CNS Tools and Services are used by hundreds of thousands around the globe

Our mission is to advance datasets, tools, and services for the study of biomedical, social and behavioral science, physics, and other networks. A specific focus is research on the structure and evolution of science and technology (S&T) and the communication of results via static and interactive maps of science. Learn more at cishell.org.

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cns.iu.edu

20+ CNS staff and students work on 20+ projects

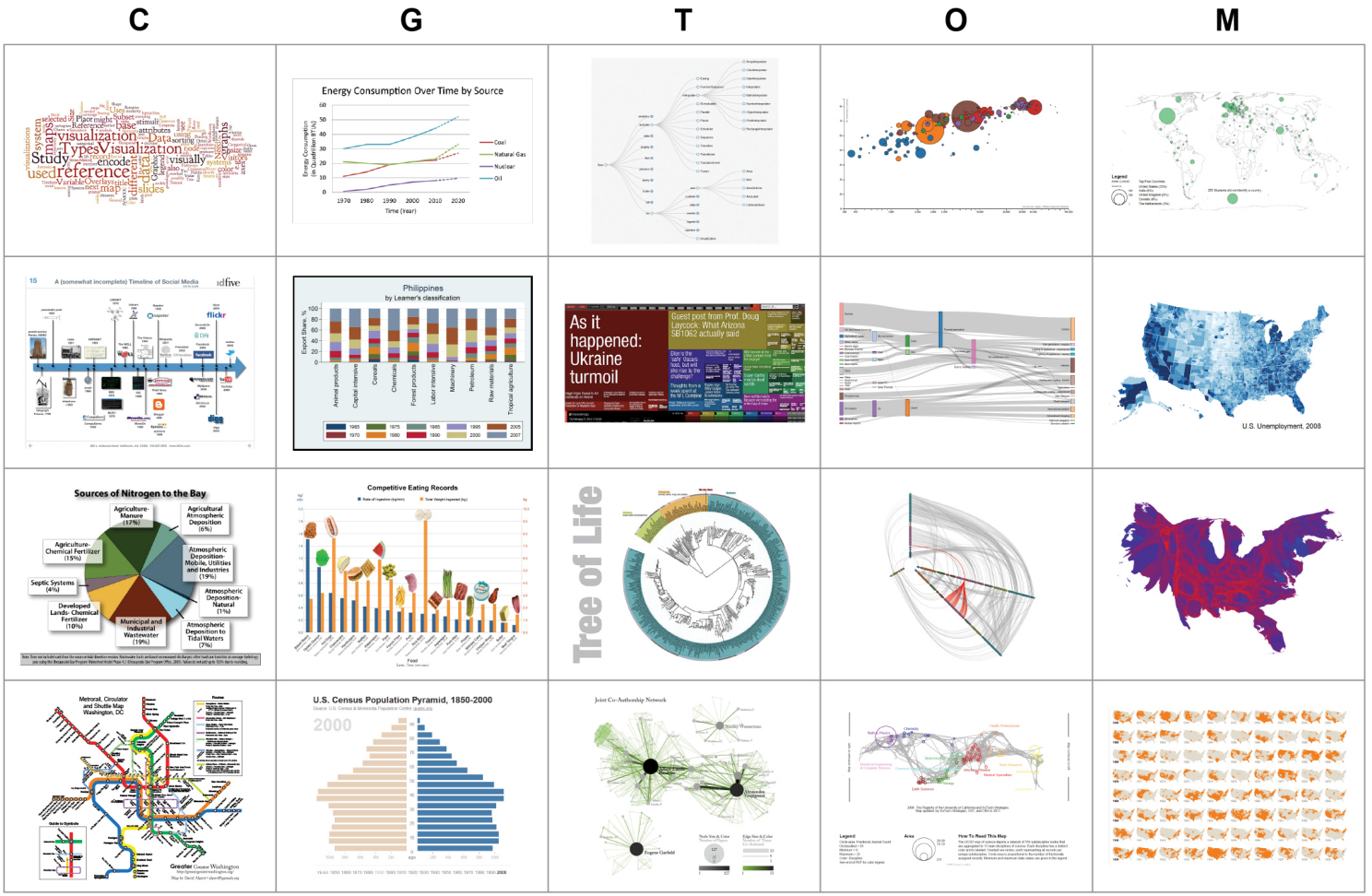
- **Innovation in an Aging Society.** Econ P01 National Bureau of Economic Research (Bruce Weinberg, Gerald Marschke, and Katy Börner, $650,000) 2013.09.01 - 2018.08.31.
- **SMS-VAT: A Scalable Multi-Scale Visual Analytical Tool**. NIH/NCAT (Katy Börner, $300,000) 2014.09.01 - 2016.07.30.
- **Visualizing healthcare system dynamics in biomedical Big Data**. NIH 1U01CA198934-01 (Griffin Weber, and Katy Börner, $537,387) 2015.06.01 - 2018.05.31.
- **Network for Computational Nanotechnology Cyber Platform**. NSF 1227110 (Gerhard Kilmeck, $13,799,392) 2012.12.01 - 2017.11.30.
- **Conference on Modelling Science, Technology, and Innovation, May 2016**. NSF 1546824 Award (Katy Börner, and Stasa Milojevic, $48,750) 2015.09.01 - 2016.08.31.
- **MOOC Visual Analytics**. Tides Foundation (Katy Börner, $50,000) 2015.04.03 - 2016.08.31.
- **Monitoring, Modeling, and Forecasting Tools for Fostering an Innovative S&T Workforce.** NIH U01 GM098959-01 Award (Katy Börner, and James P. Crutchfield, $746,758) 2011.09.01 - 2015.08.31.
- **Visualizing Biomedical Research Characteristics.** NIH/SBIR (Katy Börner, $400,282) 2013.09.01 - 2015.08.31.
- **Pathways: Sense-Making of Big Data.** NSF ISE DRL-1223698 Award (Katy Börner, Adam V. Maltese, Joe E. Heimlich, Stephen Miles Uzzo, Paul Martin, and Sasha Palmquist, $250,000) 2012.07.01 - 2015.06.30.
- …

Self-portraits of the brain: cognitive science, data visualizations, and communicating brain structure and function

Goldstone, Robert, Franco Pestilli, and Katy Börner Trends in Cognitive Science doi:10:1016.
http://cns.iu.edu/docs/publications/2015-goldstone-sef-portraits.pdf

Investigating Aspects of data visualization literacy using 20 information visualizations and 273 science museum visitors

Börner, Katy, Joe E. Heimlich, Russell Balliet, and Adam V. Maltese. 2015. Information Visualization 1-16.
http://cns.iu.edu/docs/publications/2015-borner-investigating.pdf

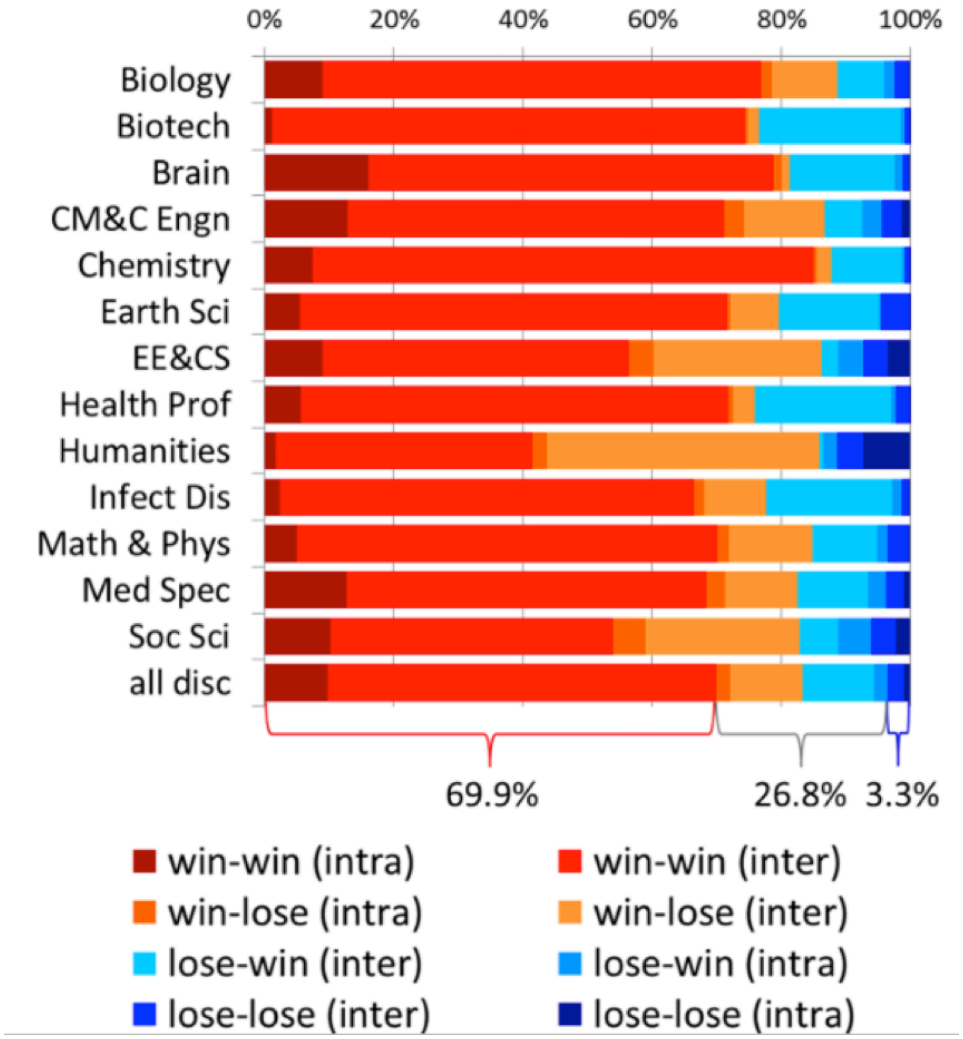


Long-Distance Interdisciplinarity Leads to Higher Scientific Impact

Larivière, Vincent, Stefanie Haustein, and Katy Börner. 2015. PLOS ONE DOI: 10.1371.

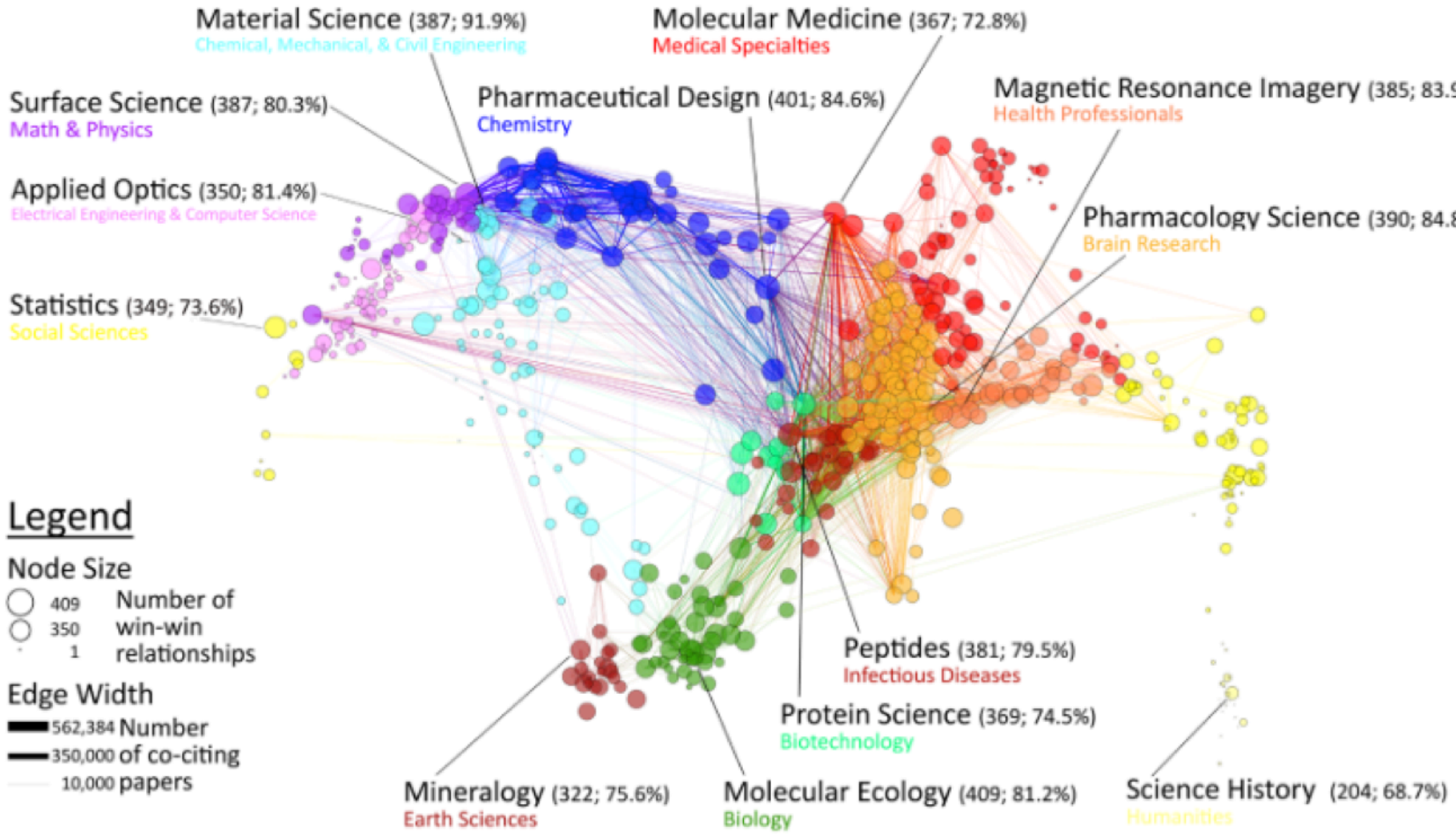
Data: 9.2 million interdisciplinary research papers published between 2000 and 2012 .

Results: majority (69.9%) of co-cited interdisciplinary pairs are "win-win" relationships, i.e., papers that cite them have higher citation impact and there are as few as 3.3% "lose-lose" relationships. UCSD map of science is used to compute "distance."



A1 Number of papers citing win-win relationships (≥10,000 citing papers)

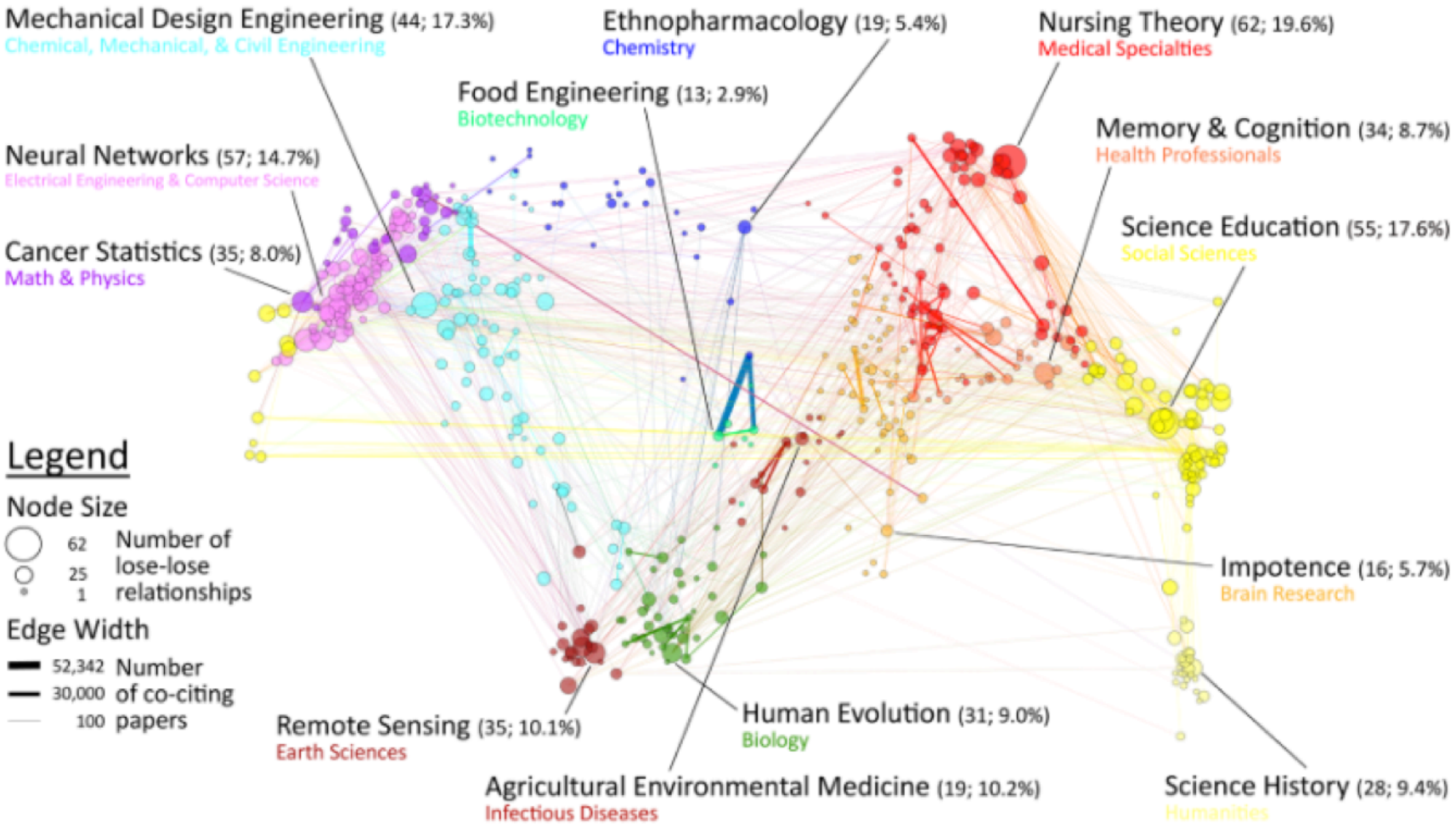
citing papers



2,940 (5.19%) of 56,614 win-win edges

node color: discipline | edge color: mix of adjacent nodes | labels: subdiscipline with highest number of win-win relationships per discipline (number and percentage of win-win relationships)

B1 Number of papers citing lose-lose relationships (≥100 citing papers)



1,204 (44.4%) of 2,712 lose-lose edges

node color: discipline | edge color: mix of adjacent nodes | labels: subdiscipline with highest number of lose-lose relationships per discipline (number and percentage of lose-lose relationships)

Atlas of Knowledge: Anyone Can Map

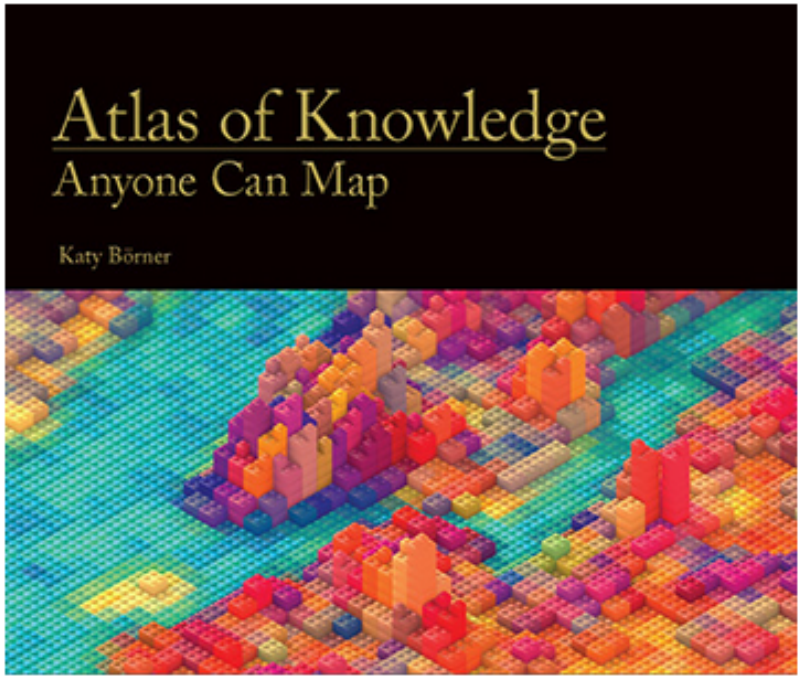
« back to the store

by Katy Börner
To be published by MIT Press in early 2015

13 x 11, 250 pp.
580 illus.
978-0-262-02881-3

Introduction | Author | Awards | History | Vendors | Images | References | Q&A | Press

Introduction



In an age of information overload, the ability to make sense of vast amounts of data and to render insightful visualizations is as important as the ability to read and write. The *Atlas of Knowledge* explains and exemplifies the power of visualizations not only to help locate us in physical space but also to help us understand the extent and structure of our collective knowledge, to identify bursts of activity, pathways of ideas, and borders that beg to be crossed.

Drawing on 15 years of research and tool development, the *Atlas* introduces a theoretical visualization framework meant to empower anyone to systematically render data into insights. It aims to teach "timeless" knowledge that holds true over a lifetime while referring to an extensive set of references for "timely" advice on what tool and workflow is currently the best for answering a specific question.

http://scimaps.org/atlas_of_knowledge.html

Places & Spaces Exhibit

This exhibit aims to demonstrate the power of maps to navigate and make sense of physical places and abstract topic spaces. The tenth and final iteration of maps debuted at the University of Miami on September 4, 2014, where all 100 maps will remain in display through December 11, 2014.

Phase 2 of this unique exhibit is designed to bring Macroscope tools to public places to help exhibit visitors not only learn how to **read** science maps but how to **make** them.

See all the maps and more at the new scimaps.org.

PLACES & SPACES
MAPPING SCIENCE

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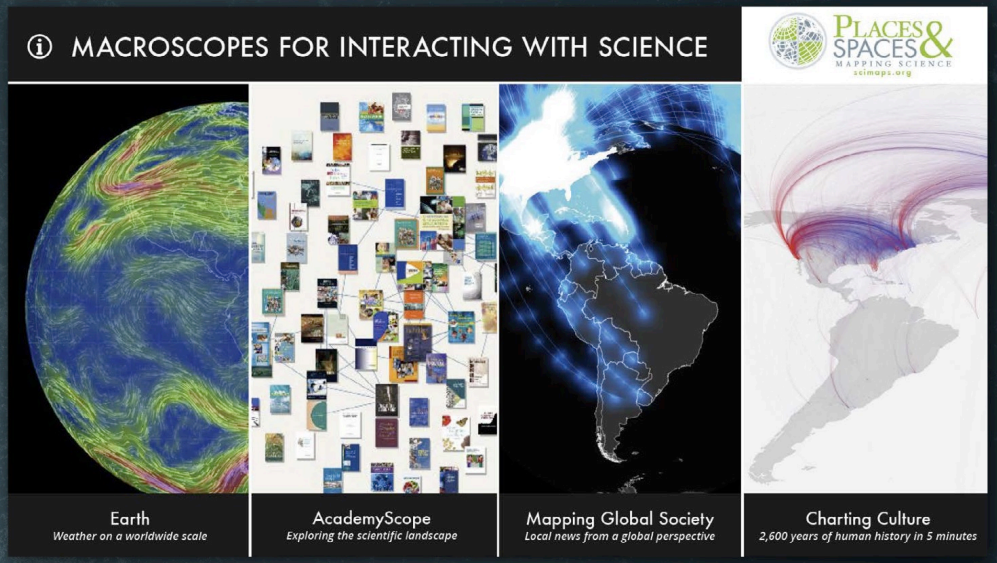
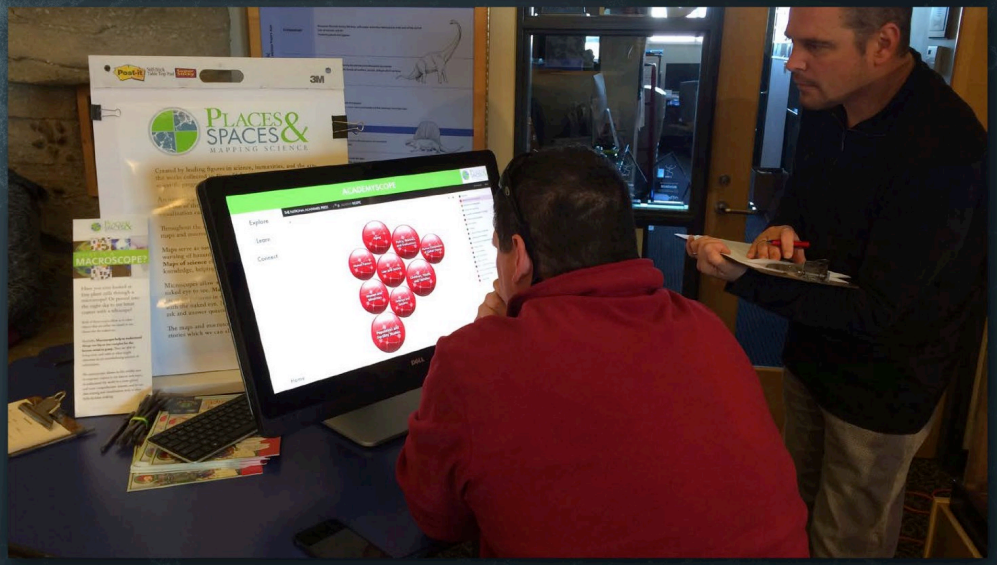
Macroscopes For Interacting With Science

As of 2015, the *Places & Spaces* exhibit shifted its focus from maps to macroscopes. Simply put, macroscopes allow us to see the "big picture." They are tools that gather vast amounts of data about many kinds of organisms, environments, and technologies. And from that data we can analyze and comprehend the way these elements coexist, compete, or cooperate.

This view "behind the scenes" of data visualization will increase the ability of viewers to gain meaningful insights from such visualizations. It is the hope of the exhibit that this will then empower individuals from all backgrounds to use data more effectively and endeavor to create maps that address their own needs and interests.





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IVMOOC 2016

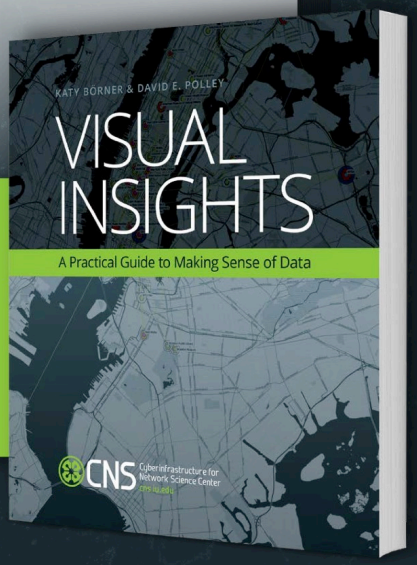
The Information Visualization MOOC provides an overview about the state of the art in information visualization, teaching the process of producing effective visualizations that take the needs of users into account.

The inaugural IVMOOC, which launched in January 2013, attracted participants from more than 100 countries. It is one of the first MOOCs offered by IU and the first to offer an opportunity for students to work in teams with real clients. All registrants gain free access to the Scholarly Database and the Sci2 Tool.

The course can be taken for three Indiana University credits as part of the Online Data Science Program offered by the School of Informatics and Computing.

The course will return on January 12, 2016. Learn more at ivmooc.cns.iu.edu.

This IVMOOC companion textbook offers a gentle introduction to the design of insightful visualizations. It seamlessly blends theory and practice, giving readers both the theoretical foundation and the practical skills necessary to render data into insights.



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Humanexus

This groundbreaking semi-documentary animation is the result of a collaboration between Katy Börner, artist Ying-Fang Shen, and sound designer Norbert Herber. The film visualizes human communication from the Stone Age to today and beyond. It aims to make tangible the enormous changes in the quantity and quality of our collective knowledge and the impact of different media on knowledge exchange.

Since its release in 2013, *Humanexus* has won 20 awards around the world, including Third Prize at the Aviff Cannes Art Film Festival, Best in Show at the Virginia Museum of Contemporary Art's New Wave 2014, and Best Animation at the 2014 Dublin International Short Film and Music Festival.

Learn more about the film and watch the trailer at cns.iu.edu/humanexus.

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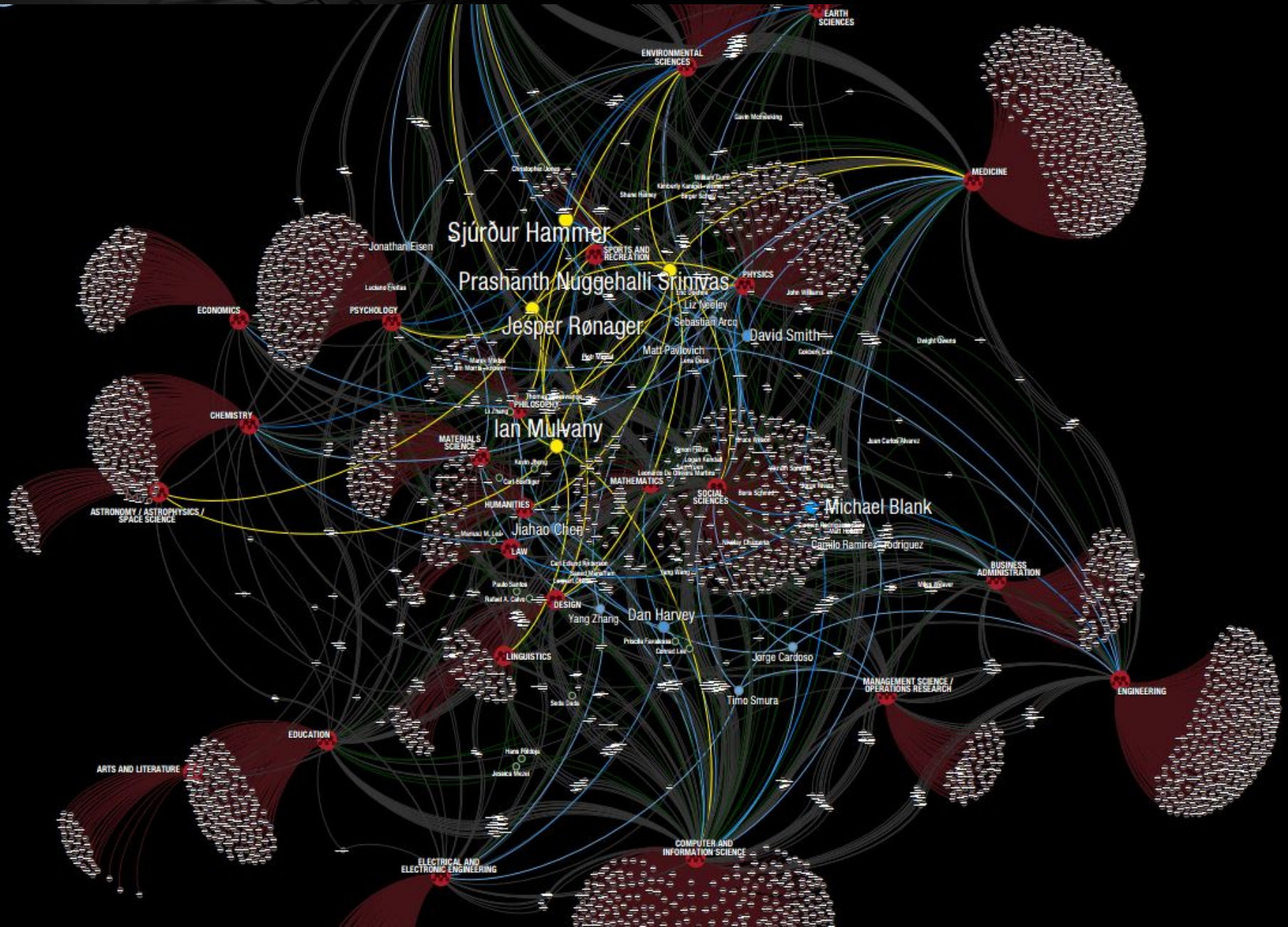
Science Forecast

Bringing Data Visualization to Everybody

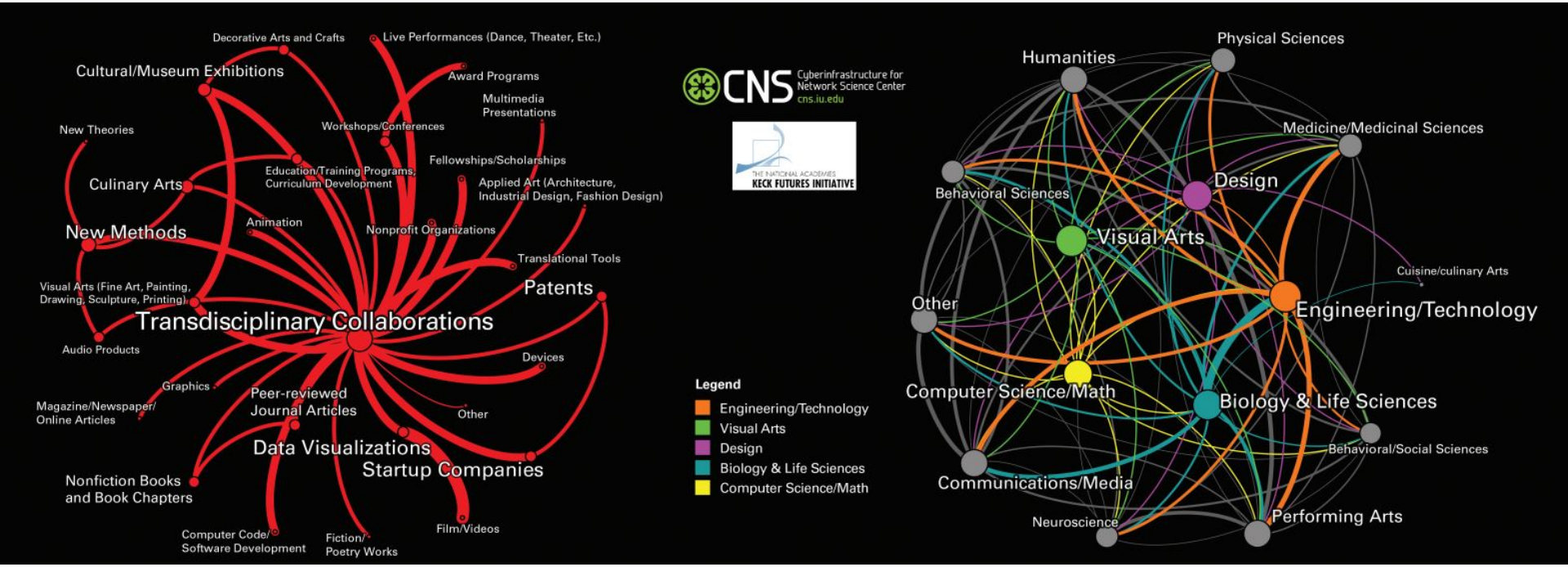
Andreas Bueckle

CNS Cyberinfrastructure for Network Science Center

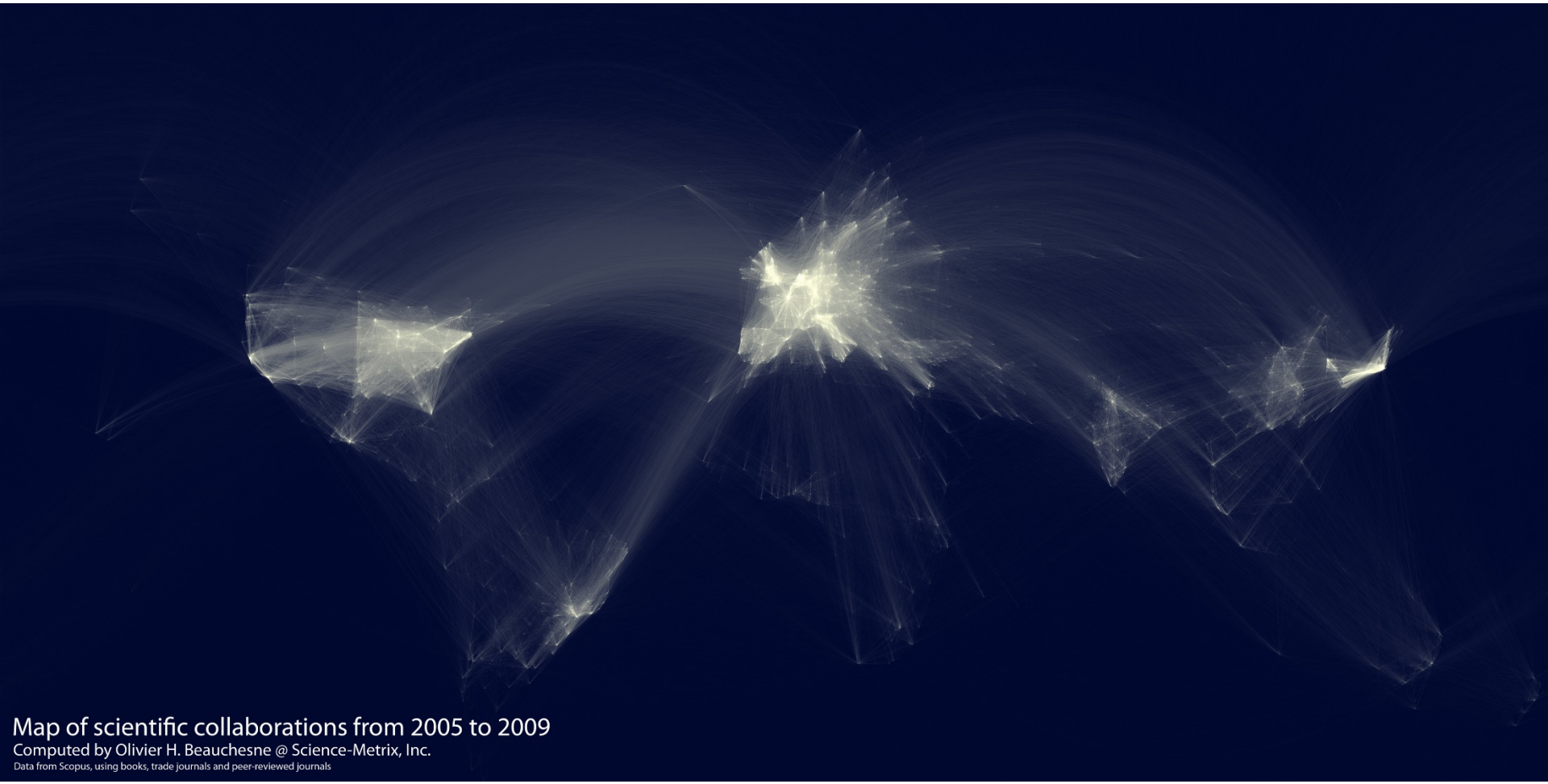
Science Forecast



Science Forecast



Science Forecast



Science Forecast

How can we explain these visualizations and the research behind them to a wide audience?

Science Forecast

CNS Cyberinfrastructure for Network Science Center

Science Forecast

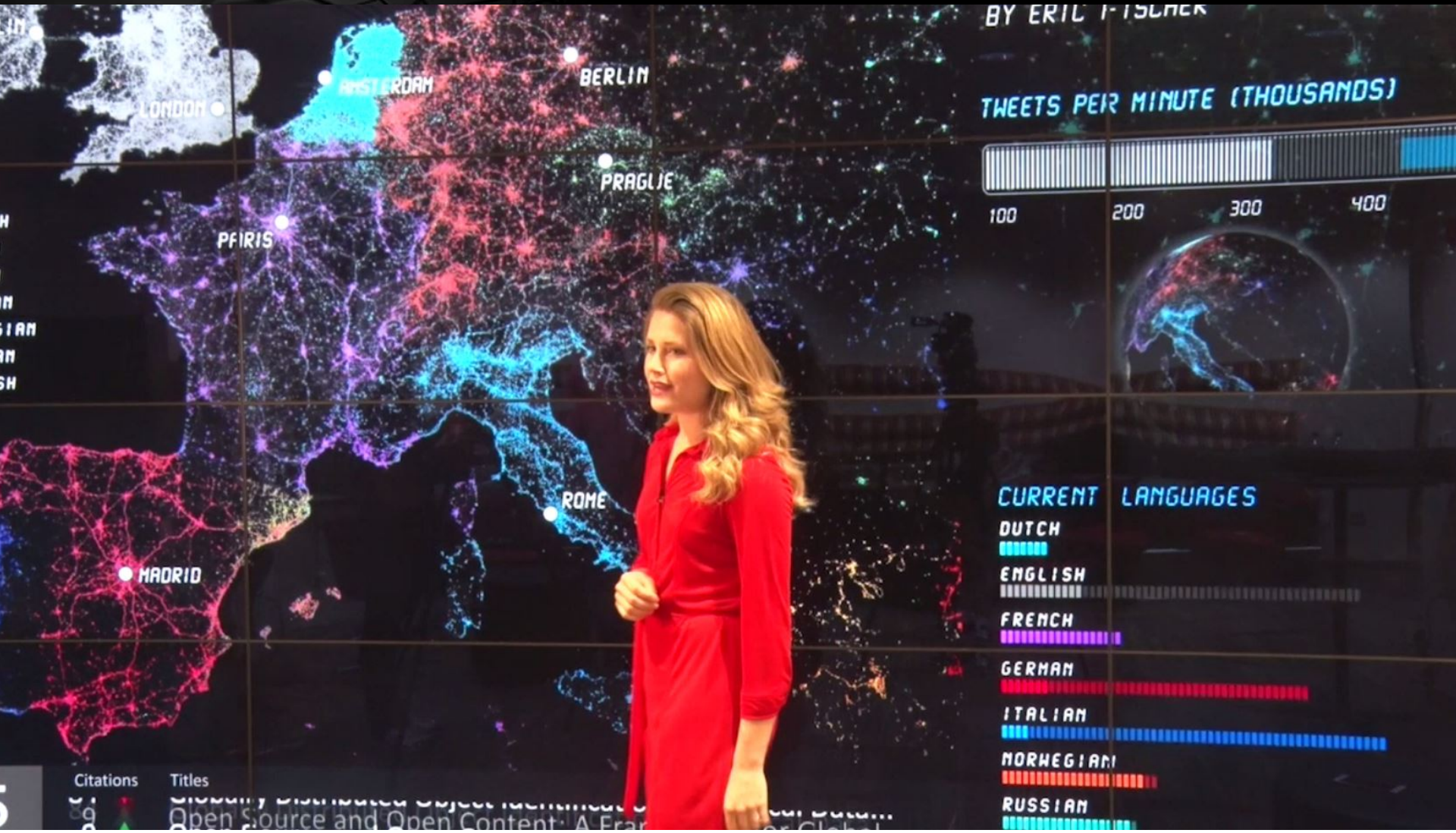
SCHOOL OF INFORMATICS AND COMPUTING

INDIANA UNIVERSITY

INDIANA UNIVERSITY
NETWORK SCIENCE INSTITUTE

CNS Cyberinfrastructure for Network Science Center

Science Forecast



Science Forecast

CNS Dashboard

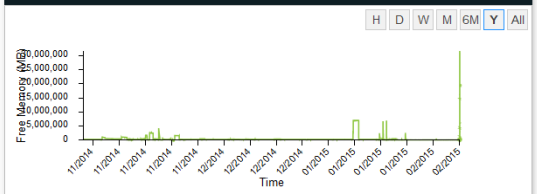
Flexible, user-configurable, real-time data visualization / reporting framework.

Ashwin Nimhan

CNS Dashboard

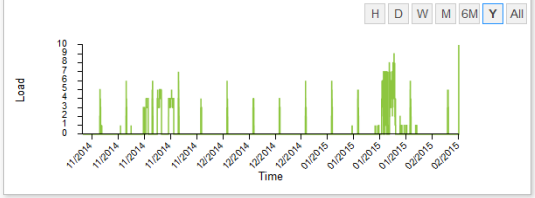
Servers

Memory: fnmann

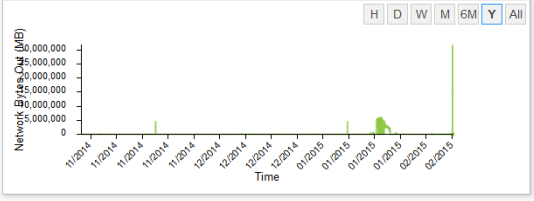


Disk: Feynman

Load: Feynmann



Network: Feynman

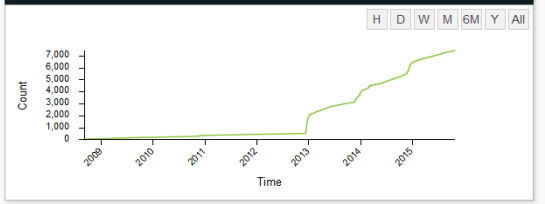


Websites

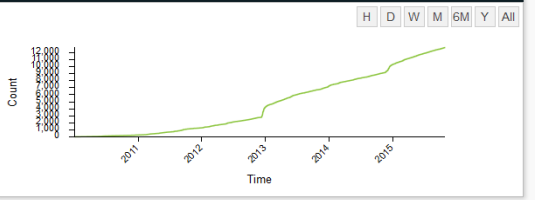
Registrations

SDB sdb.cns.iu.edu	7,458
Sci2 Tool sci2.cns.iu.edu	12,718

Website: SDB-Downloads



Website: Sci2 Tool Downloads



Top 10: CNS URL's

URL	Count
/	4,456
/docs/presentations/2014-borner-opentoolstutorial-oecd.pdf	3,486
/robots.txt	2,735
/docs/presentations/2015-borner-atlas2-umd.pdf	2,086
/css/CNS_Global.css	1,307
/sitemap/sitemap-html.xml	1,192
/docs/publications/2011-borner-macroscopes-acm.pdf	1,136
/images/pres/2012-polley-netsci-tutorial2.pdf	1,104
/docs/presentations/2013-borner-visualinsights-cs10k.pdf	1,102

Services

Registrations: Sites

Time	SDB				Sci2 Tool	
	Registrations	Searches	Downloads	Records DLed	Registrations	Downloads
Last Week	6	46	12	5,437	34	61
Last Month	69	64	27	20,875	207	293
All Time	7,458	17,965	7,252	26,188,493	12,718	26,709

http://dev.cns.iu.edu/CNS_Dashboards/dashboard.html

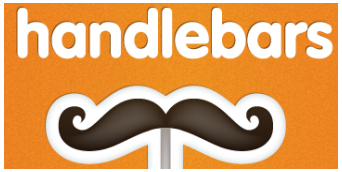
Features

- Customizable JSON descriptors to define properties of widgets
- Customizable and Responsive multi-column layouts based on Twitter Bootstrap.
- Easily extensible to include new visualizations
- Way to define custom parsers for widgets

Sample page definition

http://dev.cns.iu.edu/CNS_Dashboards/meta/page.json

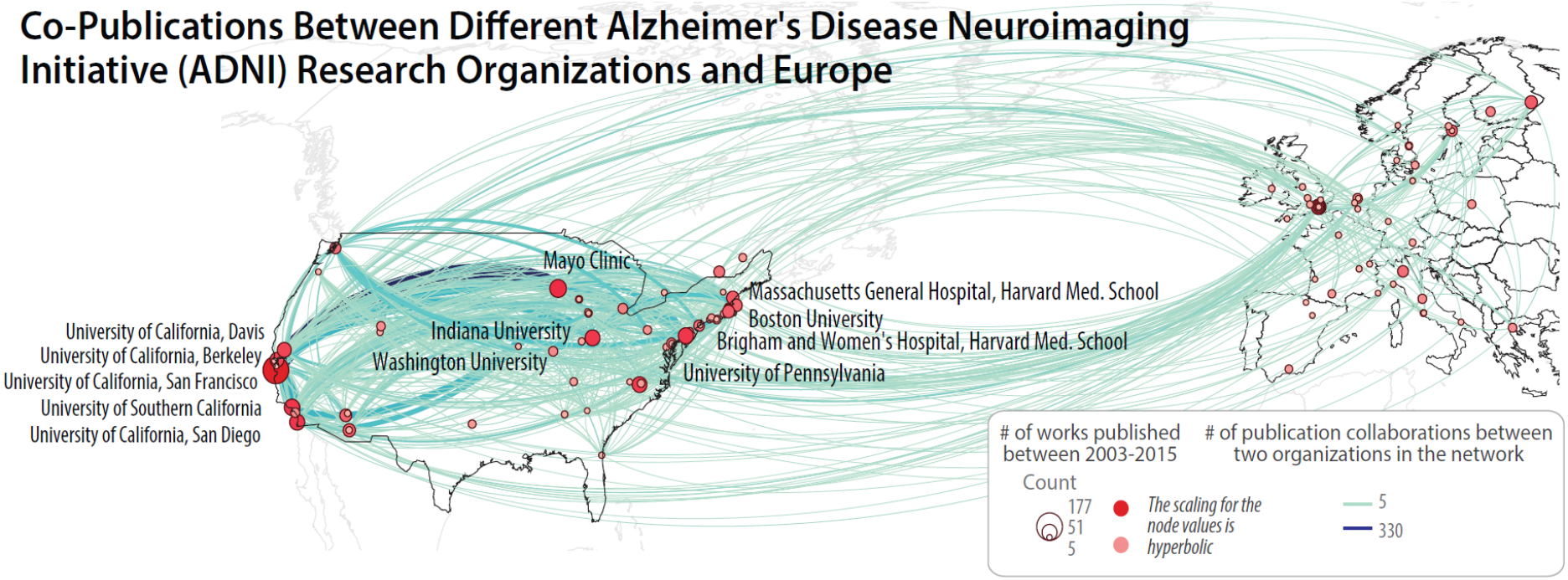
Technologies



ADNI

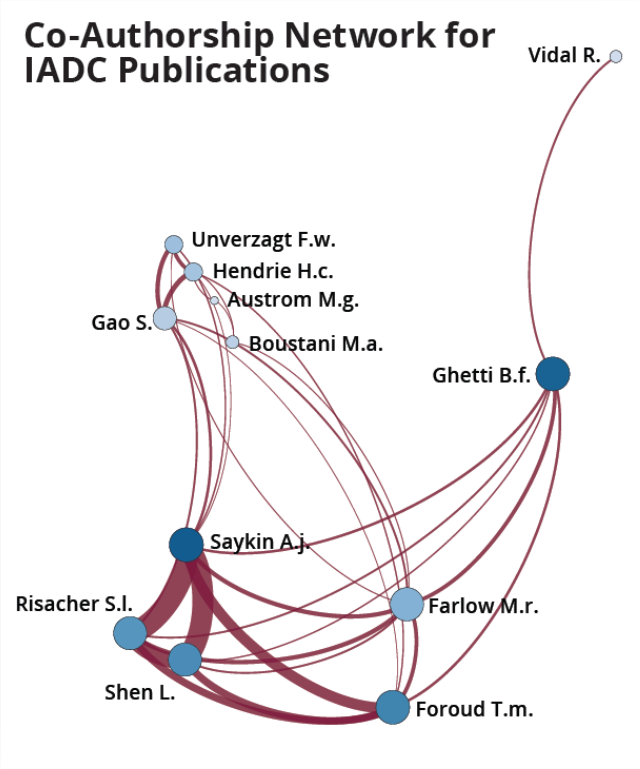
Michael Ginda

Alzheimer's Disease Neuro-Imaging (ADNI) research

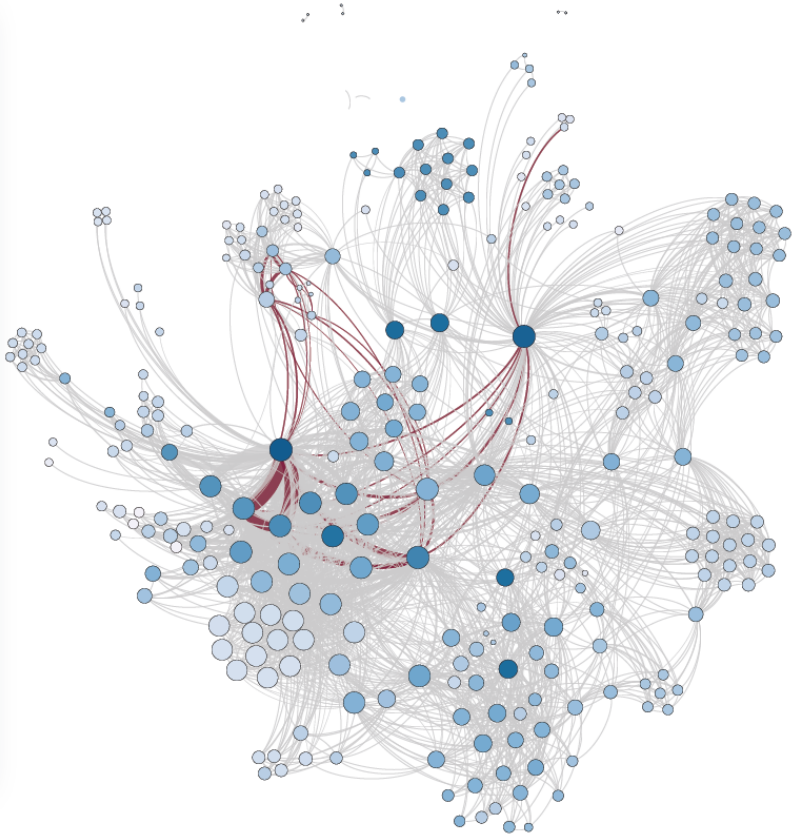


- Affiliated with Indiana Alzheimer Disease Center (IADC) looking at publication data sets for IADC and the ADNI project.
- Project is to create visualizations that exploring growth and impact of IADC and Alzheimer's Disease (networks, burst detection)
- Goals of research is to support translational health sciences and funding

Alzheimer's Disease Neuro-Imaging (ADNI) research Analysis and Visualization



IADC Core Administrator Partition



NODES

Eigenvector Centrality

1
.096
0 *scale for inset network*

Count of Citations

0 509 1433

EDGES

Count of Co-Authored Works

2
20
39

Collaboration Type

Collaborations between IADC Core Administrations

All other collaborations

Web of Science Data Enclave

Robert Light

Web of Science Data Enclave

The Data

Provided by Thomson Reuters in the form of 166 XML files (561 GB)

Collection of 56,442,146 scholarly metadata records

Including scholarly articles and books

Funded by IU Network Science Institute (IUNI)

Licensed for use by all Indiana University faculty and staff for research purposes

Web of Science Data Enclave

The Enclave

Created by IU as a secure environment for working with the data

Powered by the Karst cluster and maintained by UITS administrators

Overseen by the Data Steward and the Data Advisory Board

Opened for testing in September 2015

Currently houses the raw XML files, along with statistical and analysis software

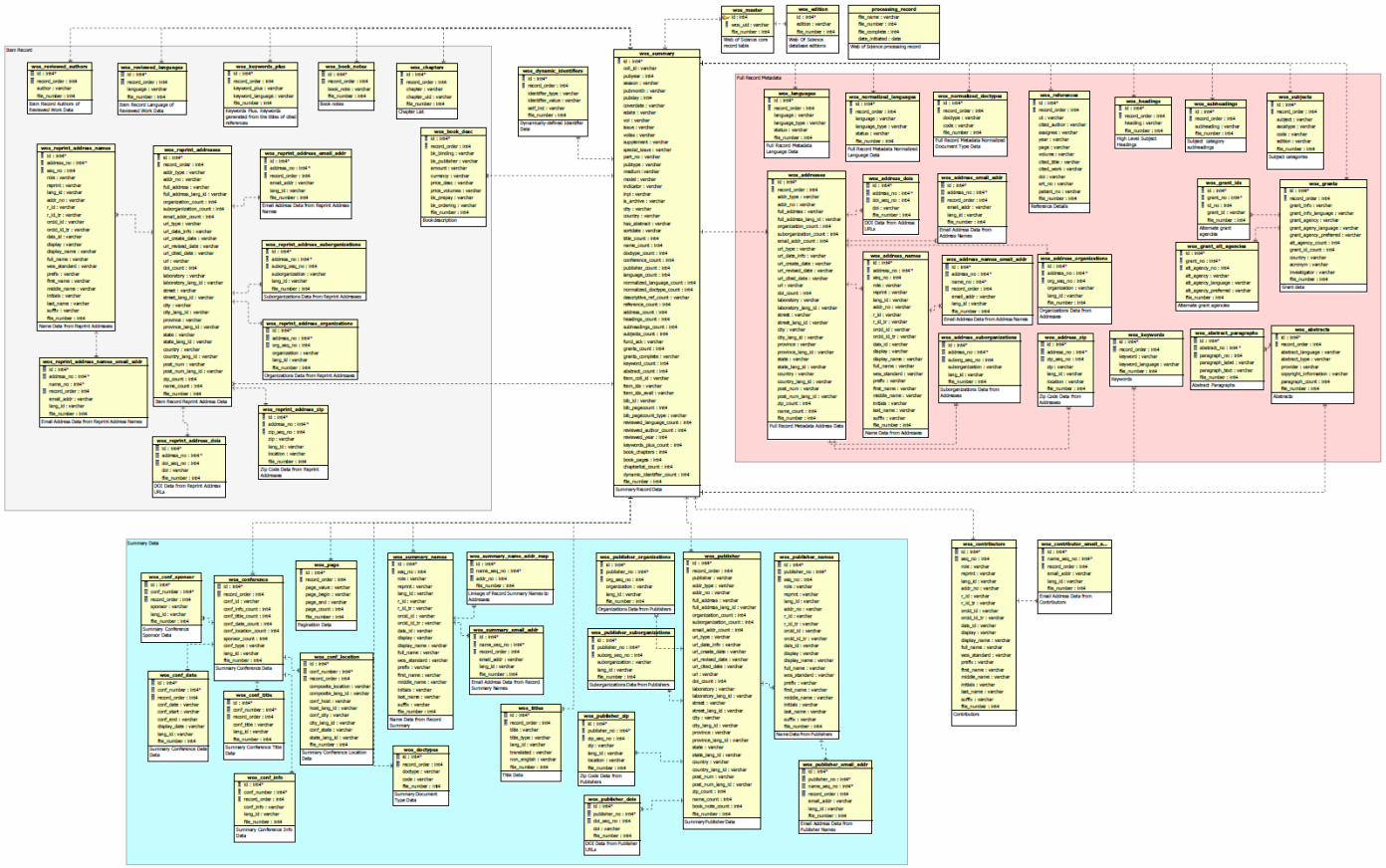
Apply for access at http://www.iuni.iu.edu/resources/wos.html

Web of Science Data Enclave

In Progress

PostgreSQL database with a fully parsed set of the data for all to use.

Upgraded documentation for ease of use.



Building Insightful Visualization Tools

http://dev.cns.iu.edu/iai

[Base visualization + sub-visualizations]

Daniel Halsey and Adam Simpson

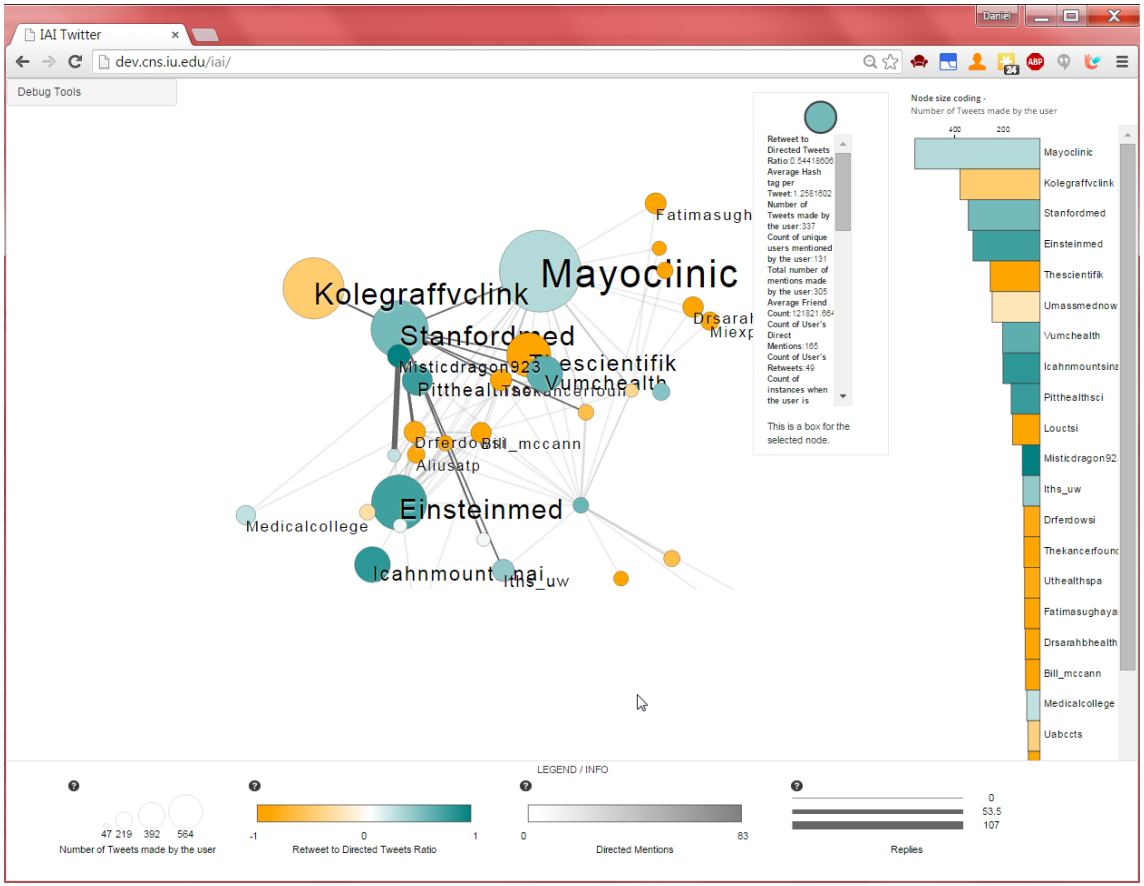
Insights

Relationships

Center-to-Center vs. Public interaction

Interaction styles

Potential translation vectors



Background: NCATS and CTSA Hubs

NCATS/CTSA Hubs:
National Center for Advancing Translational Sciences
Clinical and Translational Science Awards (CTSA) Program

62 Hubs (and increasing) throughout the country

Translation:
Turning research discovery into improved patient care

Background: Why Twitter

Public interaction ***doesn't*** necessarily mean research is translational

NCATS would like to find:

How centers are interacting using social media

How social media use fits into an overall center communication strategy

Whether hubs can use social media to increase effectiveness of their translation efforts

Data Sets

This visualization:

- Tweets for CTSA Hubs, NCATS, and key NIH accounts
- Tweets referencing these accounts (retweets, direct replies, mentions)
- Tweets using CTSA/NCATS hashtags

Available and in use for other visualizations:

- MEDLINE: biomedical journal articles
- NIH RePORTER: grant and project-related information
- ClinicalTrials.gov: clinical trial-specific project information

Visualization Framework

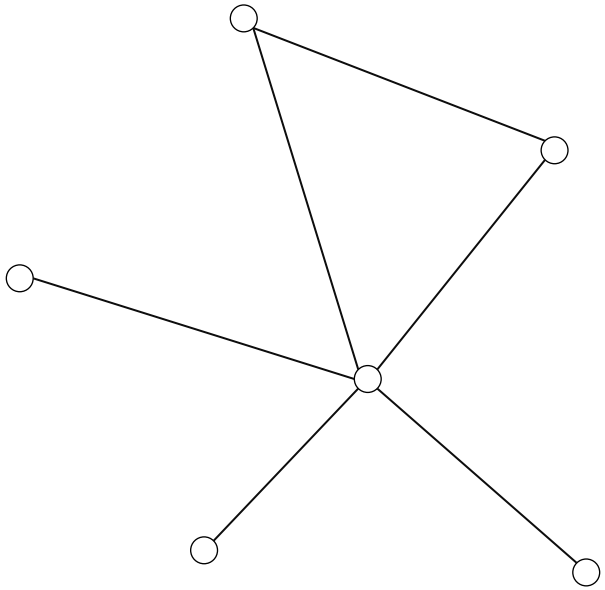
```
<div ng-cns-visual ng-data-field="twitterNetworkTop100" ng-vis-type="forceNetwork" id="vis-div" ng-identifier="mainVis"></div>
```

Framework – Data Processing

```
<div ng-cns-visual ng-data-field="twitterNetworkTop100" ng-vis-type="forceNetwork" id="vis-div" ng-identifier="mainVis"></div>
```

Framework – *Underlying Visualization*

```
<div ng-cns-visual ng-data-field="twitterNetworkTop100" ng-vis-type="forceNetwork" id="vis-div" ng-identifier="mainVis"></div>
```



Framework – *Underlying Visualization Customization*

```
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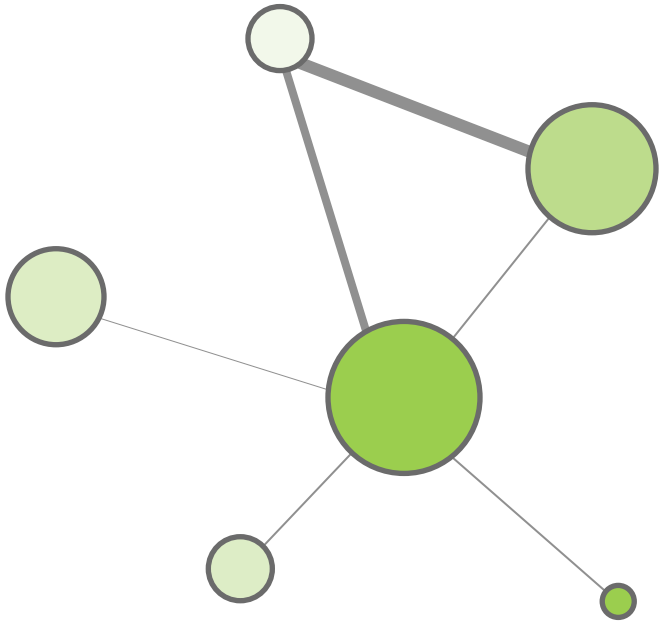
```



Framework – *Visualization Component*

```
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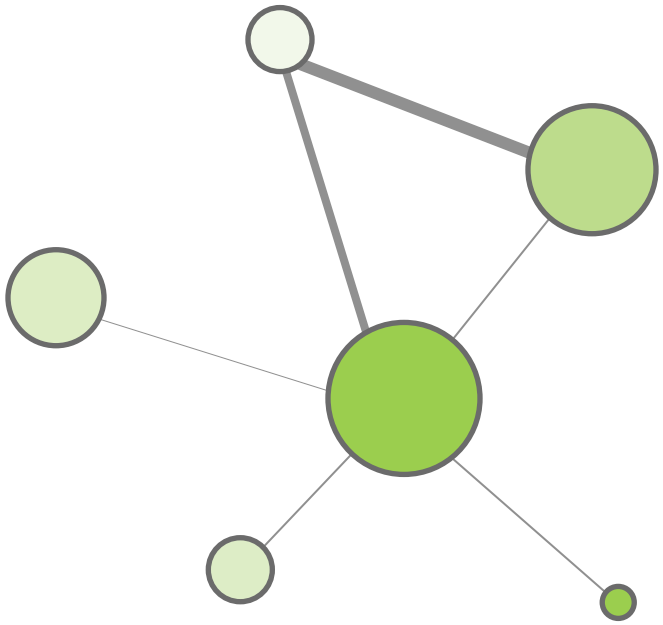

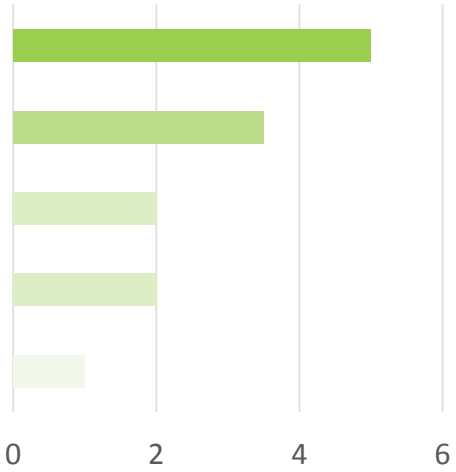


```
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```

Framework – *Visualization Component Filtering*

```
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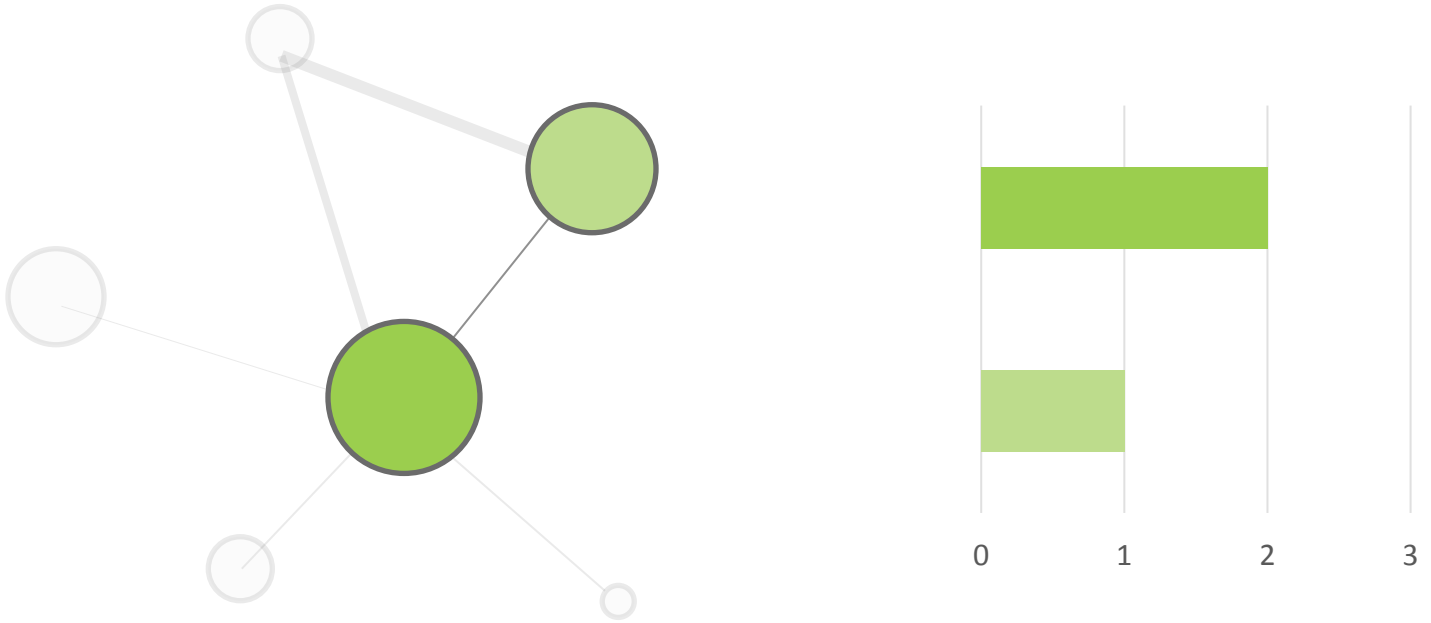
```




```
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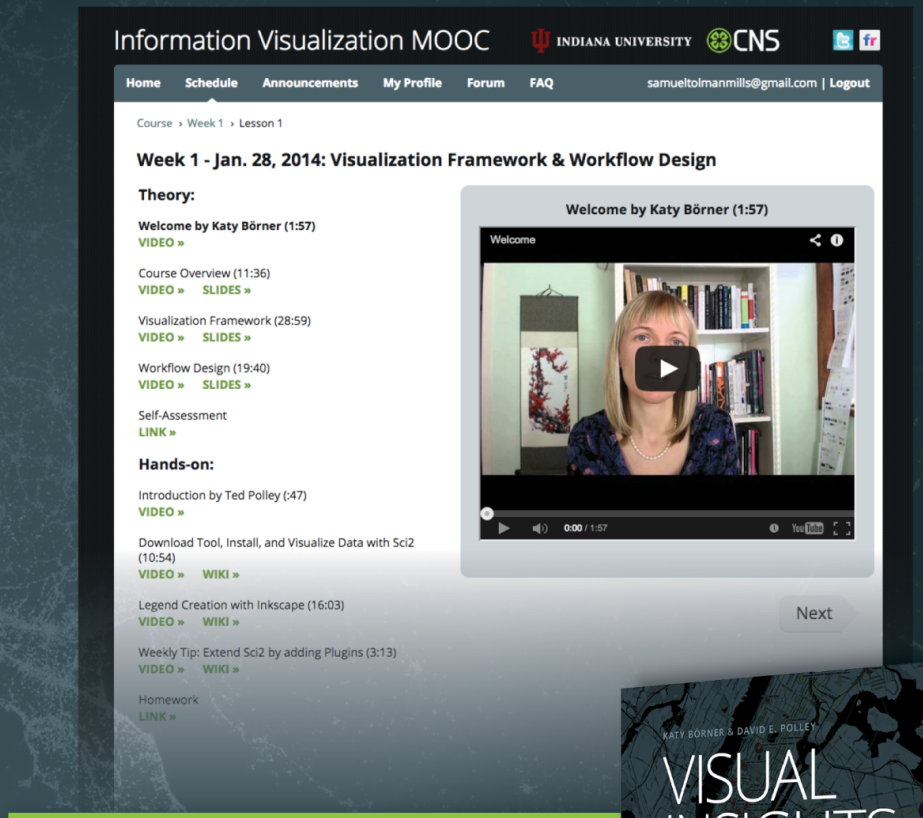
```

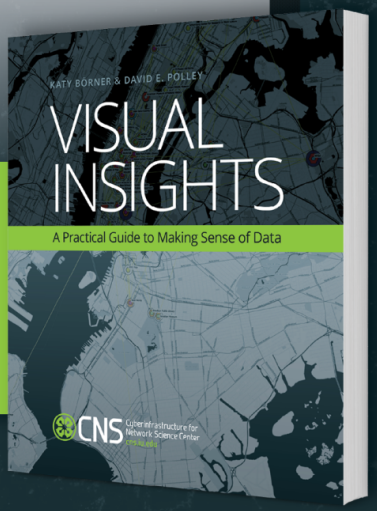
Information Visualization MOOC

Ashish Shendure

IVMOOC 2016

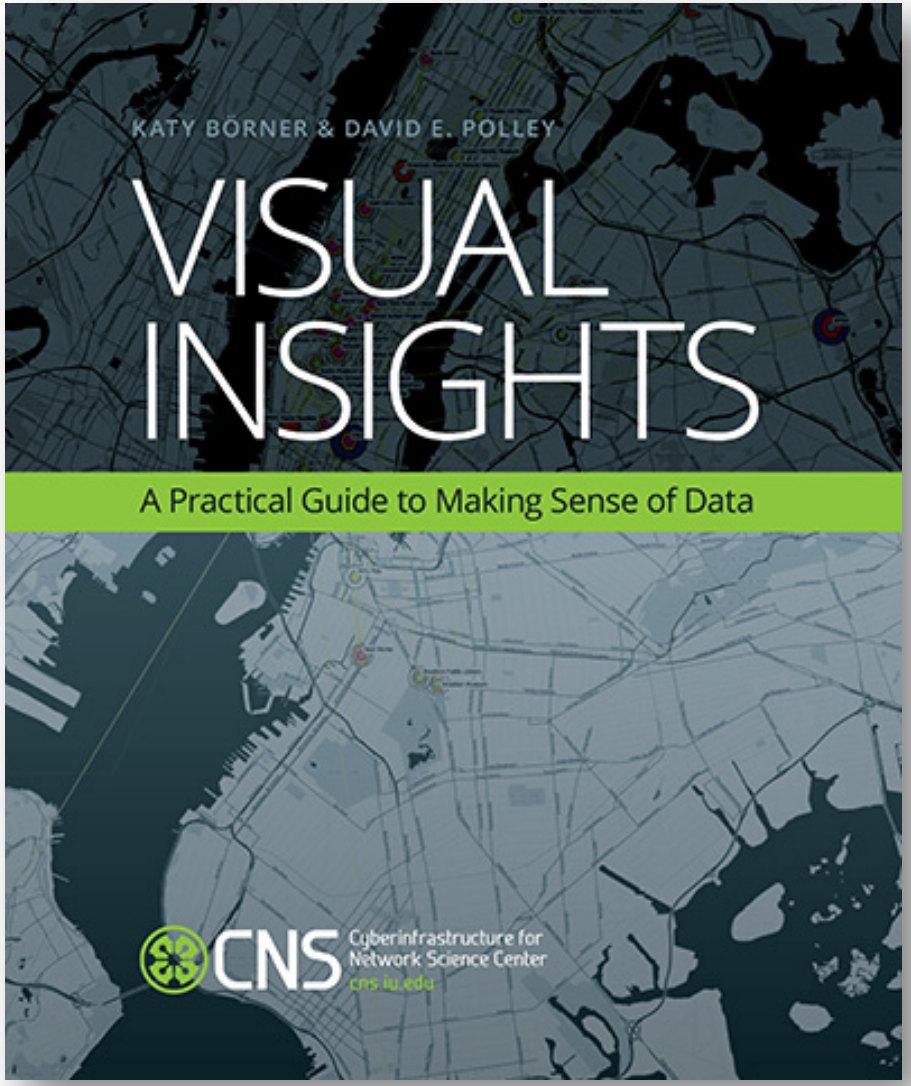
- Provides state of the art in information visualization, teaching the process of producing effective visualizations that take the needs of users into account.
- Inaugural IVMOOC launched in January 2013, attracted participants from more than 100 countries. This will be the 4th iteration of the course.
- Course can be taken for 3 Indiana University credits as a part of MS in Information Science, MS and online programs in Data Science offered by School of Informatics and Computing.
- Course returns in January 2016, spring semester.

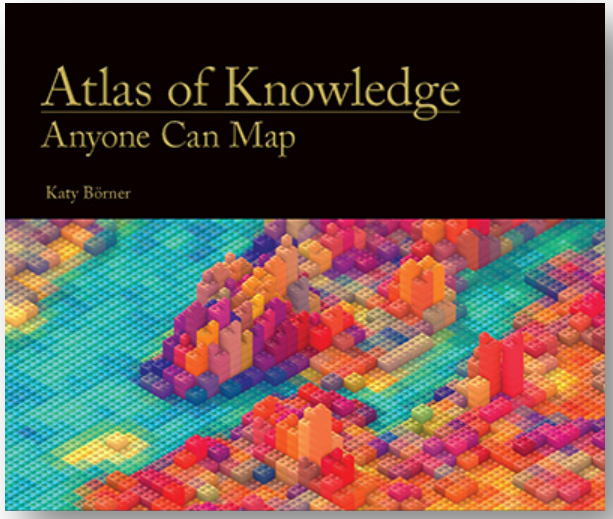


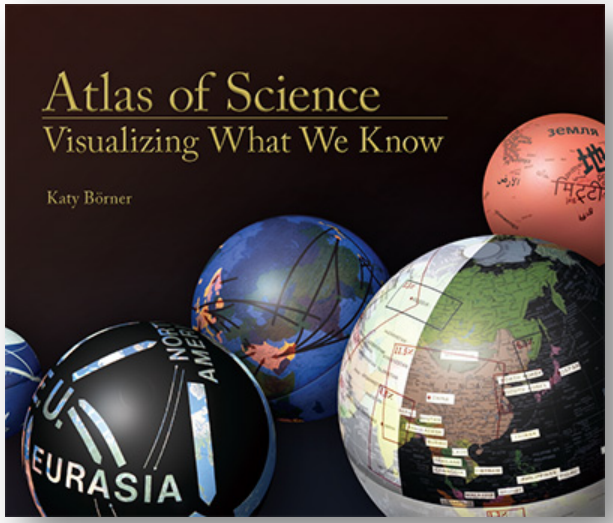


This IVMOOC companion textbook offers a gentle introduction to the design of insightful visualizations. It seamlessly blends theory and practice, giving readers both the theoretical foundation and the practical skills necessary to render data into insights.

Resources

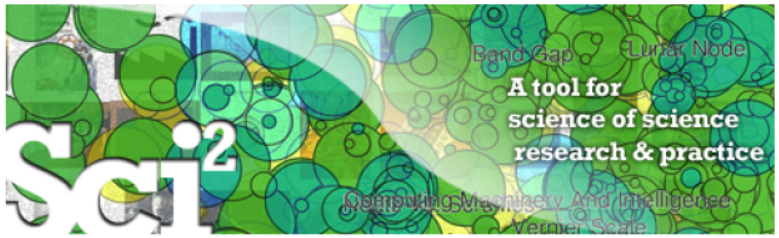

KATY BÖRNER & DAVID E. POLLEY
VISUAL INSIGHTS
A Practical Guide to Making Sense of Data
CNS Cyberinfrastructure for Network Science Center
cns.iu.edu


Atlas of Knowledge
Anyone Can Map
Katy Börner


Atlas of Science
Visualizing What We Know
Katy Börner
EURASIA

Why IVMOOC?

- Visualization techniques
- Learn visualization tools
- Self – paced course
- Real-world client projects
- Certificate and badge
- IU Credits and free online course



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Register Today!

Places & Spaces Exhibit

Lisel Record

CNS Cyberinfrastructure for Network Science Center

Places & Spaces exhibit

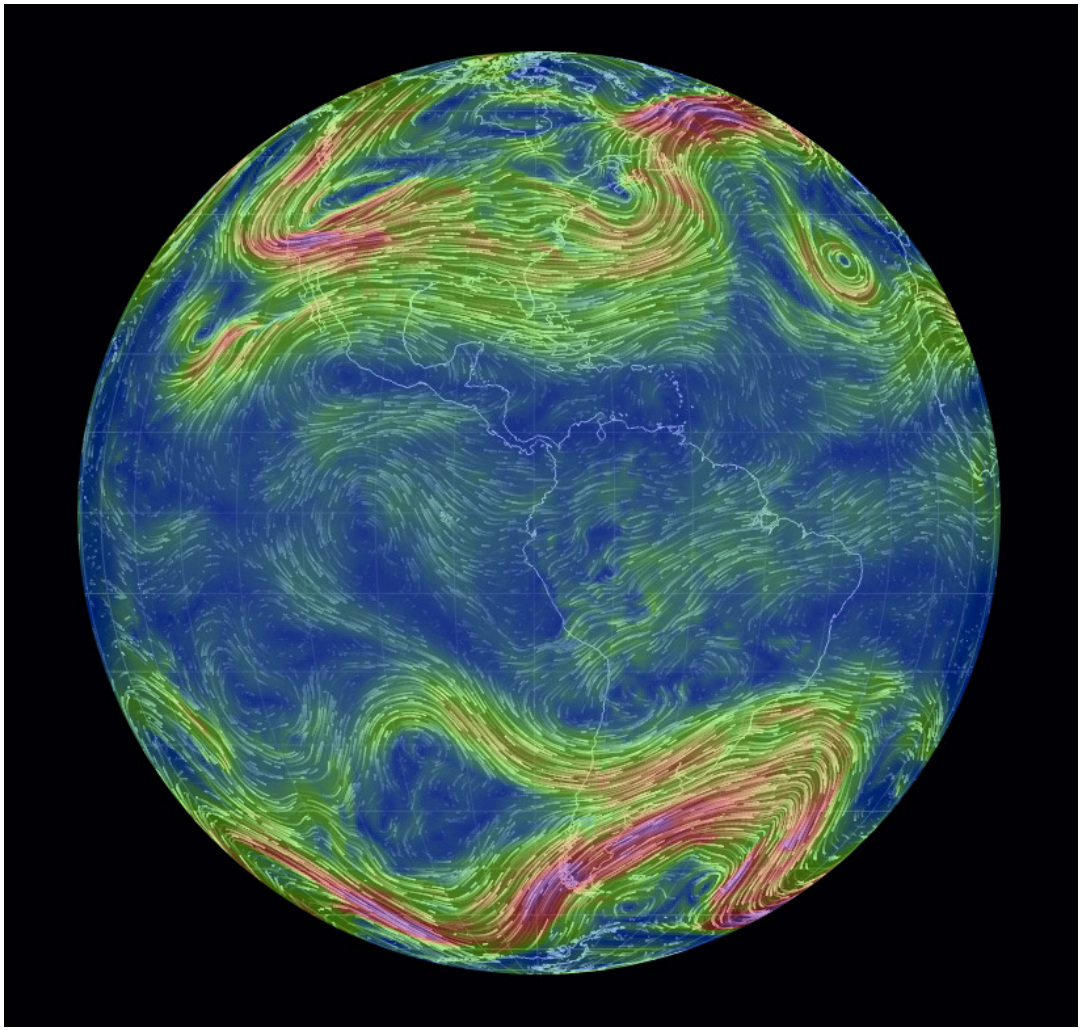
The ***Places & Spaces: Mapping Science*** exhibit showcases outstanding examples of data visualizations from around the globe and from diverse disciplines.

This year, for the first time, interactive macroscopes will be joining science maps on the exhibit floor.

Earth

Earth maps real-time weather data onto the surface of a globe, so one can explore current conditions anywhere on Earth.

Explore wind speed at different altitudes, temperature, ocean conditions, pollution levels, and more.



Cameron Beccario

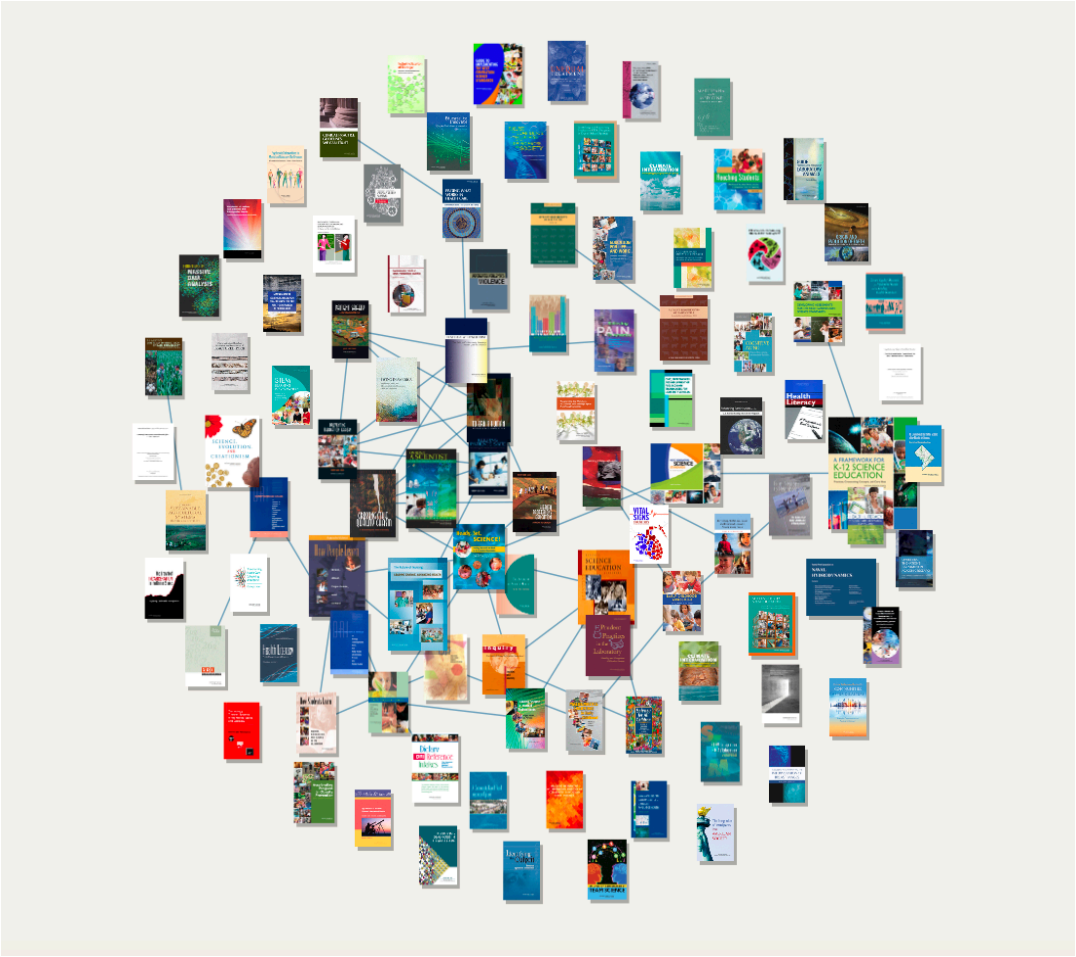
CNS Cyberinfrastructure for Network Science Center

AcademyScope

The National Academies of Sciences, Engineering, and Medicine are the nation's premier source of advice on science, technology, and health policy issues.

AcademyScope serves as a navigational guide through the more than 4000 documents the Academies have published.

National Academy of Sciences and Indiana University's CNS Center

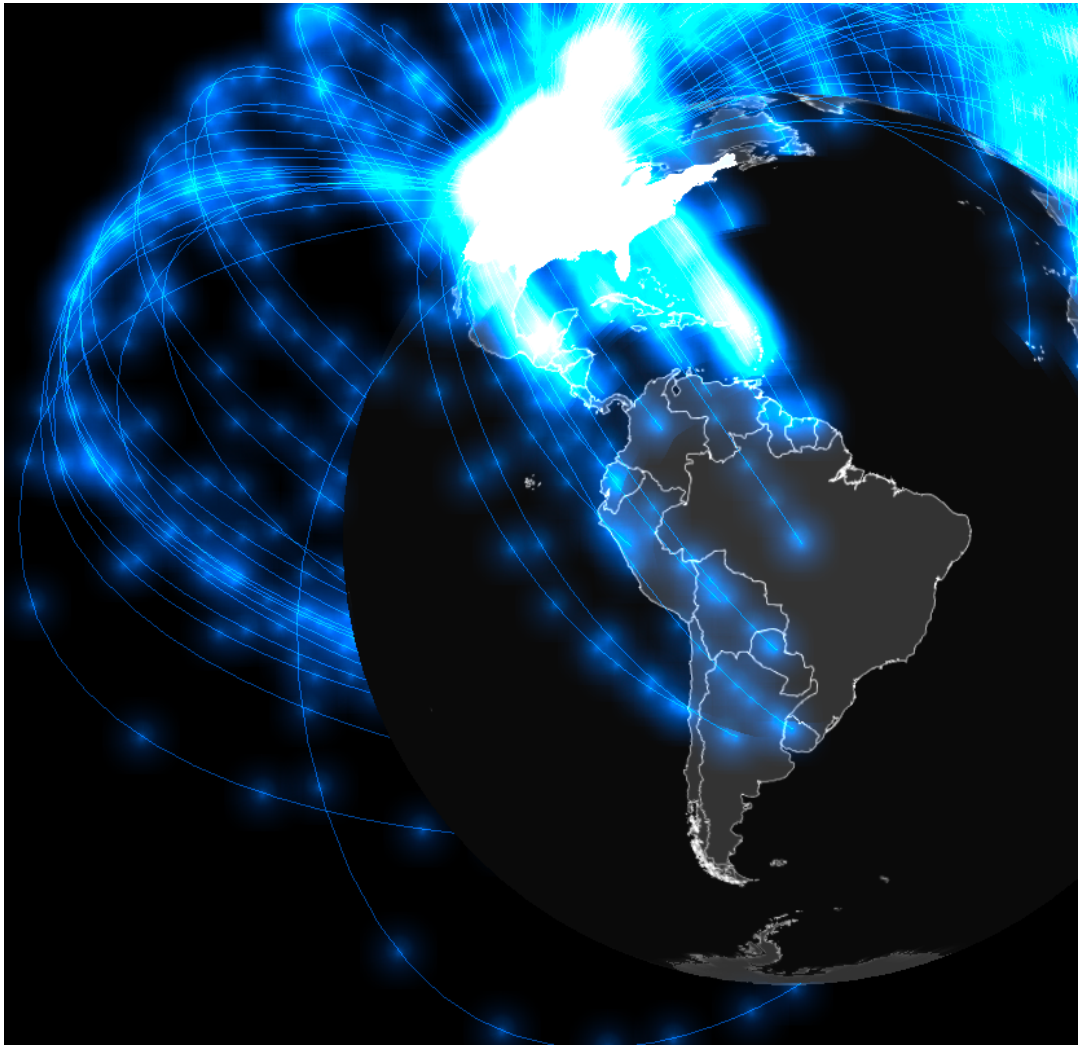


Mapping Global Society

Mapping Global Society uses local news sources in more than 100 languages to show how countries are connected via today's news stories.

Countries connected by arcs are mentioned in news stories together.

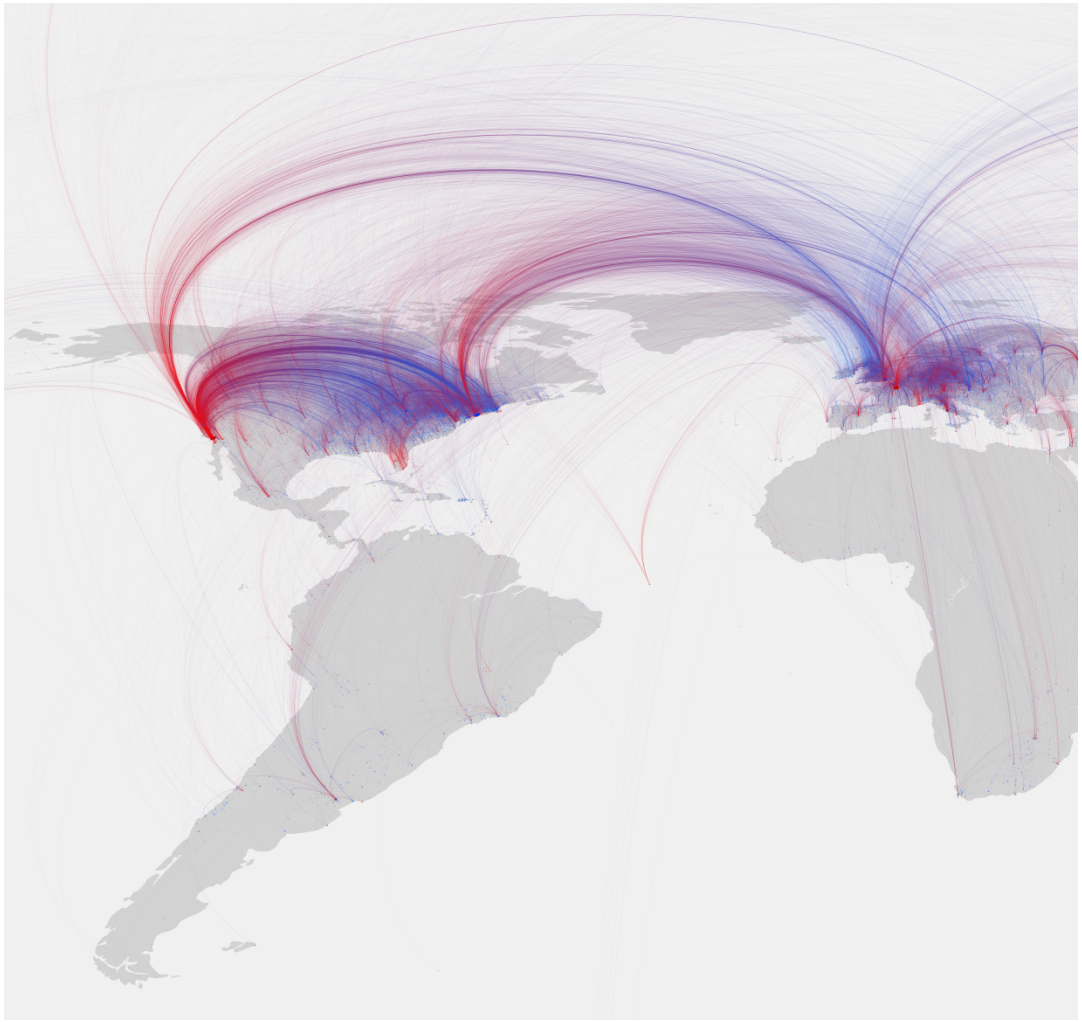
Kalev Leertaru



Charting Culture

Charting Culture shows how macroscopes can bring complex data patterns into focus, tracing life and death locations for more than 120,000 people over the last 2,600 years.

Birth places are blue and places of death are red.



Maximillian Schich and Mauro Martino

Macroscope Debut

The macroscopes will be debuting at the **David J. Senser Museum** at the **Centers for Disease Control and Prevention** in Atlanta this January.