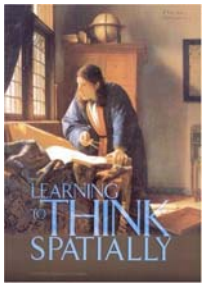
Spatial Sciences Institute

GIS and Location Analytics



John P. Wilson
USC Marshall School of Business
9 November 2012

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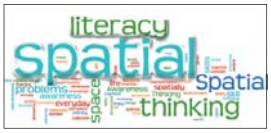
Outline

- Background
  - Geography | Maps
  - Geographic Information Science
  - Geographic Information Technologies
  - Geospatial Technical Competency Model
- Spatial @ USC
- Location Analytics
  - Business Analyst
  - Esri Maps
  - ArcGIS Onine
- Final thoughts



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Geography as a discipline …

- Focuses on what is or what has been
  - Tracks interactions and flows to understand how and why things happen
  - Increasingly relies on visual thinking to handle ever-larger amounts of data and to make ever more complex connections between phenomena
  - Has excelled in helping us to understand the nature and impact of an exponentially growing human population, using finite resources at unsustainable rates, damaging the natural environment at an ever-increasing rate, and concentrating wealth and power among an increasingly small number of people
- Few geographers have focused on what to do about these problems going forward

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Synthesis courtesy of Tom Fisher, University of Minnesota

Maps …

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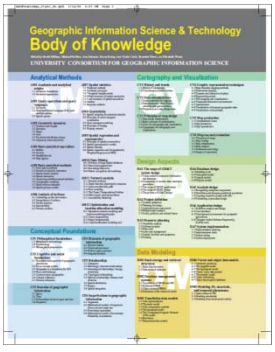
Geographic information science



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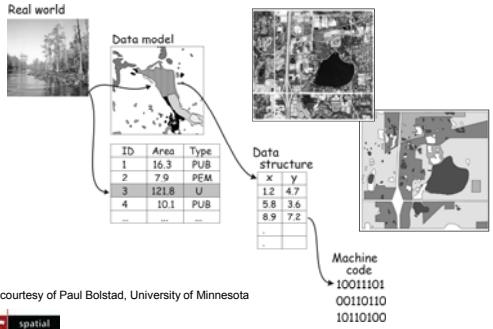
Typical Geospatial Workflow



Slide courtesy of Paul Bolstad, University of Minnesota

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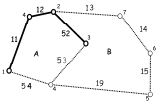
Vector and Raster Data Models

Points

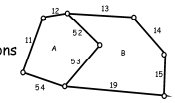
Point ID	X	Y
Q	32.7	45.6
R	76.3	19.5
S	22.7	15.8
etc...		

Lines



Line ID	Begin node	End node	Left poly	Right poly
11	1	4	...	A
12	4	2	...	A
52	2	3	B	A
etc ..				

Polygons



Polygon ID	Lines
A	11,12,52,53,54
B	52,53,19, 15,14,13

Slide courtesy of Paul Bolstad, University of Minnesota

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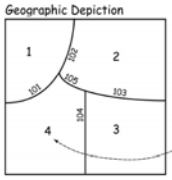
Where, What & When …

Geographic Depiction



Attribute Table

ID	type	area
1	big	16.8
2	little	22.2
3	mid	18.4
4	tiny	20.7

Polygon	Lines
1	101, 102, ...
2	102, 103, ...
3	103, 104, ...
4	104, 101, ...

Topology & Coordinate Data

N & V	Type	X	Y
21	v	124.7	155.2
35	n	202.2	150.9
47	v	16.3	35.5
94	n	135.5	22.2
...	...	...	...

Line	Nodes & Vertices
101	58, 47, 48, 49, 50, ...
102	71, 72, 73, 74, 75, ...
103	35, 21, 22, 23, 24, ...
104	94, 79, 80, 81, 82, ...
...	...

Slide courtesy of Paul Bolstad, University of Minnesota

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Spatial analysis

Class	Examples
Core concepts	Place, scale, location, distance, centrality, area
Place-based analysis	Distance & directional analysis, geometrical processing, point pattern analysis, map algebra, grid models
Spatial statistics	Exploratory spatial data analysis & spatial statistics, incl. spatial autocorrelation & spatial regression
Surface analysis	Surface form & flow analysis, gridding & interpolation methods, visibility analysis
Network analysis	Shortest path calculation, traveling salesman problems, facility location & routing
Geo-computation	Agent-based modeling, artificial neural networks & evolutionary computing
Geo-visualization	Spatial query, representation as process & meaning, map (data) transformation

Various classes of transformations, manipulations & methods that comprise spatial analysis

(Source: Smith et al. 2000, Longley et al. 2010)

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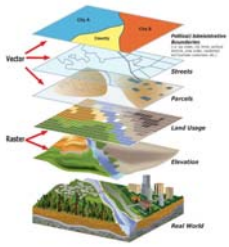
Context … location … location … location!

Representation, Pattern, Process



Integration, Synthesis

Informed site analysis!

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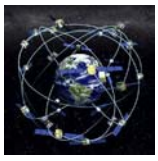
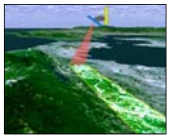
Geospatial technologies

- Traditional components
  - Geographic information systems
  - Global positioning systems
  - Remote sensing systems
- Provide tools to solve real world problems
  - Locating things – knowing where things are
  - Routing – bringing people & assets to locations
  - Location/allocation – site optimization
  - Locating linear facilities – highways, pipelines, corridors, transmission lines
  - Land use models – predicting urban growth, control conditions, public participation





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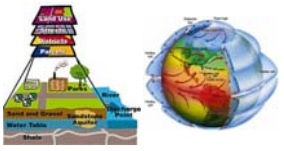
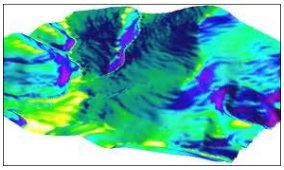
What Does a GIS Look Like?

- Information about what is where (when)
  - The contents of maps and images
- You would know when a computer was being used for GIS because the data stored in it would include maps and images





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Multiple Platforms

- Provides multiple entry and exit points for users
- Bundles software with data
- Supports geo-processing workflows and services
- Rapid growth in demand for people with spatial skills

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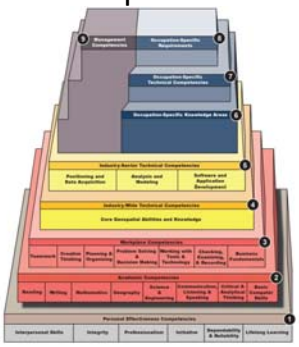
Workforce development

- Geospatial Technology Competency Model
  - Positioning and data acquisition
  - Analysis and modeling
  - Software and application development
- UCGIS GIS&T Body of Knowledge
- Los Angeles County



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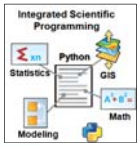
Web / GIScience 2.0



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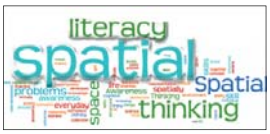
Spatial @ USC

- Spatial Sciences Institute was established in July 2010
- New classes
- New Minor in Spatial Studies
- New B.S. in GeoDesign
- New Online M.S. & Graduate Certificate Programs in Geographic Information Science & Technology
- New Ph.D. in Population, Health & Place
- Enhanced support for spatially enabled research & teaching across USC



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Spatial … cross-cutting … the spatial turn

- Rapid spread of spatial thinking and GIS throughout the sciences
  - Snow's 19th century work on cholera
  - ACM SIGSPATIAL
- Has swept through social sciences and humanities as well
  - All human action literally *takes place* somewhere
  - Spatial dimension of social interaction key for understanding all of the classic questions about the human condition
- Cf. with statistics as a field of study

Map showing clusters of cholera cases in London epidemic of 1854

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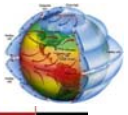
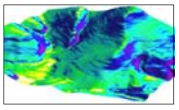
Spatial science … technology … discovery

Geographic Information Science



Geospatial Technologies

Scientific Discovery



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Geographic information infrastructure

- Contains knowledge describing natural and human environments on Earth
- Includes multiple components
  - Data
  - Data models that provide structure to the data
  - Models and analytic tools that show predictions or suitability
  - Geospatial workflows
  - Metadata, which describes the aforementioned components, and is key to **sharing, discovery and access**
- Relies on web & **mobile** environments to make these ways of thinking about the world more accessible

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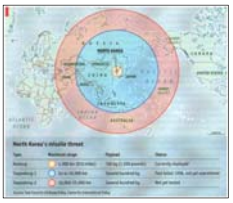
Map projections …



Flat-earth thinking. Thank you to those readers who pointed out that, by superimposing concentric circles on a Mercator projection, the map in our May 3rd issue (now corrected online) greatly underestimated the potential reach of North Korea's missiles. We stand corrected.

The Economist

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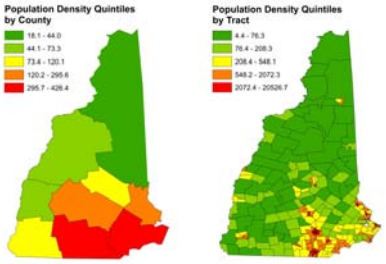
The Modifiable Area Unit Problem



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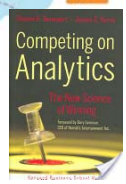
Slide courtesy of Karen Kemp, University of Southern California

The Broader Context

- Big Data
  - Barcodes
  - RFID tags
- Cloud Computing
- Analytics …
  - Gain insight
  - Drive decision-making

Cloud Computing
everything and the kitchen sink



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Business Analytics

- Key features
  - Organizational data | actionable information
  - Patterns | trends | relationships
  - Statistical data | tables | charts | graphs
- Independent systems
  - Cognos
  - MicroStrategy
  - SharePoint
- Enterprise systems

COGNOS

MicroStrategy Best In Business Intelligence

SharePoint 2010

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Location Analytics

- Slow growth
  - Desktop | **Business Analyst™** | Integration & technical barriers
  - Web | Integration & limited functionality
- Current status
  - Growing realization adding geographic locations to business data and mapping it gives a whole new context that is not possible with tables, charts, and graphs
  - Geospatial visualization listed by Deloitte's as 1 of top 10 technical priorities for business in 2012

Market Planning

Territory Design

Marketing

Customer Segmentation

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Pictures courtesy of Esri, Inc.

Esri Maps

- Mapping visualization
  - Point, color-coded, temporal, clustered, heat maps
- Spatial analysis
  - Bidirectional interaction, map filtering, proximity, drive time, trade area, and advanced analysis tools
- Geographic information enrichment
  - Base maps, imagery, demographics, consumer & lifestyle data, environment & weather, social media, business, etc.
- Esri Maps for IBM Cognos
- Esri Maps for MS Office

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ArcGIS Online (arcgis.com)

- Large web mapping platform
  - Provides enterprise mapping & spatial analysis services for whole organization
- Spatial analytics …
  - Can share, visualize, & analyze all kinds of organization data using geography as a common framework
  - Can incorporate data that has been mapped using location analytics
- Geospatial data integration
  - Can create mash ups by adding geospatially referenced data available on the web

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Starbuck's GIS Strategy

- Statistics (2009)
  - 16,635 U.S. stores
  - $9.8 billion in revenue
- GIS Operations
  - Global Market Planning Group uses ArcGIS Desktop plus several extensions to perform advanced analytics, business & geospatial intelligence
  - Real Estate Partners uses ArcGIS Server with tablets and smart phones to run reports, view maps & models, generate commentary, etc.

Continuously build fresh go-to-market strategies

What is going on in this trade area?
What are the general retail trends in this area?
Where are the competitors?
Who are those competitors?
Where is business being generated?
Where are the highest traffic volumes?
Where are people living?
Where are they going to work?
How are they traveling to work?

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The GIS Business Case

- Many aspects of retail are defined by place …
  - Where customers live, work & travel
  - Where your competition is
  - How your merchandise moves through the supply chain
  - Where your next store should be located
- Many potential benefits …
  - Merchandising mix improvement
  - Better management of your portfolios and assets
  - Better promotions execution

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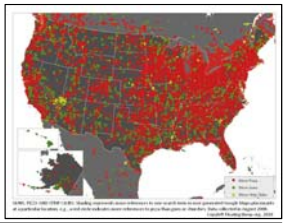
Spatial @ USC …

- **SSCI 101 Spatial Analytics Workshops (2 units)**
  - GIS for Business
  - GIS for Design
  - GIS for Environment
  - GIS for …
- **New GIS courses**
  - Maps & Spatial Reasoning
  - Principles of Geographic Information Science
  - Spatial Sciences Practicum
- **GIS help desk**



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Questions …

Project for Public Spaces

Placemaking plans

City-wide strategic plans

Capacity building and cultural change

Placemaking 101

Lighter
Quicker
Cheaper

http://www.pps.org/

John Wilson
jpwilson@usc.edu
http://spatial.usc.edu/

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