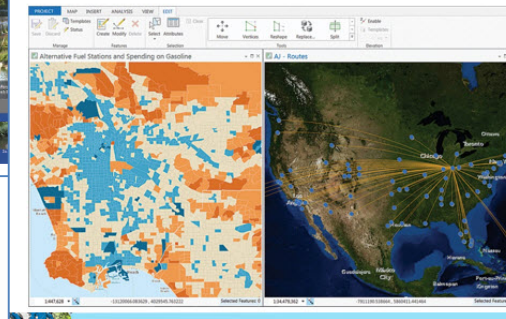
- [ArcGIS Online](#)*
- [Carto](#)*
- [Mapbox](#)
- [Google MyMaps](#)
- [ESRI StoryMaps](#)*

*use an MIT account for more storage



Desktop

- [ArcGIS Desktop](#) (MIT only)
- [ArcGIS Pro](#) (MIT only)
- [QGIS](#) (Public)
- [Specialized \(Geoda, ENVI, CrimeStat, etc\)](#)

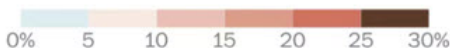


Exercise and Discussion

How 65 Bay St. was deemed part of a needy area

In the final map approved by state officials, 16 census tracts were linked together to connect the affluent Jersey City waterfront to impoverished and crime-ridden neighborhoods nearly four miles away. This allowed the project to qualify for low-interest loans through a U.S. visa program.

UNEMPLOYMENT RATE PER CENSUS TRACT, 2011-2015



Source: Census Bureau

ANDREW TRAN AND GABRIEL FLORIT/THE WASHINGTON POST

- Retrieval activity
- Self-paced
- Choice of ArcGIS or QGIS
- Open-ended: no “right” answer
- Shared some maps to reinforce critical thinking skills learned during workshop

Implementation and Feedback

- **Two workshops were held in January 2018 with 39 total attendees**
- **Attendees were emailed a survey after the workshops.**

Respondents reported:

- **an increase in knowledge of all GIS concepts, with knowledge of GIS software options increasing the most**
- **a better understanding of the data literacy and critical thinking skills that we were trying to teach, especially, “I understand how my map design can be used to influence the map audience.”**

Looking ahead

- **More retrieval activities & integration of critical thinking skills**
- **Plan ways to integrate other software**
- **Focus on documenting the research process in other GIS workshops**
- **Re-design more workshops, starting with GIS Level 2**
- **Provide activities that attendees can do on their own after the workshop to reinforce learning**
- **Review the workshops on an annual basis**

Tips & Tricks

- **Allocate and schedule lots of time for planning.**
- **Use the software as a way to teach concepts, rather than trying to teach how to use the software.**
- **Start with maps and mapping tools that attendees may already be familiar with and build on that knowledge.**
- **Integrate retrieval and testing activities frequently.**
- **Keep activities open-ended.**
- **Collect examples of maps and mapping stories.**
- **Allow for flexibility of activities, depending on time, the ability of participants, room set-up, etc.**