GIS

What my friends think I do
What my mom thinks I do
What society thinks I do

What my clients think I do
What I think I do
What I really do
Recall

- Geospatial information is **unique**
- Definition 1: A GIS is a toolbox
- Definition 2: A GIS is an information system

**Dueker's 1979 definition (p.106)**

“A geographic information system is a special case of information systems where the database consists of observations on spatially distributed features, activities or events, which are definable in space as points, lines, or areas. A geographic information system manipulates data about these points, lines, and areas to retrieve data for ad hoc queries and analysis.”

**The Feature Model**

- **Human's role**: “activities” link to geographic patterns and distributions. Activities link to features → e.g., migration
- **Time**: “event” part of GIS implies space and time. → e.g., car accident
Definition 3: GIS is an approach to science

- Geographic Information Science is the research both on and with GIS.

“The generic issues that surround the use of GIS technology, impede its successful implementation, or emerge from an understanding of its potential capabilities.”

-------- Goodchild, 1992
Definition 4: GIS is a multi-billion dollar business

“The growth of GIS has been a marketing phenomenon of amazing breadth and depth and will remain so for many years to come. Clearly, GIS will integrate its way into our everyday life to such an extent that it will soon be impossible to imagine how we functioned before.”
A glance at Esri User Conference 2019
Other GIS related companies

MapBox

SuperMap

OpenStreetMap

QGIS

PostGIS

Google

Google Earth

Apple

here

lyft
Definition 5: GIS in society

“(GIS is an) organized activity by which people measure and represent geographic phenomena, and then transform these representations into other forms while interacting with social structures.”

-------- Nick Chrisman (1999)

How GIS fits into society as a whole?

- Business
- Institutions/organizations
- Decision making
- ...
A Brief History of GIS - BC (Before Computer)

- GIS’s origins lie in **thematic cartography**
- Many planners used the method of **map overlay** using manual techniques
- Manual map overlay described comprehensively by **Tyrwhitt** in a 1950 planning textbook
- **McHarg** used transparent overlays for site selection in *Design with Nature*
A Brief History of GIS - AT (After Tomlinson)

- Early systems (examples) were CGIS and MLMIS
- Early influential data sets were the World Data Bank and the GBF/DIME files
- The Harvard University ODYSSEY system was influential due to its topological arc-node (vector) data structure

"Father of GIS" CGIS history
Key innovations to push GIS into the mainstream

- IBM-PC 1982
- ArcView 1.0 1994
- Canada GIS 1967
- SAGE 1963
GIS community - Journals

- International Journal of Geographic Information Science
- Cartography and Geographic Information Science
- Transactions in GIS
- Geoinformatica
- ...
GIS community - Conferences

- Esri’s User Conference
- International Conference on Geographic Information Science
- International Conference on Geo-information Science
- ACM International Conference on Advances in Geographic Information Systems
- International Conference on Spatial Information Theory
- Annual Meeting of American Association of Geography
- ....
GIS community - Organizations

- AAG: Association of American Geographers (www.aag.org)
- ACM: Association for Computing Machinery SIG-SPATIAL/GIS (www.sigspatial.org)
- CAGIS: Cartography and Geographic Information Society (www.cartogis.org)
- AGILE: Association of Geographic Information Laboratories in Europe (www.agile-online.org)
- CPGIS: Chinese Professionals in Geographic Information Sciences (www.cpgis.org)
- ASPRS: American Society for Photogrammetry and Remote Sensing (www.asprs.org)
- NACIS: North American Cartographic Information Society (www.nacis.org)
- ...
GIS community - Web resources

Data:
- OpenTopography (www.opentopo.sdsc.edu)
- USGS (www.earthexplorer.usgs.gov)
- US Census (www.census.gov)
- Esri Open Data (www.hub.arcgis.com/pages/open-data)
- OpenStreetMap (www.wiki.openstreetmap.org)
- ...

GIS blogs/forums/Q&A
- StackExchange-GIS (www.gis.stackexchange.com)
- GISGeography (www.gisgeography.com)
- ArcGIS (www.desktop.arcgis.com/en/arcmap)
- GISLounge (www.gislounge.com)
- ...
GIS community - Job markets
GIS community - Job markets
GIS job category

www.directionsmag.com/article/1143

In an effort to understand distinctions and requirements of GIS jobs, Jung Eun (Jessie) Hong, an assistant professor in the Department of Geosciences at the University of West Georgia, recently completed a content analysis of GIS job advertisements. She compiled almost 1000 GIS job postings, spanning 2007 – 2014, from GIScareers.com, GISJobs.com and the GIS Jobs Clearinghouse. The titles of the jobs were used to sort the positions into five different job categories:

- Analysts (27.4% of job postings)
- Programmers/developers/engineers (29.8%)
- Specialists (14.0%)
- Technicians (11.2%)
- Other (17.7%).
GIS job skills

Then, individual skills specified in each ad — such as data mining, web mapping, programming or project management, for example — were all coded into four technical areas:

- Analysis/modeling
- Cartography/visualization
- Data processing/management
- Software/application development

and three general skill areas:

- Analytical
- Management
- Personal/social
Summary

- GIS is an emerging **technical and scientific field**. It changes people’s life everyday.
- GIS is everywhere! **We see others' can't!**
Lecture 02: Introduction to ArcGIS

Rui Zhu
Gauchospace Forums


- Questions about lectures
- Questions about lab sessions
- Syllabus

Post your questions for discussions!
What is ArcGIS?

ArcGIS is a ‘family’ of software products produced by Esri.
ArcGIS Desktop
ArcMap

- View and edit data
- Create maps
- Analyze data (Geoprocessing)
ArcCatalog

View data
(like a file browser)

Graphical previews

metadata

View and edit metadata

Metadata

Tables

Preview geographic information.
Arc Toolbox

Map Projections
ESRI GIS history

Arc/Info (coverage model)
Versions 1-7 from 1980 – 1999

ArcGIS (geodatabase model)
Version 8.0, ..., 9.3, and 10.3 ... 10.7

ArcGIS Pro
Next-generation Desktop GIS

ArcView (shapefile model)
Versions 1-3 from 1994 – 1999
Data models

- **Coverage, shapefile, and geodatabases** are **spatial data models** used in ArcGIS.
- A **data model** is a structure for organizing data so that data can be easily stored and retrieved.
- A spatial data model organizes spatial data.
Coverage model

- Standard vector model for Arc/Info software
- Widely used from 1980s to 1990s
- **Preserves topologies**, but has a complex structure
- Old but you may run into it in the future
Shapefile model

- New vector model for ArcView
- Widely used since 1993, and still popular today
- Open specification; can be processed by many GIS software packages
- Simple structure but does not preserve topologies

ArcCatalog view

Three required files:

- *.shp: geometry information
- *.shx: index file for faster geometry retrieval
- *.dbf: attribute file

File explorer view
Shapefile extensions

- **.shp** is a *mandatory* Esri file that gives features their geometry. Every shapefile has its own .shp file that represent spatial vector data.
- **.shx** is mandatory Esri and AutoCAD shape index position. This type of file is used to search forward and backwards.
- **.dbf** is a standard database file used to store attribute data and object IDs. A .dbf file is mandatory for shape files. You can open .DBF files in Microsoft Access or Excel.
- **.prj** is an optional file that contains the metadata associated with the shapefiles coordinate and projection system.
- **.xml** file types contains the metadata associated with the shapefile.
- **.sbn / .sbx** are optional spatial index files that optimizes spatial queries. These two files make up a shape index to speed up spatial queries.
- **.cpg** is optional plain text file that describes the encoding applied to create the shapefile. If your shapefile doesn’t have a cpg file, then it has the system default encoding.
Geodatabase model

- Both coverage and shapefile are file-based data models.
- The fast development of relational database in 1990s enables geodatabase model.
- A geodatabase is built on a relational database but extends it with capabilities to manage spatial data.
- A geodatabase obtains the powerful storing, indexing, and retrieving functions of databases.
Geodatabase model

- Stores **geographic coordinates as one attribute (shape)** in a relational database table
- Uses MS Access for “personal geodatabase” (single user)
- Uses Oracle, MS SQL Server, Postgres/PostGIS or other commercial relational databases for “enterprise geodatabases” (many simultaneous users)