The Era of Manual Cartography

- Media: ink on paper
- Reproduction: hand copy to lithographic printing
- Distribution: print and sales
- Archive: Library and map trade

The craft

- Manual
- Artistic
- Tedious
- Error-prone
- Non-standard
- Rules of thumb
- Cartographic traps
- Protectionism and competition

Cartographic traps
Cartography and calculation

- Manual techniques yield to calculation for specific tasks, e.g. contour mapping and interpolation
- Mechanizes error prone tasks such as labeling
- Automates drawing of curves and graticules

Tobler 1959 “Automation and cartography”

- Map input
- Map Manipulation
- Map storage
- Map output

Some early landmarks

- WDBI and II
- GBF/DIME for 1960-70 census
- GIRAS: USGS LULC mapping

GIRAS: National LULC

Figure 1. Generalized land use and land cover for the Roseau, Minnesota, 1:250,000-scale quadrangle (modified from U.S. Geological Survey, 1998).
Raster and vector diverge

Data and programs

Data structures

The Digital Mapping Process

- Capture or access data
- Convert and transform projections, scales, coordinates, data structures
- Compose and design
- Select representation method
- Select symbols and text
- Apply design loop
- Publish or distribute
Cartographic transformations

Input data → Transformation → Output data

Getting data

- USGS
  - DEM
  - DRG
  - DLG
  - GNIS
  - The National Map
- Census Bureau
  - TIGER
- NOAA
- NGA
- DCW
- SRTM
- NASA
- Private data
  - Navteq
  - TeleAtlas
  - Many more

OpenStreetmap.org
### Commercial software

- **MapGuide** Autodesk
- **Cadcorp** – Developers of GIS software and OpenGIS standard (e.g. Read/Write Open Source PostGIS database).
- **Intergraph GeoMedia**
- **ERDAS IMAGINE** Leica Geosystems
- **ESRI** includes ARCGIS
- **IDRISI** – Clark Labs.
- **MapInfo** – Products include **MapInfo Professional** and **MapXtreme**.
- **MapPoint** – Microsoft.
- **Caliper** – Products include **Maptitude**, **TransCAD** and **TransModeler**.

### Some very useful utilities

- **Xv** (Unix)
- GPS Utility
- GlobalMapper
- GoogleMaps/Earth
- Golden Software: Surfer
- MicroCAM
- MicroDEM
- Landserf
- Blue Marble geographics
- Open source GIS: MapWindow, uDig, QGIS

### GlobalMapper DEMs

![GlobalMapper DEMs](image)

### MicroCAM

![MicroCAM](image)
### Design tools
- Adobe Photoshop
- Adobe Illustrator
- Map Publisher
- Adobe Freehand

### Open source software
- **GRASS** – Originally developed by the U.S. Army Corps of Engineers, open source: a complete GIS.
- **MapServer** – Web-based mapping server, developed by the University of Minnesota.
- **ILWIS** – ILWIS (Integrated Land and Water Information System) integrates image, vector and thematic data.
- **MapWindow GIS** – Free, open source GIS desktop application and programming component.
- **PostGIS** – Spatial extensions for the open source PostgreSQL database, allowing geospatial queries.
- **Quantum GIS** – QGIS is a user friendly Open Source GIS that runs on Linux, Unix, Mac OSX, and Windows.
- **TerraView** – GIS desktop that handles vector and raster data stored in a relational or geo-relational database.

### MicroDEM: Goleta, CA

### Internet-based mapping
- Mapquest
- GoogleMaps
- Openstreetmap
- Bing
- YahooMaps
- MSN Mappoint
Mobile cartography

GeoViz
- Immersive VR
- Augmented Reality
- Web-based VR: e.g. X3D
- Exploratory visualization
- Visual Analytics
- Haptic and sound-based
- Animation
- Interactivity

Spatialization

GeoVISTA Studio: Penn State
National Cancer Institute: Small Multiples

Lung cancer mortality rate, white males

% below poverty level

% current smokers

Interaction: GeoVRML

Interactive Campus Map

Virtual Cities
Some tasks often still done “by hand”

- Composition and layout
- Generalization
- Projection selection
- Color and font selection
- Text labeling and abbreviations
- Metadata
- Animation!

Summary

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