GIS Institute

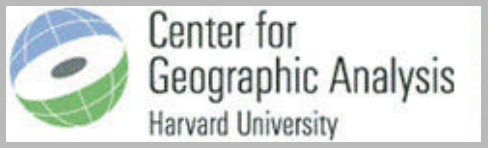
Center for Geographic Analysis

Scott Bell

Jill Kelly

Welcome

- Intensive training in the application of GIS to research
- Collection, management, analysis, and communication of spatial data
- Topics include: data collection, management and manipulation, spatial and non-spatial analysis, and communication (graphic and cartographic)
- We are following a long tradition of GIS training and research at Harvard



Institute and CGA Team

- Jason Ur, Director
- Wendy Guan
- Jill Kelly
- Jeff Blossom
- Samantha Carr
- Devika Kakkar
- Paolo Corti
- Josh Lieberman
- Peter Bol, Founding Director
- Ben Lewis

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The Institute Team

- Week 1 will include end-of-day forums
- Today: Everyone
- Tuesday – Friday: small group each day in thematic seminars
- Participant introductions, research interests, AND project topic
- Opportunity to learn more about each other's project and continue to develop project parameters

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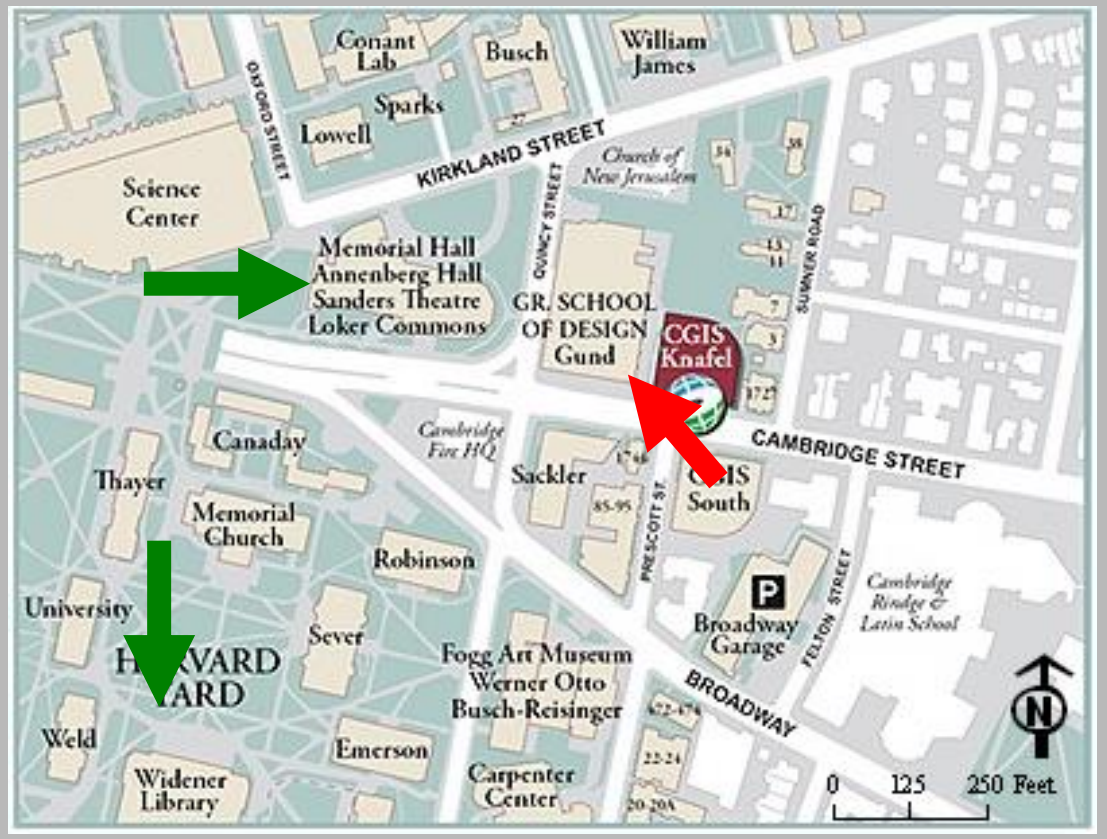
Locations

- The internet, keep our distance…
- CGA, Science Center



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Learning Outcomes

- Integration of spatial analysis into research
  - Requirements
  - Limitations
  - Thinking Spatially/Geographically
- Use a research tool, vocabulary, and approach to thinking about problems
- Ask spatial and geographic questions

Goals

- Primary
  - Your projects
- Secondary
  - Asking spatial questions
  - Performing spatial analysis
  - Managing, displaying, and querying spatial data

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Spatial Relevance vs. Spatial Analysis

- Some spatial questions don't require spatial analysis
  - Do some states have higher infant mortality than others? If so, which?
- Others do
  - Are states with higher infant mortality clustered together? Are infant mortality rates within states associated with other geographic phenomena?

Geographic Terminology

- Definitions are critical
- What does it mean for something to be:
  - Clustered, close, near, far, proximal, within, peripheral, central, distributed, regular, associated with something else, etc.?
- Our view of the world also matters
  - Often in GIS we are limited by our data
  - The search for good data can take as much effort as the analysis we perform

Projects

- Contribute to the success of your research
- GIS exists to supplement your research: letting it play a role in conducting your research should be done thoughtfully
- Spatial analysis vs. analysis of place
  - Units of Analysis and Area of Study

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Project Presentations

- While we have high expectations for your presentations we don't have the same expectations for each of you
- Grouped by theme
  - Topic
  - Technique
  - Place
  - Other
- Lunch, Social

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Agenda

- Skills and Knowledge based
- Workshops and Exercises will focus on developing GIS and related software skills
- Lectures and Seminars will focus on providing background, context, and critical thinking opportunities

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Agenda

- Week 1 focus is skill development related to creating, acquiring, managing, analyzing, and communicating spatial information
- Week 2 focus is critical thinking related to your personal research project
- Overall focus is generating a foundation in the practice and theory of spatial information

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What is GIS?

Outline

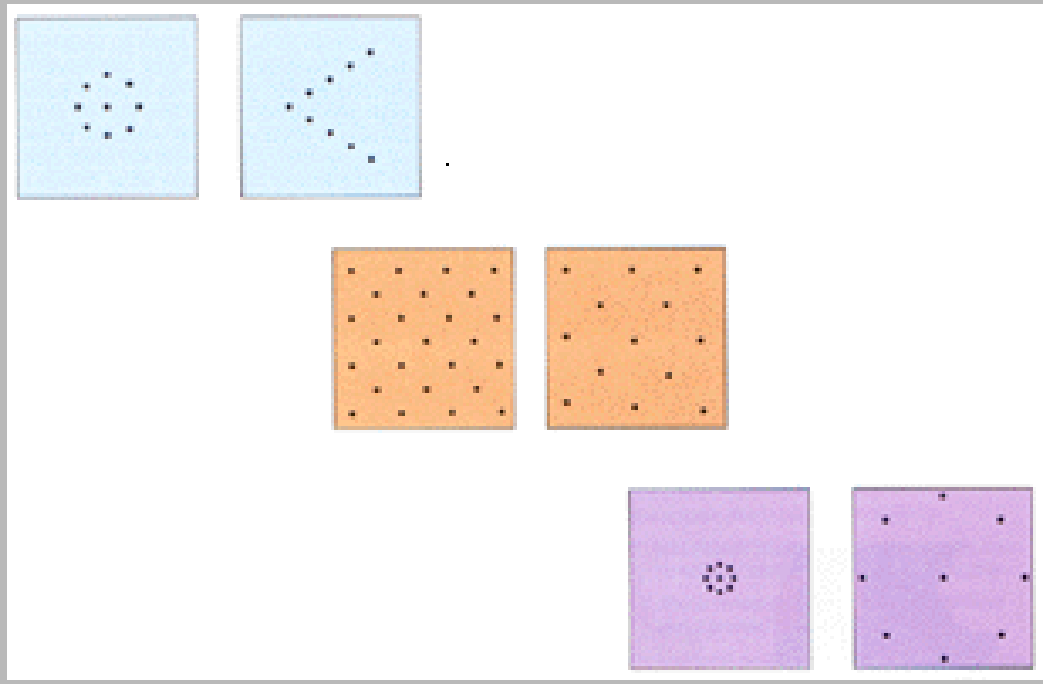
- The roots of GIS
  - Geography, Information, System
- Learning Outcomes
  - Distinguish between Geography and GIS
  - Describe advantages and limitations of taking a formal and quantitative view of the world

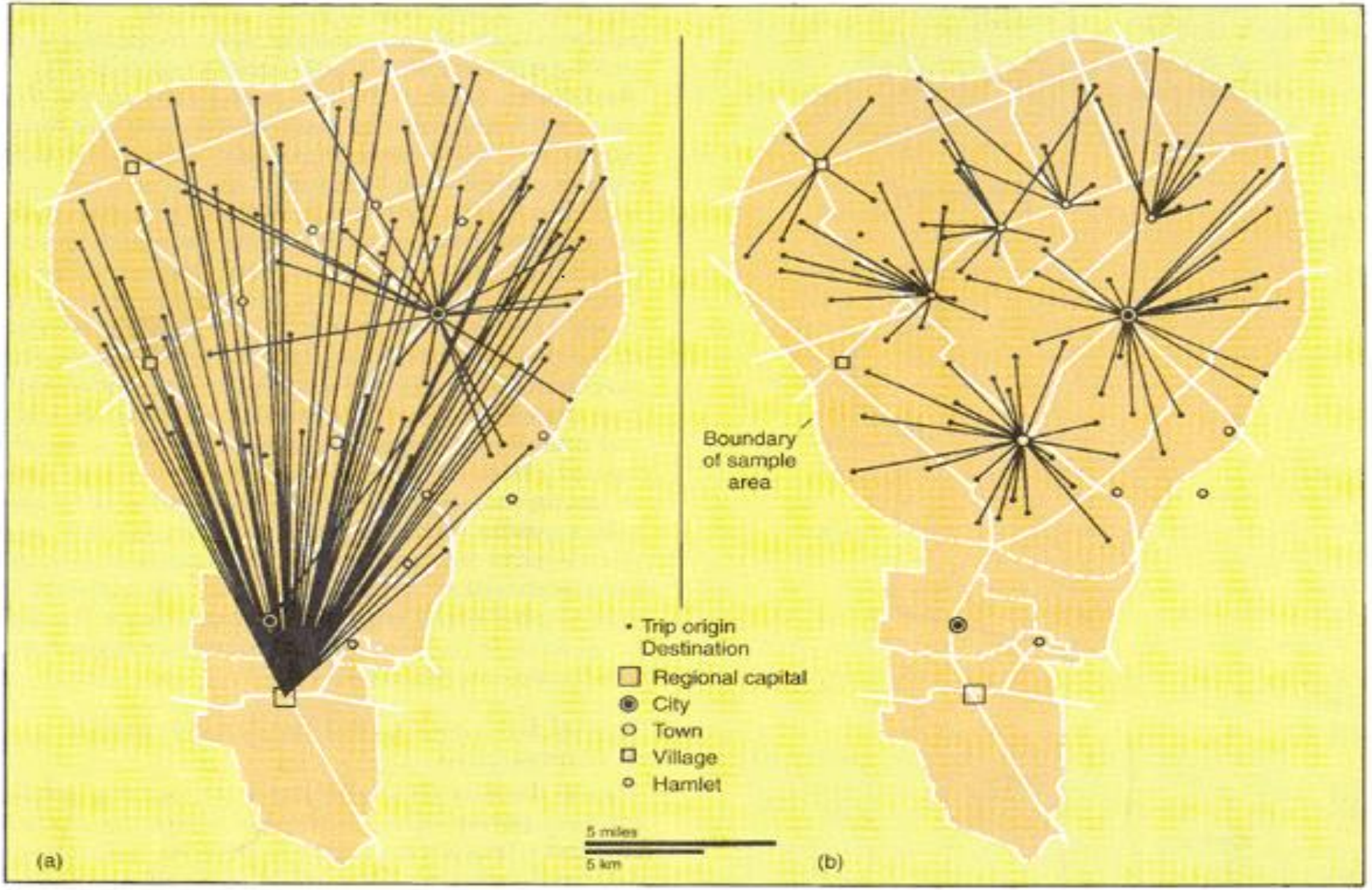
What is GIS?

- Roots of GIS
  - Geography, Information, System
- Geography: A discipline focused on the spatial arrangement of features (human and non-human) on and near the Earth's surface
- Information: facts about known reality
- System: a whole composed of parts based on rules and definitions

Geographic Concepts

- Spatial arrangements
  - Distributions, networks, areas
- Spatial relationships
  - Distance, direction, correlation
- Spatial processes
  - Flows, forces, movement
- Processes that alter spatial arrangements
  - Energy
- Scale





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Geography

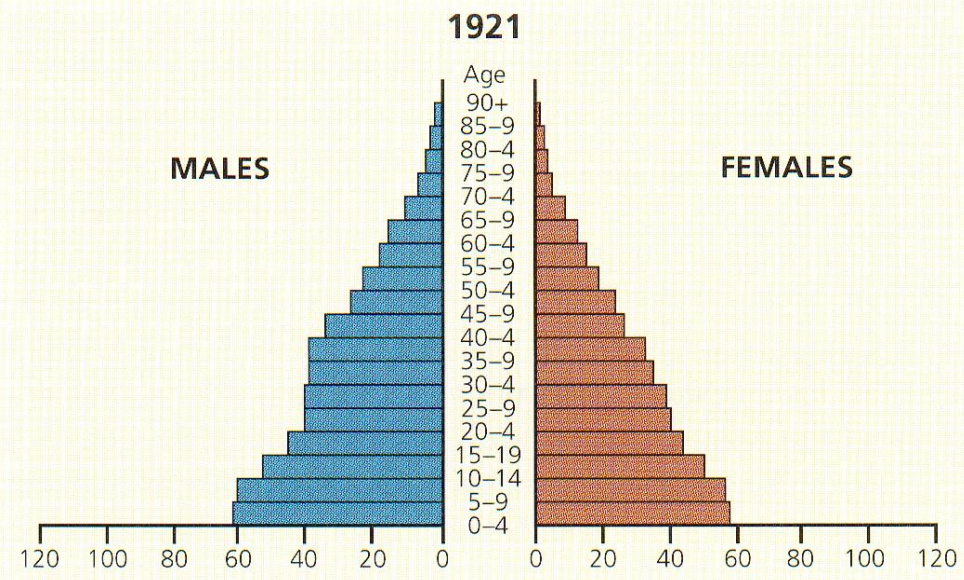
- Exploration of geographic phenomena
  - Modern day explorers of already discovered places
- Space vs. Place
- **1st "Law" of Geography**
  - **Everything is related to everything, near things are more related.**
  - Waldo Tobler, 1970 (building on Hume's theory of contiguity, in time AND/OR space)

Information

- Can come in many forms
  - Text, numbers, pictures, lists and tables, sounds, maps and images, movies, animation, models
- These forms can represent almost anything
  - locations, quantities, identities, time, emotions, attitudes, etc.

Value of Information

- Information is the basis for knowledge
  - Experience (and other modes or acquisition) exposes us to information
  - Exposure to information, along with understanding, leads to knowledge
  - Knowledge is the basis for problem solving (which at some point in history meant survival)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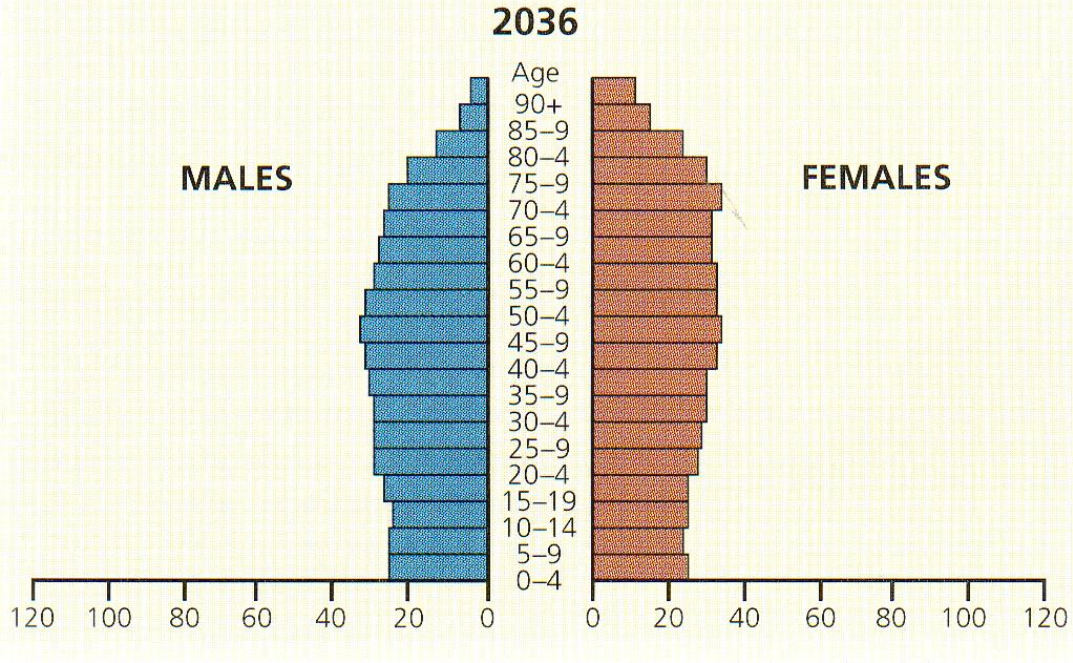
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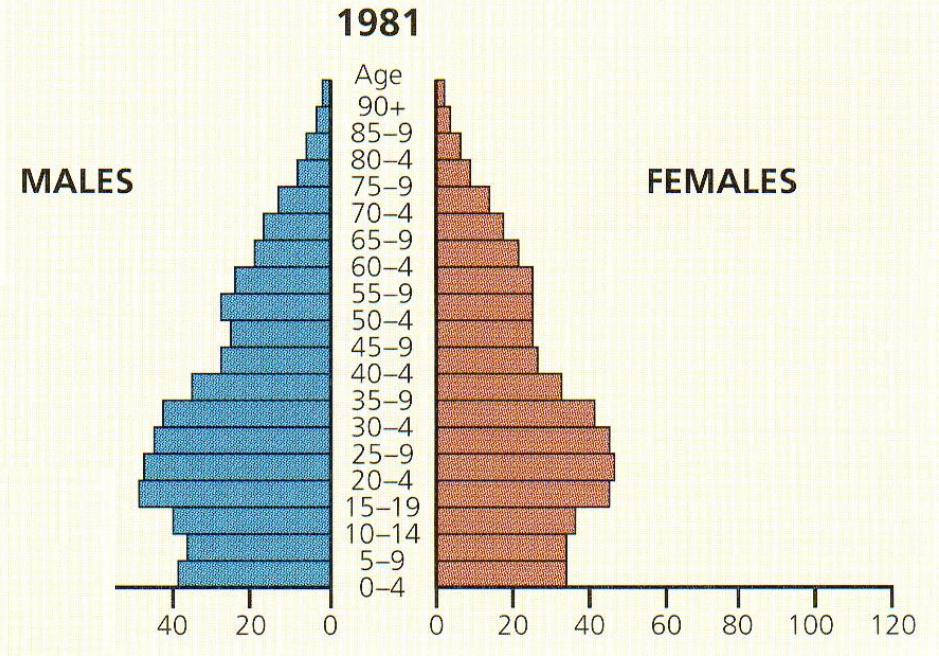
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Spatial Representations

- A spatial representation uses aspects of space to communicate
  - Example include graphs, diagrams, cartoons, plots, plans, AND maps
- A spatial representation can communicate both spatial and non-spatial information
  - Population pyramids use space to summarize the age and sex distribution of a place's population

Representations of Space

- There are many ways we can summarize the geographic and spatial nature of the world
  - Route description, computer program, music, lyrics, novels, AND maps
- We are not limited to maps or other spatial representations when communicating about geographic or spatial entities, patterns, or information

System for Integrating Information

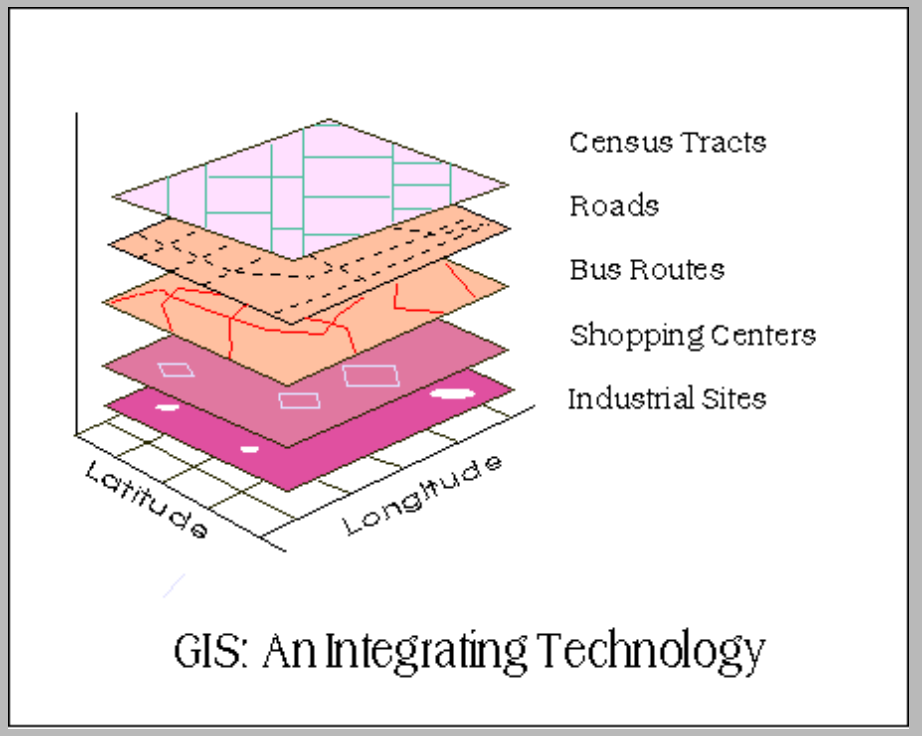
- System: a whole composed of parts (in an orderly arrangement) based on some scheme or plan
  - Not associated with a simple composition
- Information System (informal)
  - Provides the baseline for sharing and combining information
  - Not necessarily digital

Formal Information Systems

- Integration of information in a digital system
  - Provides formal rules for entry, storage, editing, relating, querying, and presenting information
  - While most of above could be done by hand, a computing environment makes it easier and faster (if you learn the language)
  - Benefits outweigh the drawbacks
- Drawbacks
  - Traditionally difficult to incorporate qualitative, fuzzy, affective information

Geographic Information Systems

- Formal structure for *dealing with* geographic information
- Generic and Specific technology
- GIS as an application
  - hardware, data, software and people needed to solve a problem
- GIS as software
  - Developer specific (i.e. Microsoft, Oracle, ESRI)

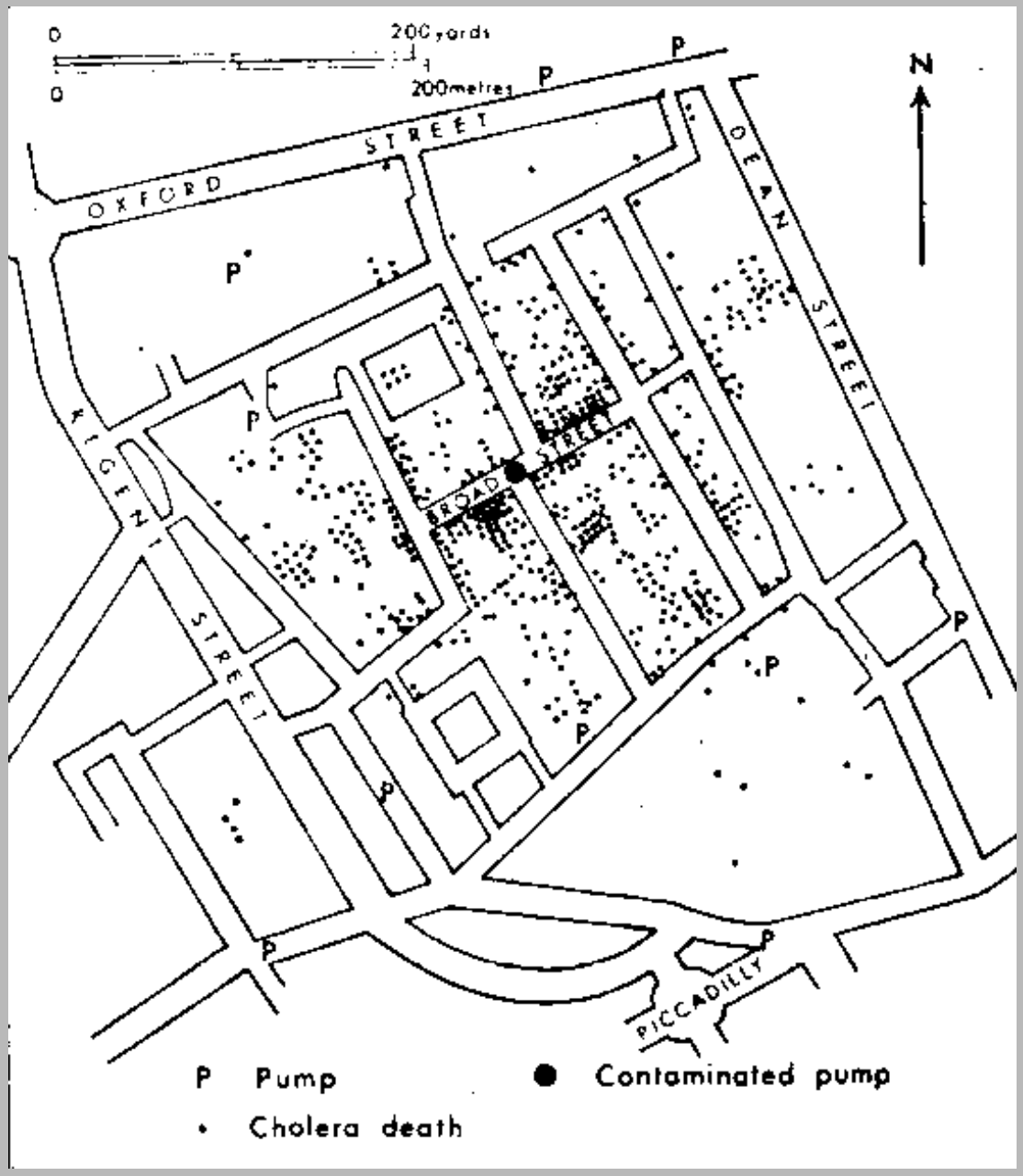


Essential Elements of GIS

- Location, Location, Location
  - Coordinate Systems
    - Global Absolute vs Other (local, regional, personal, etc.)
  - Models of Earth
    - Geodetic Datums
    - Globes
    - Maps
  - Models of Reality
    - Data Models

GIS Software

- Spatially explicit commands and functionality
  - Display, edit, change, transform, measure (distances, areas, volumes), and combine
  - Manage, compare, judge, analyze, decide, predict, etc.
- The user combines their knowledge, with existing data, using generic hardware running GIS software
  - Can range from free to very expensive
  - Can focus on a subset of GIS functions or can cover the breadth of possible functions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