Spatial 2.0: Spatial literacy, analysis, modeling, & visualization

John P. Wilson
School of Architecture
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Outline
- Background
  - Pattern & process
  - Location, location, location
  - Flows & cycles
  - Space & time
- Spatial literacy & thinking
  - Geographic information science
  - Geospatial technologies
  - The spatial turn
- A spatially infused university
- Spatial@USC
- Final thoughts

Got GIS? We do, and it really works!

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

Building Blocks
- Systems
- Spatial
- Sciences
- Models
- Institute

Data
- Assessment
- Measurements
- Observations

Pattern ... WA precipitation map
Processes ...

Location, location, location ...

Land use / land cover

Landscapes

Average hours of exposure to extreme heat by land cover type

Mobility ... Flows
Cycles ... Scale, space & time

Spatial literacy & thinking
- Spatial literacy
  - Ability to use properties of space to communicate, reason, and solve problems
- Spatial thinking ...
  - A cognitive skill that can be used in everyday life, the workplace, and science to structure problems, find answers, and express solutions using the properties of space
  - It can be learned and taught formally to students using appropriately designed tools, technologies, and curricula
  - A properly positioned GIS (program) could be used to foster spatial thinking across the curriculum

Spatial concepts
- Spatial structures
- Spatial properties
- Space-time context
- Positioning
- Spatial dynamics
- Spatial relations
- Spatial interaction
- Spatial transformation
- Representation
- Spatial principles
  - Position
  - Distance
  - Orientation
  - Spatial autocorrelation
  - Spatial heterogeneity
  - Spatial association
  - Distance decay
  - Access
  - Availability
  - Isotropy
  - Congruence

Source: TeachSpatial (teachspatial.org)

Geospatial technologies
- Provides tools to solve many of real world problems ...
  - Locating things
  - Routing
  - Location/Allocation
  - Locating linear facilities
  - Land use modeling

Web / GIScience 2.0

Multiple Platforms
- Bundle software with data
- Build geoprocessing workflows and services
- Provides multiple entry and exit points for users
- Rapid growth in demand for people with spatial skills
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 human condition
- Cf. with statistics as a field of study

Spatial analysis

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

Spatial analysis: Various classes of transformations, manipulations & methods that comprise spatial analysis
(Source: Smith et al. 2000; Longley et al. 2000)

Geographic information science

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

Workforce development

A spatially infused university

- Teaching spatial literacy – Promote and facilitate spatial approaches to thinking and reasoning about the Earth
- Teaching spatial science – Maps & spatial reasoning, principles of geographic information science, etc.
- Teaching spatial applications – Promote and enable spatial thinking across multiple disciplines
- Managing universities as spatially enabled enterprises – Facilities management, fund raising, public safety, etc.

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
Bundling geospatial data & tools

- Bing Maps
- Business Analyst Online
  - http://www.esri.com/software/bao/demos
- CityEngine
  - Unique conceptual design & modeling solution for the efficient creation of 3D cities & buildings
  - http://www.esri.com/software/cityengine
- Community Analyst Online
- Google Maps / Earth
- Microsoft Word / Excel
- Spatially informed site analysis!

Map projections ...

The Economist

The Modifiable Area Unit Problem

Spatial @ USC ...

- GeoPortal
  - LA County geospatial data assets
- GIS courses
  - Maps & Spatial Reasoning
  - Principles of Geographic Information Science
  - Spatial Sciences Practicum
- GIS/GPS hardware & software
- GIS/GPS short courses
- GIS help desk
- Spatial Studies Minor
- B.S. in GeoDesign

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