



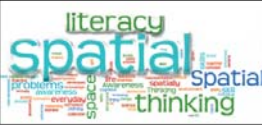

How should GIS education be reshaped to serve future needs?

John P. Wilson
GI Forum 2012
University of Salzburg
4 July 2012





Outline

- Background
 - Geographic information science
 - Geospatial technologies
 - Web / Spatial 2.0
 - The spatial turn
- Spatial literacy & spatial thinking
 - Fundamental concepts & linkages
- A spatially infused university
 - Teaching spatial science
 - Teaching spatial applications
 - Teaching spatial literacy
 - Workforce development
- Conclusions

Geographic information science

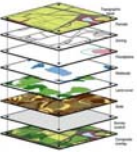



Knowledge collection

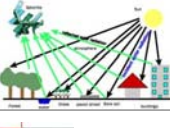






Geospatial technologies


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



Constraining Design Approach

Web / GIScience 2.0

Multiple shortcomings

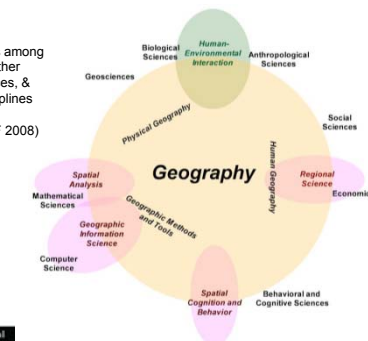
- Focus on what is or what has been
- Focus on terrestrial environments
 - Both reflect geography contributions
- Most of the world has been ignored
 - Oceans – cover 70% of Earth's surface
 - Buildings – people spend 85% of their lives indoors & dense urban areas have more interior space than land area
- Not well aligned with the non-expert user (& everyday places)
- Not connected to sketch & recording needs of design disciplines



Geography & Spatial Sciences?

Relationships among geography, other spatial sciences, & cognate disciplines

(Source: NSF 2008)



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



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 could be used to foster spatial thinking across the curriculum

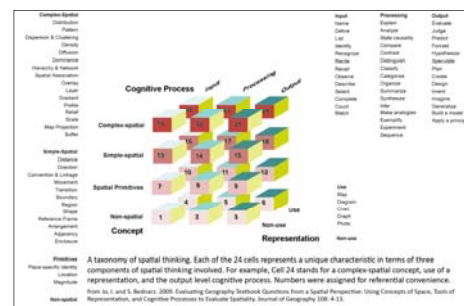


Spatial concept terms

- Spatial structures
- Spatial properties
 - position
 - distance
 - direction
 - orientation
- Space-time context
- Positioning
- Spatial dynamics
- Spatial relations
 - object
 - field
 - surface
 - network
 - region, etc.
- Spatial interaction
- Spatial transformation
- Representation
 - spatial autocorrelation
 - spatial heterogeneity
 - spatial association
 - distance decay
 - access
 - availability
 - isotropy
 - congruence
- Spatial principles

Source: TeachSpatial (teachspatial.org)

Geography from a spatial perspective



Spatial / science teaching standards

Source: UCSB Center for Spatial Studies

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
Geocomputation	Agent-based modeling, artificial neural networks & evolutionary computing
Geovisualization	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)

A spatially infused university

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

Spatial programs at the University of Redlands

B.S. in GeoDesign ... as one example

- Goal
 - To identify the best and most sustainable designs that take into account livability (people), environmental impact (the planet) and efficiency (profit)
- Relies on an expanding foundation consisting of ...
 - An enabling technology (and science)
 - An emphasis on collaboration
 - An interest in interdisciplinary approaches
 - A renewed interest in livable cities and sustainability

Spatial applications ...

Teaching spatial literacy ...

- Target audience
 - The entire student body?
- Possible vehicles ...
 - Single "spatial" GE course
 - Single "spatial" course for non-majors
 - Many spatially "certified" (GE) courses
 - A spatial studies minor
 - Many "small" courses focused on specific technologies and application domains ... that may or may not be linked to courses on spatial theory

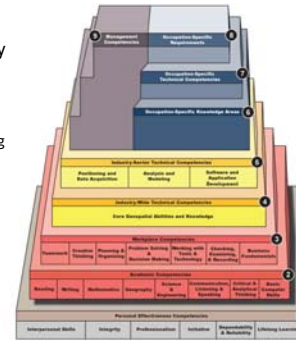
Geographic information infrastructure

- 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

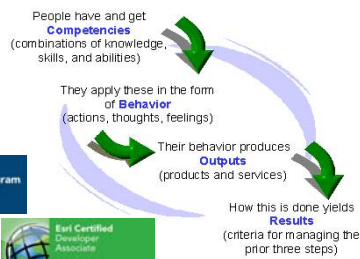


Workforce development

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



Workforce development



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>

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