GEO 447 PRINCIPLES OF GIS

- What is GIS?
  - Acronym
  - define GIS(ystems)
- The History of GIS
  - Multiple Themes
  - Computers
  - Key Institutions & Developments

Acronym

- GIS = geographic(al) information system
  - the hardware, software, & routines
- GIS = geographic(al) information science
  - philosophical questions
  - methods issues
- Why does it matter?
  - Discipline specific implications
  - software versus science

A GIS. . .

- Is a subset of information science that deals with spatially or geographically referenced data.
- Is a collection of hardware, software, methods, and instructions, to:
  - capture, manage, manipulate, analyze, & display
- Is a decision support system
- Is different from mapping & computer aid-cartography because of its analytical capacity
- Is different from CAD programs because it performs spatial operations
- Is different from DBMS because it has a cartographic interface

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GIS: An Inter-Disciplinary Science

- Geography
- Cartography
- Photogrammetry
- Remote Sensing
- Geology
- Geodesy
- Surveying
- Statistics
- MIS
- Computer Science
- Mathematics
- Civil Engineering

Similar & Synonymous Software Applications/Terms

- AGIS (Automated Geographic Information System),
- AM/FM (Automated Mapping and Facilities Management)
- CAD/M (Computer-Aided Drafting/Mapping or Manufacturing)
- Environmental Information System
- Image-Based Information System
- LIS (Land Information System)
- Land Management System
- Land Record System
- Land Resources Information System
- Natural Resources Inventory System
- Natural Resources Management Information System
- Planning Information System
- Multipurpose Cadastre
- Resource Information System
- Spatial Data Handling System

History: Multiple Themes

- Maps are efficient data storage devices--but inefficient analysis tools
- Pre-GIS spatial analysis was limited to ‘multiple’ themes
  - rough overlays
  - eyeballing data
  - imperfect method
    - Accounting for scale difference?
    - Data sources?
    - Quantification of an overlay?

Famous Examples of Overlay

Source: University of British Columbia NCGIA Core Curriculum Project

- Maps of the Battle of Yorktown (American Revolution) contained hinged overlays to show troop movements
- A mid-19th Century Irish Railway Atlas showed population, traffic flow, geology and topography superimposed on the same base map
- Dr. John Snow used a map to track the source of Cholera outbreak to a contaminated well - an early example of geographical analysis

History: Computers

- Computer hardware developed the capacity to provide cartographic output
- Computer systems became more robust in terms of speed & memory
- Computers become smaller & cheaper

History: Computer Events

- Late1950s, Transportation planners begin digitizing flow & traffic data
  - mapping
- Late1950s, University of Washington Geography students begin quantitative revolution which includes developing spatial statistics, analytical operations & computer-aid mapping
  - heavy on spatial operations & mapping

History: Administrative/Government

- Mid 1960s, Canadian Geographic Information System developed to inventory land and resources, as well as rate habitats
  - Conceptual Innovations
    - database structure
    - overlay/area calculations
    - vectorization
    - layers
    - differentiating spatial & attribute
  - Technical Innovations
    - scanning as data entry
    - query polygons

History: Administrative/Government

- Minnesota Office of Planning: Land Management Information System
  - like CGIS

History: Administrative/Government

- U.S. Census
  - development of digital enumeration districts (1960s)
  - Geocoding for address matching
  - Geographic base files using Dual Independent Map Encoding (DIME) files developed for 1970 census
    - DIME files were urban only pre-cursors to TIGER
    - Creation of popular Urban Census Atlas were a by-product of DIME

History: Military/Government

- U.S. military was developing raster-based capabilities associated with satellite imagery & air photo
  - The popular and freely distributed package GRASS developed by Army Corps of Engineers is an example
    - Today, the on-going development of GRASS software is a collaborative project between public and private sector users, as well as university-based researchers.
  - Military developments has slowly made it to the commercial market

History: Education

- Harvard Laboratory For Computer Graphics And Spatial Analysis (a.k.a. Harvard Graphics)
  - developed numerous software packages
    - SYMAP (1964)
    - CALFORM (late 1960s)
    - SYMVU (late 1960s)
    - GRID (late 1960s)
    - POLYVRT (early 1970s)
    - ODYSSEY (mid 1970s)

History: Commercial

- Environmental Systems Research Institute (ESRI) created in 1969
  - Jack Dangermond built on Harvard Graphics developments
    - overtime, ESRI built on the successes of many other software companies it purchased and/or hire away their staff
  - By the 1980s, ESRI had created a standard RDMS-based structure
    - the integrated cartographic (arc) & RDMS (info) system was to be called Arc/Info

History: Commercial

- Intergraph Corporation
  - Closely associated with federal contracts, particularly defense
    - A spin-off of former IBM Federal Systems Division employees working on NASA/USAF Saturn Rocket-development in Huntsville, AL
  - Initially, CAD--but developed into a GIS

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History: Commercial, Government, & Education

- Contemporary development is driven by commercial sector
- De-classification of military applications & data leading to proliferation of GIS
- University-based development limited
- Commercial sector continues to consolidate. ESRI is the single most prominent GIS provider
- Government Agencies taking the lead on data standardization, decreased redundancy, and data sharing