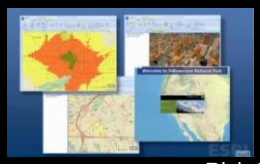
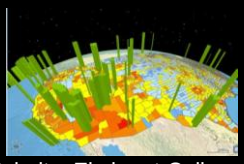
A Spatial Concepts Primer: Applications for Reasoning and Critical Pattern Recognition

Mashups and Geocoding





Rich Schultz, Elmhurst College
Chris McGarry, City of Rockford

What is a "mashup"?

- **Jamaican Creole term meaning to destroy**
- **Musical genre of songs that consist entirely of parts of other songs**
- **Web application that combines data and/or functionality from more than one source**

What is a "mashup"?

Can be a very simple Google "My Maps" data display (maps of static data)

TO

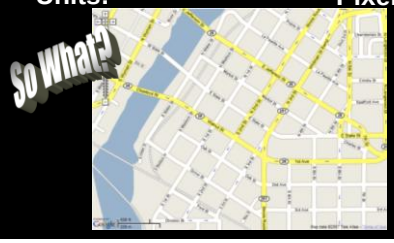
Very sophisticated applications displaying data from many sources (tracking H1N1 infections globally)

Why invest in map mashups?

- **Easy way to convey map data to an audience**
- **Most familiar UI for some audiences**
- **Politics: "Why don't we just use Google's GIS?"**
- **Fastest growing application development arena**
- **Rapid development / hackable**
- **Distribute ownership**

Google Infrastructure

- **Datum:** WGS 1984
- **Projection:** Mercator
- **Units:** Pixels!



Google Infrastructure

Mercator Projection

- Conformal (angles are preserved)
- Scale varies by location
- Distortion increases further from the equator
- Scale approaches ∞ at poles, so full global display is impossible

Google Infrastructure

Zoom Levels & Tiles

- Predefined zoom levels (18 levels, 0-17)
- Each tile is 256 x 256 pixels
- The number of tiles to cover the planet in each zoom level:

$2^{(\text{zoom level})}$ tiles across by $2^{(\text{zoom level})}$ tiles down

Zoom 17: $2^{(17)^2}$ tiles = 17,179,869,184 tiles!

Google Infrastructure

Pixel Unit Space

- Most maps use feet or meters as the base map unit.
- The individual tiles are measured in pixels (256 x 256)
- Makes it easy to align them
- Avoids having to convert them to feet or meters since screen resolutions vary (usually 72 dpi, but there's always exceptions)

Why? Google Infrastructure

Performance

- By dividing the planet into tiles at pre-defined scales, each tile can be pre-rendered, making access *fast*.

Usability

- By using the Mercator projection, angles are preserved… which is key for a small-scale routing application

Issues Google Infrastructure

Storage

- Google has to store (and back up!) the pre-rendered tiles somewhere.

Updates

- When Google obtains new data, the tiles must be rebuilt.

Scale

- The scale varies at the same zoom level at different locations due to projection issues.

Scale Google Infrastructure

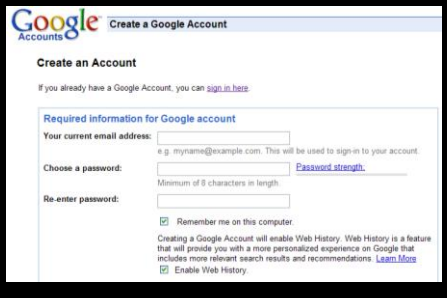
Note how the scale changes even though both are at zoom level 4

Getting Started

1. Get a Google Account
2. You need access to a web server
3. Get your API key
4. Visit useful reference sites
5. Get a little brave with JavaScript
6. Create a basic “hello world” map
7. Modify to use more advanced features

Google Account

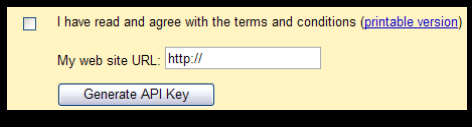
https://www.google.com/accounts/NewAccount



Google Maps API Key

http://www.google.com/apis/maps/signup.html

- **A single Google Maps API is valid for all subdirectories on your web server.**
- **You can have more than one API key.**



Reference Sites

- **Google**
  - **http://www.google.com/apis/maps/documentation/**

- **Users**
  - **http://www.econym.demon.co.uk/googlemaps/**

- **Wiki**
  - **http://mapki.com/wiki/Main_Page**

Reference Sites

How to use references:

1. **Read it and try to understand the principles involved.**
   - **Slow & painful, but you *know* it**
2. **Use the examples provided as templates.**
   - **Paste the code into your own web page**
   - **Change the API key and data**
   - **Read the "potential pitfalls" sections**

Get Brave with JavaScript

- **You don't have to be a programming wiz**
- **Just give the sample a try and see if you can get it working**
- **Try to follow the logic**

Reference:
http://www.w3schools.com/jsref/default.asp

Google Maps Exercises

- **Work through the exercises**
- **Start very basic, then increase in complexity**
- **Exposure, not mastery**
- **Ask if you have any questions**

Geocoding

A GIS feature is an object that has geometry
- e.g.: point, line, or polygon representation
- i.e.: a parcel of land or a street

Data exists that *implies* geographic location and geometry, but is not explicit.
- Street address, telephone number, city name

A geometric representation is needed to map and perform analysis with this type of data.

- Often represented as a point

Geocoding

- Geocoding is:
  - the process of creating geometric representations from a description of a location.
  - a mechanism for building a database relationship between addresses and features.

- AKA: "Address Matching" or "Address Locating"

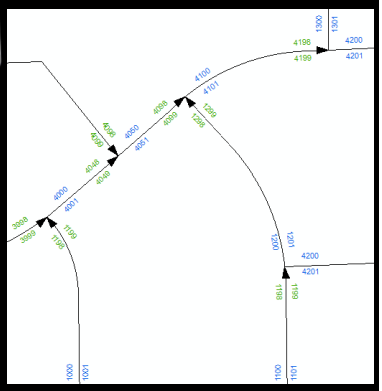
Geocoding

Street Reference Data

- GIS lines are *vectors*, they have a beginning and an end; a FROM and a TO
- Since they have a direction, they have sides… a LEFT and RIGHT side.
  - RIGHT FROM ADDRESS
  - LEFT FROM ADDRESS
  - RIGHT TO ADDRESS
  - LEFT TO ADDRESS

Geocoding

- Street feature class with address ranges



Geocoding

How geocoding works:

1. Address standardization (parsing)
   - Delcy Dr. vs Delcy Drive vs Delcy
2. Find candidate segments given the address range
   - 2056 Delcy Dr. is on the segment of Delcy Drive with address ranges between 2000 and 2098.
3. Each candidate is assigned a score (0-100) based on how closely it matches the address.
4. For the highest scoring candidate, interpolate where the address falls on the line and calculate the coordinate
   - 2056 Delcy Dr. is 56% along the distance of the segment on the left side – get coordinate at that location (with offset?).
5. Unmatched addresses require additional attention.

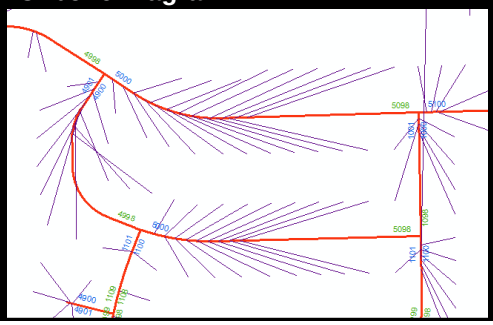
Geocoding

Why isn't the address location correct?

- Theoretical address ranges
  - Street data often contain the full 100-block address range
  - Addresses are rarely assigned over the entire hundred block
  - 2116 Warner Ave might actually be the last house on the street, but geocodes to 16% of the distance from the segment FROM position.
- Actual address ranges
  - Better geocode locations
  - Harder to develop and maintain

Geocoding

Fishbone Diagram:



Geocoding

- So how do I do it?
  - Clean address data works best!
- Use a “Geocoding Service”
  - ArcGIS uses the term “Address Locator”
- Defines:
  - Reference data
  - Rules for standardizing alphanumeric descriptions of locations into geometric shapes
  - Parameters for reading address data and creating output

Geocoding

- www.geocoder.us
- www.batchgeocode.com
- webgis.usc.edu/Services/Geocode/Default.aspx
- Google, Bing, Yahoo maps
  - Support single and bulk geocode, but limitations on how many operations per day, etc.
- GIS software solutions