Building a Vibrant and Enduring Spatial Science

John P. Wilson
IWGIS2014
Beijing, China
21 June 2014

USC spatial sciences

Outline

- Spatial roots
  - Geography
  - Landscape architecture
  - Computer science
- The (current) opportunity
- **Guiding principles**
  - **Spatial as an enabling discipline**
  - **Core concepts (& distractions)**
  - **Role of collaboration**
  - **Changing character of spatial data**
  - **Role of geodesign | actionable science**
- Final Thoughts

The opportunity

- Spatial turn
  - Rapid spread of spatial thinking & GIS throughout sciences
    - Snow's 19th century work on cholera
    - Scholten's new book
    - ACM GIS Conference series
  - 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
- New academic units
- New academic programs

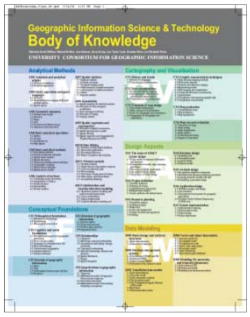
Map showing clusters of cholera cases in London epidemic of 1854

Five guiding principles

- Spatial as an enabling discipline
- Core concepts | distractions
- Role of Collaboration
- Changing character of spatial data
- Role of Geodesign | actionable science

Spatial as an enabling discipline

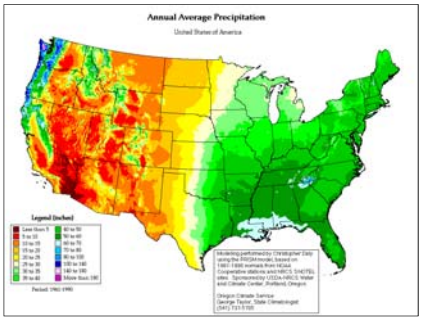
- Cf. with statistics
- Need small number of fundamental spatial scientists, larger numbers of translational scientists?
- Know ourselves, our role in the knowledge discovery process
  - GIS&T Body of Knowledge projects
- Learn how to connect & collaborate with others



Core concepts | Duckham 2014

Spatial structure

Dynamism
Uncertainty
Cognition
Design
Scale



Dynamism

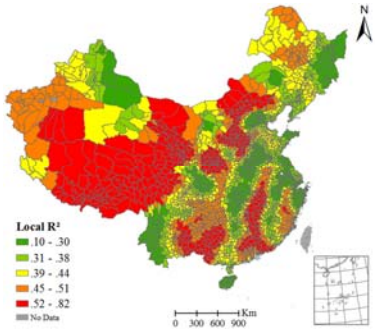
Catalina Island Fox, Photo: Courtesy of Tim Coonan

Mission Blue Butterfly, Photo: Courtesy of Travis Longcore

Poronui Lodge: Home Ranges for Stags

7

Uncertainty



8

Cognition

9

Design

Maps

Technology

1:25K 1:50K 1:100K

10

Scale | complexity

Global		Cloud cover and CO2 levels control primary energy inputs to climate and weather patterns
Meso		Prevailing weather systems control long-term mean conditions; elevation-driven lapse rates control monthly climate; and geological substrate exerts control on soil chemistry
Topo		Surface morphology controls catchment hydrology; slope, aspect, horizon, and topographic shading control surface insolation
Micro		Vegetation canopy controls light, heat, and water for under-story plants; vegetation structure and plant physiognomy controls nutrient use
Nano		Soil microorganisms control nutrient recycling

(Slide: Courtesy of Michael Hutchinson)

11

Distractions

esri HEXAGON

USGS MDA

FOSS4G EUROPE BREMEN2014

Bentley DIGITALGLOBE

GeoEye Hitz Hitachi Zosen Ubisense

CYBER GIS

GeoComputation 2007

The Art and Science of Solving Complex Spatial Problems with Computers.

OGC Making location count. www.opengeospatial.org

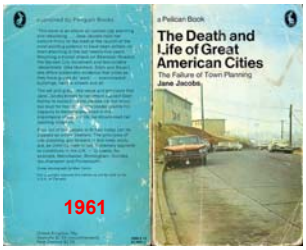
12

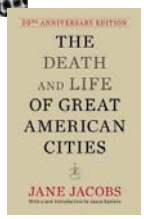
Role of Collaboration

- Work with scientists in other domains
- Tackle "big" questions in new and important ways
  - Use of taxi, cell phone & social media data to explore form and function of metropolitan regions, cities, etc.
- **Key criteria for success …**
  - **Collaboration needs to involve more than spatial scientists**
  - **Sum of the parts must be greater than the parts themselves**

13

Urban form | function

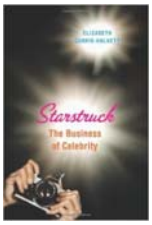




Placemaking, neighborhoods, active living

14

Economic organization



Industry in Motion: Using Smart Phones to Explore the Spatial Network of the Garment Industry in New York City
Sarah Williams
Elizabeth Currid-Halkett

PLOS ONE

2014

15

Role of the Web

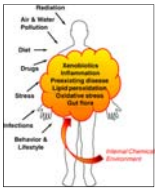
16

Changing character of spatial data

- Finer granularity in terms of both space and time …
  - Exposure modeling
  - Digital terrain modeling
  - Other examples?
- 3D
- Crowdsourcing | Volunteered Geographic Information
- Social media
- Sensing systems
- Changing role of government

17

Exposome

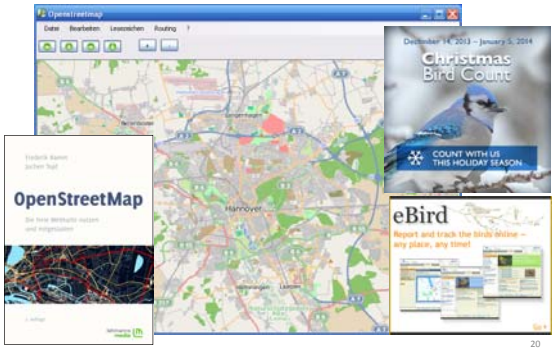


18

3D | LiDAR surface models

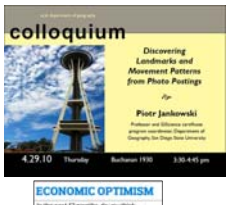
19

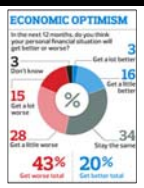
Crowdsourcing | VGI



20

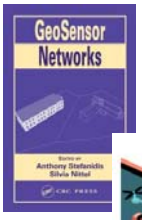
Crowdsourcing | social media

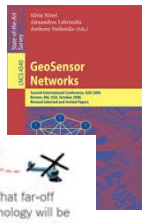




21

GeoSensor networks

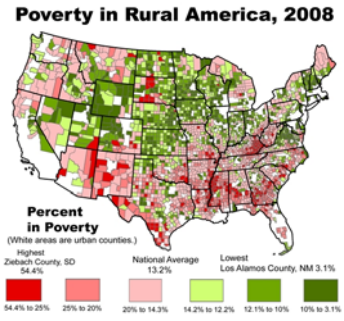




22

Changing role of government

American Community Survey



23

Geodesign | placemaking

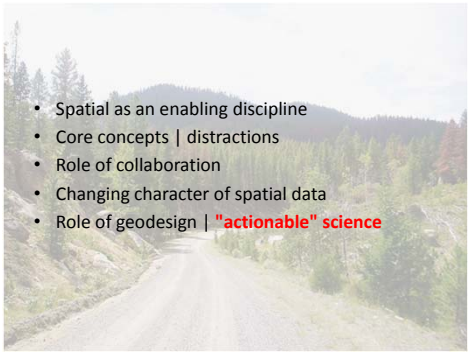
Spatial thinking
Geospatial technologies
Focus on the future
Design as a force for good
Collaboration

Capacity building
Human well-being
Sustainable development

Spatial leadership
Professional ethics

24

Final thoughts



- Spatial as an enabling discipline
- Core concepts | distractions
- Role of collaboration
- Changing character of spatial data
- Role of geodesign | **"actionable" science**

25

Our past work …

- Focused on terrestrial environments
- Focused on space (less about time)
- Focused on what is or what has been
- Ignored most of the world …
  - Oceans – cover 70% of Earth's surface
  - Buildings – people spend 85% of their lives indoors & dense urban areas have far more interior space than land area
- Not well aligned with everyday places & non-expert users
- Not connected to sketch & recording needs of design disciplines

USC spatial sciences

26

Close | 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

27