



## Visualization & Fashion

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*Fashion Tech Week NY, The Internet of Fashion  
September 18, 2017*







(Fashion) Needs Visualized

# Maslow's hierarchy of needs

proposed in his 1943 paper "A Theory of Human Motivation" and fully expressed in his book "Motivation and Personality" in 1954.

Abraham Maslow was one of the most important representatives of the humanistic and transpersonal psychology.



Abraham Maslow  
1908 - 1970

## SELF-ACTUALIZATION

5



## ESTEEM

4



## LOVE & BELONGING

3



## SAFETY

2



## PHYSIOLOGICAL

1



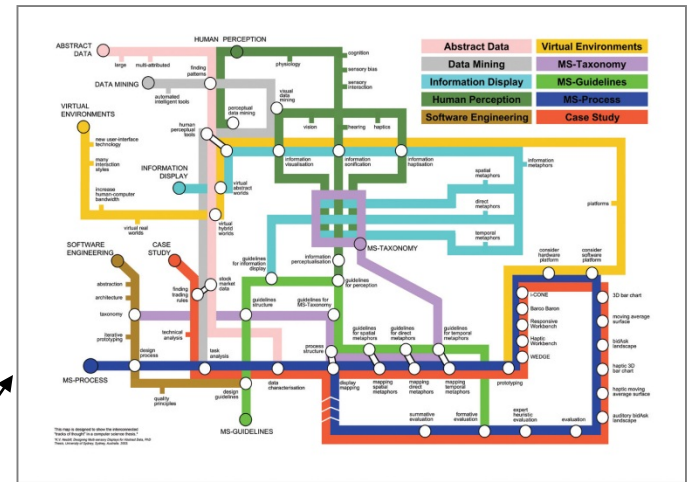


# Visualizations Answer Questions



Terabytes of data

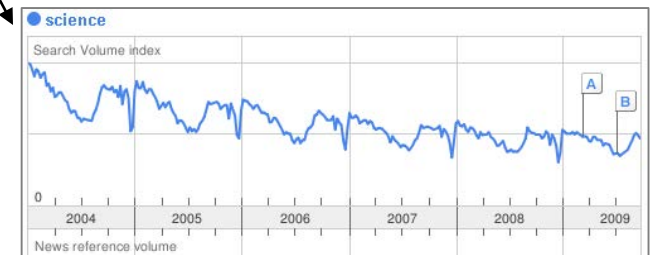
Descriptive &  
Predictive  
Models



Find your way



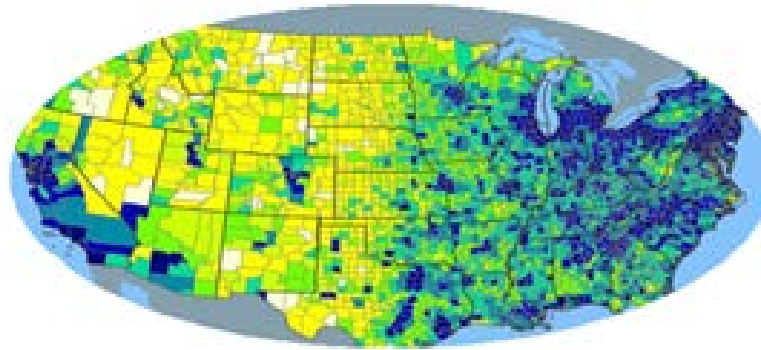
Find collaborators, friends



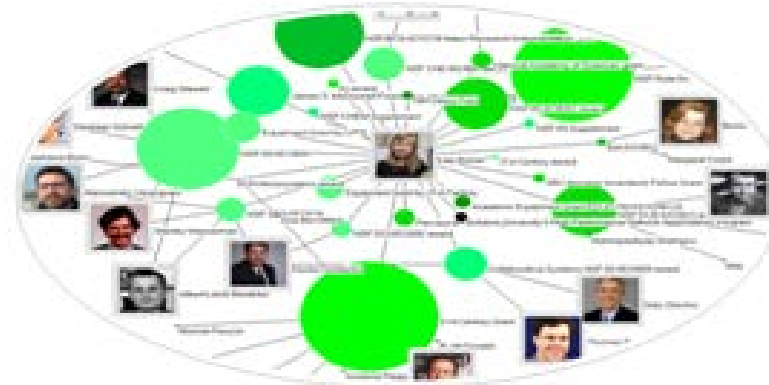
Identify trends

# Different Levels of Abstraction/Analysis

Macro/Global  
Population Level



Meso/Local  
Group Level



Micro  
Individual Level

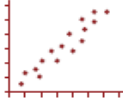



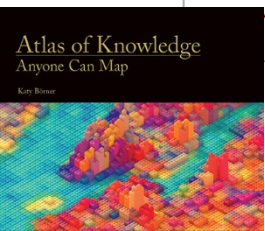


# Tasks

## LEVELS

## TYPES

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



See page 5



# Fashionable Visualization





PLACES  
SPACES &  
MAPPING SCIENCE

[scimaps.org](http://scimaps.org)

# Map of Scientific Collaborations from 2005-2009



Computed Using Data from Elsevier's Scopus

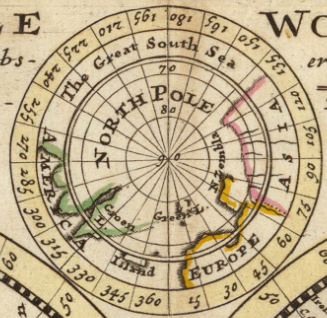
*Stream of Scientific Collaborations Between World Cities* - Olivier H. Beauchesne - 2012



A New Map of the **WHOLE**  
According to y<sup>e</sup> latest and most Exact Obs-

**WORLD** with the Trade winds  
errations By H. Moll Geographer

In this Maps is inserted A View of y<sup>e</sup> General & Coasting Trade Winds, Monsoons or y<sup>e</sup> Shifting Trade-winds Note that y<sup>e</sup> Arrows among y<sup>e</sup> Lines shew y<sup>e</sup> Course of those General & Coasting Winds, and y<sup>e</sup> Arrows in y<sup>e</sup> void Spaces shew y<sup>e</sup> Course of y<sup>e</sup> Shifting Trade-winds, and y<sup>e</sup> Abbreviation sep<sup>r</sup> & c. Shew y<sup>e</sup> Times of y<sup>e</sup> Year when such Winds Blow.



The Signs of the Zodiac, The First 6 are Northern, the other Southern Signs  
♈ Aries . March      ♌ Leo . July  
♉ Taurus . April    ♍ Virgo . August  
♊ Gemini . May      ♎ Libra . September  
♋ Cancer . June     ♏ Scorpio . October  
♐ Sagittarius . November  
♑ Capricornus . December  
♒ Aquarius . January  
♓ Pisces . February



Printed for Tho: Bowles Print and Map Seller next y<sup>e</sup> Chapter- Houfe in S.<sup>t</sup> Pauls Church-yard; and John Bowles Print and Map Seller at the Black-Horse in Cornhill London.

A New Map of the Whole World with Trade Winds According to the Latest and Most Exact Observations - Herman Moll - 1736













# Check out our **Zoom Maps** online!

**VII.10**  
History of Science Fiction, by Ward Shelley

BROOKLYN, NY, 2011  
Courtesy of Ward Shelley Studio

Ward Shelley is an artist identified with the Williamsburg scene in Brooklyn, New York. In this map, he organizes the science fiction literary genre from its nascent beginnings in the 18th century to the present day. The map plots the science fiction literary genre from its nascent beginnings in the 18th century to the present day. The map plots the science fiction literary genre from its nascent beginnings in the 18th century to the present day. The map plots the science fiction literary genre from its nascent beginnings in the 18th century to the present day.

**PLACES & SPACES**  
MAPPING ONLINE

Visit [scimaps.org](http://scimaps.org) and check out all our maps in stunning detail!



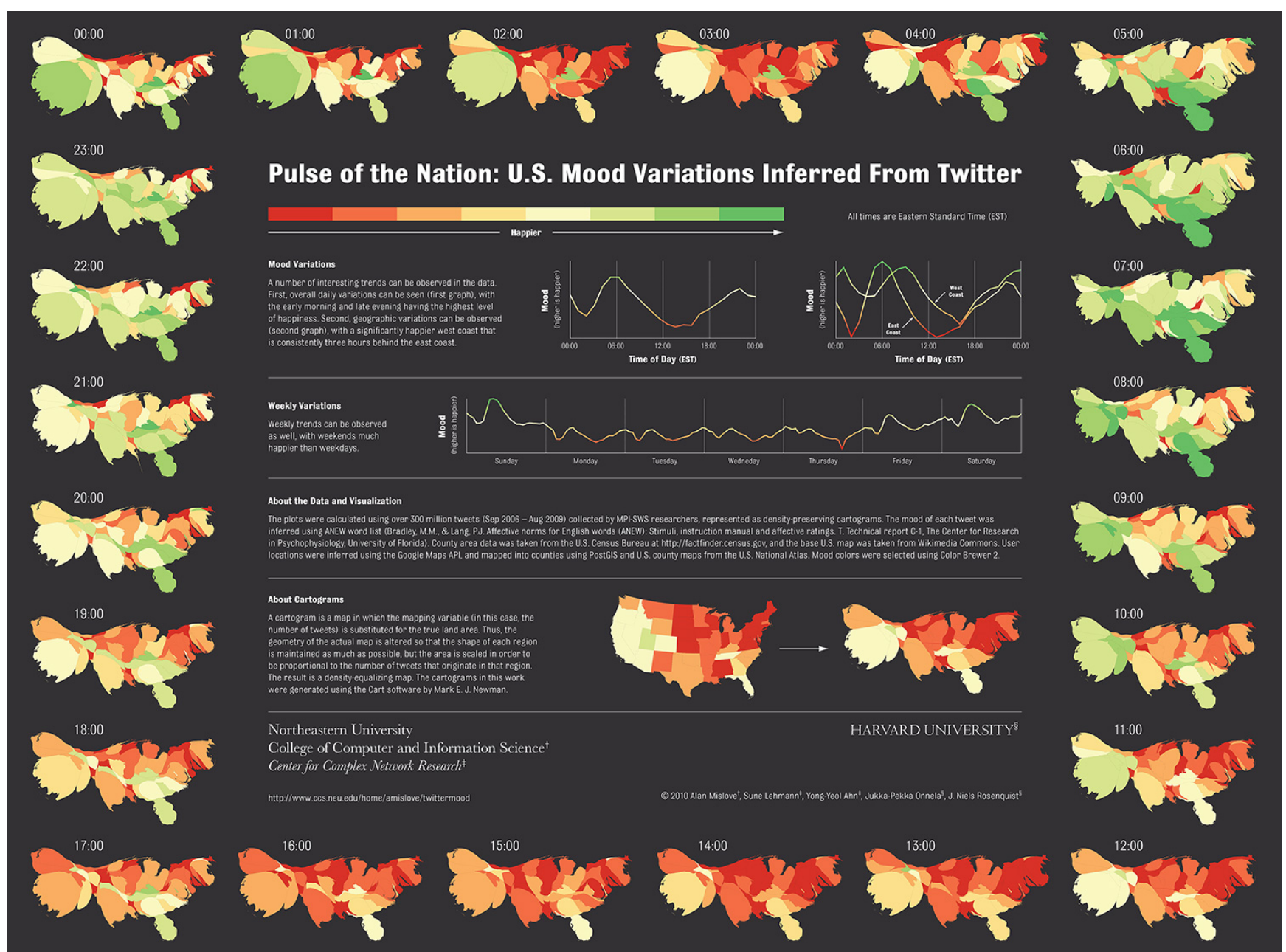
Fashion that attracts “close reading” attention

Fashionable maps that guides smart navigation (or reading) decisions.



Many maps have been printed on clothing and bodies.

Future maps will be interactive and updated in real-time.

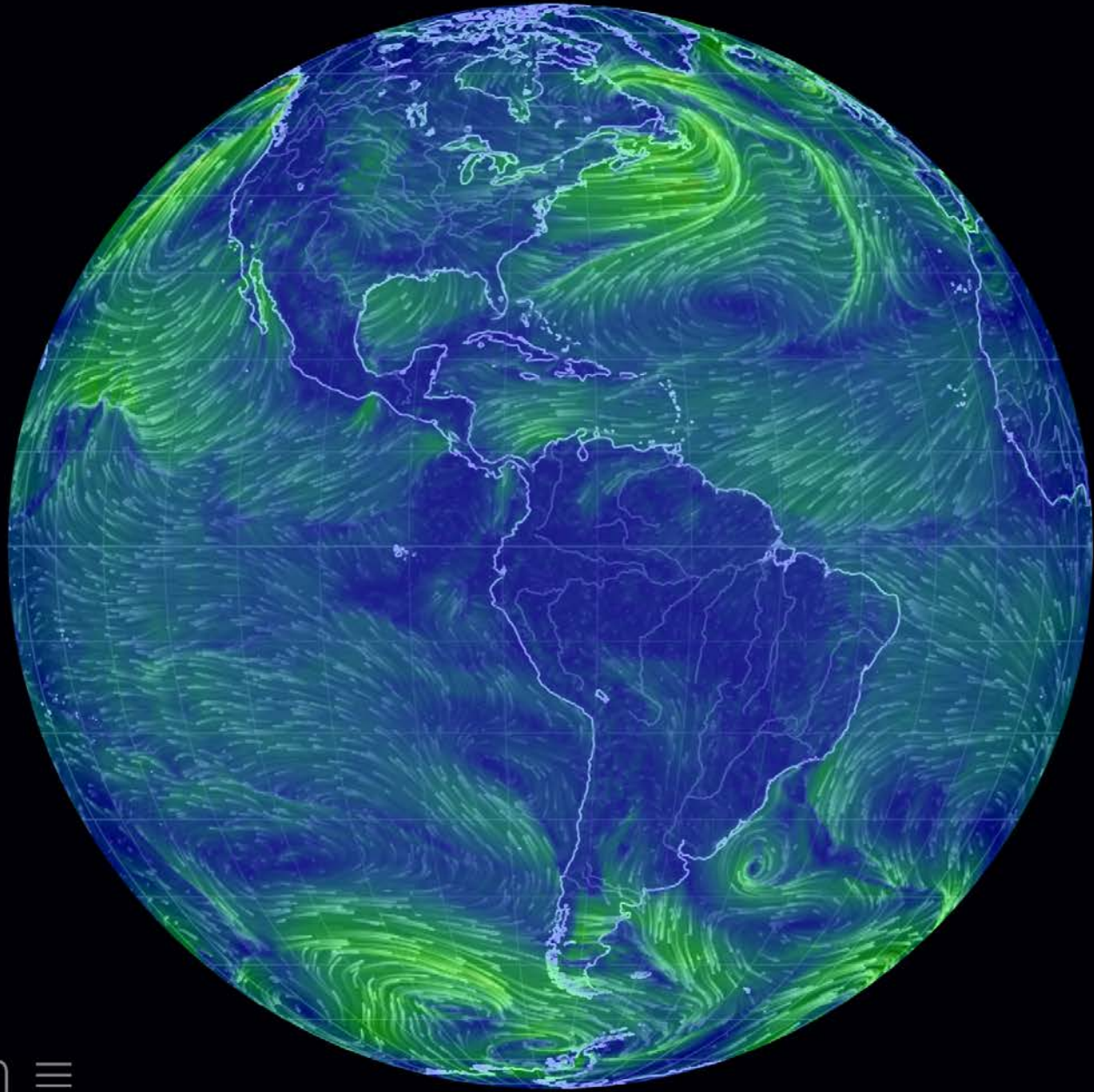


*Pulse of the Nation* - Alan Mislove, Sune Lehmann, Yong-Yeol Ahn, Jukka-Pekka Onnela, and James Niels Rosenquist - 2010



# Interactive Visualizations





earth ≡

*Earth* – Cameron Beccario



# The News Co-occurrence Globe

An interactive visualization of how countries are mentioned together in the world's news media

+ - UNITED KINGDOM SEARCH ABOUT



2.92K  
COOCCUR%

**UNITED KINGDOM** cooccurrences in: 2,922%  
cooccurrences out: 80%

Timeline: Feb 22, Mar 1, Mar 8, Mar 15, Mar 22, Mar 29, Apr 5, Apr 12, Apr 19, Apr 26, May 3, May 10, May 17, May 24



COOCCUR

IN%

OUT%





*Smelly Maps* – Daniele Quercia, Rossano Schifanella, and Luca Maria Aiello – 2015





Ingo Gunther's Worldprocessor globe design on display at the Museum of Emerging Science and Innovation in Tokyo, Japan.



SCWS 2017

Connecting the World  
for a Sustainable Future

15th.Nov.-17th.Nov.2017

ACCESS / INQUIRY

EN JP

ABOUT

PROGRAMME

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# Science Centre World Summit 2017 IN TOKYO

National Museum of Emerging Science and Innovation (Miraikan)

SCWS Session: Visualizing STEAM Data in Support of Smart Decision Making  
November 15-17, 2017, Tokyo, Japan. <http://scws2017.org>



A fashion show runway scene with a central black circle containing the text "Envisioned Fashion". The runway is a long, narrow white strip in the center, flanked by a crowd of people on both sides. The crowd is mostly seen from behind, with many people holding up cameras and smartphones to capture photos. The lighting is dramatic, with the runway brightly lit and the audience in relative shadow. The overall atmosphere is that of a high-profile fashion event.

# Envisioned Fashion

Sparkling augmentation

Virtual fitting

Wayfinding

and more



*Shoe Augmentations* by Andreas Bueckle and Yingnan Yu, Indiana University

*Presented on Sept 19, 2017*





# Extended Fashion

Clothing is the smallest Tiny House!



Future environments, fashion will be smart.

Sensors, actuators, machine learning algorithms connected via IoT.







Sentient Veil, Isabella Stewart Gardner Museum, Boston, MA (2017)



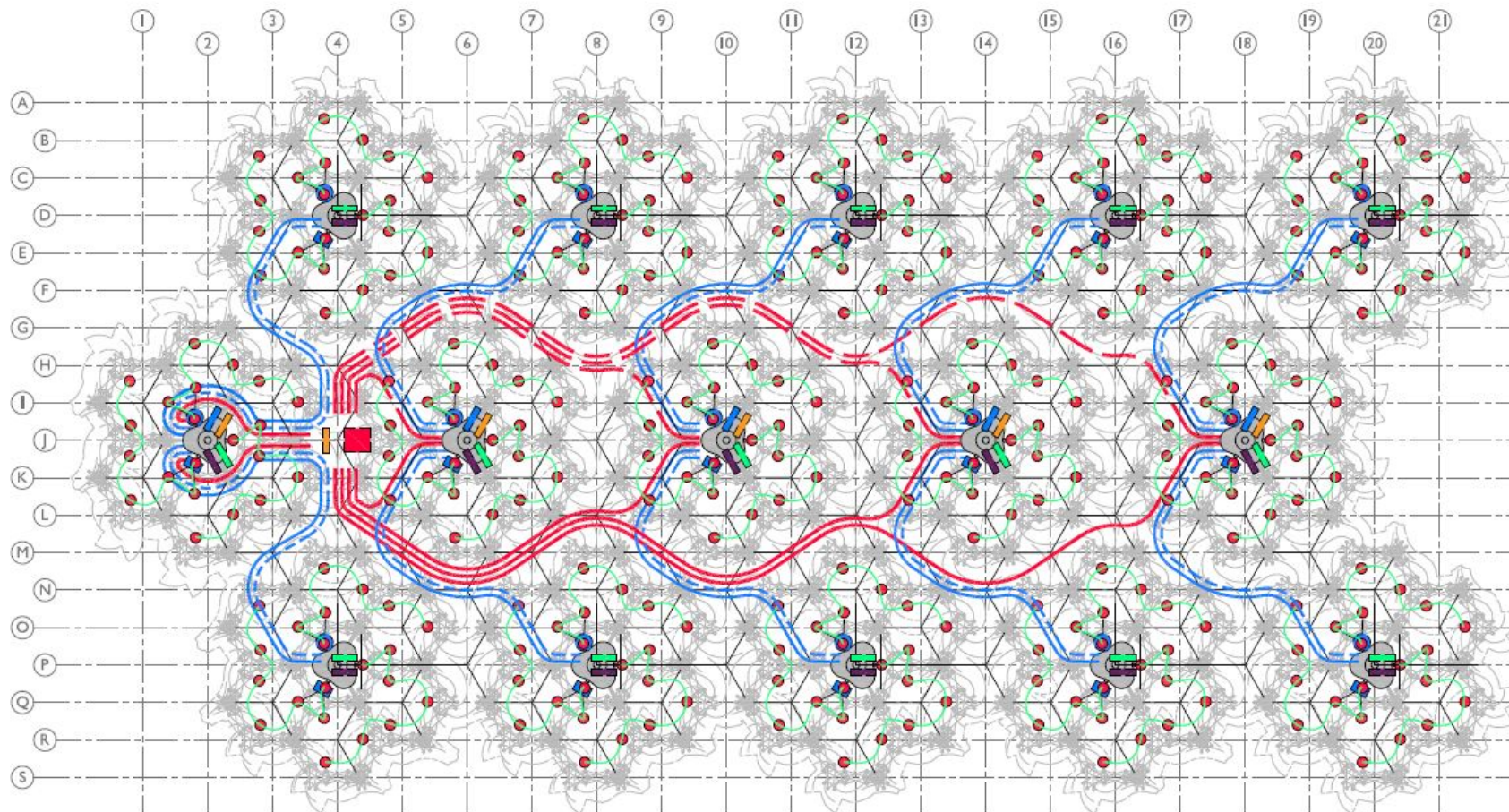


Sentient Veil, Isabella Stewart Gardner Museum, Boston, MA (2017)








Sentient Veil, Isabella Stewart Gardner Museum, Boston, MA (2017)









### PCBs

-  Raspberry Pi 3.0 B
-  3.1 Control Node
-  3.1 Device Module
-  Power Distribution board
-  Mp3 Trigger board

### Interactive Devices

-  Light Module Cluster
-  Sound Unit
-  Short Range IR Proximity Sensor
-  Microphone Sensor

### Mechanisms

-  Main Power Trunk
-  Main Communications Trunk
-  Node to Device Module Power
-  Node to Device Module Communications
-  Neo Pixel Chain

# Maslow's hierarchy of needs

proposed in his 1943 paper "A Theory of Human Motivation" and fully expressed in his book "Motivation and Personality" in 1954.

Abraham Maslow was one of the most important representatives of the humanistic and transpersonal psychology.



Abraham Maslow  
1908 - 1970

## SELF-ACTUALIZATION



## ESTEEM



## LOVE & BELONGING



## SAFETY



## PHYSIOLOGICAL







# DIY Visualizations

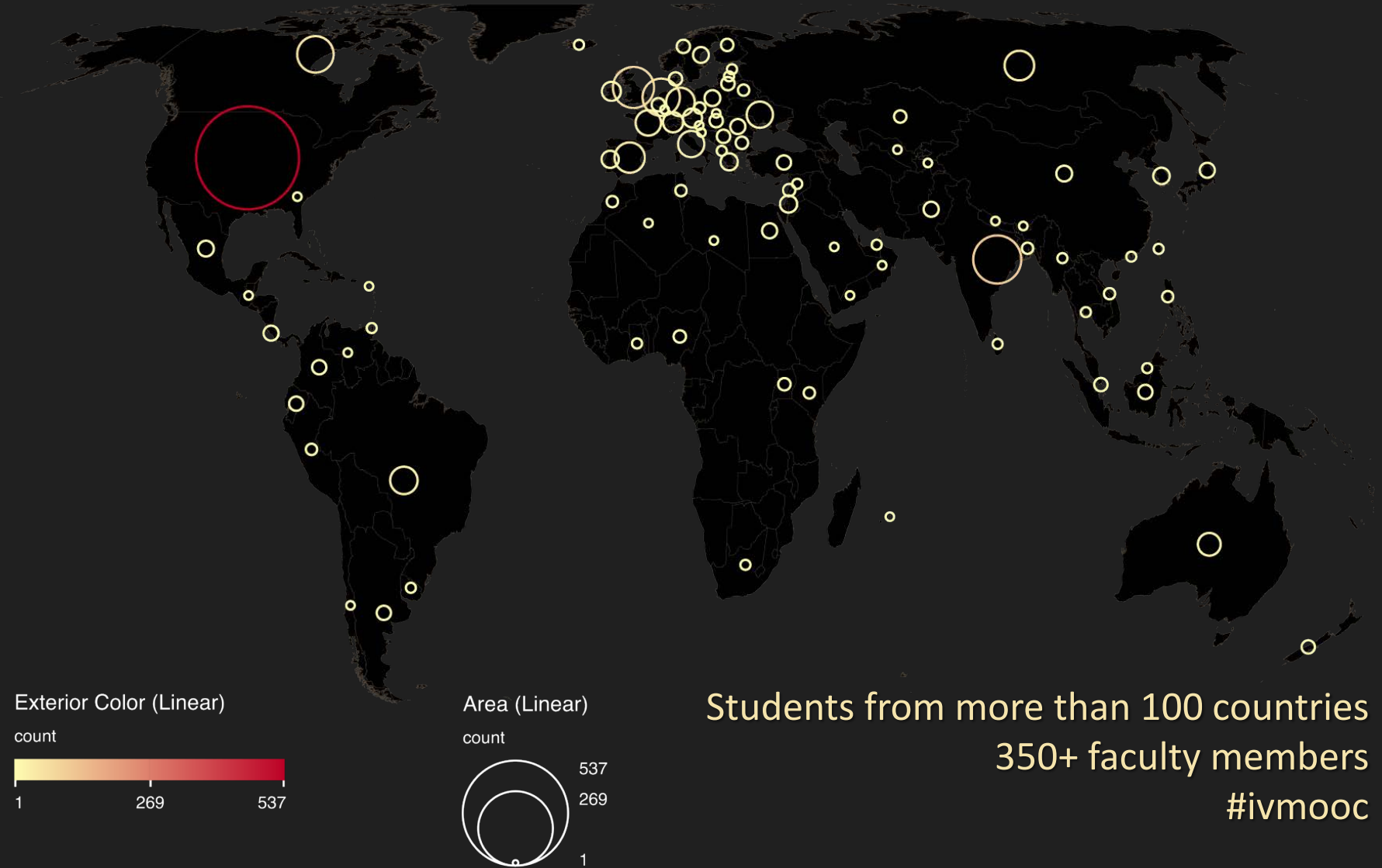


Register for free: <http://ivmooc.cns.iu.edu>. Class restarts Jan 9, 2018.

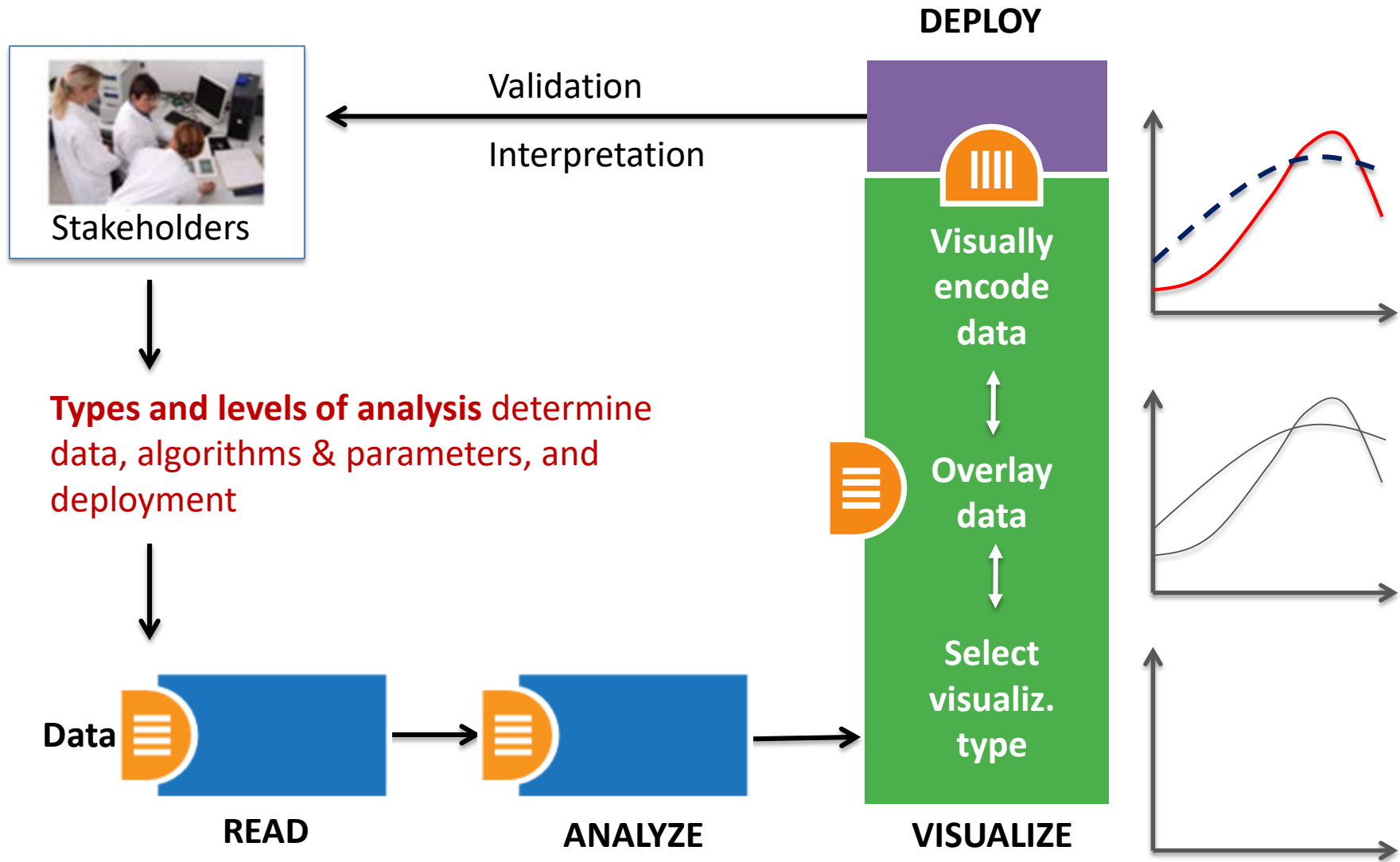


# The Information Visualization MOOC

[ivmooc.cns.iu.edu](http://ivmooc.cns.iu.edu)

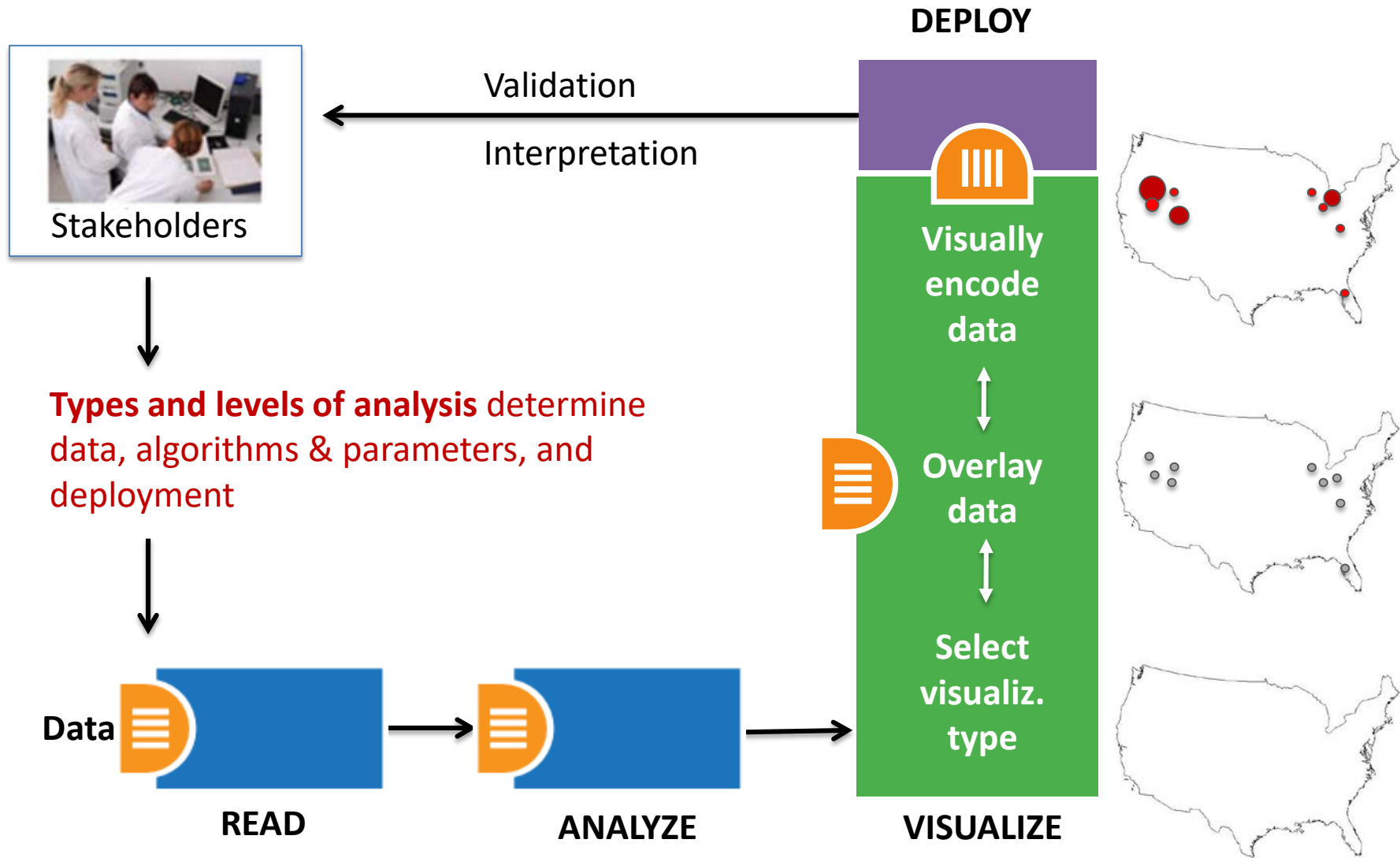


# Needs-Driven Workflow Design



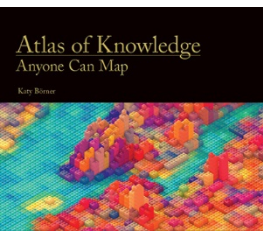


# Needs-Driven Workflow Design



# 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
<ul style="list-style-type: none"> <li>• categorize/cluster</li> <li>• order/rank/sort</li> <li>• distributions (also outliers, gaps)</li> <li>• comparisons</li> <li>• trends (process and time)</li> <li>• geospatial</li> <li>• compositions (also of text)</li> <li>• correlations/relationships</li> </ul>	<ul style="list-style-type: none"> <li>• nominal</li> <li>• ordinal</li> <li>• interval</li> <li>• ratio</li> </ul>	<ul style="list-style-type: none"> <li>• table</li> <li>• chart</li> <li>• graph</li> <li>• map</li> <li>• network layout</li> </ul>	<ul style="list-style-type: none"> <li>• geometric symbols               <ul style="list-style-type: none"> <li>point</li> <li>line</li> <li>area</li> <li>surface</li> <li>volume</li> </ul> </li> <li>• linguistic symbols               <ul style="list-style-type: none"> <li>text</li> <li>numerals</li> <li>punctuation marks</li> </ul> </li> <li>• pictorial symbols               <ul style="list-style-type: none"> <li>images</li> <li>icons</li> <li>statistical glyphs</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• spatial               <ul style="list-style-type: none"> <li>position</li> </ul> </li> <li>• retinal               <ul style="list-style-type: none"> <li>form</li> <li>color</li> <li>optics</li> <li>motion</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• overview</li> <li>• zoom</li> <li>• search and locate</li> <li>• filter</li> <li>• details-on-demand</li> <li>• history</li> <li>• extract</li> <li>• link and brush</li> <li>• projection</li> <li>• distortion</li> </ul>



See page 24



# Graphic Variable Types Versus Graphic Symbol Types

			Geometric Symbols					
			Point		Line		Area	
Spatial	x	quantitative						
	y	quantitative						
	z	quantitative						
Retinal	Form	Size	quantitative	NA (Not Applicable)				
		Shape	qualitative	NA				
		Rotation	quantitative	NA				
		Curvature	quantitative	NA				
		Angle	quantitative	NA				
		Closure	quantitative	NA				
	Color	Value	quantitative					
		Hue	qualitative					
		Saturation	quantitative					

# Graphic Variable Types Versus Graphic Symbol Types

		Geometric Symbols					Linguistic Symbols Text, Numerals, Punctuation Marks		Pictorial Symbols Images, Icons, Statistical Glyphs	
		point	line	area	surface	volume				
Symbol	1									
	2									
	3									
Form	size	NA (Not applicable)								
	shape	NA								
	rotation	NA								
	curvature	NA								
	angle	NA								
	closure	NA								
	value									
	hue									
	saturation									
Texture	spacing									
	consistency									
	pattern									
	orientation	NA								
	accent									
	blur									
	transparency									
	shading									
	stereoscopic depth	Point in foreground - background	Line in foreground - background	Area in foreground - background	Surface in foreground - background	Volume in foreground - background	Text in foreground - background	Text in foreground - background	Icons in foreground - background	Icons in foreground - background
	speed									
Motion	velocity									
	strobium	Blinking point slow - fast	Blinking line slow - fast	Blinking area slow - fast	Blinking surface slow - fast	Blinking volume slow - fast	Blinking text slow - fast	Blinking text slow - fast	Blinking icons slow - fast	Blinking icons slow - fast

# References

Börner, Katy, Chen, Chaomei, and Boyack, Kevin. (2003). **Visualizing Knowledge Domains**. In Blaise Cronin (Ed.), *ARIST*, Medford, NJ: Information Today, Volume 37, Chapter 5, pp. 179-255. <http://ivl.slis.indiana.edu/km/pub/2003-borner-arist.pdf>

Shiffrin, Richard M. and Börner, Katy (Eds.) (2004). **Mapping Knowledge Domains**. *Proceedings of the National Academy of Sciences of the United States of America*, 101(Suppl\_1). [http://www.pnas.org/content/vol101/suppl\\_1](http://www.pnas.org/content/vol101/suppl_1)

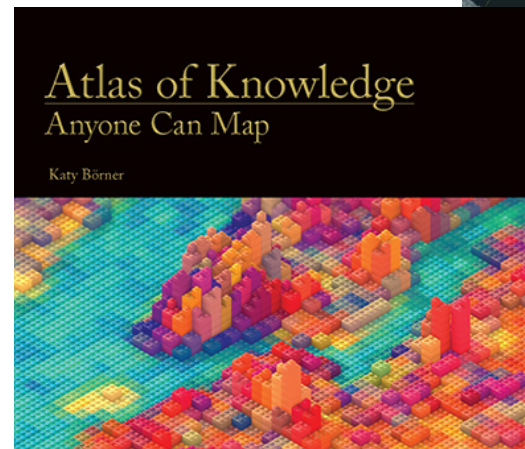
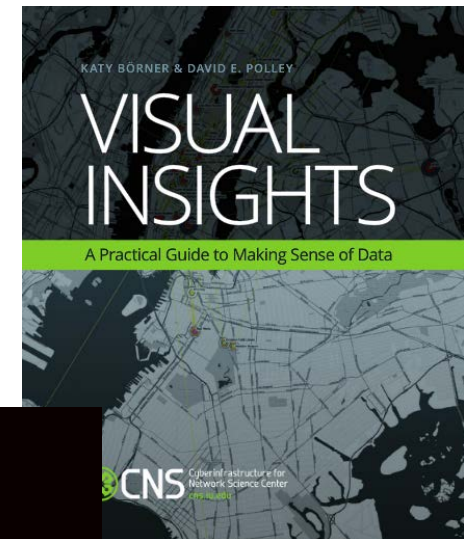
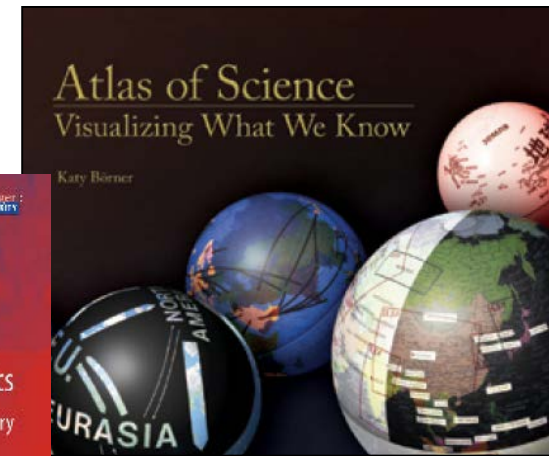
Börner, Katy (2010) **Atlas of Science: Visualizing What We Know**. The MIT Press. <http://scimaps.org/atlas>

Scharnhorst, Andrea, Börner, Katy, van den Besselaar, Peter (2012) **Models of Science Dynamics**. Springer Verlag.

Katy Börner, Michael Conlon, Jon Corson-Rikert, Cornell, Ying Ding (2012) **VIVO: A Semantic Approach to Scholarly Networking and Discovery**. Morgan & Claypool.

Katy Börner and David E Polley (2014) **Visual Insights: A Practical Guide to Making Sense of Data**. The MIT Press.

Börner, Katy (2015) **Atlas of Knowledge: Anyone Can Map**. The MIT Press. <http://scimaps.org/atlas2>








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