Macroscopes

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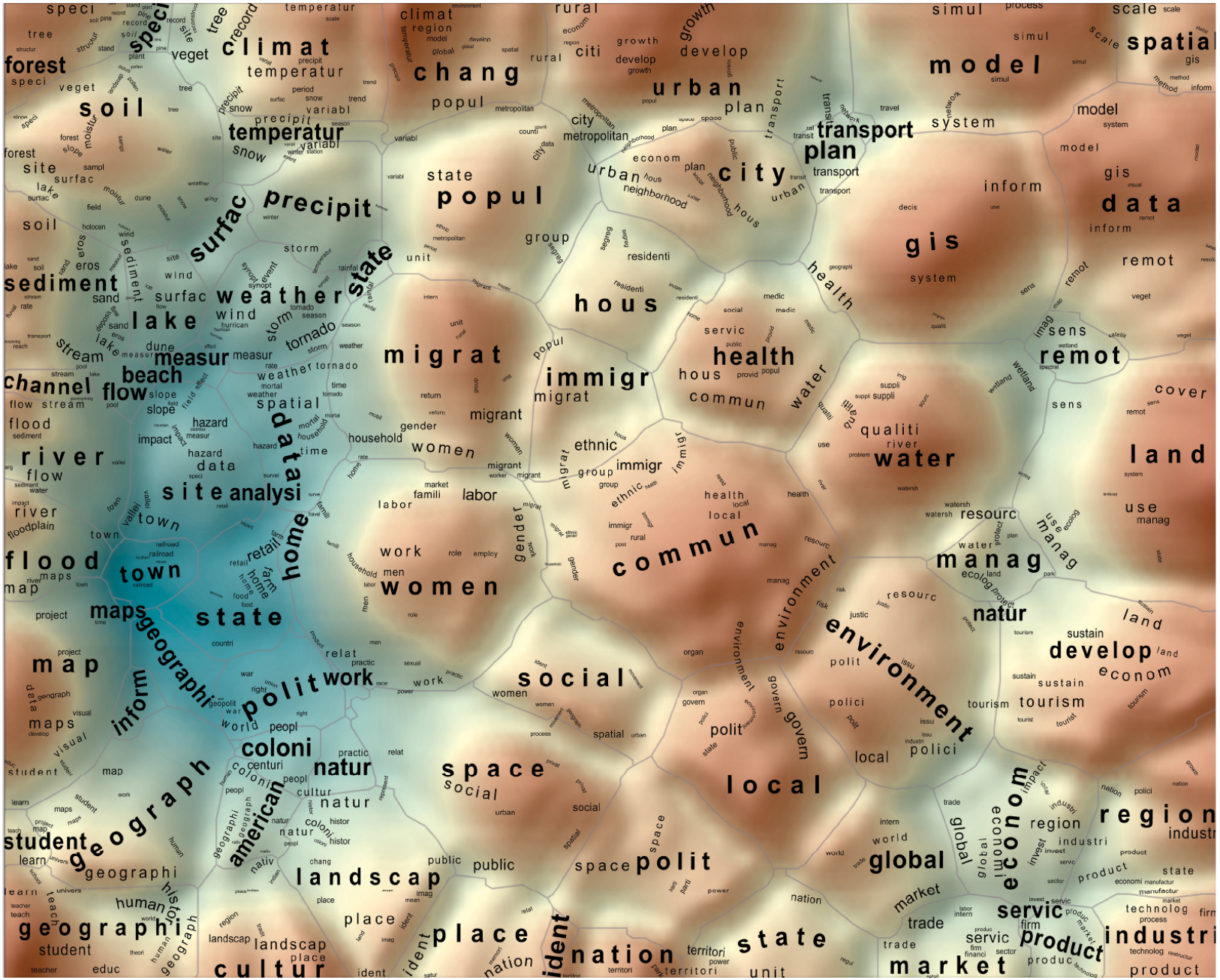
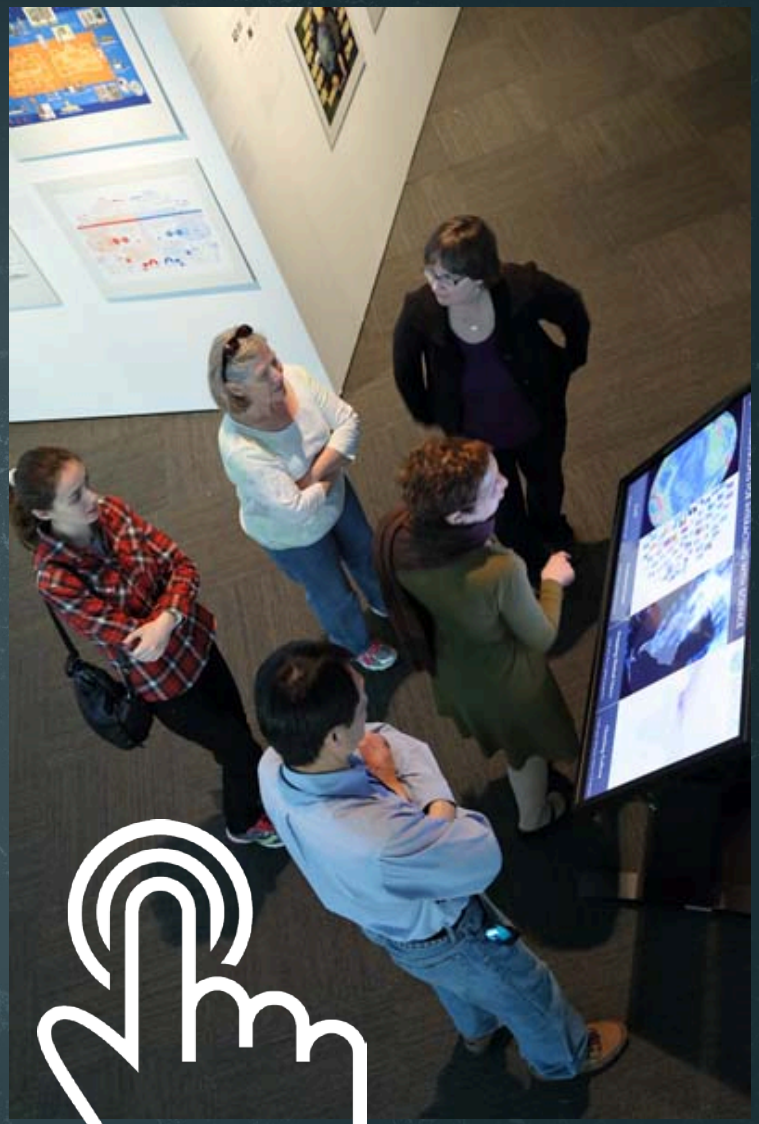
Indiana University, USA

IUB Data Science Club
IQ Wall Room in Library East, Indiana University, Bloomington
Wednesday, April 12, 2017



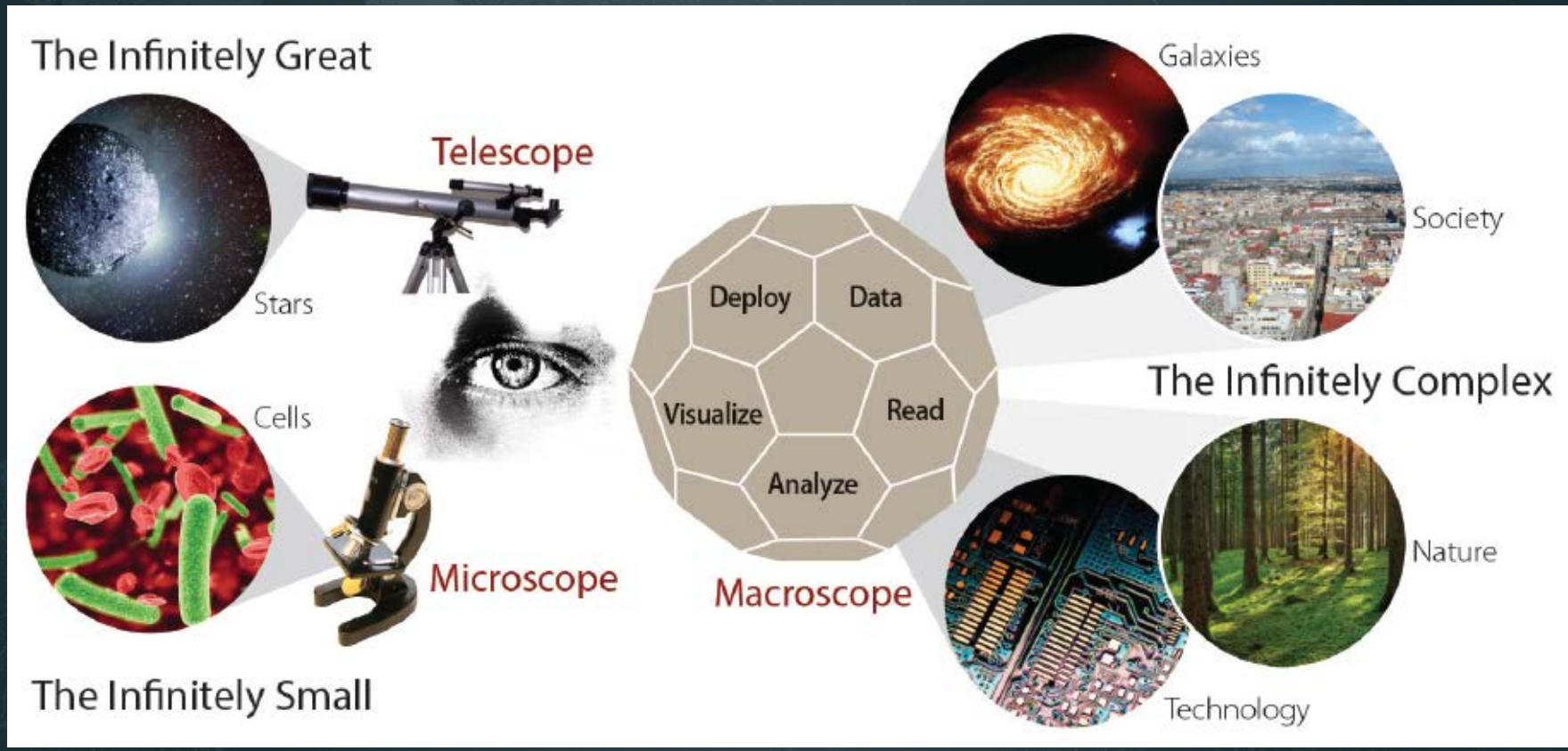
In Terms of Geography - Andre Skupin - 2005



MAPS
vs.
MACROSCOPES

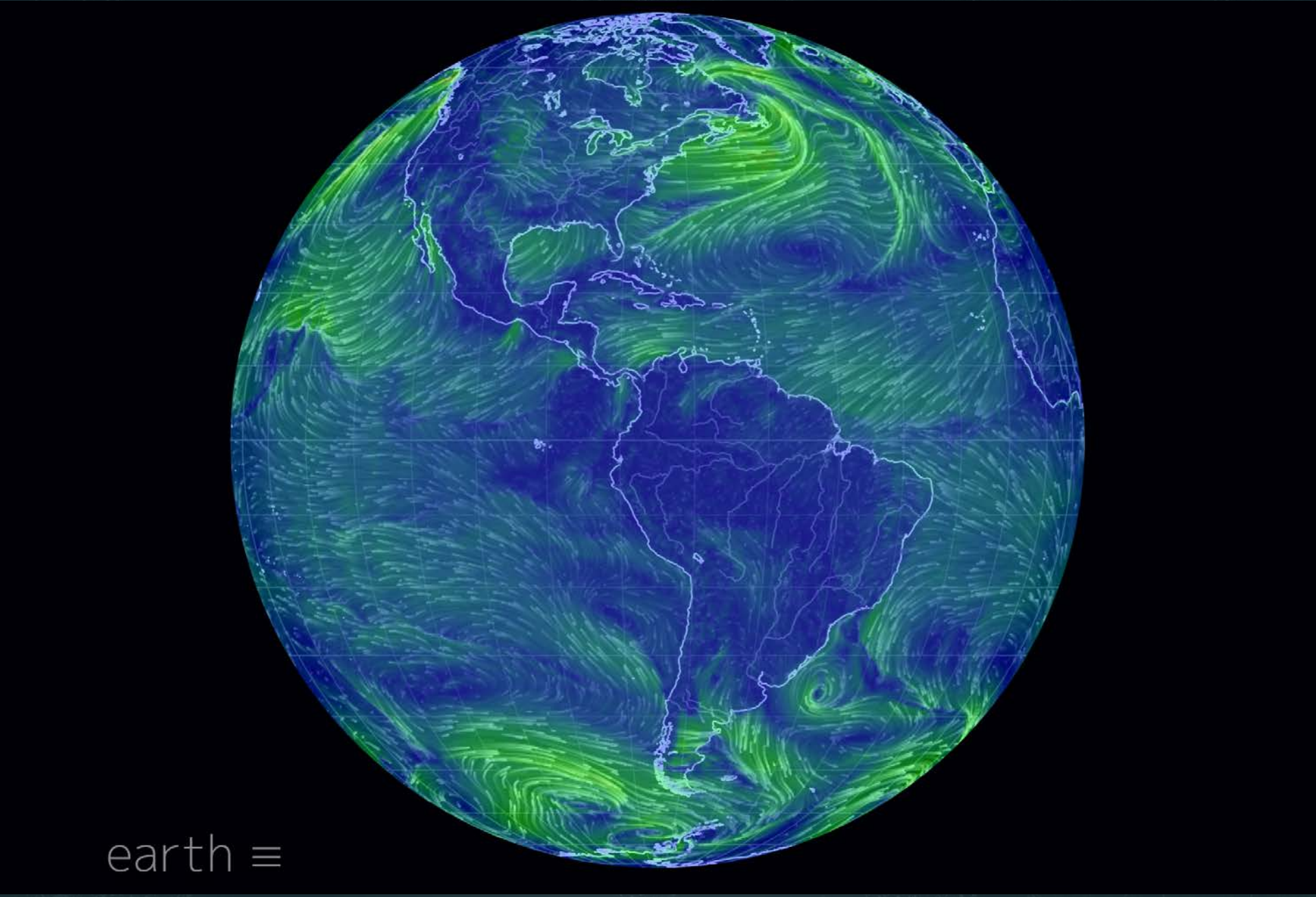
http://web.avl.indiana.edu/~pdbeard/macroscope-kiosk/dist/#/

Microscopes & Telescopes vs. MACROSCOPES

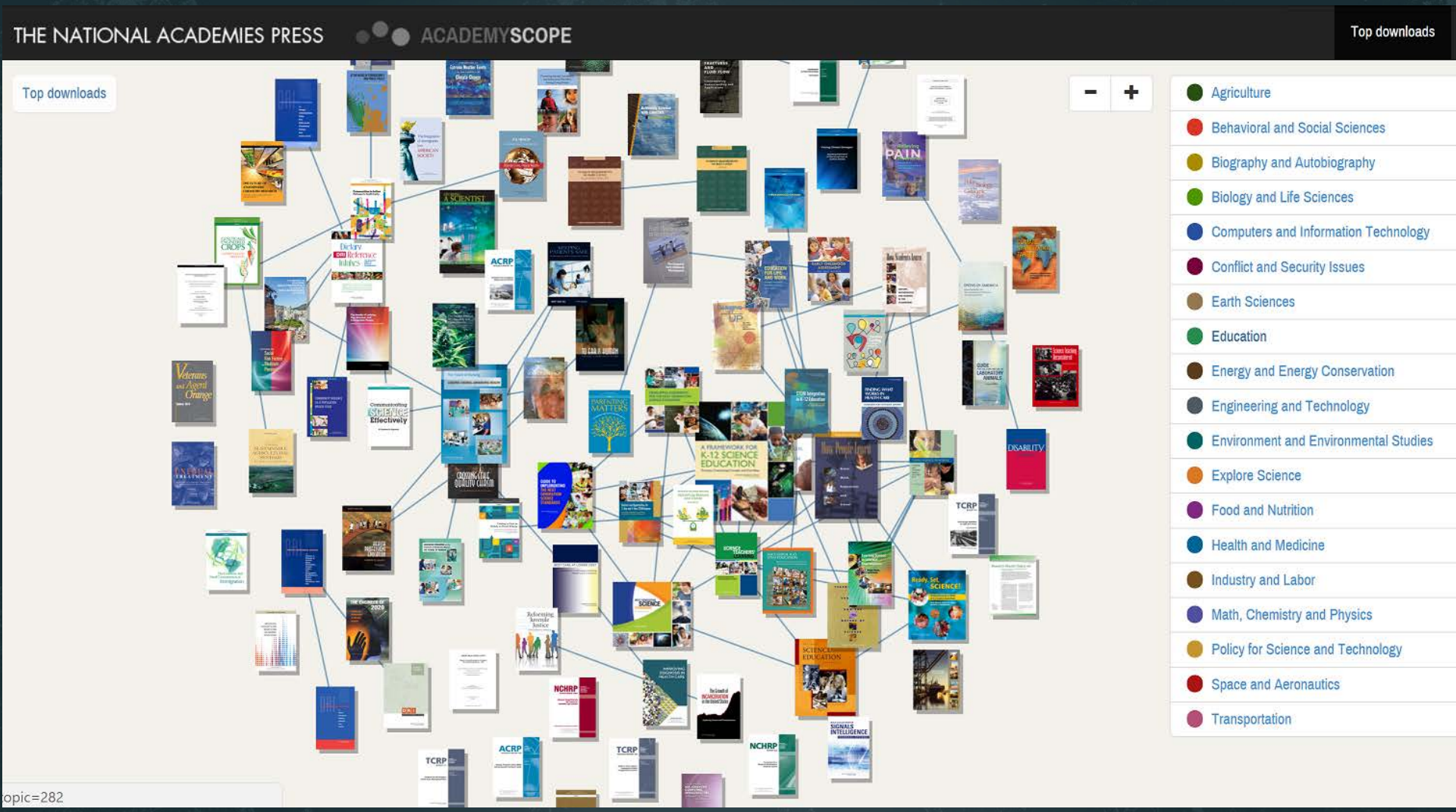


Iteration XI (2015): Macroscopes for Interacting with Science

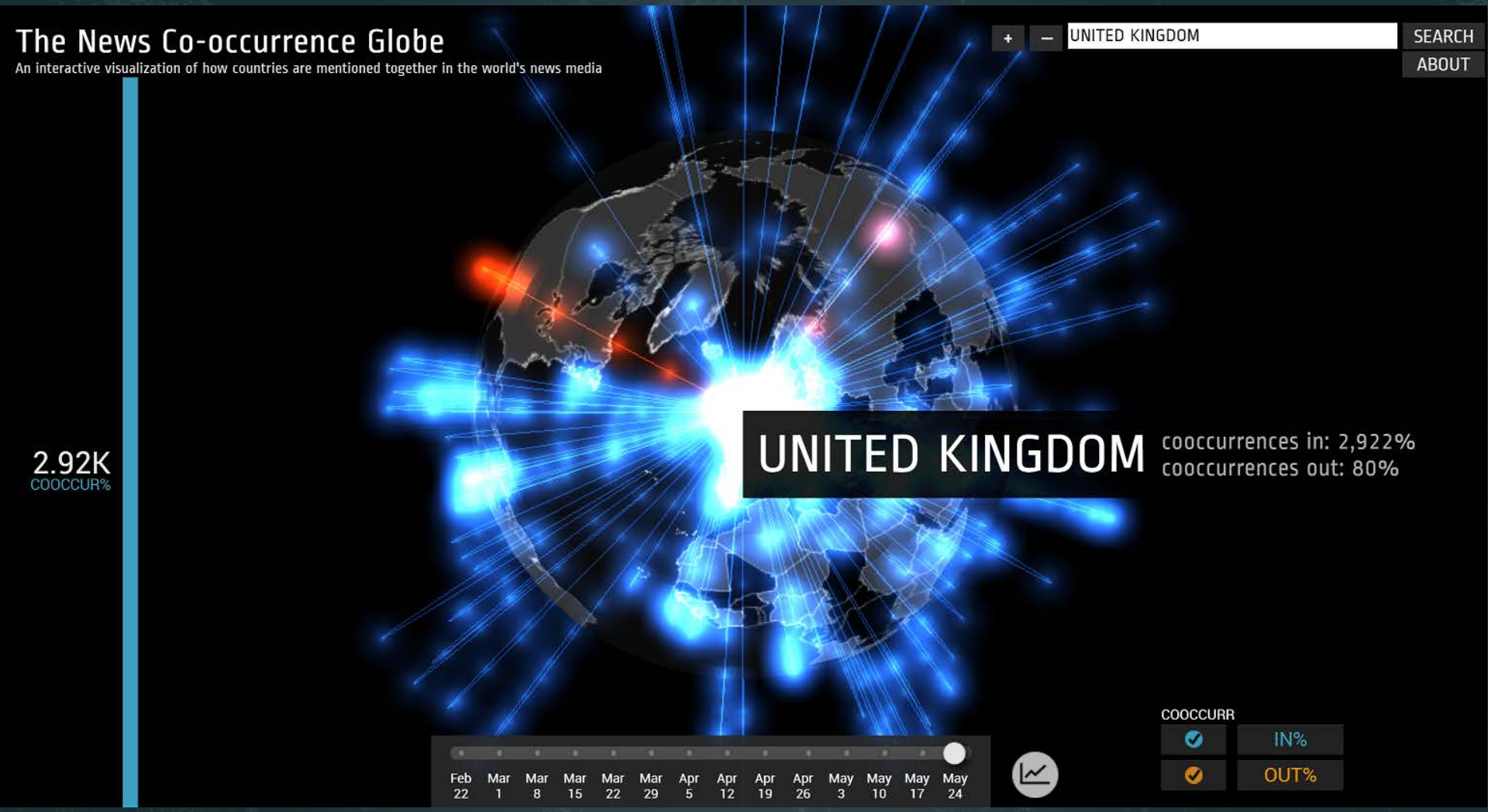
http://scimaps.org/iteration/11



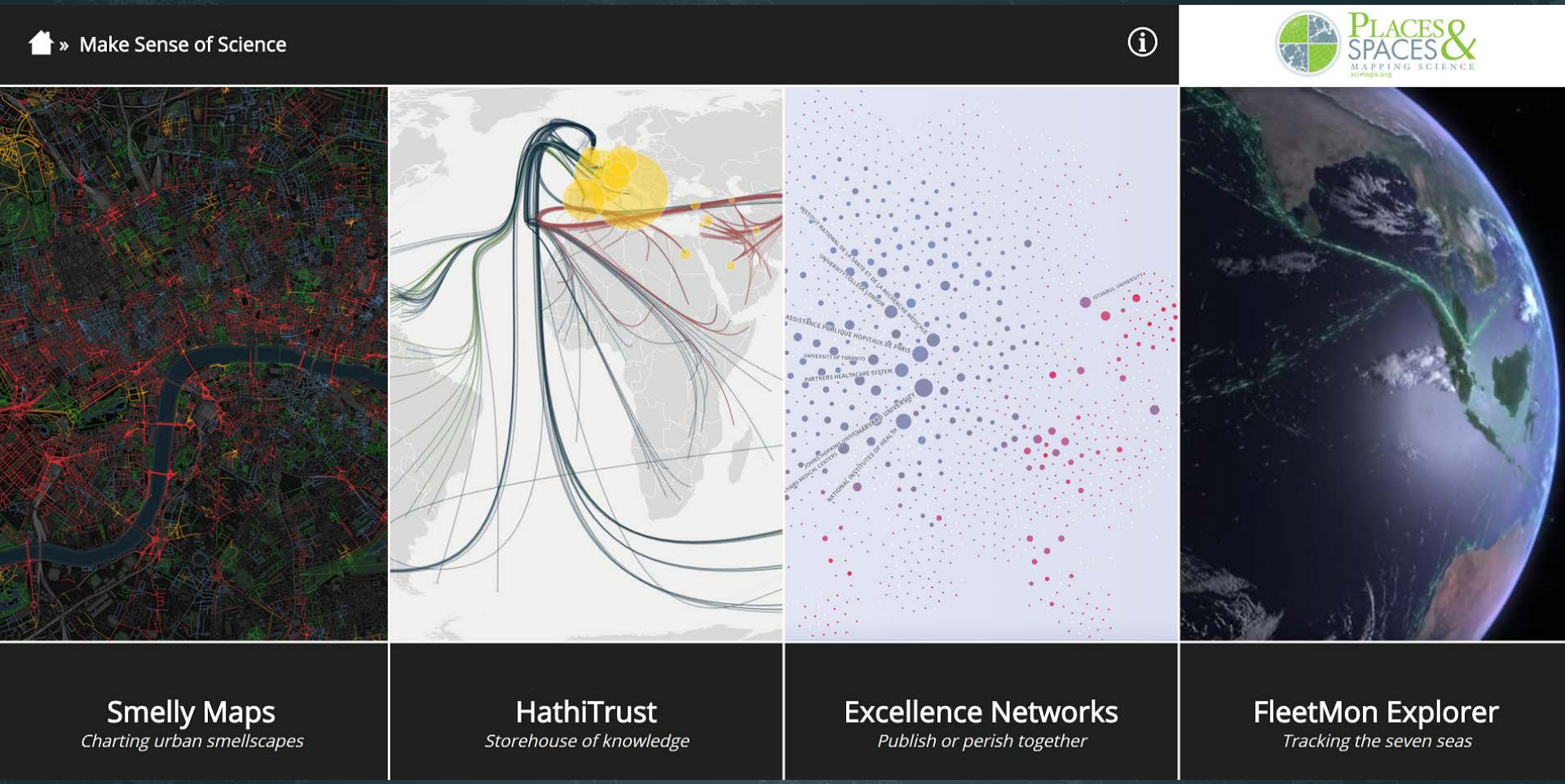
Earth – Cameron Beccario



AcademyScope – National Academy of the Sciences & CNS

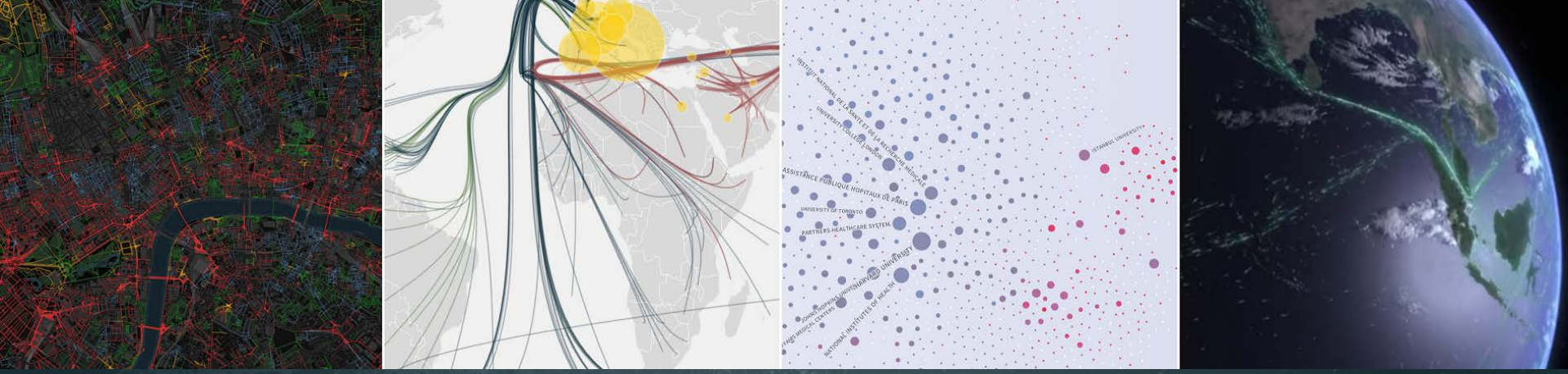


Mapping Global Society –Kalev Leetaru



Iteration XII (2016): Macroscopes for Making Sense of Science

http://scimaps.org/iteration/12



Four new macroscopes debut at Vanderbilt University:

1. **Smelly Maps:** Features a "smellscape" of 12 cities mapped by smell using social media
2. **HathiTrust:** Highlights the diversity of publications collected in digital form by HathiTrust.
3. **Excellence Networks:** Compares how research institutions, such as Indiana and Vanderbilt universities, collaborate with one another.
4. **FleetMon:** Shows how the amount of shipping traffic that navigates the Strait of Malacca compared to other major shipping lanes of the world.

http://scimaps.org/vanderbilt

A visitor explores the macroscope kiosk at the Eskenazi Museum of Art at Indiana University.

Call for Macroscope Tools for the *Places & Spaces: Mapping Science* Exhibit (2017) http://scimaps.org/call

Background and Goals

The *Places & Spaces: Mapping Science* exhibit is designed to open people's hearts and minds to the value, complexity, and beauty of maps of science and technology.

Drawing from across cultures and across scholarly disciplines, the *Places & Spaces: Mapping Science* exhibit demonstrates the

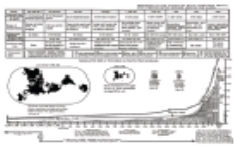
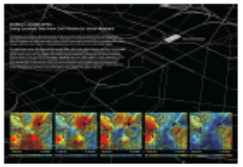
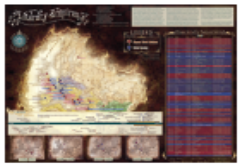
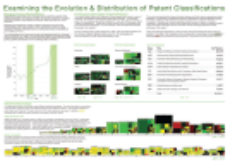
IVMOOC.cns.iu.edu

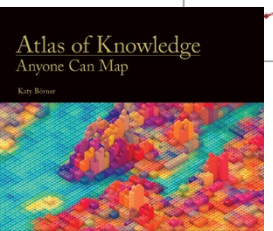
PLACES & SPACES
MAPPING SCIENCE

scimaps.org

Register for free: http://ivmooc.cns.iu.edu. Class started Jan 10, 2017.

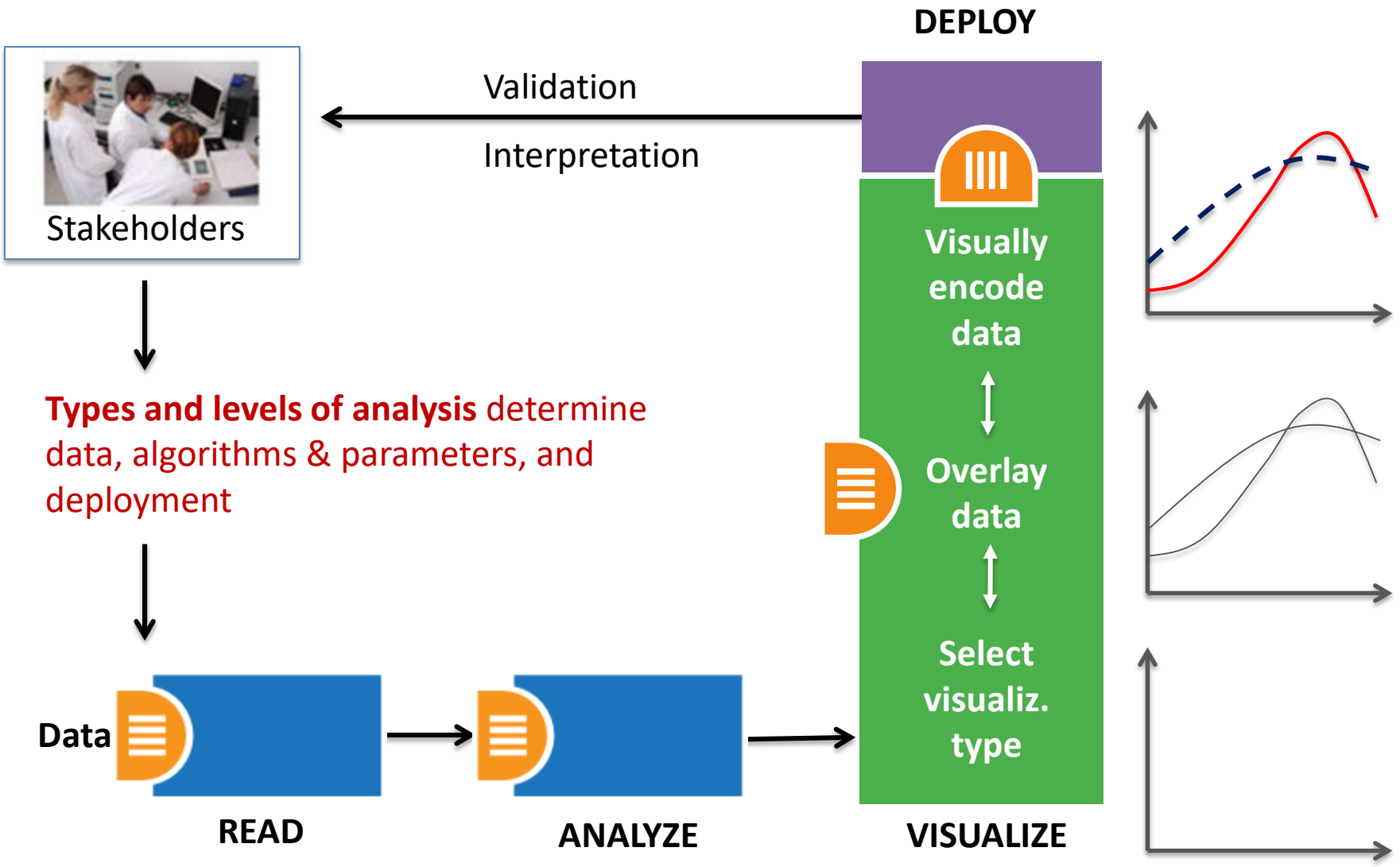
Tasks

TYPES	LEVELS		
	MICRO: Individual Level about 1–1,000 records page 6	**MESO: Local Level** about 1,001–100,000 records page 8	**MACRO: Global Level** more than 100,000 records page 10
Statistical Analysis page 44	 Knowledge Cartography page 135	 Productivity of Russian life sciences research teams page 105	 Number of scientists versus population and R&D costs versus GNP. page 103
WHEN: Temporal Analysis page 48	 Visualizing decision-making processes page 95	 Key events in the development of the video tape recorder page 85	 Increased travel and communication speeds page 83
WHERE: Geospatial Analysis page 52	 Cell phone usage in Milan, Italy page 109	 Victorian poetry in Europe page 137	 Ecological footprint of countries page 99
WHAT: Topical Analysis page 56	 Evolving patent holdings of Apple Computer, Inc. and Jerome Lemelson page 89	 Evolving journal networks in nanotechnology page 139	 Product space showing co-export patterns of countries page 93
WITH WHOM: Network Analysis page 60	 World Finance Corporation network page 87	 Electronic and new media art networks page 133	 World-wide scholarly collaboration networks page 157

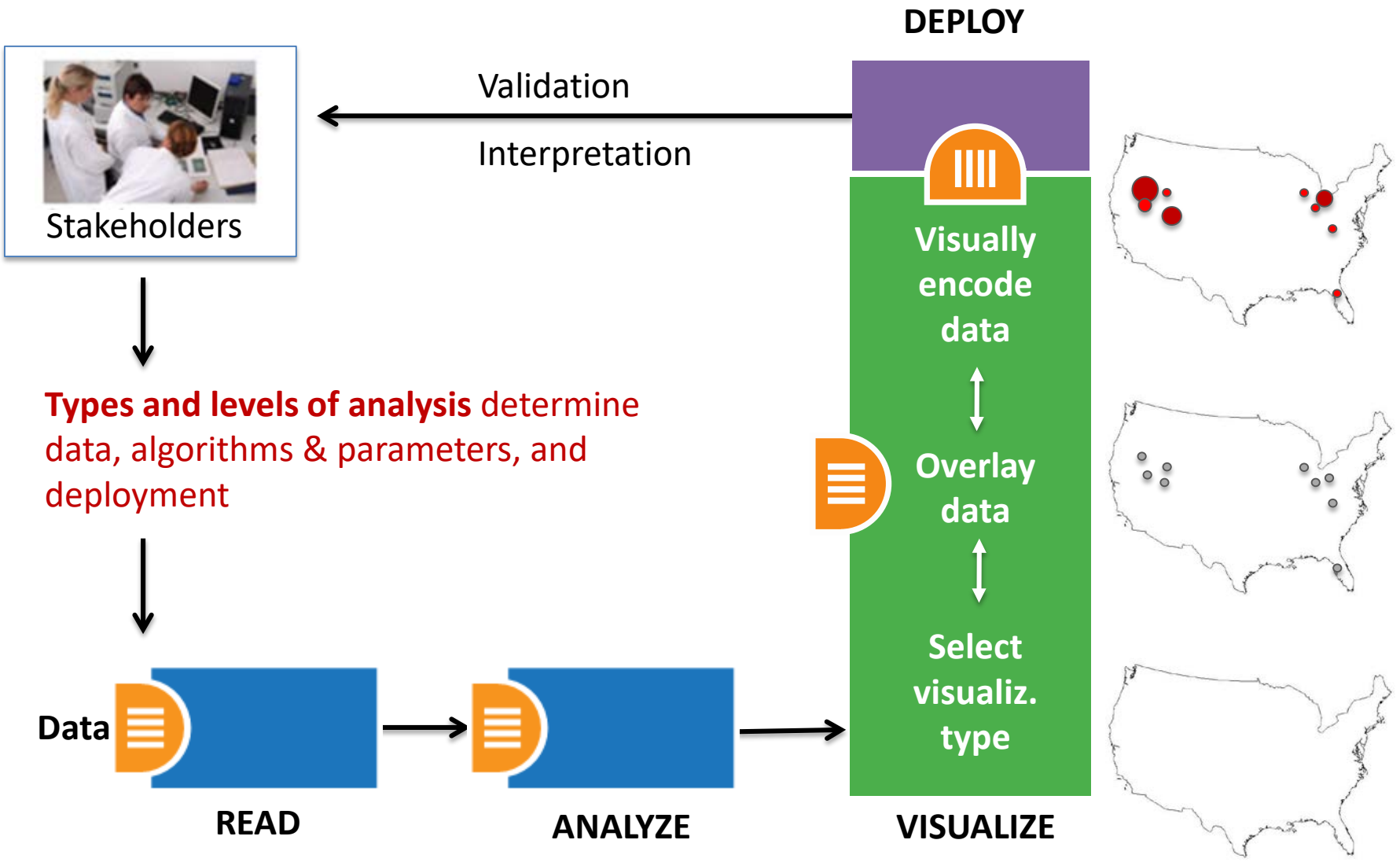


See page 5

Needs-Driven Workflow Design



Needs-Driven Workflow Design



Course Schedule

Part 1: Theory and Hands-On

- **Session 1** – Workflow Design and Visualization Framework
- **Session 2** – “When:” Temporal Data
- **Session 3** – “Where:” Geospatial Data
- **Session 4** – “What:” Topical Data

Mid-Term

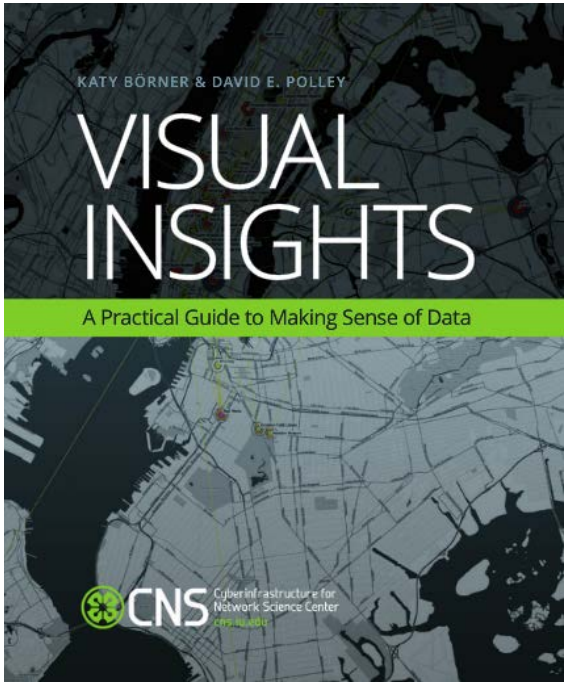
- **Session 5** – “With Whom:” Trees
- **Session 6** – “With Whom:” Networks
- **Session 7** – Dynamic Visualizations and Deployment

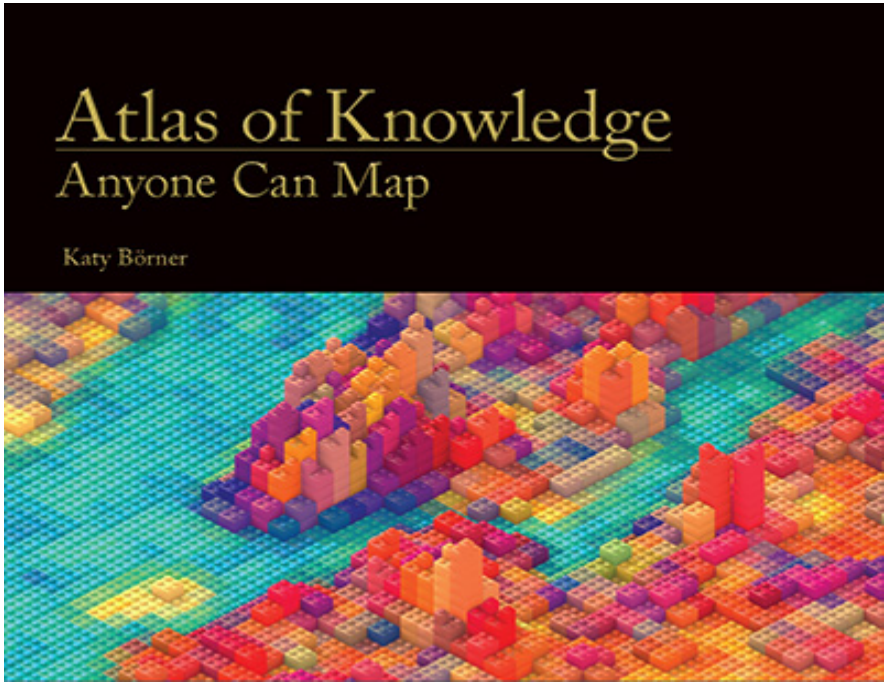
Final Exam

Part 2: Students work in teams on client projects.

Final grade is based on Class Participation (10%), Midterm (30%), Final Exam (30%), and Client Project(30%).

Books Used in the IVMOOC





Teaches timely knowledge:

Advanced algorithms, tools, and hands-on workflows.

Teaches timeless knowledge:

Visualization framework—exemplified using generic visualization examples and pioneering visualizations.

Load **One** File and Run **Many** Analyses and Visualizations

Times Cited	Publication Year	City of Publisher	Country	Journal Title (Full)	Title	Subject Category	Authors
12	2011	NEW YORK	USA	COMMUNICATIONS OF THE ACM	Plug-and-Play Macroscopes	Computer Science	Borner, K
18	2010	MALDEN	USA	CTS-CLINICAL AND TRANSLATIONAL SCIENCE	Advancing the Science of Team Science	Research & Experimental Medicine	Falk-Krzesinski, HJ|Borner, K|Contractor, N|Fiore, SM|Hall, KL|Keyton, J|Spring, B|Stokols, D|Trochim, W|Uzzi, B
13	2010	WASHINGTON	USA	SCIENCE TRANSLATIONAL MEDICINE	A Multi-Level Systems Perspective for the Science of Team Science	Cell Biology |Research & Experimental Medicine	Borner, K|Contractor, N|Falk-Krzesinski, HJ|Fiore, SM|Hall, KL|Keyton, J|Spring, B|Stokols, D|Trochim, W|Uzzi, B

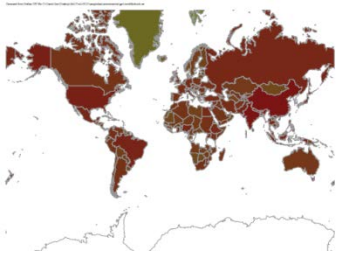
Statistical Analysis–p. 44

Location	*Count*	*# Citations*
Netherlands	13	292
United States	9	318
Germany	11	36
United Kingdom	1	2

Temporal Burst Analysis–p. 48

Geospatial Analysis–p. 52

Geospatial Analysis–p. 52



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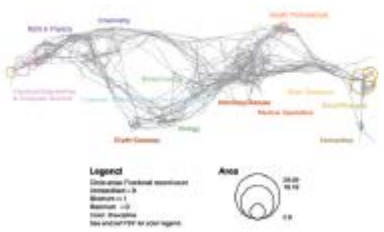
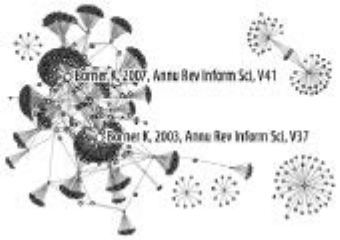
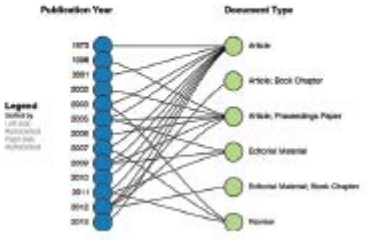
Topical Analysis–p. 56



Paper Citation Network–p. 60



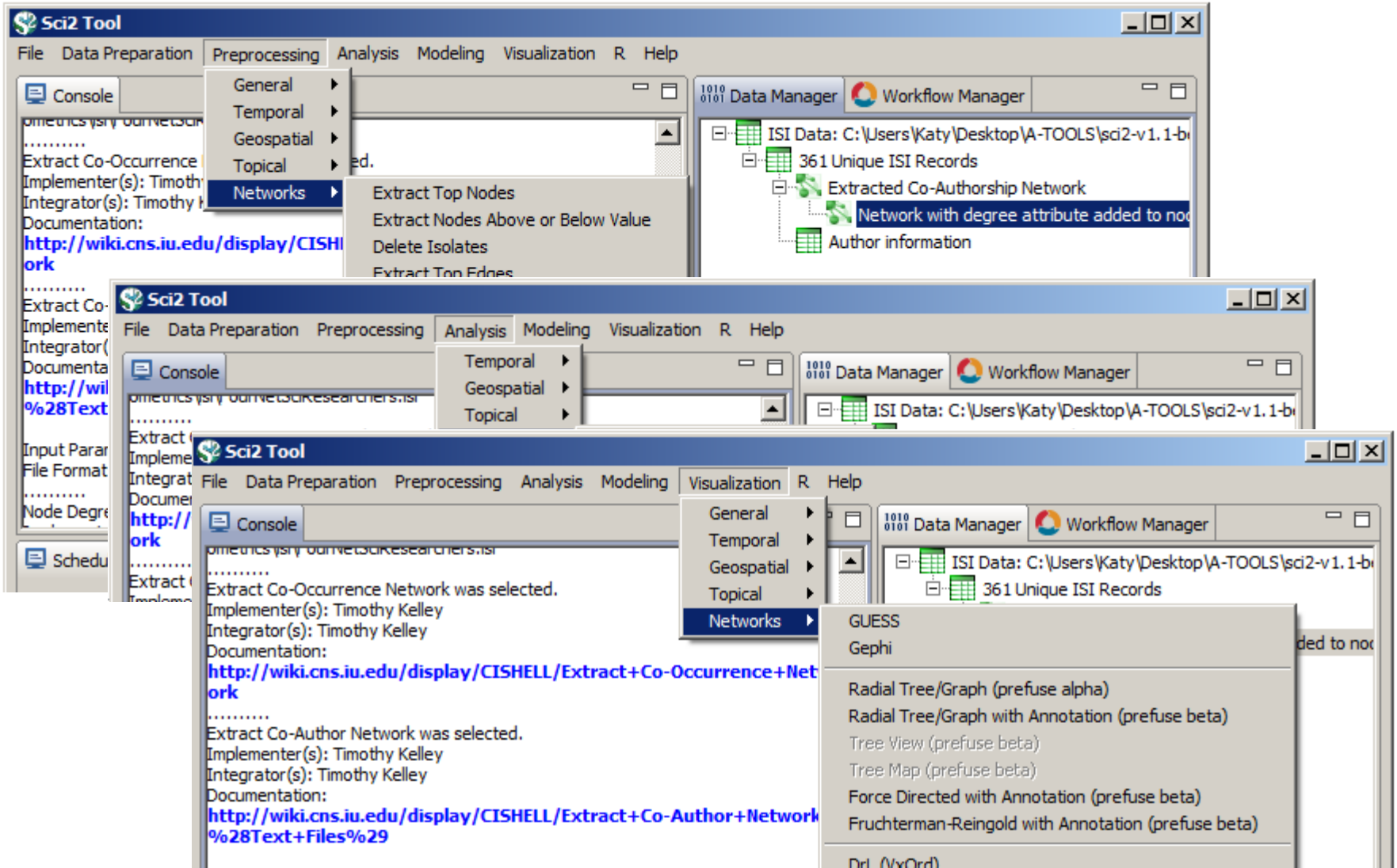
Bi-Modal Network–p. 60



Co-author and many other bi-modal networks.

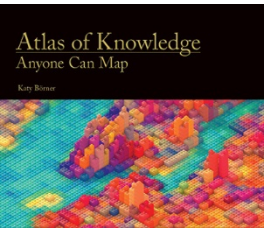
Sci2 Tool Interface Components

Download tool for free at http://sci2.cns.iu.edu



Visualization Framework

Insight Need Types page 26	Data Scale Types page 28	Visualization Types page 30	Graphic Symbol Types page 32	Graphic Variable Types page 34	Interaction Types page 26
• categorize/cluster • order/rank/sort • distributions (also outliers, gaps) • comparisons • trends (process and time) • geospatial • compositions (also of text) • correlations/relationships	• nominal • ordinal • interval • ratio	• table • chart • graph • map • network layout	• geometric symbols point line area surface volume • linguistic symbols text numerals punctuation marks • pictorial symbols images icons statistical glyphs	• spatial position • retinal form color optics motion	• overview • zoom • search and locate • filter • details-on-demand • history • extract • link and brush • projection • distortion



See page 24

Visualization Framework

Basic Task Types								
Bertin, 1967	**Wehrend & Lewis, 1996**	**Few, 2004**	**Yau, 2011**	**Rendgen & Wiedemann, 2012**	**Frankel, 2012**	**Tool: Many Eyes**	**Tool: Chart Chooser**	**Börner, 2014**
selection	categorize			category				categorize/ cluster
order	rank	ranking					table	order/rank/ sort
	distribution	distribution					distribution	distributions (also outliers, gaps)
	compare	nominal comparison & deviation	differences		compare and contrast	compare data values	comparison	comparisons
		time series	patterns over time	time	process and time	track rises and falls over time	trend	trends (process and time)
		geospatial	spatial relations	location		generate maps		geospatial
quantity		part-to-whole	proportions		form and structure	see parts of whole, analyze text	composition	compositions (also of text)
association	correlate	correlation	relationships	hierarchy		relations between data points	relationship	correlations/ relationships

Visualization Framework

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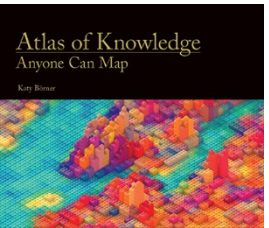

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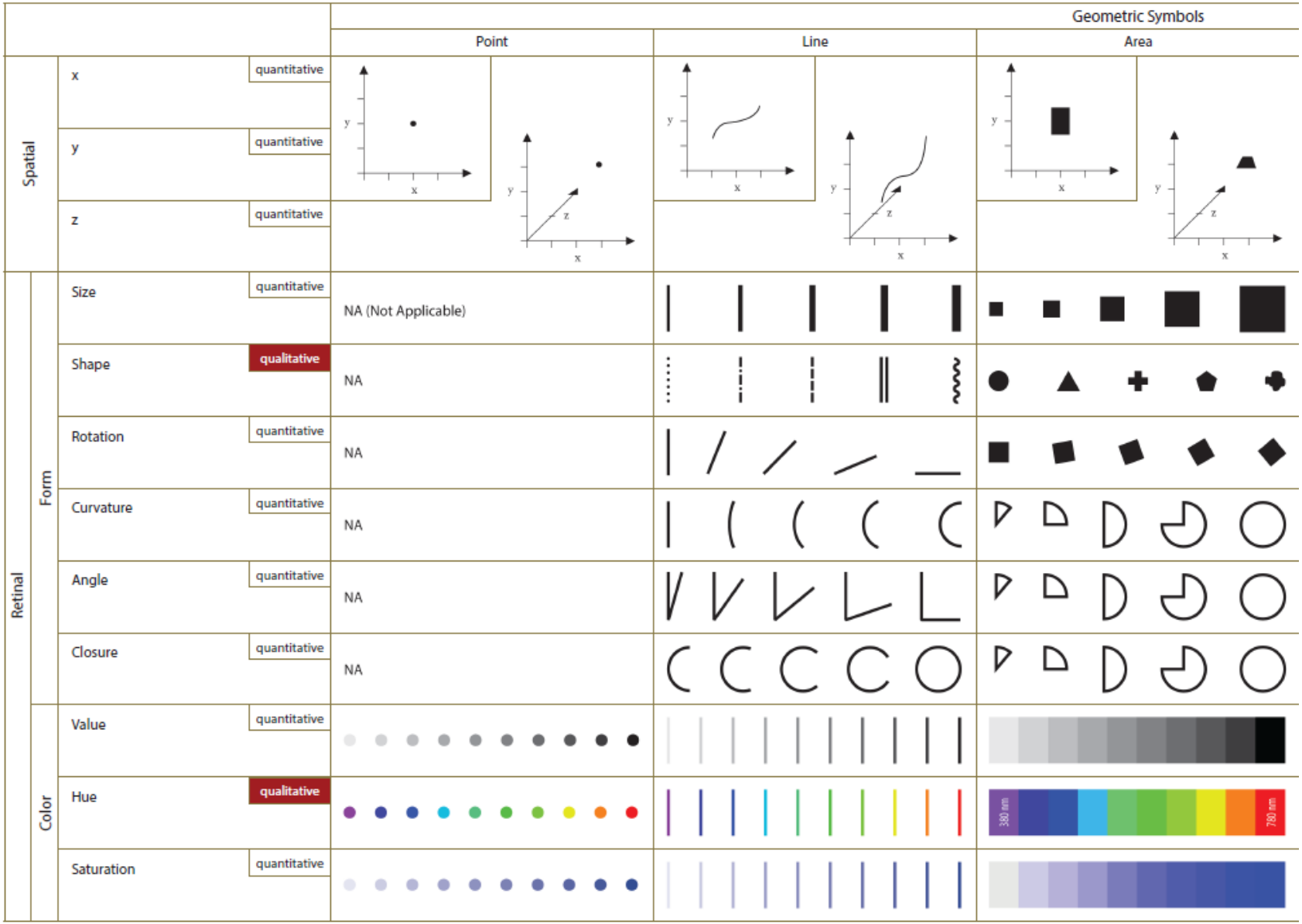
Graphic Variable Types Versus Graphic Symbol Types



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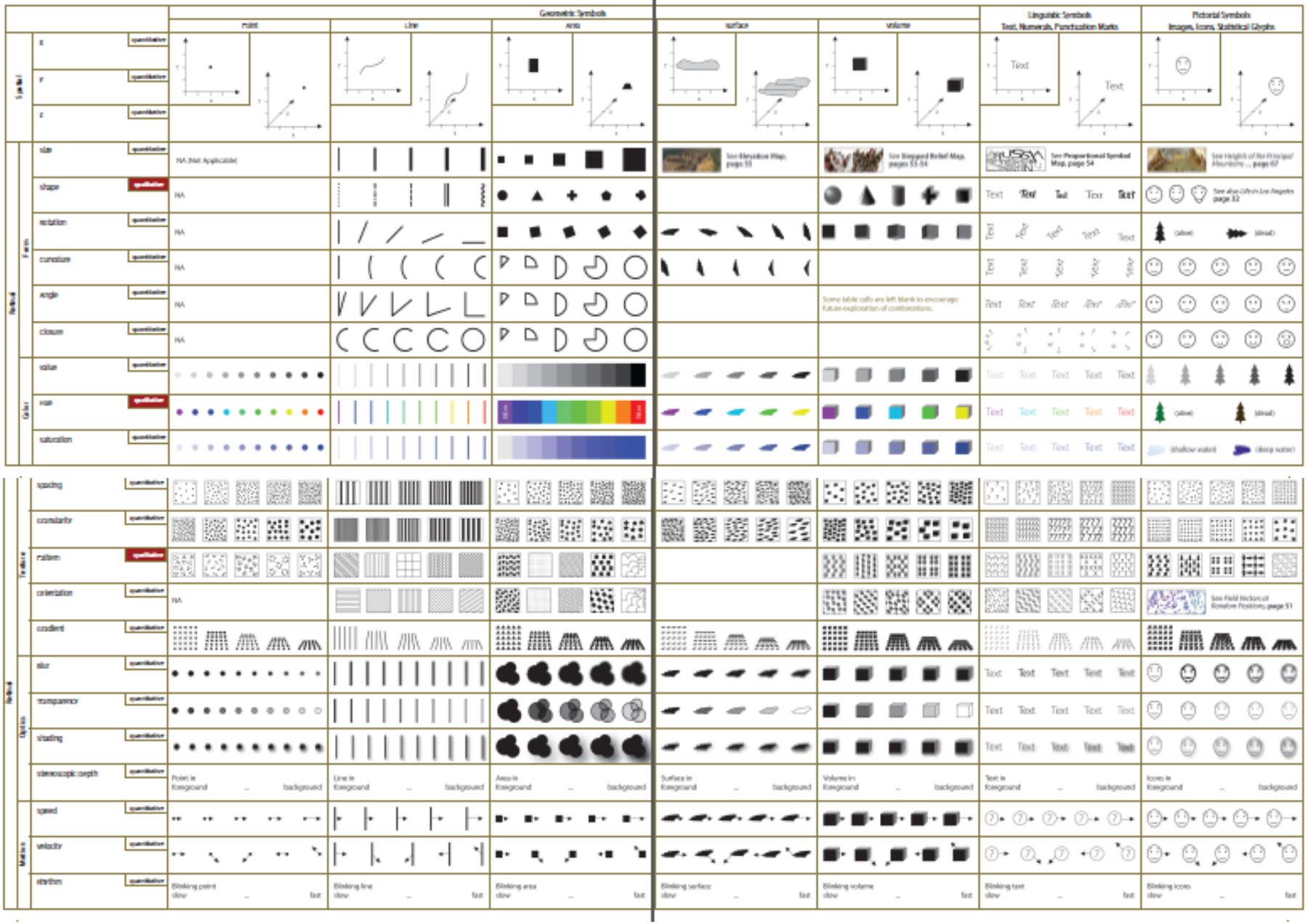

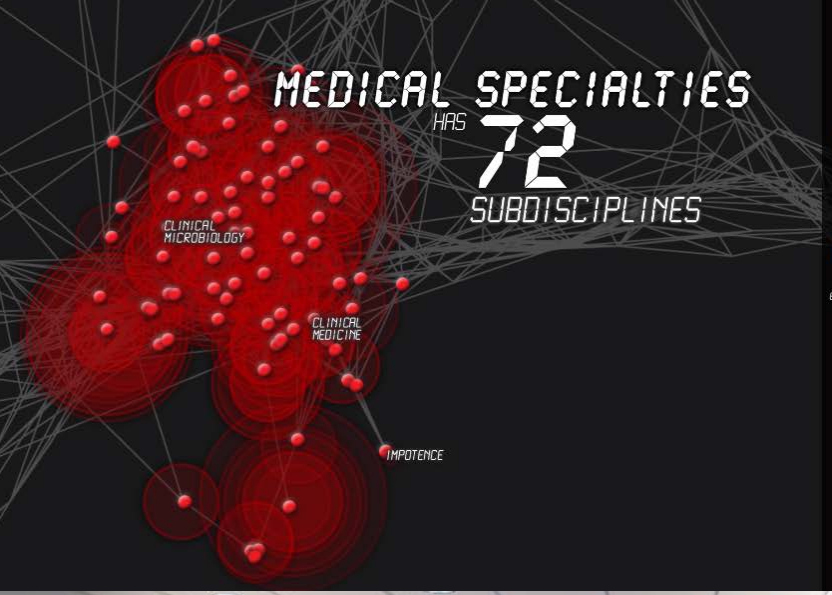

Science Forecast S1:E1, 2015

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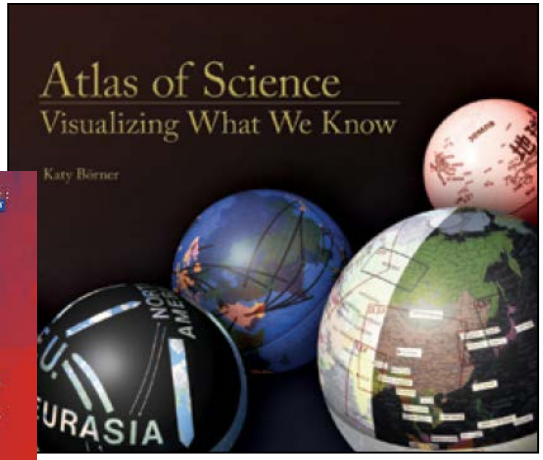

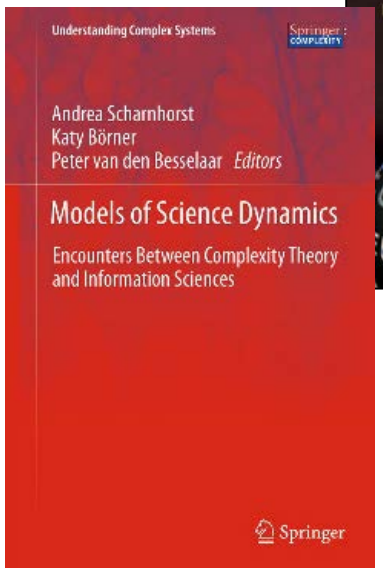

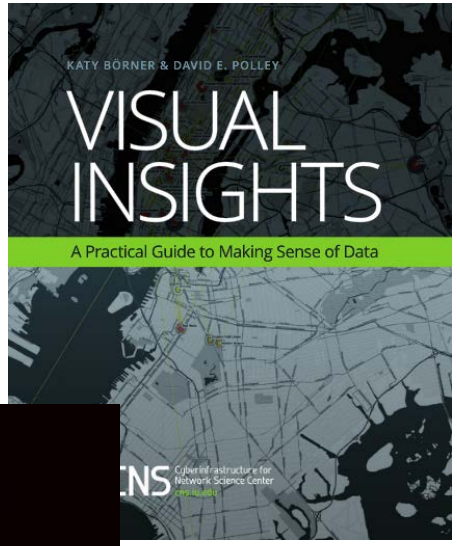

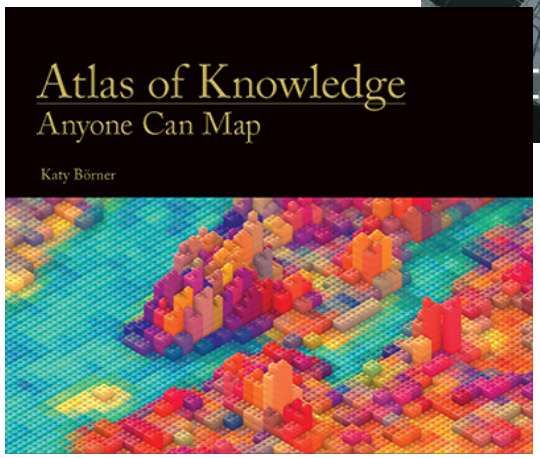

All papers, maps, tools, talks, press are linked from http://cns.iu.edu
These slides are at http://cns.iu.edu/presentations.html

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