Geography 12: Maps and Spatial Reasoning

Lecture 27:
Class Summary

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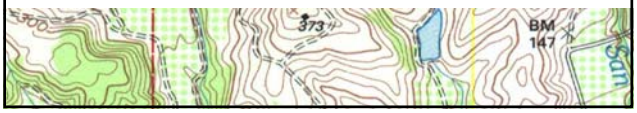

What you learned

- Map geometry, construction and content
- Practical map use, reading and navigation
- Map representation
- Cartometry and map analysis
- Basics of cartography's sister disciplines

How you learned it

- Textbook
- Lectures
- Gauchospace
- Supplemental materials
- Exercises in lab
- Evaluations

Maps and geodesy

- For maps showing the whole earth, a sphere is fine
- For detailed mapping, the ellipsoid is necessary
- For extreme mapping, the geoid is necessary
- This impacts the map's DATUM
- Location of places and their height change with the datum
- In the USA, we usually use NAD83 (very similar to WGS84) based on GRS80

Map scale

- The map scale transformation is the first, and changes data about the earth into a representation at a particular scale
- Don’t use the terms large and small scale
- Most maps are between 1:1000 and 1:400M
- RF = MD / GD
- The paper strip trick works
- Most maps are at standard scales, like 1:50 000
- Computer-based maps can be zoomed

Map Projections

- We can project onto a plane, a cylinder or a cone
- We can orient the projection as equatorial, oblique or transverse
- We can make the projection tangent or secant
- No flat map can be both equivalent and conformal

More projections

- Many features of projections can be varied
- Since no flat map can be both conformal and equivalent, all have distortion
- We can customize where and how much error is in a projection
- We can know and display the error
- The smaller the extent the map covers, the less overall distortion
- Always include information about the projection

Coordinate systems

- Universal Transverse Mercator System (UTM)
- National Grid
- State Plane Coordinate System

Land partitioning

- Land partitioning systems describe areas on the earth's surface
- Early systems were metes and bounds, centuriation, long lots
- The US standardized on the USPLSS
- System users principal meridians, base lines, townships, ranges, sections
- A grid imposes itself on the human landscape

Map generalization

- Selection
- Simplification
- Combination
- Displacement
- Exaggeration

Cartometry 1

- The map model and cartometry
- Features have dimension: Point, Line, Area (and text)
- Dealt with point symbols on topo maps
- Can measure distance and direction from map, earth or by using coordinates
- Grid, true and magnetic north differ

Cartometry 2

- Topo maps and others show line and area features
- Features have different symbols and colors
- We can measure length and bearing of lines
- We can measure area of areas
- We can do this from the map or the coordinates

Positioning

- There are many ways to approximate position in the field, e.g. map and compass resection
- GPS is a GNSS (one of three)
- Works under specific circumstances
- GPS receivers capable of 30m accuracy
- Using differential, about 1-10m depending on PDOP
- With WAIS about 1-7m common
- With carrier phase: millimeters

Navigation: Route selection

- Maps show information that allows direction finding
- Projection and declination are important
- Maps are often more useful when oriented
- Route selection depends on goals
- Simplest is dead reckoning
- Many different aids to navigation for air, land and sea
- Special purpose charts assist navigation

Navigation: Location-based services and Web Mapping

- Googlemaps
- LBS
- RFID
- Precision agriculture
- Cell phones and mobile systems
- In vehicle navigation systems
- Data

Terrain visualization

- Pictorial
- “Woolly worms”
- Hachures
- Contours
- Colors: Hypsometry
- Block diagrams
- Shading
- Perspective
- True 3D (or 2.5D)

Heights on maps

- Contours: CI, relief, interval, depressions
- Interpretation hard, but can tell height
- Slope = contour density
- Convex, concave, peak, pit, saddle
- Rule of V's
- Cut and fill, transects, profiles

Topographic features

- Contours and other relief methods can show terrain structure
- Structure can be interpreted to see what natural and human features are present
- Skeleton features of the landscape
- Different landscapes have different features
- Many clues for interpreting where and what

Measuring shape and distribution

- Shapes of individual features can be compared
- Distributions can be quantified, using quadrat analysis
- Other methods, such as NNS

Applications of Feature Measurements

- Distributions can be quantified, using NNS or other means
- Maps can be compared using Chi-squared, Yule's Q etc.
- Allows cartometry of higher order structures on maps: shape, distribution, arrangement and pattern

Network maps

- Terminology from topology: node, link, directed, planar
- Simple measures possible e.g. diameter, connectivity index
- Tree networks have orders, e.g. Strahler and measures e.g. branching ratio
- Algorithms can compute shortest path
- Isochrones

Special purpose and thematic maps

- Many special purpose thematic maps
- Cartograms especially powerful
- Specialty maps for different applications and disciplines, e.g. weather, geology, travel
- Many different media: books, magazines, newspapers, TV, internet
- Once uncommon, now part of the everyday fabric of life

Air photos for mapping

- Long history of photos in mapping
- Principal point, nadir, reseau, stereo, ortho, parallax
- Stereo imagery allows heights to be measured: photogrammetry
- Can do interpretation, measurement and change detection

Computer mapping

- Dates from about late 1950s
- Linked with development of map data bases
- Maps stored in computer in raster and vector formats
- Huge number of software programs and data sources
- Includes visualization and animation

GoogleEarth

- Geobrowser with a history
- Not the only one
- Allows pan, zoom, search, LOD
- Many resources e.g. GoolgleEarthCoolPlaces
- Users can enter content easily

Remote sensing

- Early spy satellite origins
- ERTS -> Landsat 1
- Bands, electromagnetic reflectance
- Image processing
- Can identify and map features
- Can see different parts of the spectrum, e.g. IR

How to lie with maps

- Maps can promote
- Maps can claim
- Maps can advance a particular viewpoint
- Maps are commonly used in wartime for propaganda
- Cold War maps were very global
- Where is the bias now
- Producer has responsibility

All that's left is:

- THE FINAL!