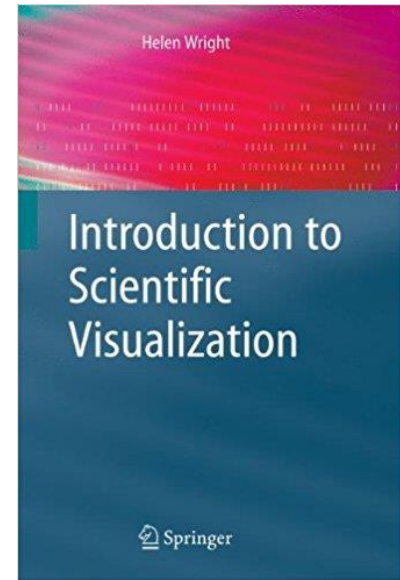


Geog183: Cartographic Design and Geovisualization Spring Quarter 2020

Lecture 14: Visual analytics and data exploration

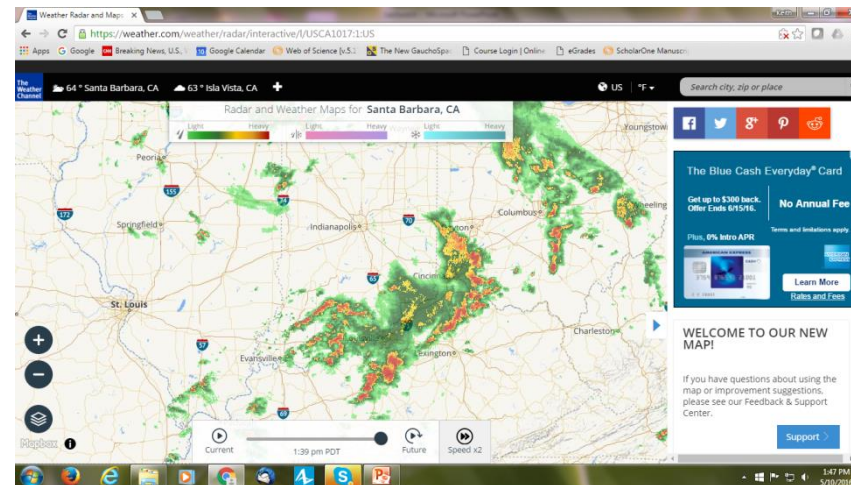
Data exploration

- Inheritor of the statistical graphic heritage
- Focus on new methods and display capabilities
- Change in needs: big data and automated data mining
- Started as scientific data exploration in the late 1990s
- Overlaps with data visualization, infographics, geoviz, infoviz and visual analytics
- Often uses maps but space is not always the focus
- Slocum reviews selected software packages



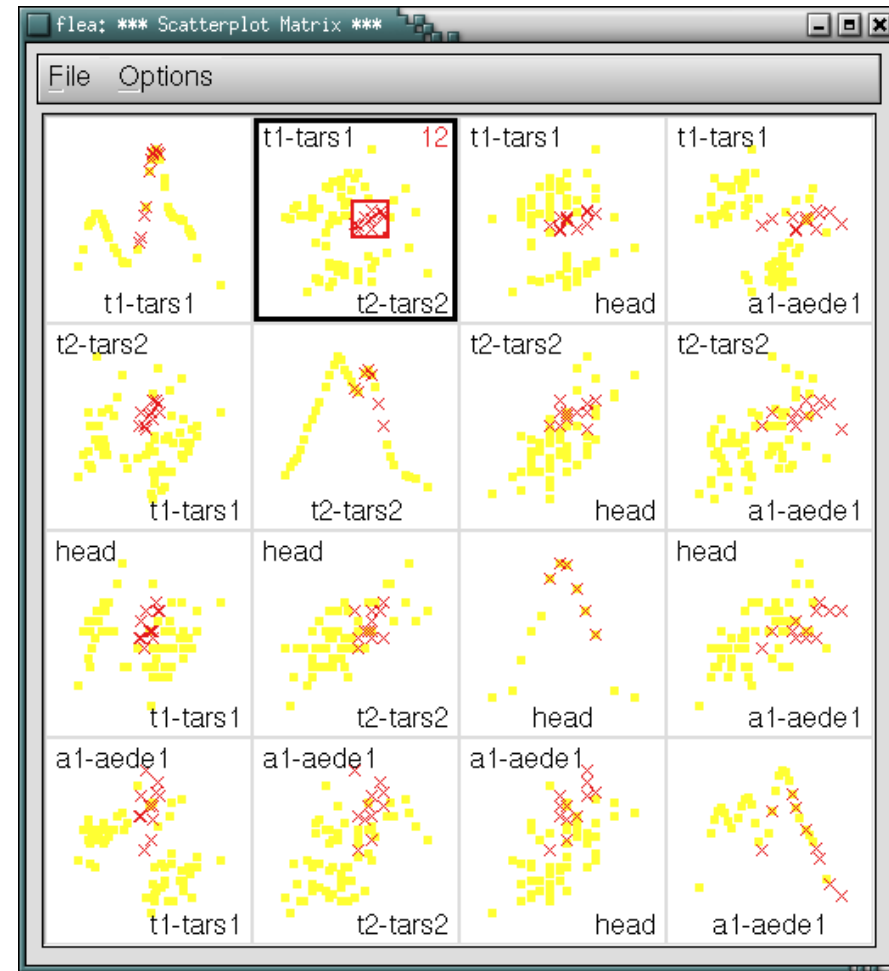
Slocum's goals of data exploration

- Goal 1: identify spatial patterns associated with one attribute at one time
- Goal 2: compare spatial distributions across attributes or time
- Goal 3: show patterns of change over time for a geographic extent
- Goal 4: compare two distributions as they change over time



Data exploration methods

- Data manipulation
- Varying symbolization
- Focus and brushing
- Multiple simultaneous views
- Linking data across views
- Small multiples and animations
- Automated map interpretation

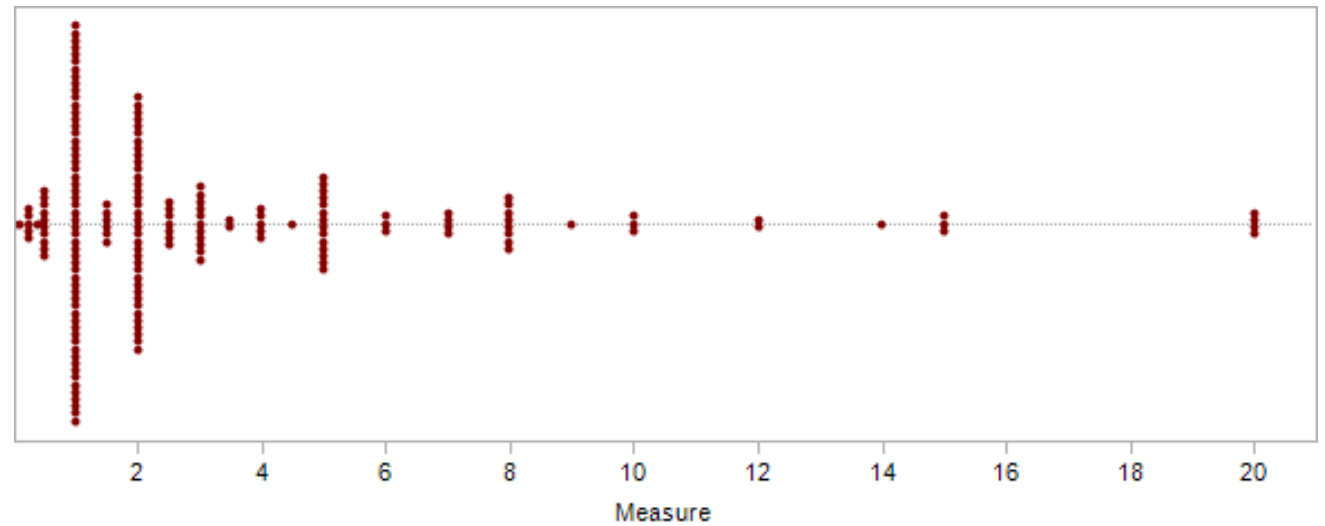
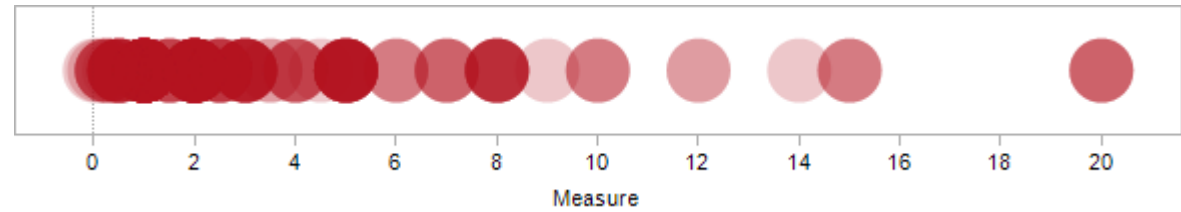


Reordering data: Stem and leaf plot

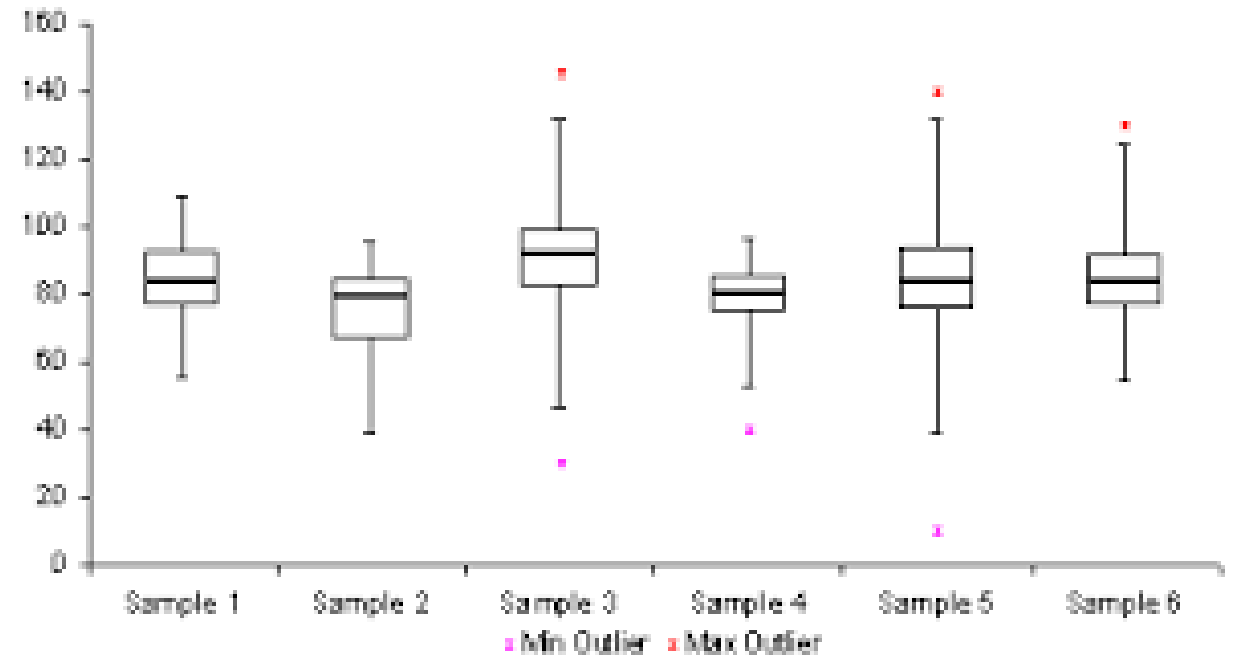
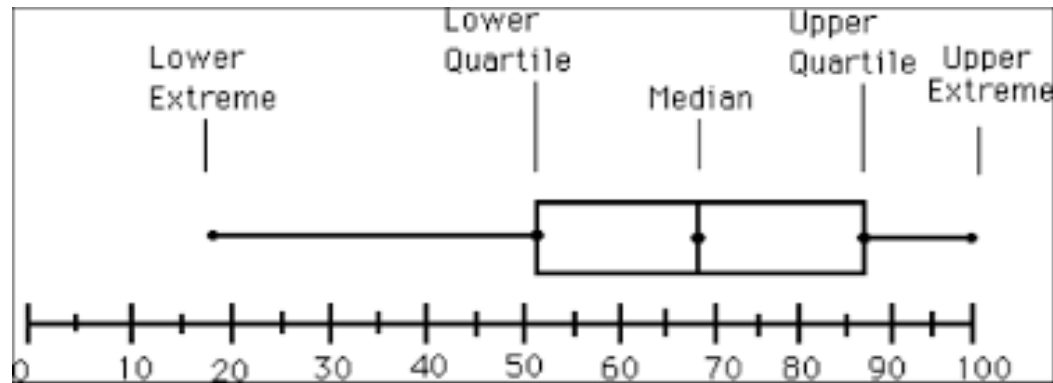
15,16,21,23,23,26,26,30,32,41

Stem	Leaf
1	5 6
2	1 3 3 6 6
3	0 2
4	1

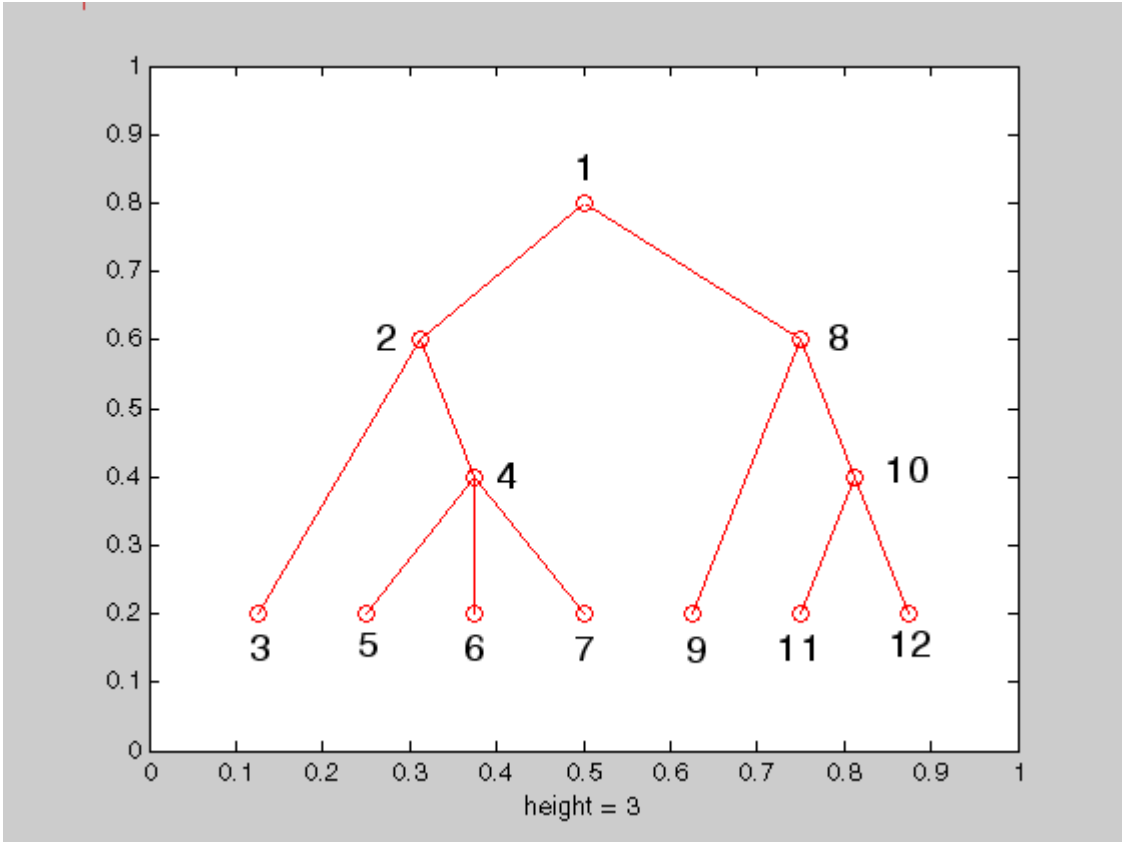
how to place "32"



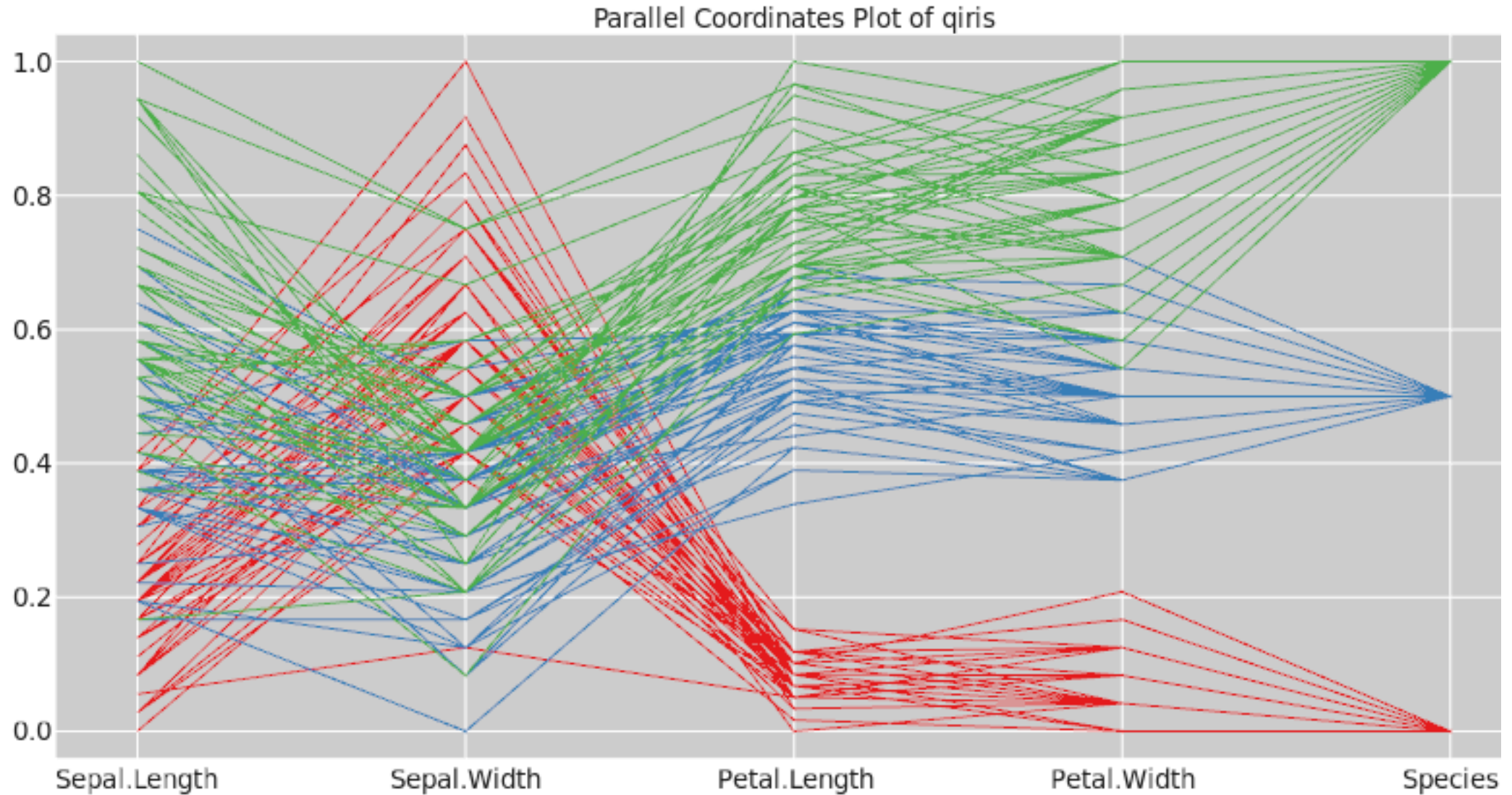
Reordering data: Box and whisker



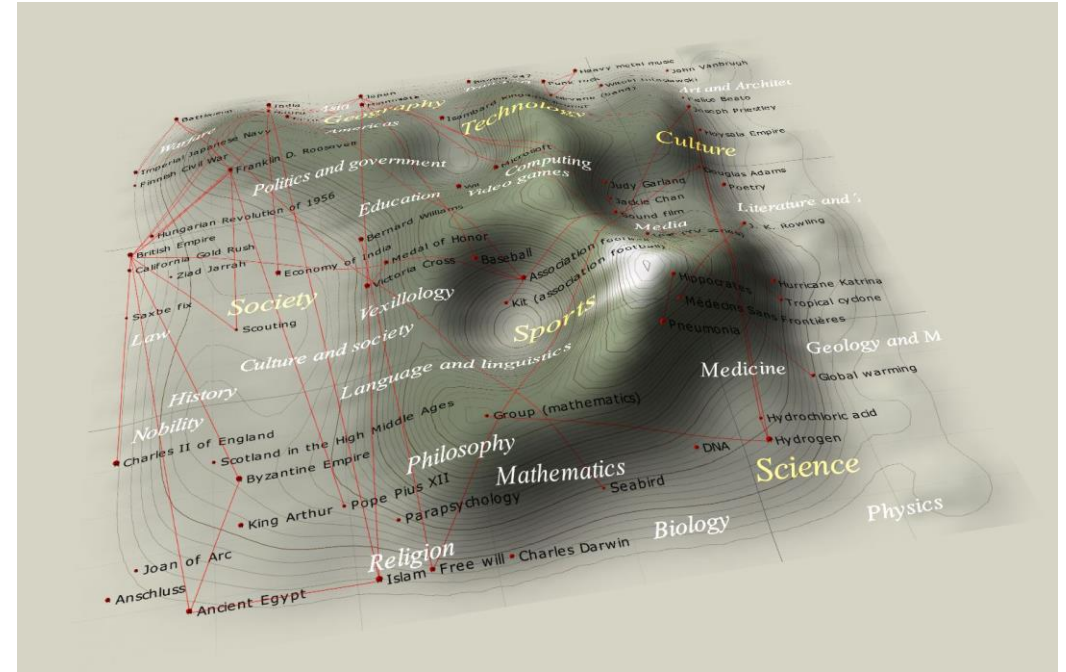
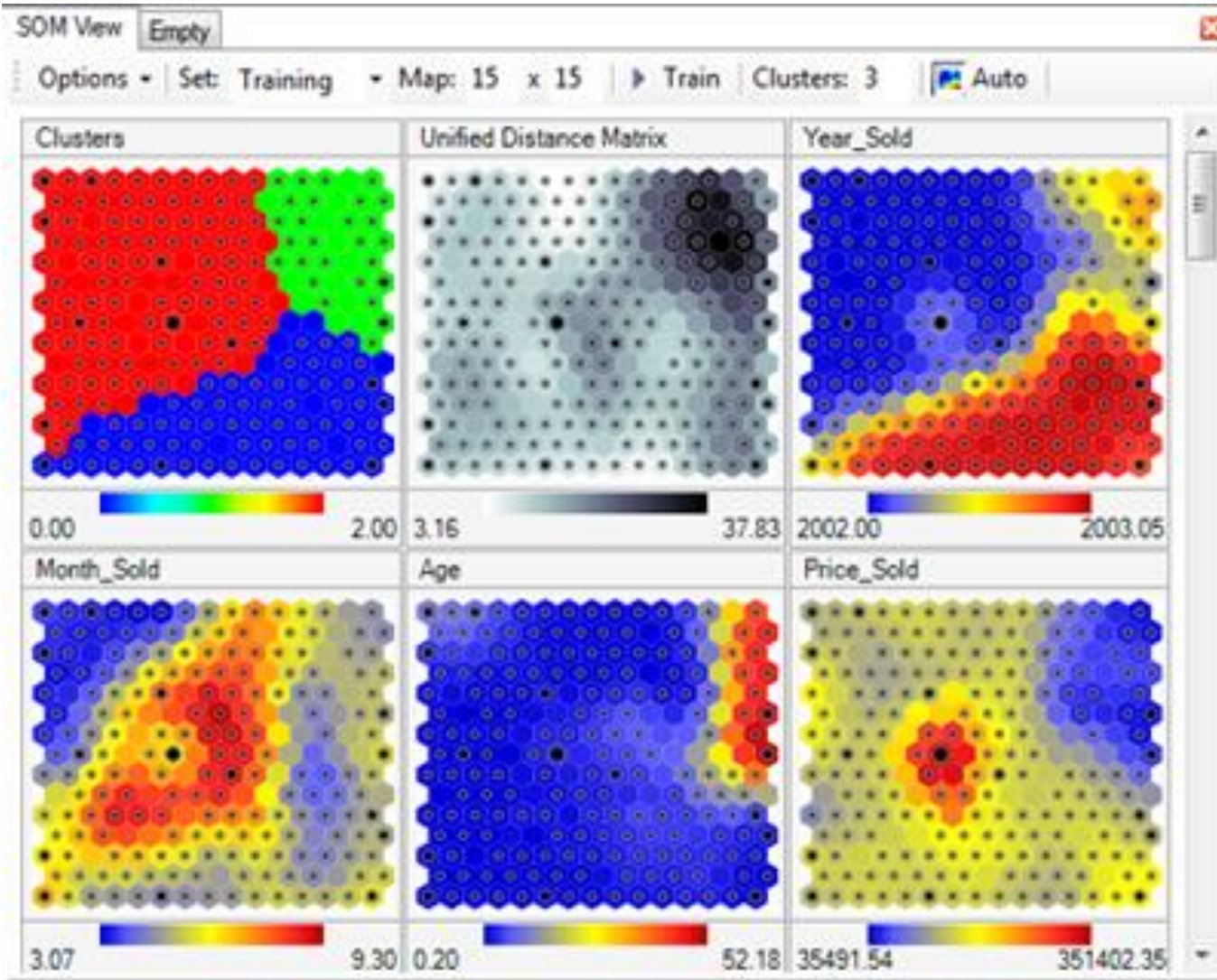
Tree plot



Parallel coordinate plot (R script on Github)



Self Organizing Map: Synapse (also an R plugin)



Spatialization

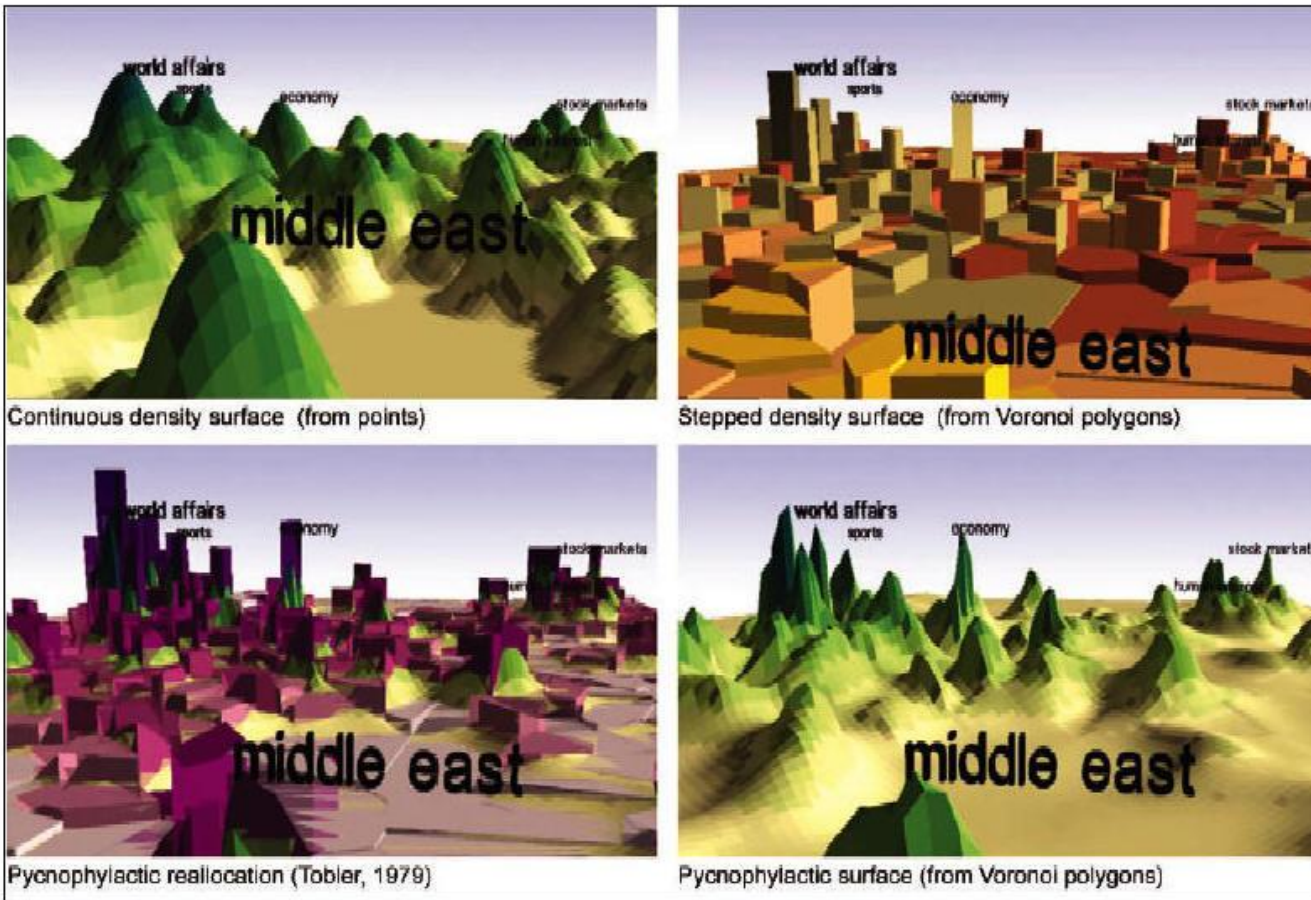


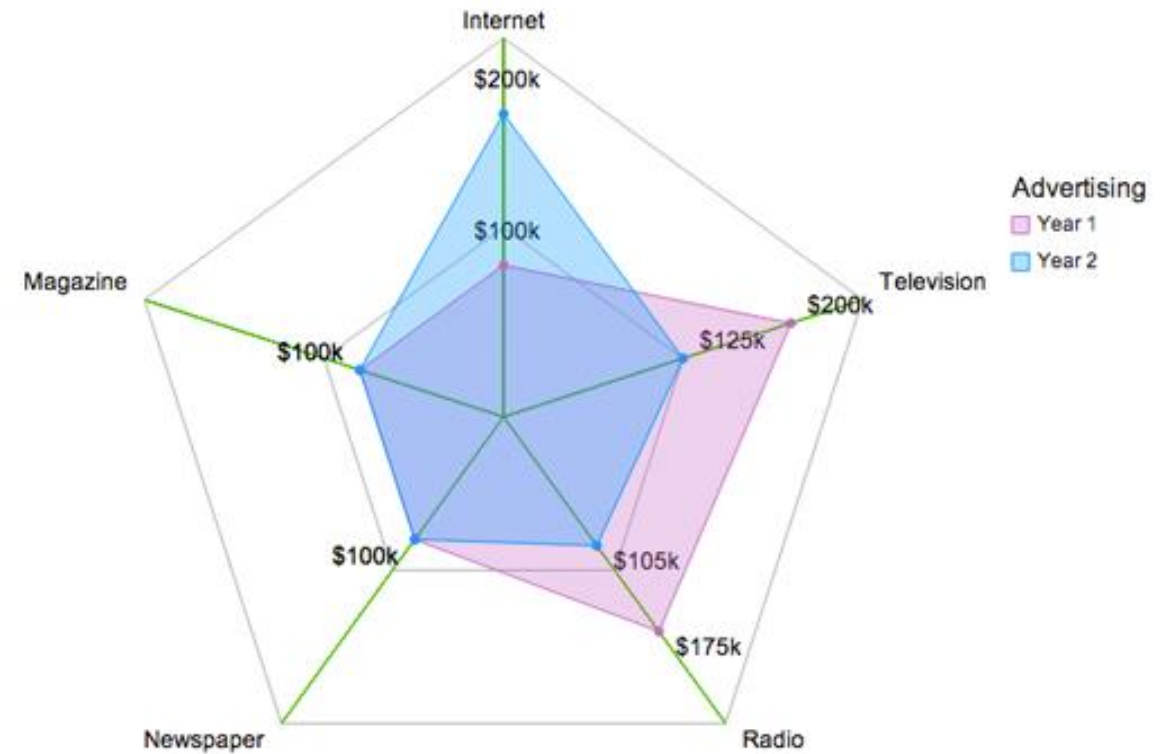
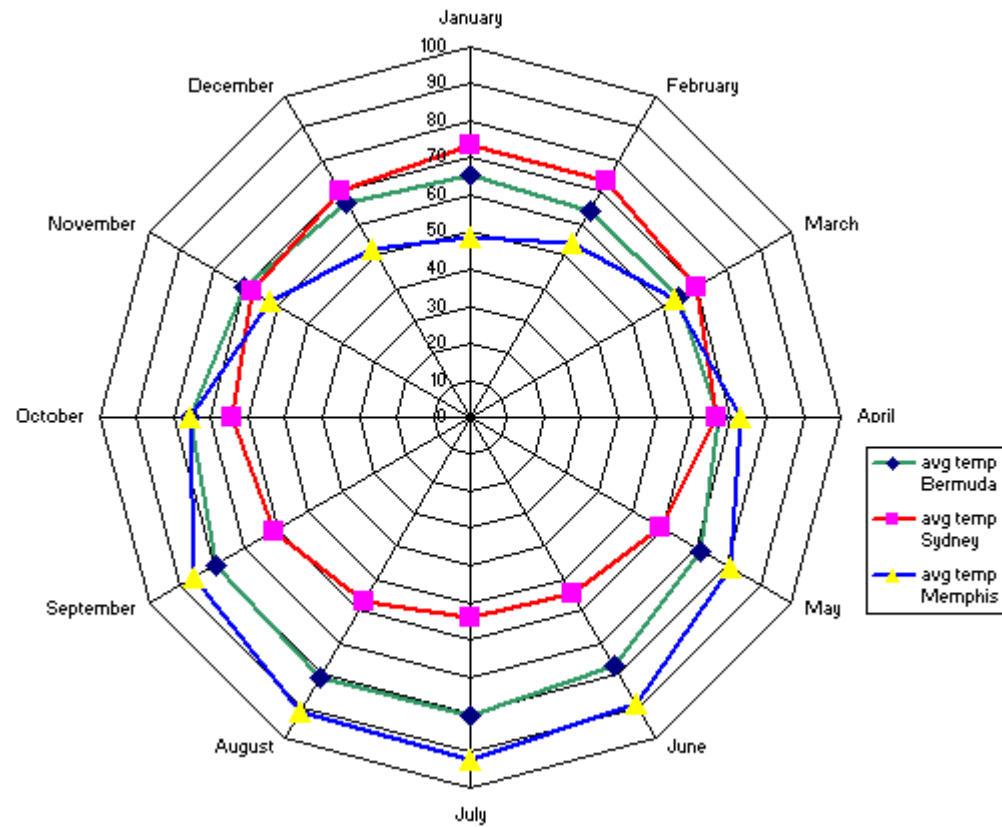
Figure 12. Density surfaces derived from a single, two-dimensional, spring configuration.

The screenshot shows a digital library interface with a 3D density surface visualization of the Middle East region. The interface includes the following components:

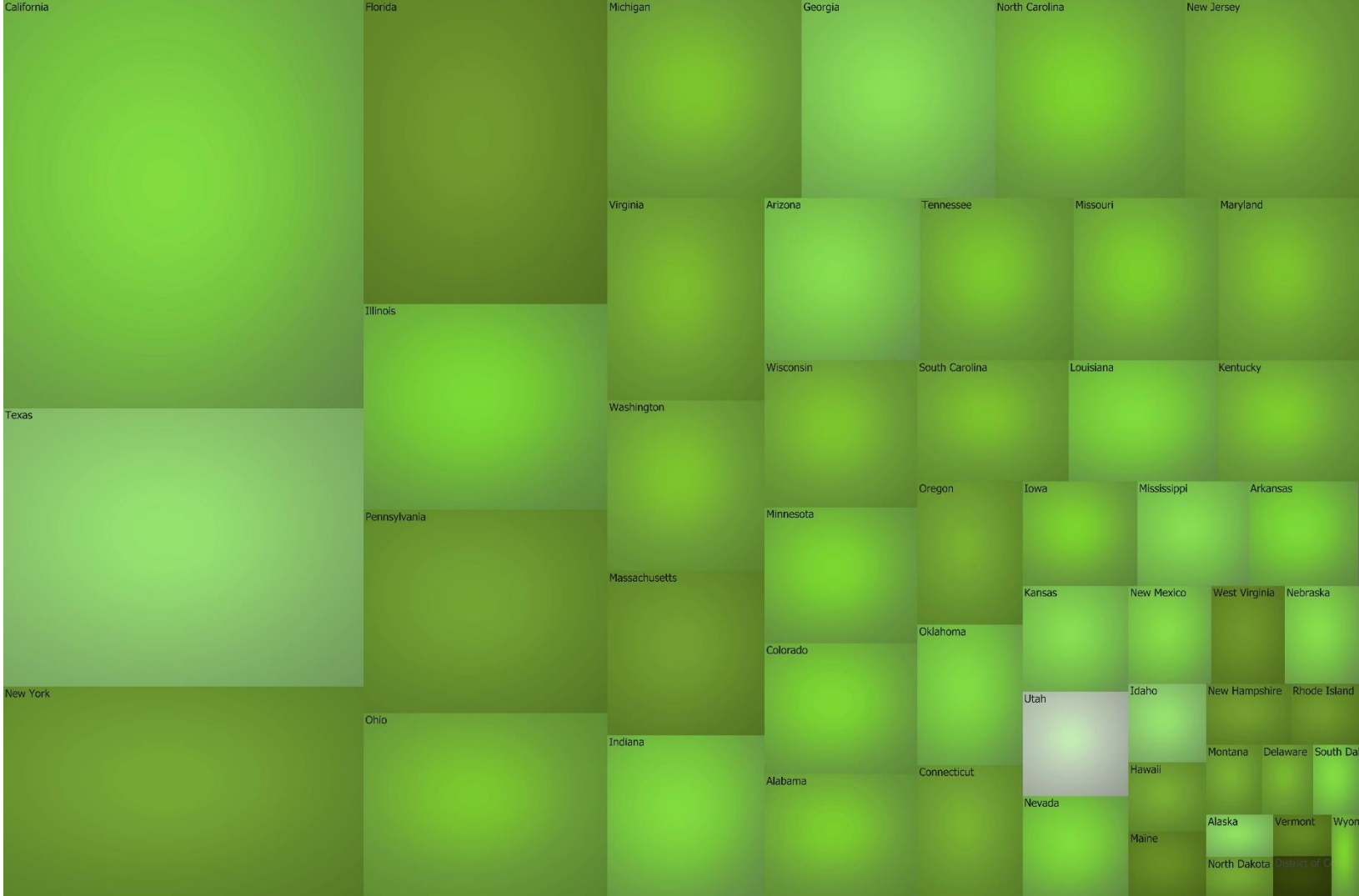
- Top Bar:** A set of navigation icons including a home icon, a search icon, a zoom icon, a pan icon, a hand icon, a zoom in icon, a zoom out icon, and a help icon.
- Left Panel:**
 - Catalog/Gazeteer
 - Map
 - Hierarchy Tree:**
 - aerial
 - orthographic
 - oblique
 - photograph
 - analog
 - digital
 - vector
 - raster
 - carto
 - image
 - sensor
 - type

- Center Panel:** A 3D density surface visualization of the Middle East region. The surface is colored green and yellow, with peaks corresponding to the four regions. Labels are placed on the surface: "Aerial photograph", "Cartographic material", and "Atlases".
- Right Panel:**
- Labels on/off
- 2D/3D View
- Keyword List:**
 - Aerial photograph
 - Aperture cards
 - Art original
 - Art prints
 - Art reproduction
 - Atlases
 - Braille
 - Braille cassettes
 - Cartographic material
 - Charts
 - Chorus scores
 - Close scores
 - Computer cartridges
 - Computer cassettes
 - Computer disks
- Buttons: tag all, sort..., promote
- Bottom Panel:**
- Ending Year: 1800 - 1900 - 1997
- Starting Year: 1800 - 1900 - 1997
- Buttons: Home, Refresh, Previous, Next
- Percent of hits from the whole collection:**
 - Hits [%] 0% 100%
 - Aerial Photograph
 - Cartographic material
 - Atlases
- Buttons: Quit, Submit

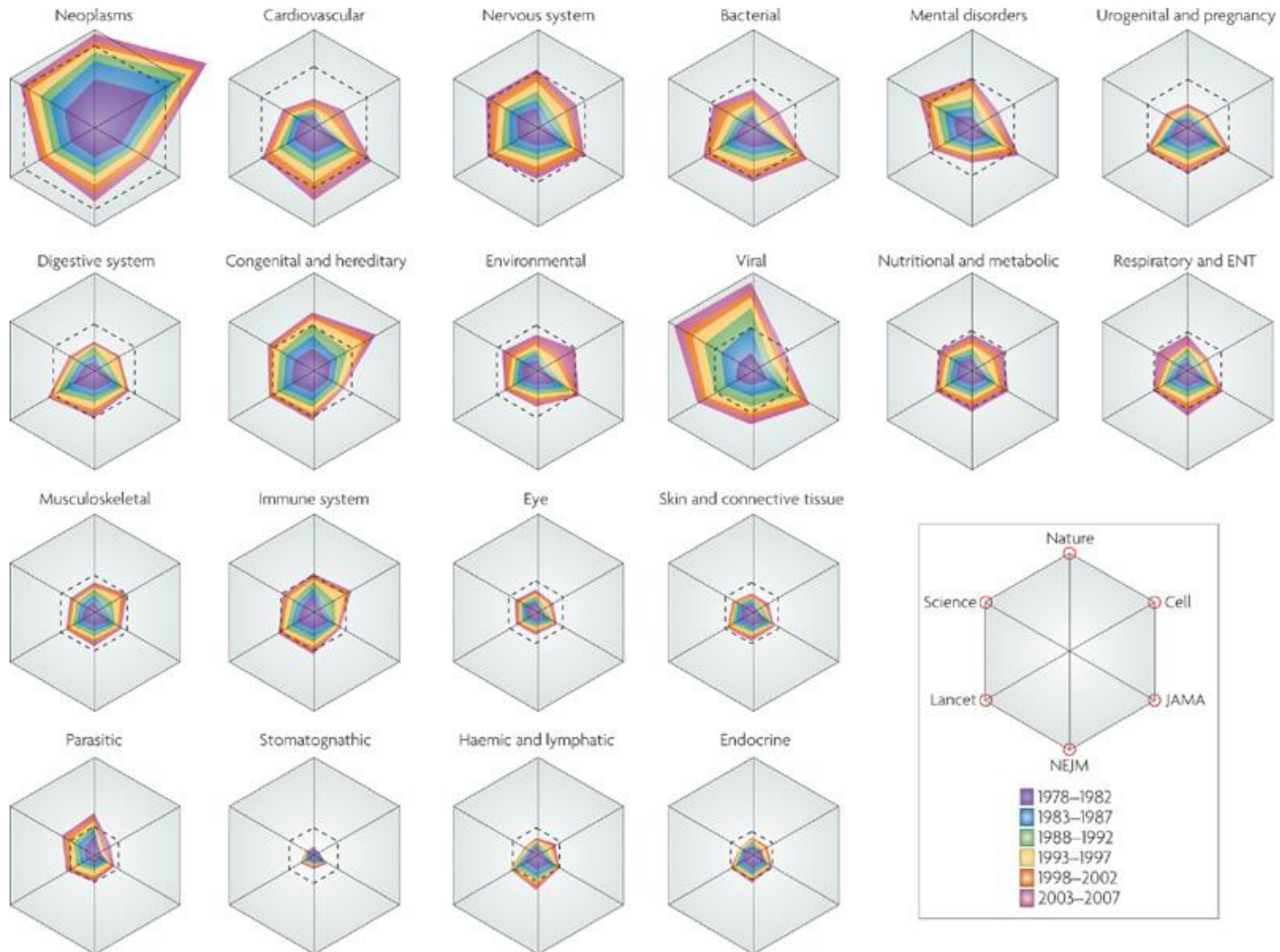
Radar plot: Cyclic time and multivariate



Tree plot: 2011 Census population



Medical research: Papers in 6 major journals, 6 time periods



Timeline

VIDEO GAME timeline

As the world of video games continue to evolve, we take a look back at popular consoles and video games that helped make Nintendo, Sony, and Microsoft the giants they are today



1972
The world's first home video game console, the Magnavox Odyssey, sold 330,000 units in its lifetime



1974
Gran Tron 10, the first racing arcade game, is released. It is the first arcade game to use ROM.



1974
Maze Wars is released. Considered to be the earliest first person shooter.



1977
Nintendo releases Color TV Game 6, packing 6 variations of "Light Tennis" (pong)



1979
Notable Releases: Asteroids, Lunar Lander, Monaco GP, Flight Simulator



1980
Notable Releases: Pac-Man, Missile Command, Defender, Centipede



1981
Notable Releases: Dragon Buster, Galaga, Donkey Kong, Frogger



1983
Nintendo releases the Family Computer console in Japan and is later released in the United States as the Nintendo Entertainment System, 62 million units sold

1984
Notable Releases: Dragon Buster, Tetris, Balloon Fight, Gauntlet, 1942, Paperboy



1986
The Sega Mega Drive (Sega Genesis in the US) is released. Sega's most successful console sold 29 million units

1986
Notable Releases: Altered Beast, Super Mario Bros. 3, Power Pad



1990
Nintendo releases the Super Famicom (SNES), the best-selling console of the 16-bit era sold 49 million units

Other Releases: Neo Geo Game Genre, TurboExpress, Bonk's Adventure, Super Mario World, F-Zero

1993
Notable Releases: Ridge Racer, Star Fox, Virtua Fighter, Artari Jaguar 300



1996
Nintendo releases the N64. The last significant cartridge based home console was released in colors, it sold 33 million units sold

Other Releases: Resident Evil, Crash Bandicoot, Sega Super GT



1994
Notable Releases: Hiller Instinct, Virtua Fighter, Earthworm Jim



2000
Sony releases the PS2, 138 million units sold and is the best selling console to date

Other Releases: Perfect Dark, Chrono Cross, Sines of Arcadia



2001
With their first venture into the video game console market, Microsoft releases the Xbox. 24 million units sold



2004
Sony releases the first handheld console to use an optical disc, the Playstation Portable



2005
Microsoft releases its second console, the Xbox 360

Other Releases: Gran Turismo 4, Guitar Hero



2009
Nintendo releases the Nintendo DSi and Sony releases the PSP Go.

1st Generation



1967
German-born television engineer Ralph Baer and his coworkers design the first video-game console that works on a standard television and dub it "Brown Box". They develop a chase game, allowing players to control two squares chasing each other on the screen. A modified toy gun is made and able to distinguish spots of light on the screen. 12 Other games are made



1972
One of the earliest arcade video games, PONG, is a simple tennis game that became the first commercially successful video game



1976
Atari releases Break-out. The prototype was designed by Apple cofounders Steve Jobs and Steve Wozniak. Blackberry's current variant is called Brick Breaker



1977
Atari opens the first Pizza Time Theatre (later Chuck E. Cheese's), a video arcade pizzeria



1977
Atari releases the Video Game Computer System (Atari 2600 or VCS). It is the most successful video game console of its time



1980
Mattel releases the Intellivision video console, releasing a total of 125 games during its lifetime



1978
Notable Releases: Space Invaders, Space Wars, Bee Gee



1982
Notable Releases: Q-Bert, Iron Megaman, Dig Dug, Pole Position, Joust



1983
Sega Releases the SG-1000 to the Japanese market. Finding only minor success



1985
Nintendo releases the NES in the US. Super Mario Bros. is released and sells 10 million copies before year's end, eventually being the top selling video game until 2008 with 40 million copies sold



1986
Sega releases the Sega Master System as a competitor to the NES



1987
Notable Releases: Megaman, Street Fighter, Metal Gear, Final Lap, Castlevania, Contra, Final Fantasy, Phantasy Star, Mamak Mansion



1991
Notable Releases: Mortal Kombat, Virtua Racing, Kirby's Dream Land, Mario Kart, Air Combat, Philips CD-i

1989
Bundled with Tetris, Nintendo releases the Game Boy and is an instant success, selling 118 million units worldwide

Also Released: Power Glove, TurboGrafx-16, Prince of Persia



1992
Notable Releases: Mortal Kombat, Virtua Racing, Kirby's Dream Land, Mario Kart, Air Combat, Philips CD-i



1995
Notable Releases: Chrono Trigger, Time Crisis

1994
Sony releases the PlayStation Console and is heavily influences the end of the cartridge, 125 million units sold

Other releases: Sega Saturn, Neo Geo CD, Sega 32X



1997
Notable Releases: Goldeneye 007, Final Fantasy 7, Oddworld, Grand Theft Auto, Gran Turismo



1999
Sega releases the Dreamcast. Considered to be ahead of its time and the pioneer of online gaming, the Dreamcast sold 10.6 million units



2001
Nintendo releases the Gameboy Advance. With several different variants and colors, 81 million are sold

Other Releases: Paper Mario, Devil May Cry, Halo



2001
Nintendo releases the Gamecube. Nintendo's first console to use optical discs, 21 million units sold

2002
Notable Releases: SOCOM, Animal Crossing, Kingdom Hearts, Vice City, Splinter Cell, Medal of Honor



2004
Nintendo releases the Nintendo DS sporting a touchscreen and stylus

Other Releases: Fable 2



2006
The Sony Playstation 3 and the Nintendo Wii are released just 8 days apart from each other, both enter the 3 way console war

2nd Generation

3rd Generation

4th Generation

5th Generation

6th Generation

7th Generation

Word clouds and tag maps



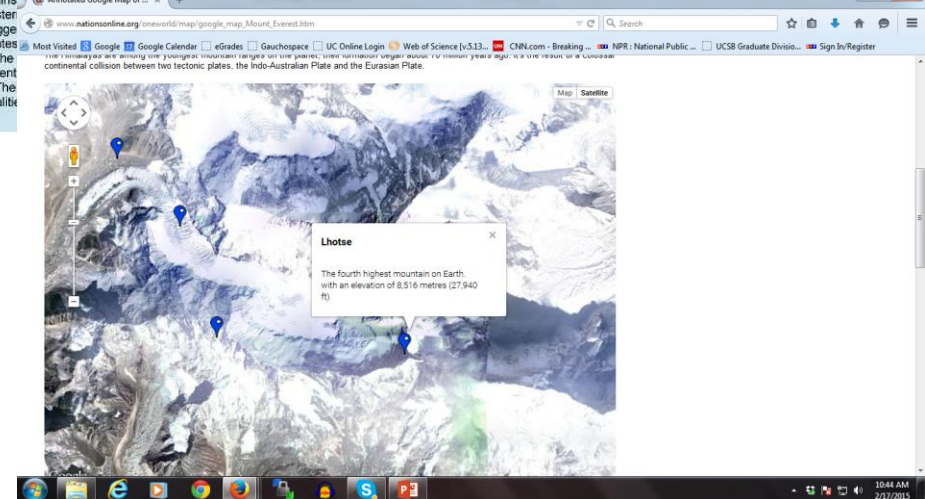
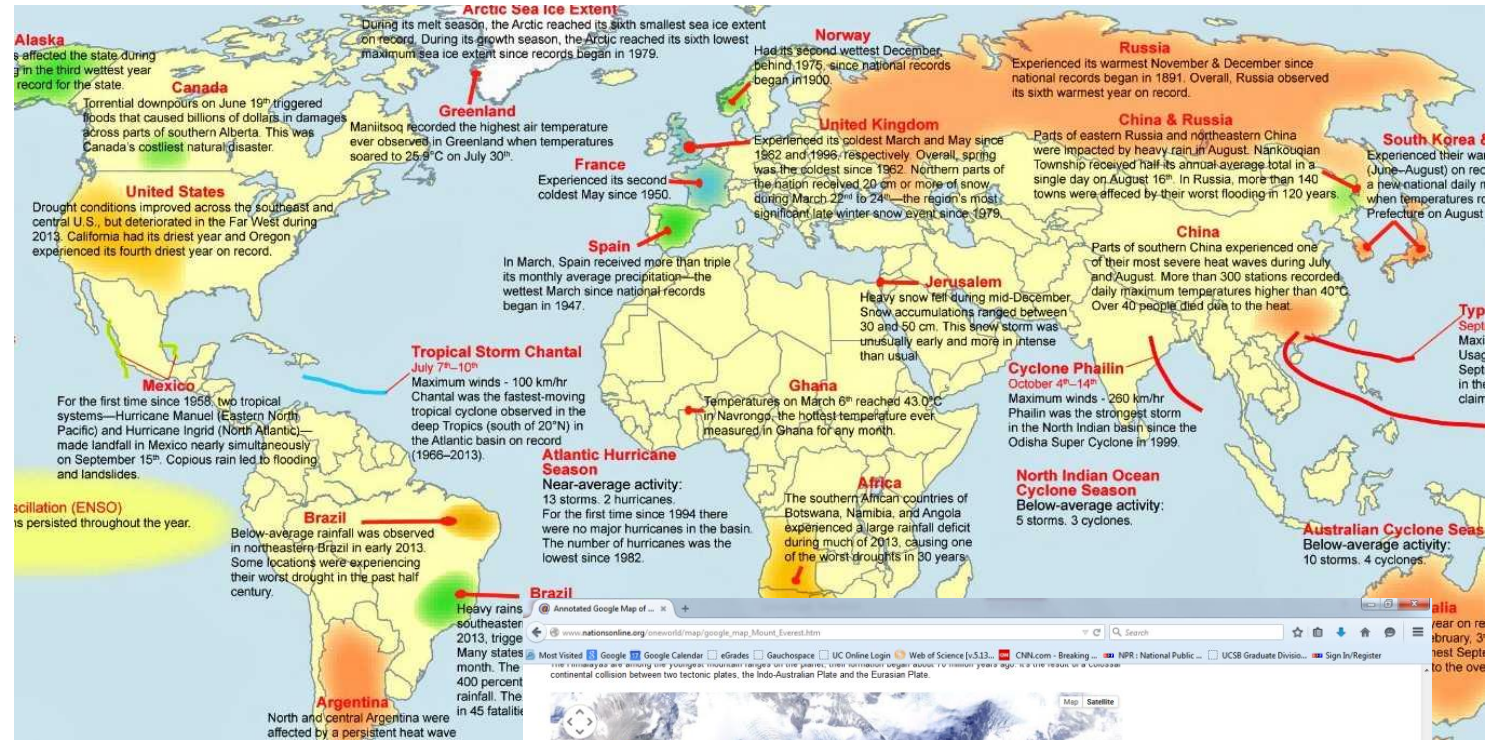
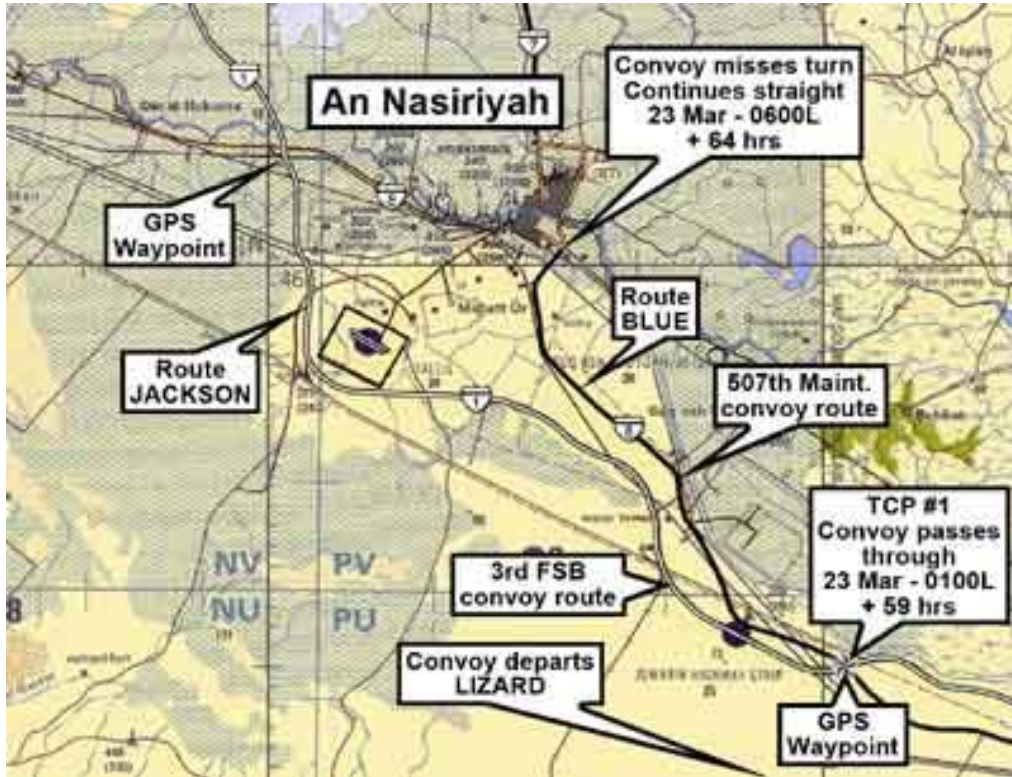
President Barack Obama
Inaugural address, 20 January 2009



SOURCE: wordle.net



Annotated maps



Infographics



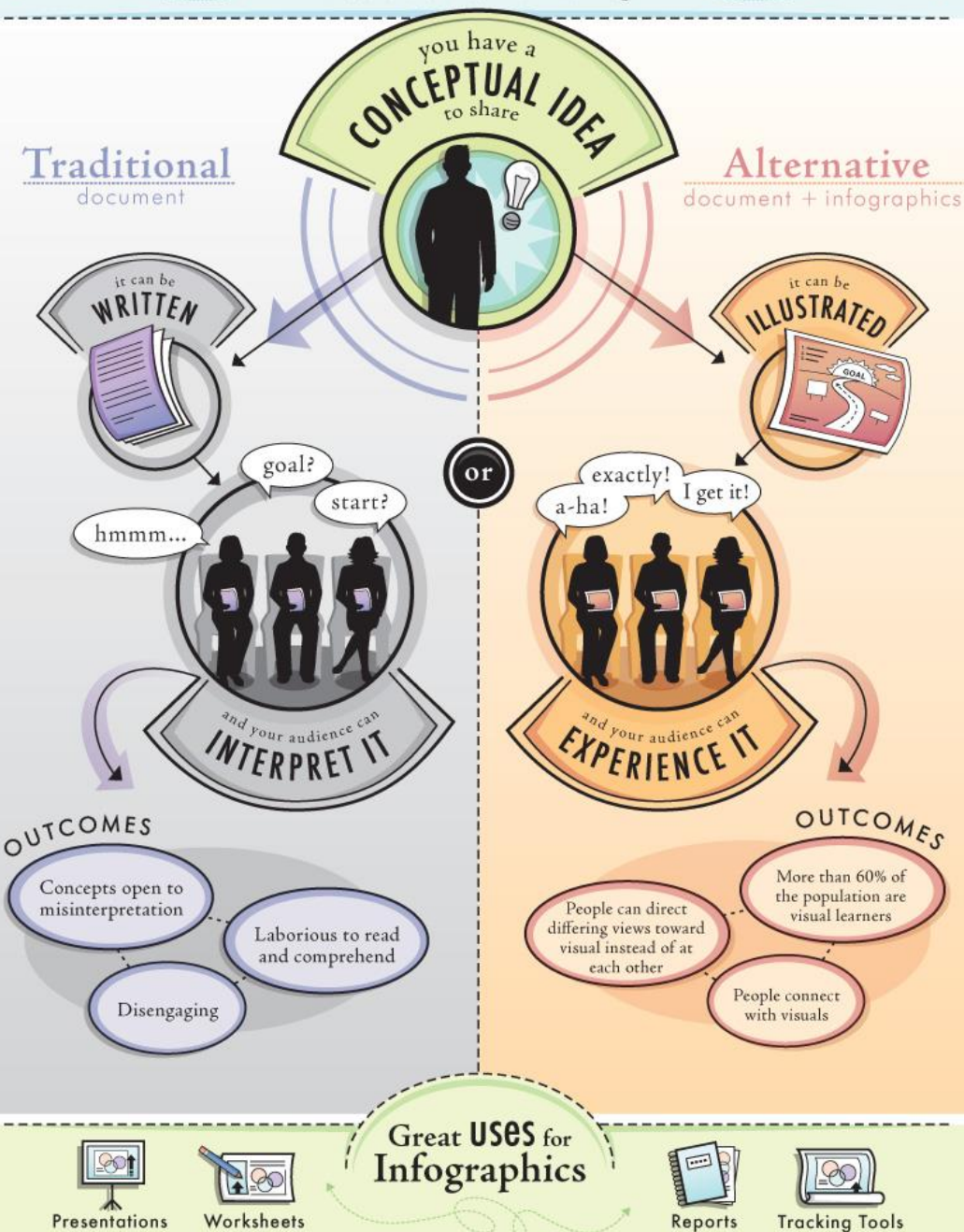
Tips for Creating Academic Posters

Forrest Rose, Instructional Technologist
Oberlin Center for Technologically Enhanced Teaching

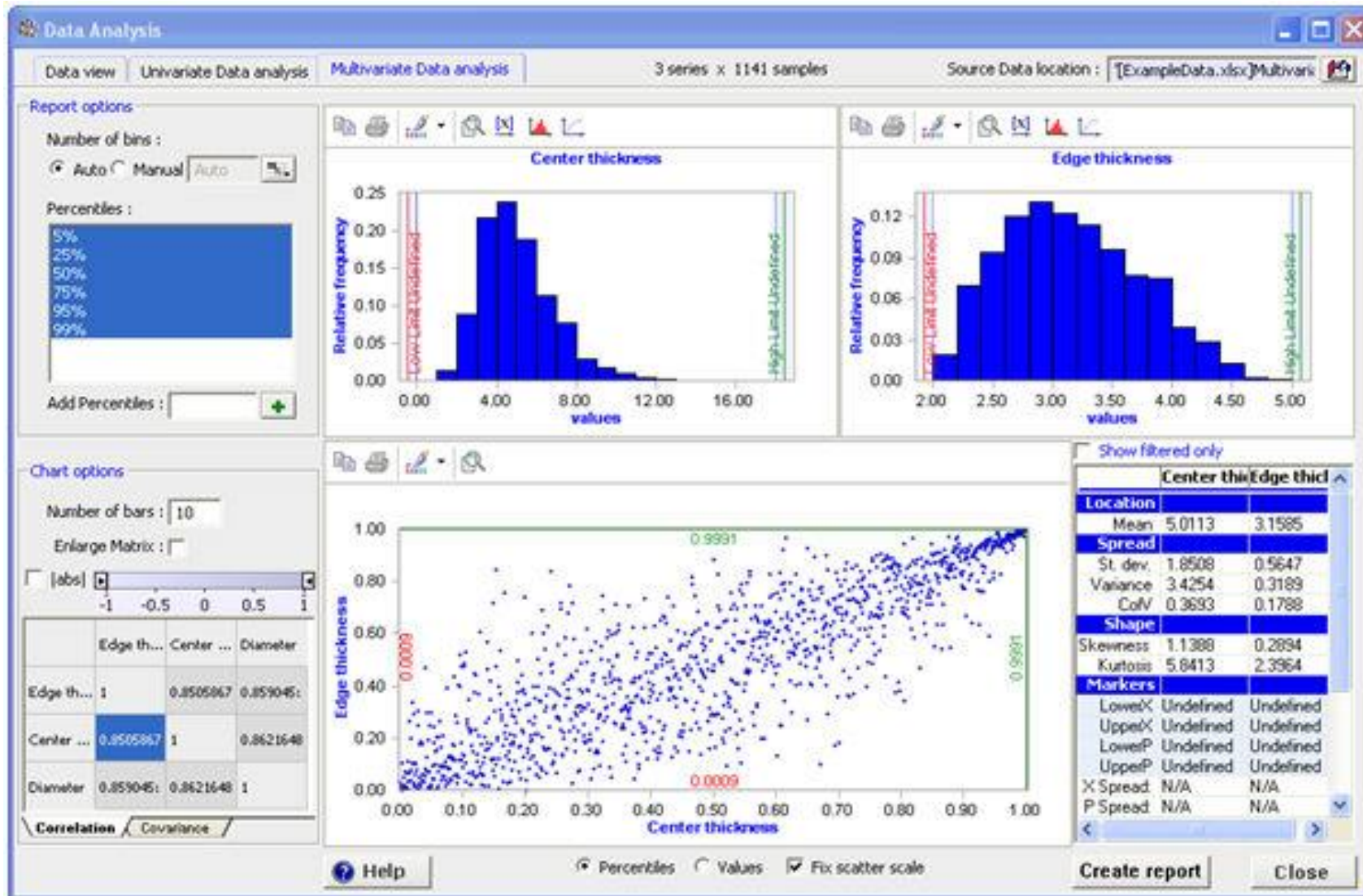
- Introduction**
 - Posters are visual representations of information. A research poster should clearly communicate your research data through the use of images, graphs, and text. Posters should be designed to support the presentation of your research both as a foundation for face-to-face discussions and as a stand-alone resource.
- Sketch it out**
 - Before you begin your poster, sketch your ideas on paper:
 - How many columns?
 - How many rows?
 - Consider images and graphs as you sketch your design.
 - Think about the sequence of your material (you are telling a story—poster should have a logical flow)
 - Good layouts have 35% empty space and 55% graphics
- Sections to include**
 - Consider what sections you need to include (discuss with mentor):
 - Title and author(s) with affiliation(s)
 - Introduction (100 words)
 - Hypothesis
 - Materials & Methods (200 words)
 - Discussion (150 words)
 - Results (150 words)
 - Conclusions (200 words)
 - References (10 citations)
 - Acknowledgements (40 words)
 - Contact info (20 words)
- Collect Materials**
 - Images**
 - Avoid pixelated images—use high resolution images. Printed images should have minimum 300 dpi.
 - Images used as backgrounds can cause problems with the printing process.
 - Add titles & captions to your graphs and images.
 - Tables**
 - Tablets (TIP):*
 - Tables should be used for data too complicated to be presented in text.
 - Data that show no significant differences can be summarized in text, without showing all the data.
 - Codes and nonessential numbers should not appear in tables.
 - Formatting**
 - Use 1 slide in PowerPoint. Set the slide size first (PPT-file menu>page setup>45" x 34").
 - Clarity and readability are important components to an effective poster. Be consistent.
 - The poster should flow. Use arrows, numbers or letters to aid viewer.
 - Use blank space. Do not fill every space or gap—leave some areas blank so that the audience can stay focused on individual sections.
 - Avoid using templates from the web. You may not realize there is a problem until you send it to be printed.
 - Text boxes should be aligned and uniform.
 - Avoid blocks of text longer than 10 sentences; instead, intersperse text with graphs and images.
 - Color**
 - 2-3 fonts. Keep it simple and consistent.
 - 90/60/30 text rule**
 - 90 pt font = title size
 - 60 pt font = subheading size
 - 30 pt font = body size
 - Use bold or italic styles to emphasize.
 - Avoid using all caps AS IT IS DIFFICULT TO READ.
 - Use bulleted lists instead of sentences and paragraphs.
 - Text should be left-justified.
 - Serif fonts are easier to read for body text.
 - Text**
 - Colors should highlight or emphasize content or separate and define sections.
 - Use 2-3 colors at most.
 - Avoid dark backgrounds.
 - Use images or graphs to determine color scheme of poster (don't let them clash).
 - Is this easy to see? Is this hard to see?*
- Points to Consider**
 - If you have more information to share, create a handout or a poster summary.
 - Avoid using jargon—consider your audience.
 - Aim for 800-1000 words (PDF-file menu>properties>statistics).
- Review**
 - Read, reread, & reread.
 - Edit to remove extraneous text.
 - Have a friend proof the poster.
 - Use the spellcheck feature (Tools/Spelling).
 - Check grammar & punctuation.
 - Ask your mentor to review poster.
- Bibliography**
 - Tufo, E. R. (2003). The visual display of quantitative information (2nd ed.). Cheshire, Conn.: Graphics Press.
 - Vallia, I. (2001). Doing science: Design, analysis, and communication of scientific research. Oxford: New York Oxford University Press.
- Additional Resources**
 - NSF Video and Poster competition <http://www.nsf.gov/monitoring/competitions/poster/>
 - Designing posters
 - Poster Perfect
 - Scientific Poster Tutorial <http://www.cmu.edu/academic/teaching/poster/>
 - Graphs
 - Tips for creating poster presentations <http://www.oxfordjournals.org/doi/pdf/10.1093/acprof:oso/9780195323222/chapter-22>
 - Making a poster using PowerPoint <http://www.oxfordjournals.org/doi/pdf/10.1093/acprof:oso/9780195323222/chapter-22>

Why Infographics

accelerate decision making

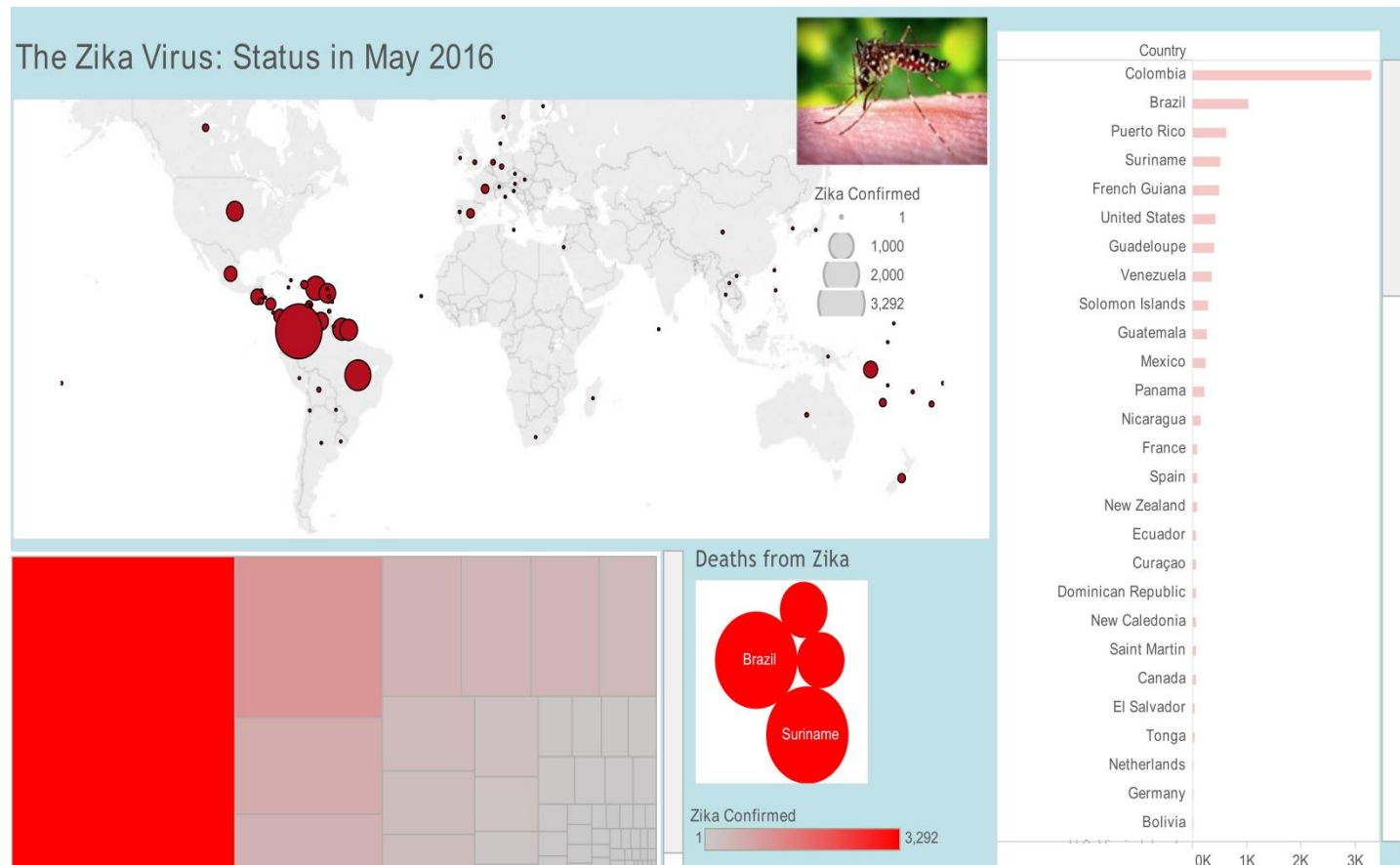


Multiple views and Linking



Example:

https://public.tableau.com/profile/keith.clarke#!/vizhome/ZikaVirus_0/TheStatusofZikaVirusMay2016



Brushing: loc.alize.us

The screenshot shows a web browser window with the URL `https://loc.alize.us/#/tag:cartography/geo:12.897489,-147.656250,2,/`. The browser's address bar and search bar are visible. The website's header includes the logo "loc.alize.us" and navigation links like "Add to del.icio.us" and "Digg this". A sidebar on the left contains tabs for "Create", "Explore", "Share", and "About". Under the "People" section, there is a search bar and a tag "cartography" with a list of related terms such as "2011 book books", "california", "cloud conference", "conventioncenter data", "epc epcps esri event geo", "geocity geocountrys geostate gis mapping maps old ottoman palm palmsprings partnerconference place python saturday springs usa". Below this is a "Photos" section with a grid of image thumbnails and a "Sort by: date interestingness" option. The main content area is a satellite map of the world with several blue location pins and a red arrow pointing to a specific location in the North Atlantic. The bottom of the browser window shows the Windows taskbar with various application icons and the system clock displaying "11:03 AM 2/17/2015".

Accessing content

The screenshot shows a web browser window with the address bar displaying `https://loc.alize.us/#/tag:cartography/geo:12.897489,-147.656250,2,/`. The page title is "loc.alize.us - Tag: cartogra...". The browser's address bar includes a search field and navigation icons. Below the address bar, there is a navigation bar with links for "Most Visited", "Google", "Google Calendar", "eGrades", "Gauchospace", "UC Online Login", "Web of Science [v.5.13...]", "CNN.com - Breaking ...", "NPR : National Public ...", "UCSB Graduate Divisio...", and "Sign In/Register".

The main content area features a map of the world with a red overlay of Djibouti. A pop-up window titled "Worldmapper Gridded Population Cartograms" is displayed over the map, showing a detailed red cartogram of Djibouti. The cartogram is labeled "Djibouti" in the center. Below the cartogram, the following information is provided:

Worldmapper.org: "Djibouti Population Cartogram"
Tags: [map](#) [cartography](#) [atlas](#) [population](#) [djibouti](#) [cartogram](#)
Date: 2011-01-01 00:00:00
License: [Attribution-NonCommercial-NoDerivs](#)
Geo: East: 42.590275, North: 11.825138 (zoom)

At the bottom right of the pop-up window, there is a link: [View on Flickr page](#).

On the left side of the page, there is a sidebar with the following sections:

- loc.alize.us** with links for "Add to del.icio.us" and "Digg this".
- Find your place!**
- Create** | **Explore** | **Share** | **About**
- People** | Search
- Find your buddy to display only his/her photos.
- Tag: cartography** | Search | Show all
- 2011 book books california cartography cloud conference conventioncenter data epc epcps esri event geo geocity geocountrys geostate gis mapping maps old ottoman palm palmsprings partnerconference place python saturday springs usa
- Photos** | Sort by: date | interestingness
- A grid of photo thumbnails.
- 3600 photos | << Page 1 / 20+ >>

The bottom of the browser window shows the Windows taskbar with various application icons and the system tray displaying the time as 11:04 AM on 2/17/2015.

Locr.com

The screenshot displays the Locr.com website interface. At the top, the browser address bar shows www.locr.com/map. The navigation bar includes the Locr logo with the tagline "locate your photos" and icons for Map, Photos, Albums, Groups, My Place, and Help. A search bar is located on the right side of the navigation bar. Below the navigation bar, the page title is "Places : Public Photos". A search address bar is present, and the text "Photos: 1 - 25 [Next]" is displayed. The main content area features a world map with several orange location pins. To the right of the map is a grid of 16 public photos. The bottom of the screen shows the Windows taskbar with various application icons and the system clock displaying 11:09 AM on 2/17/2015.

www.locr.com/photo_detail.php?id=7548&ref=33&index=0&latitude_min=-85&latitude_max=85&longitude_min=-180&longitude_max=180

iNaturalist.com

The screenshot shows the iNaturalist website interface. At the top, there are browser tabs for "Observations - iNaturalist", "Zika Virus Status: May 20", and "Keith Clarke - Achievements". The address bar shows the URL: www.inaturalist.org/observations?nelat=-33.25017290209389&nelng=25.675048828125&place_id=any&swlat=-35.73982452242507&swlng=18.2977294921875. The navigation bar includes "iNaturalist.org" and menu items: "Observations", "Species", "Projects", "Places", "Guides", "People", and "Log in or Sign up".

The main content area is titled "Observations" and features a search bar with "Species" and "Location" input fields, a "Go" button, and a "Filters" button. Below the search bar, a summary bar displays statistics: "3,051 OBSERVATIONS", "1,069 SPECIES", "228 IDENTIFIERS", and "161 OBSERVERS".

The central part of the page is a map showing observation points. A "Bounding Box" is highlighted in the top left of the map area. The map includes controls for "Map", "Grid", "List", and "Places of Interest". A specific observation is highlighted with a callout box:

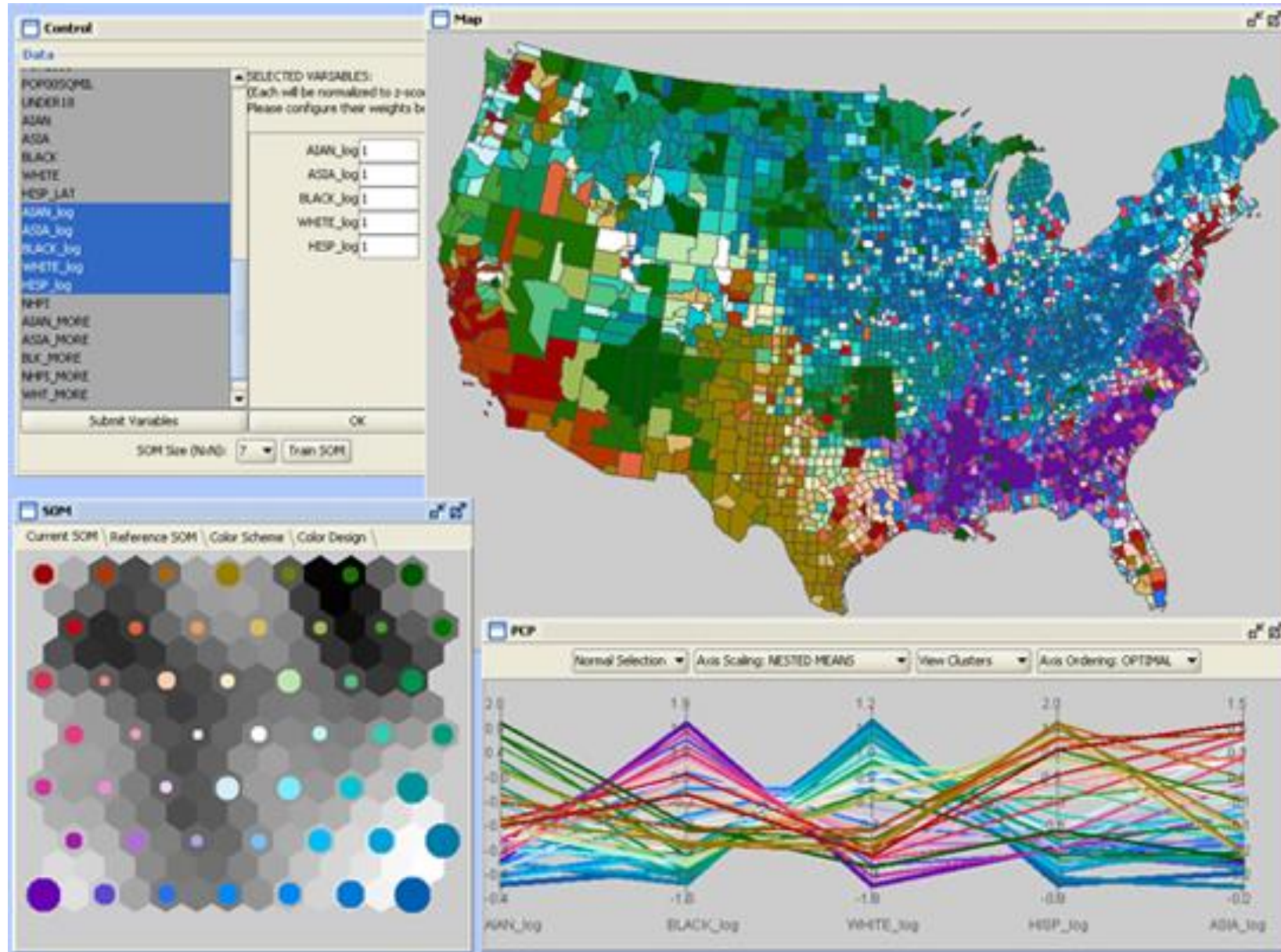
- Purple Heron** (*Ardea purpurea*)
- Overberg DC, South... • Apr 17, 2014
- Research Grade
- 2
- 4mo

On the right side, a list of recent observations is shown:

- Omomantis zebrata** (Constantia, Cape T... • May 27, 2015) 3d
- Flowering plants** (Phylum Magnoliophyta) (7690, Franschhoek,... • Mar 9, 2017) 3d
- Proteas** (Family Proteaceae) (7690, Franschhoek,... • Mar 9, 2017) 3d
- African Daisies** (Genus *Osteospermum*) (R45, Franschhoek,... • Mar 9, 2017) 3d

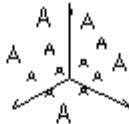
The Windows taskbar at the bottom shows the time as 9:00 AM on 5/24/2017.

Including map views (SOMVIZ)



Sound mapping

LOCATION: The location of a sound



Possible
Effective

Effective

LOUDNESS: The magnitude of a sound



Not
Effective

Effective

PITCH: The highness or lowness



Not
Effective

Effective

REGISTER: The relative location of a pitch in a given range of pitches



Not
Effective

Effective

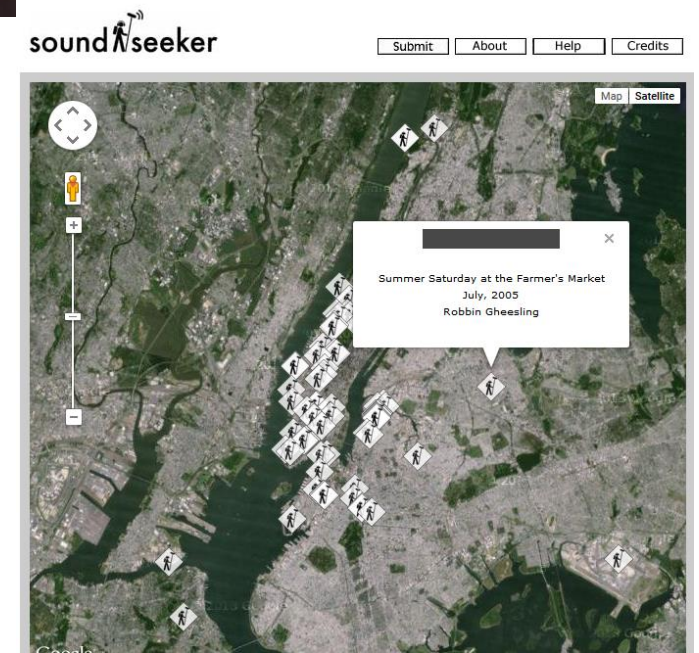
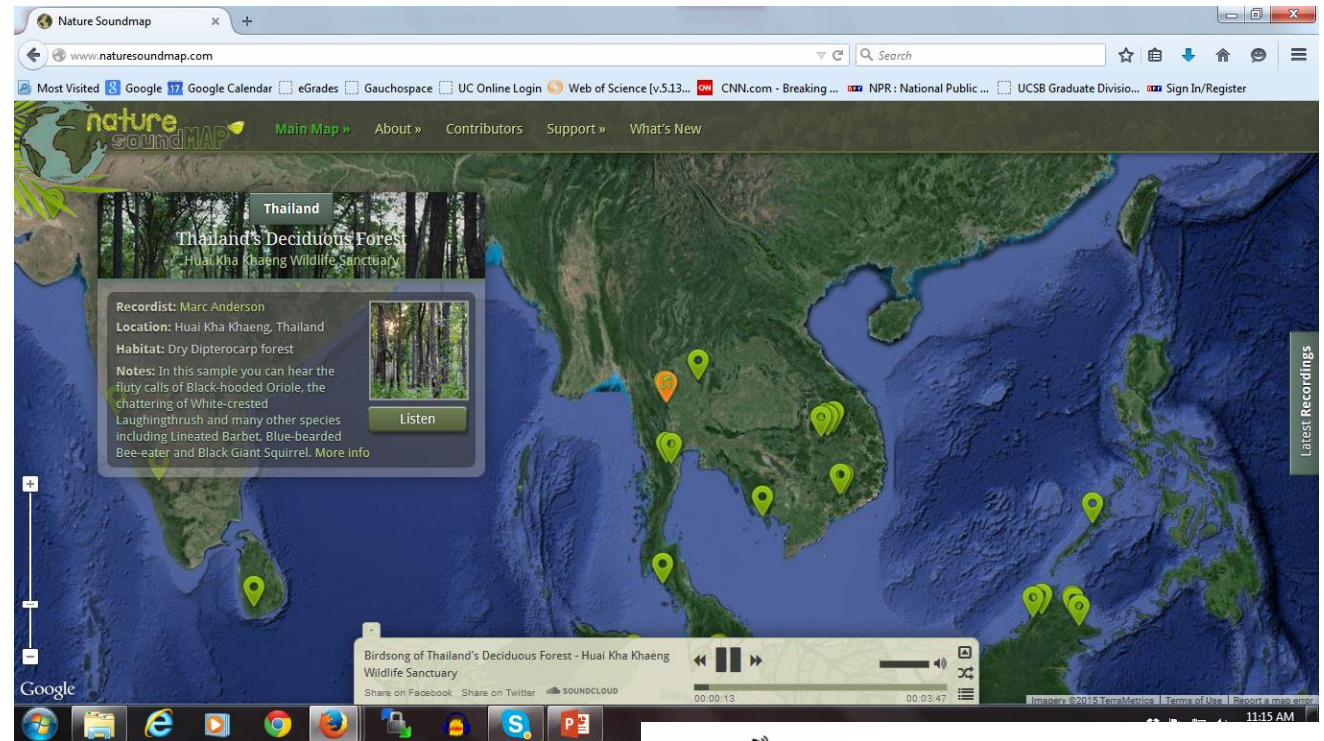
TIMBRE: The general prevailing quality or characteristic of a sound



Effective

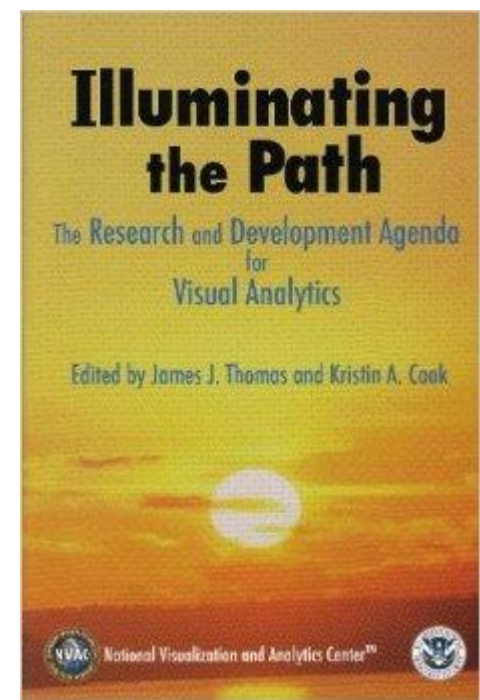
Not
Effective

<http://www.soundseeker.org/>



Visual Analytics

- "the science of analytical reasoning facilitated by interactive visual interfaces."
- James J. Thomas and Kristin A. Cook (Ed.) (2005). *Illuminating the Path: The R&D Agenda for Visual Analytics* National Visualization and Analytics Center. p.4.
- Theories of visualization include:[\[3\]](#)
 - Jacques Bertin's *Semiology of Graphics* (1967)
 - Nelson Goodman's *Languages of Art* (1977)
 - Jock D. Mackinlay's *Automated design of optimal visualization (APT)* (1986)
 - Leland Wilkinson's *Grammar of Graphics* (1998)



What is visual analytics?

- Integrates new computational and theory-based tools with innovative interactive techniques and visual representations to enable human-information discourse
- Design of the tools and techniques is based on cognitive, design, and perceptual principles
- Form of reasoning: basis in visual (and spatial) thinking and reasoning
- Provides the reasoning framework upon which one can build both strategic and tactical visual analytics technologies for threat analysis, prevention, and response
- Central to the analyst's task of applying human judgments to reach conclusions from a combination of evidence and assumptions

Some software & resources

- Tableau
- VisMaster Visual Analytics – Mastering the Information Age
- VIS-SENSE Visual Analytic Representation of Large datasets for Enhancing Network Security
- SPP - Scalable Visual Analytics
- <http://infoviz.org/>
- Visual Analytics Digital Library (VADL)
- GeoAnalytics.net - GeoSpatial Visual Analytics, ICA Commission on GeoVizualisation
- flowingdata.com, visualization and statistics blog
- Quadrigram, a visual programming language for visual analytics
- R-studio, R-Shiny
- Most statistical analysis packages: SAS, MATLAB etc.

Infoviz.org

The screenshot shows a web browser window displaying the Infoviz.org website. The browser's address bar shows the URL `infoviz.org/examples/index.html`. The website features a navigation menu with links for [Controls](#), [Builder](#), [Documentation](#), [Examples](#) (highlighted), [History](#), [Downloads](#), and [License](#). Social media and GitHub statistics are shown as `Star 207` and `Fork 37`, with buttons for `build` and `unknown`. A diagonal banner on the right side says "Fork me on GitHub".

The main content area is titled "AxisChart" and displays a grid of six different chart types: a line chart with multiple colored lines, a grouped bar chart, a bubble chart with labeled circles (e.g., "United States", "Finland", "Belize", "Cape Verde", "Poland", "Hungary"), a stacked bar chart, a grouped bar chart with error bars, and a stacked area chart.

Below the "AxisChart" section is a section titled "Round Stuff" which displays a grid of four different circular or radial visualizations: a pie chart, a network graph, a sunburst chart with labels like "Haiti", "Gorgia", "Nambis", "Peru", and "China", and a circular bar chart.

The Windows taskbar at the bottom shows the system tray with the date and time "9:08 AM 5/24/2017" and the user name "Song Guo (UC19)".

Study by Sandia National Labs

Open Source software for Visual Analytics

Table 1. Comparison of Visualization Functionality (Graphs)

	Circular	Radial	Force Directed	Hierarchical	Adjacency Matrix
Axiis					
birdeye	✓	✓ ³²		✓ ³³	
Flare	✓	✓	✓ ^{20, 34}		
Gephi	✓	✓	✓ ³⁴⁻³⁶		
Google Vis					
GraphViz	✓ ³⁷	✓ ³⁸	✓ ^{34, 39}	✓ ⁴⁰	
Improvise ^a	✓	✓ ³²	✓ ^{20, 34}		
IVTK	✓		✓ ^{34, 41}		✓
JIT		✓	✓		
JFreeChart					
JGraph	✓		✓ ⁴²	✓ ⁴⁰	
JUNG	✓		✓ ^{34, 39}		
NetworkX ^b	✓		✓ ³⁴		
Prefuse	✓	✓ ³²	✓ ^{20, 34}		
Protovis			✓ ^{20, 34}	✓ ³³	✓
R					
Titan	✓		✓ ³⁴		
Tulip	✓		✓ ⁴³	✓ ³³	
VisAD					
WilmaScope ^b			✓		
Zest ^b		✓	✓		

^a Uses Prefuse for visualization

^b Also supports using external tool(s) (such as GraphViz) for layouts

Table 2. Comparison of Visualization Functionality (Trees)

	Tree	Radial	Balloon	Tree Map	Icicle
Axiis					
birdeye	✓ ³³	✓ ³²		✓	
Flare	✓ ³³	✓ ³²		✓ ⁴⁴	✓
Gephi		✓			
Google Vis				✓	
GraphViz	✓ ⁴⁰	✓ ³⁸			
Improvise ^a	✓ ³³	✓ ³²	✓ ⁴⁵	✓ ⁴⁴	
IVTK	✓ ⁴⁶	✓		✓	✓
JIT	✓	✓		✓	✓
JFreeChart					
JGraph	✓ ⁴⁰				
JUNG	✓	✓	✓		
NetworkX ^b					
Prefuse	✓ ³³	✓ ³²	✓ ⁴⁵	✓ ⁴⁴	
Protovis	✓ ³³	✓ ³³		✓ ⁴⁴	✓
R					
Titan	✓	✓		✓ ⁴⁴	
Tulip	✓ ^{33, 46}	✓	✓ ⁴⁵	✓ ⁴⁴	
VisAD					
WilmaScope ^b					
Zest ^b	✓	✓			

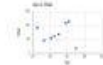



^a Uses Prefuse for visualization

^b Also supports using external tools (such as GraphViz) for layouts

Comparison of Open Source Visual Analytics Toolkits








John R. Hagera, and Patricia J. Crossnoa *Proceedings of the SPIE Conference on Visualization and Data Analysis, 2012*

Table 3. Comparison of Visualization Functionality (Tabular Data)

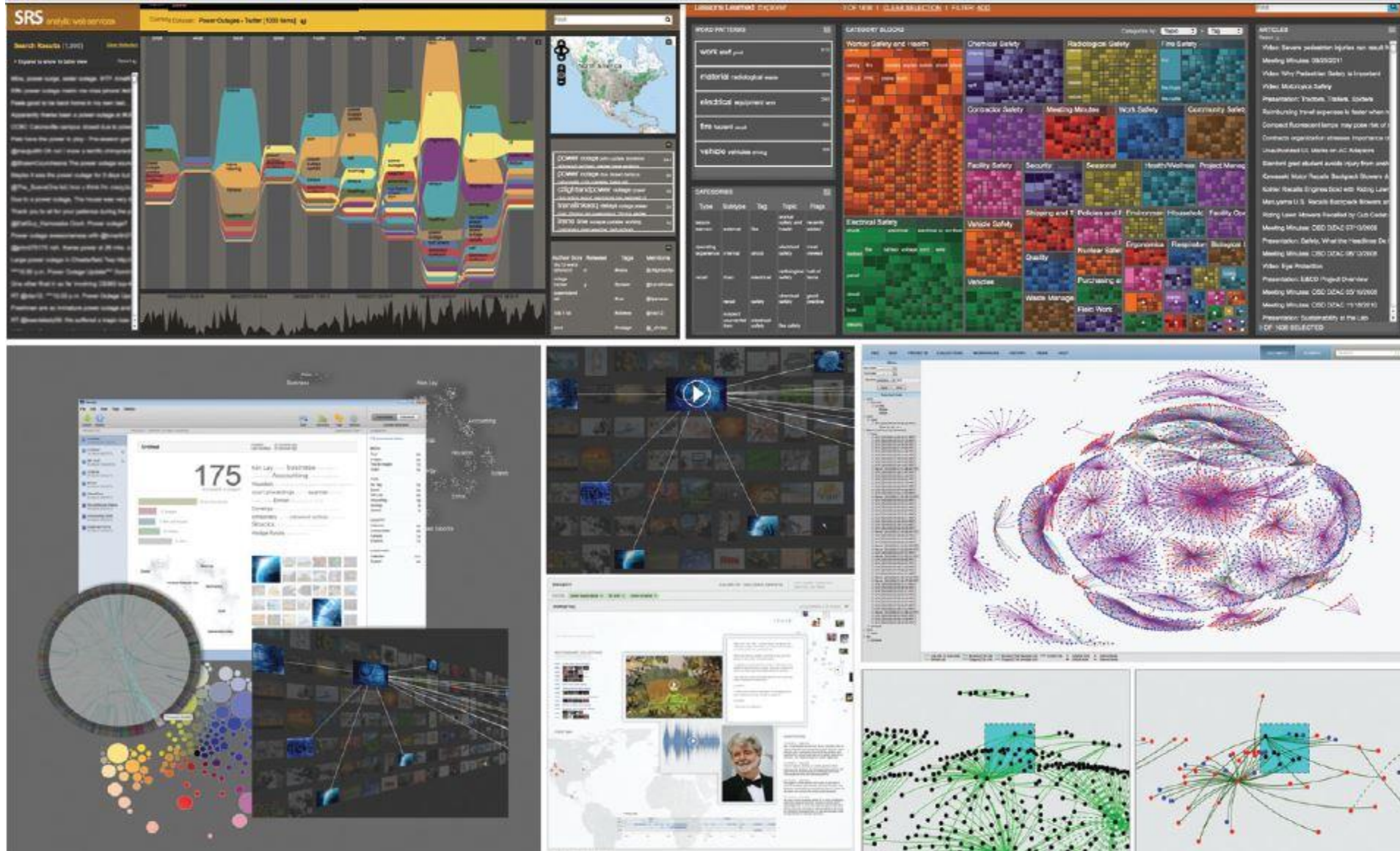
	Bar Chart	Line Chart	Scatterplot	Box Plot	Pie Chart	Contour Plot	Stacked Bar Chart	Stacked Area Chart	Parallel Coordinates
									
Axiis	✓	✓	✓		✓		✓	✓	
birdeye	✓	✓	✓		✓		✓	✓	
Flare	✓	✓	✓					✓	
Gephi									
Google Vis	✓	✓	✓	✓	✓		✓	✓	✓
GraphViz									
Improvise ^a	✓	✓	✓					✓	
IVTK	✓	✓	✓						✓
JIT							✓	✓	
JFreeChart	✓	✓	✓	✓	✓		✓	✓	
JGraph									
JUNG									
NetworkX									
Prefuse	✓	✓	✓					✓	
Protovis	✓	✓	✓	✓	✓		✓	✓	✓
R	✓	✓	✓	✓	✓	✓	✓		
Titan	✓	✓	✓		✓				✓
Tulip			✓						✓
VisAD		✓	✓			✓			
WilmaScope									
Zest									

^a Uses Prefuse for visualization

Table 4. Comparison of Visualization Functionality (Geospatial/Spatio-temporal Data)

	Map Overlays	Choropleth Maps	Graduated Symbol Maps	Map Projections	Dymaxion Maps	Cartograms	3D Globe
							
Axiis							
birdeye	✓	✓	✓	✓			
Flare							
Gephi							
Google Vis	✓	✓	✓				✓
GraphViz							
Improvise							
IVTK							
JIT							
JFreeChart							
JGraph							
JUNG							
NetworkX							
Prefuse							
Protovis	✓	✓	✓	✓	✓	✓	
R							
Titan							✓
Tulip							
VisAD							
WilmaScope							
Zest							

Information Visualization & Visual Analytics, Pacific Northwest National Laboratory



Penn State GeoVista Studio

The screenshot shows a web browser window with the URL www.geovistastudio.psu.edu/jsp/index.jsp. The page features the Penn State logo and the 'GeoVISTA Studio' title in large, stylized green and white text. Below the title, there are several navigation tabs: Overview, Architecture, Examples, Manual/Tutorial, Publications, Team Members, Support, and User List. The 'Overview' section contains a paragraph describing GeoVISTA Studio as an open software development environment for geospatial data. The 'Architecture' section includes a diagram of a modular interface. The 'Examples' section shows a 3D visualization of a geographic area. The 'Manual/Tutorial' section provides links to a 'User's Guide' and 'Tutorials'. The 'User List' section mentions that the software is supported by Java Profiler, YourKit, and other tools.

The screenshot displays the GeoVISTA Studio software interface. At the top, there is a menu bar with options: File, Edit, View, Services, Palette, Property, Preference, Help. Below the menu bar, there are several toolbars and panels. The 'System' toolbar includes buttons for 'OK', 'Cancel', 'Next', and 'Close'. The 'Studio DesignBox' panel shows a 'Map2D' view with a 'Message Area'. The main window displays a 3D visualization of a geographic area, likely a map of the United States, with a color-coded grid overlay. To the right of the main window, there is a '3D View' panel showing a 3D perspective of the data, with axes labeled 'DIANRENT', 'UNITS_1DET', and 'UNITS_1ATT'. The 3D view shows a grid of data points with varying heights and colors, ranging from blue to red. The interface also includes a 'Map' toolbar with navigation controls and a 'Preferences' dialog box.

ESRI Story Maps

The screenshot displays the ESRI Story Maps Gallery interface. At the top, the browser address bar shows the URL <https://storymaps.arcgis.com/en/gallery/#s=0>. The main content area features a grid of story map thumbnails. On the left, a sidebar contains a search bar labeled "Search Story Maps Gallery" and a "Show Me" section with the "All" filter selected. Below this, the "Story Map App" section lists various app types: Basic, Cascade, Crowdsourcing, Map Journal, Map Series (with sub-options for Bulleted, Side Accordion, and Tabbed), Map Tour, Shortlist, and Swipe and Spyglass. The grid of thumbnails includes:

- Combating Homelessness in Los Angeles Cour** by Lauren2_Pro
- Paisajes de otro mundo en España** by Sergio Domenech Zueco, Esri Spain
- River of Resilience: Part 7** by Krista Schlyer
- Sending a Convincing Message** by Andy Mitchell and Lauren Griffin, Esri
- Sul cammino del Rinascimento** by l'Ecole Internationale Provence-Alpes-Côte
- Julie's Improbable Flight** by John Nelson, Esri

The bottom of the screen shows a Windows taskbar with various application icons and a system tray displaying the time as 9:50 AM on 5/21/2018.

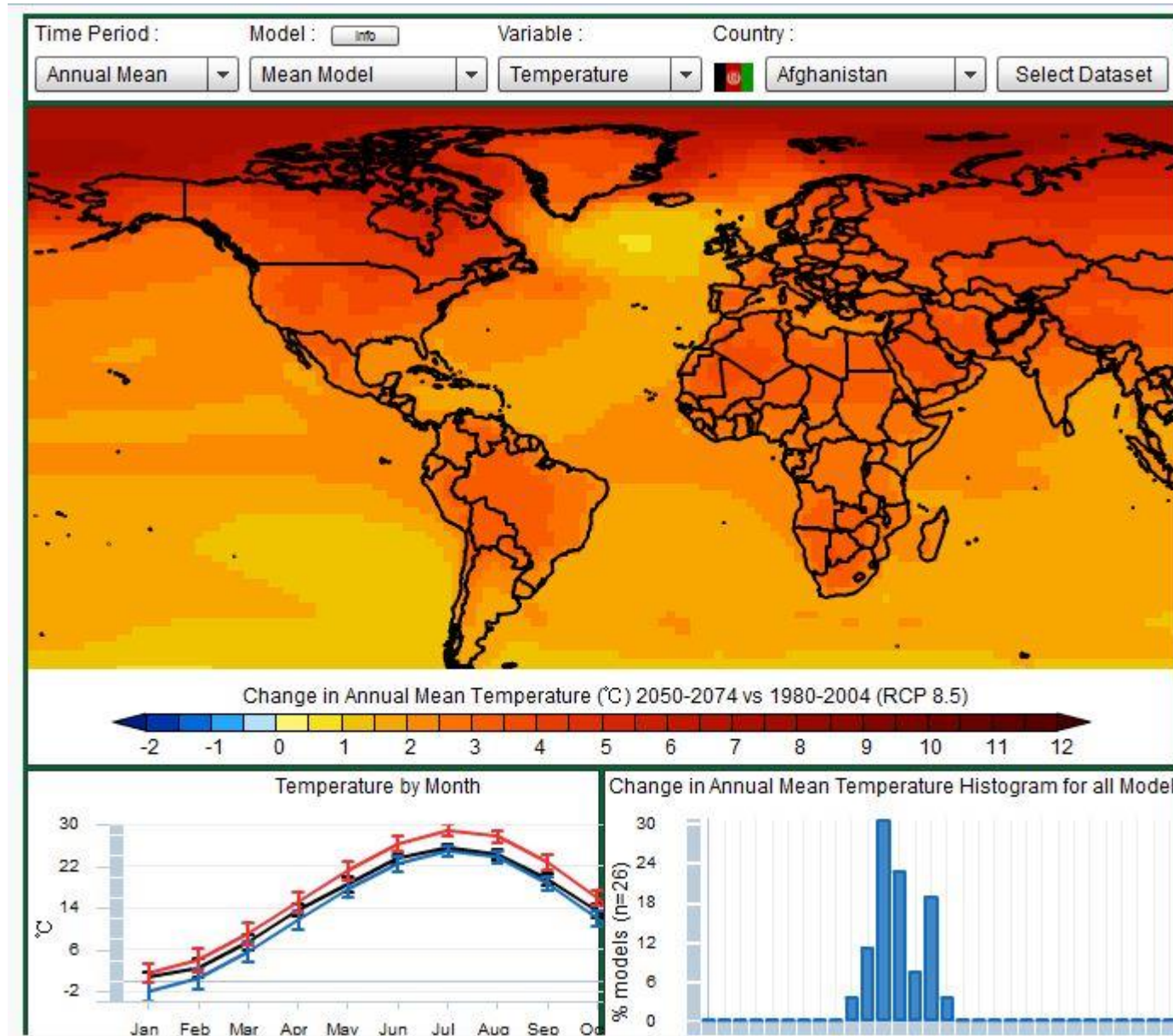
Hip Hop interactive story map

Geography of Hip-Hop

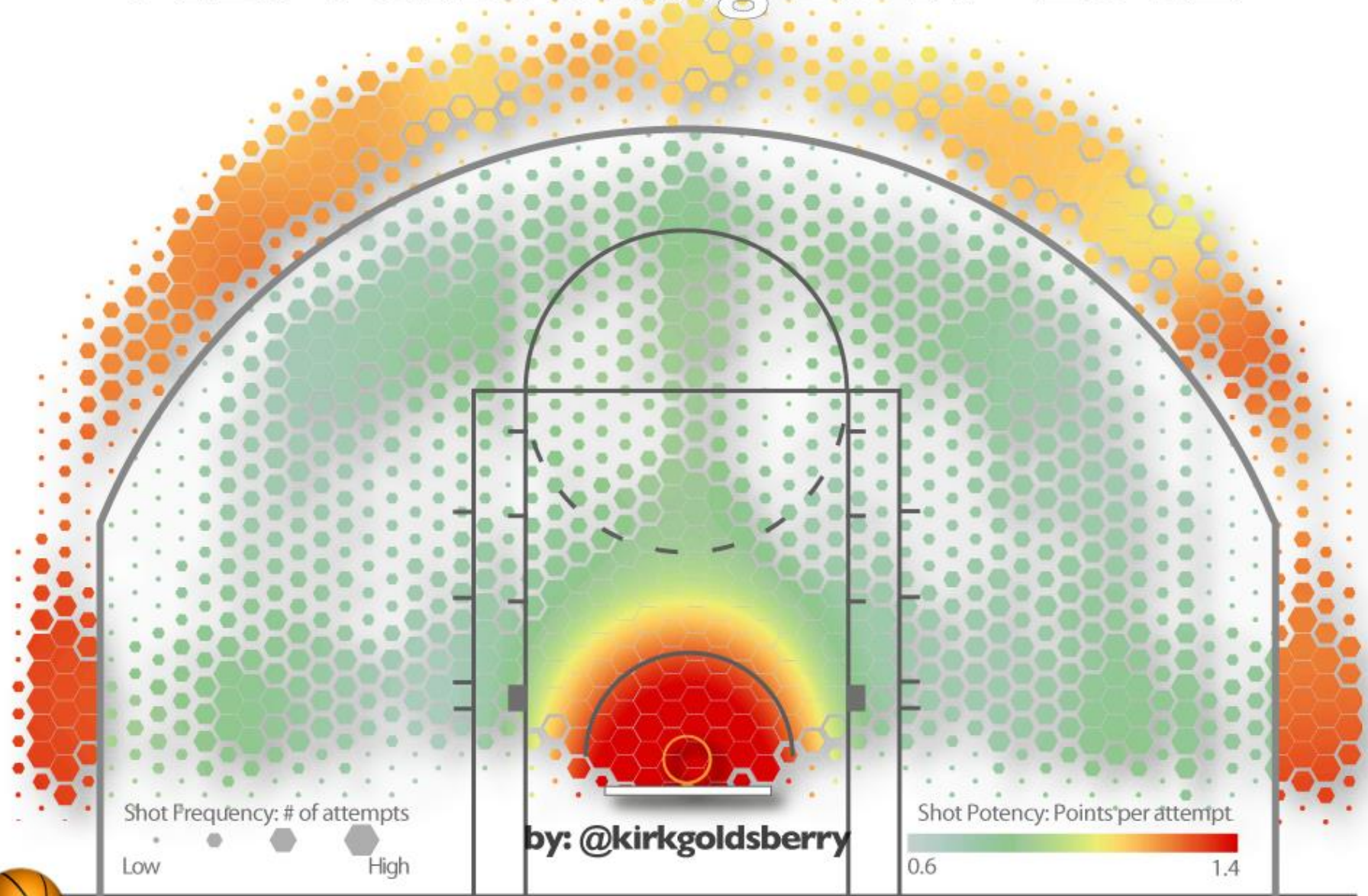
By Esri Story Maps team / Katya Deveory 2017

The screenshot displays a web browser window with the URL <https://storymaps.esri.com/stories/2017/hip-hop/map/>. The page title is "esri Hip-Hop Map" and it is identified as "A Story Map". The main content is a map of North America with yellow circles of varying sizes representing hip-hop artists by city. The largest circles are in Los Angeles, New York, and Chicago. Other cities shown include Seattle, San Francisco, Dallas, Houston, Atlanta, Miami, Philadelphia, Washington, Detroit, Toronto, Boston, and Ottawa. The map also shows parts of Canada (Edmonton, Calgary, Vancouver) and Mexico (Monterrey, Guadalajara, Mexico City). A sidebar on the right contains a search bar labeled "Search for an artist", a year slider set to 2017, and a list of artists with their release years: Yoshi Thompkins (2016), A Boogie Wit Da Hoodie (2016), Marcellus Juvann (2016), and Jay Jumpin (2016). The bottom of the browser shows the Windows taskbar with various application icons and the system clock displaying 9:11 AM on 5/24/2017.

CMIP5: Global change explorer (LLNL)



NBA Shooting 2011-2012

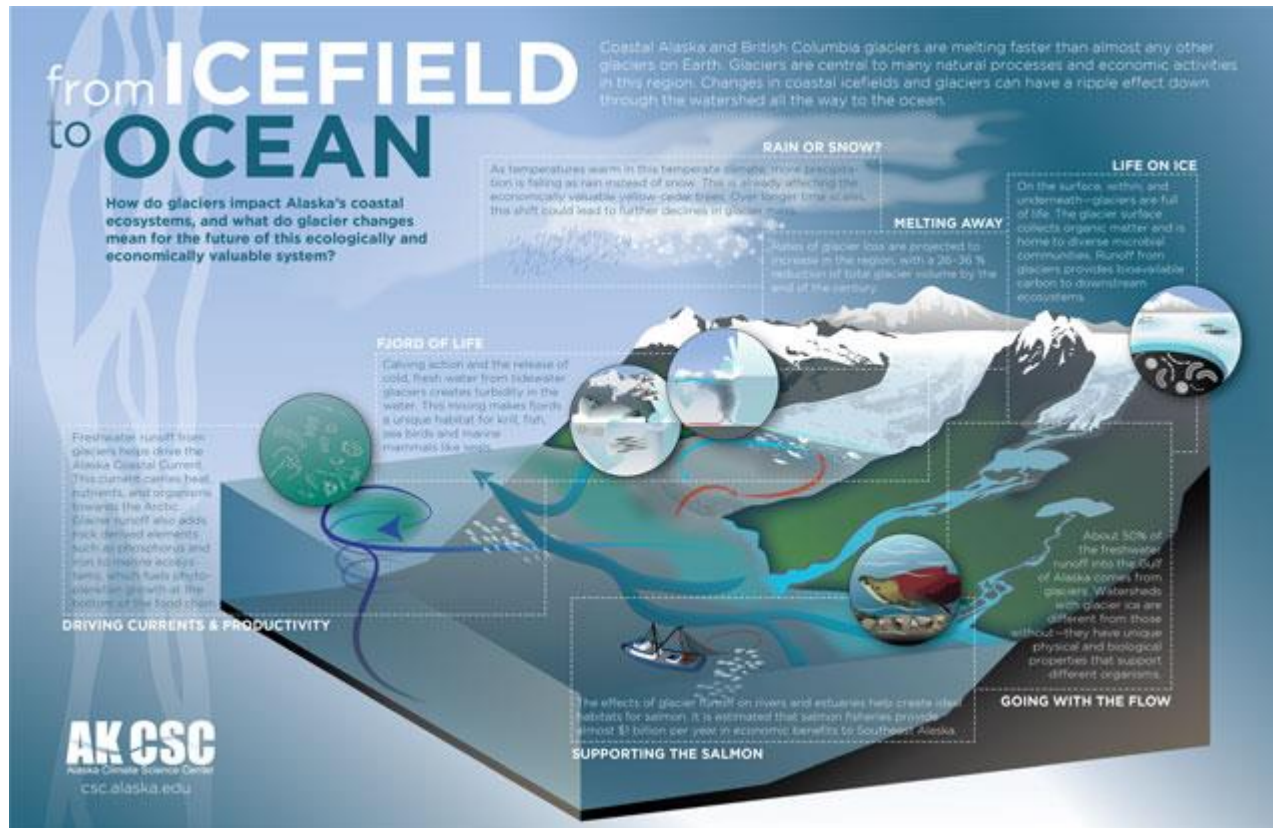


by: @kirkgoldsberry

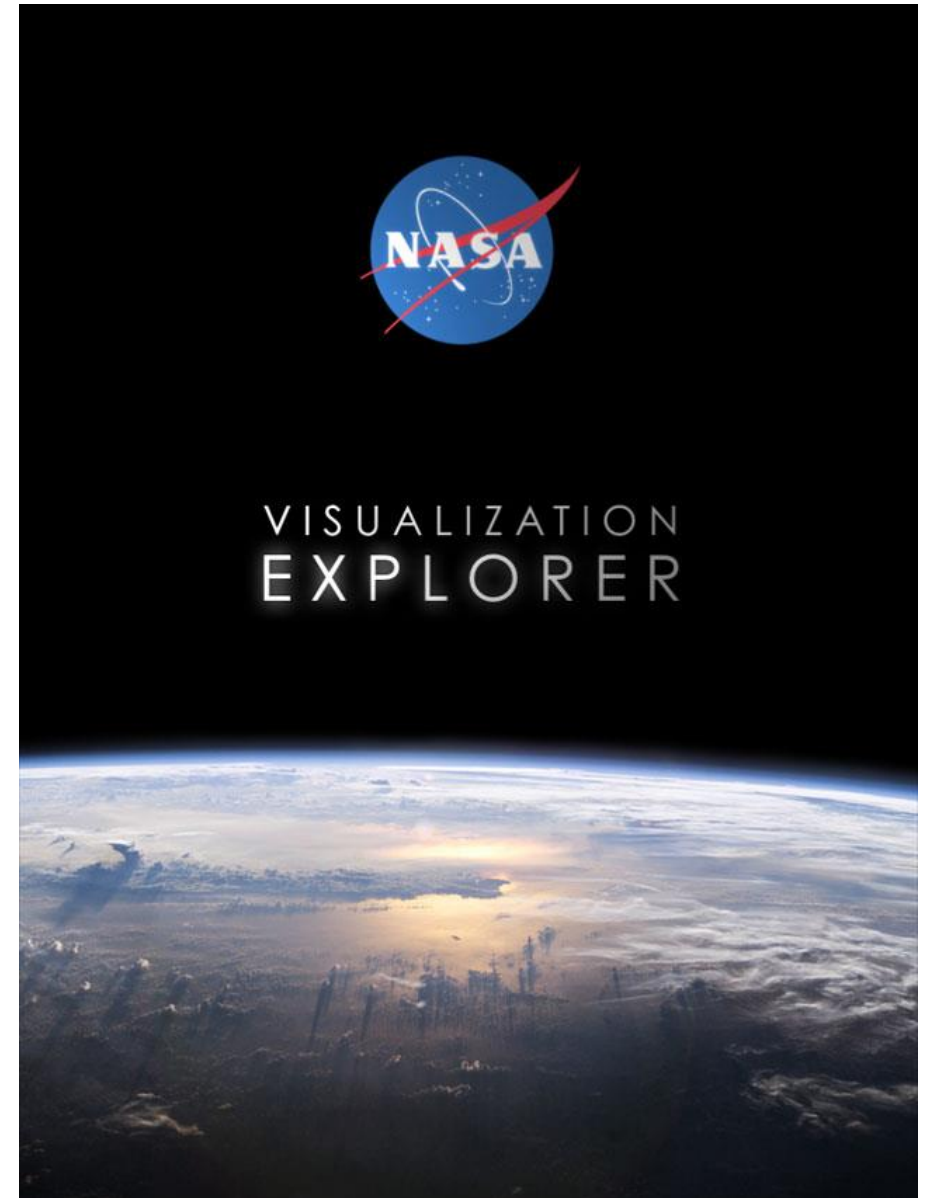


Analytics / Design: Kirk Goldsberry
Data Assist: Jumpin' Matt Adams

NSF: Annual Visualization Challenge

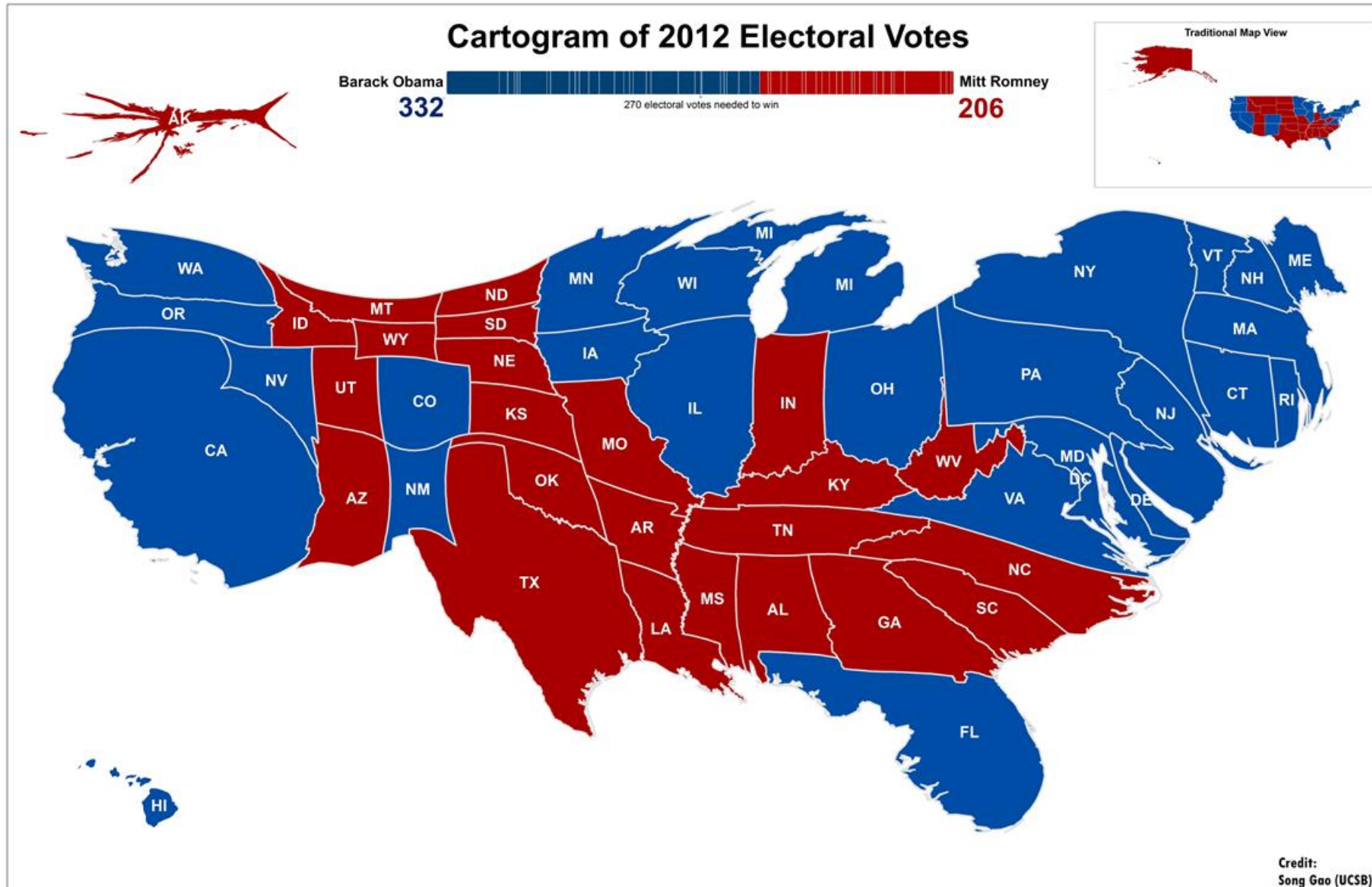


From icefield to ocean
Credit: Kristin Timm, Shad O'Neel, Allison Bidlack and Eran Hood

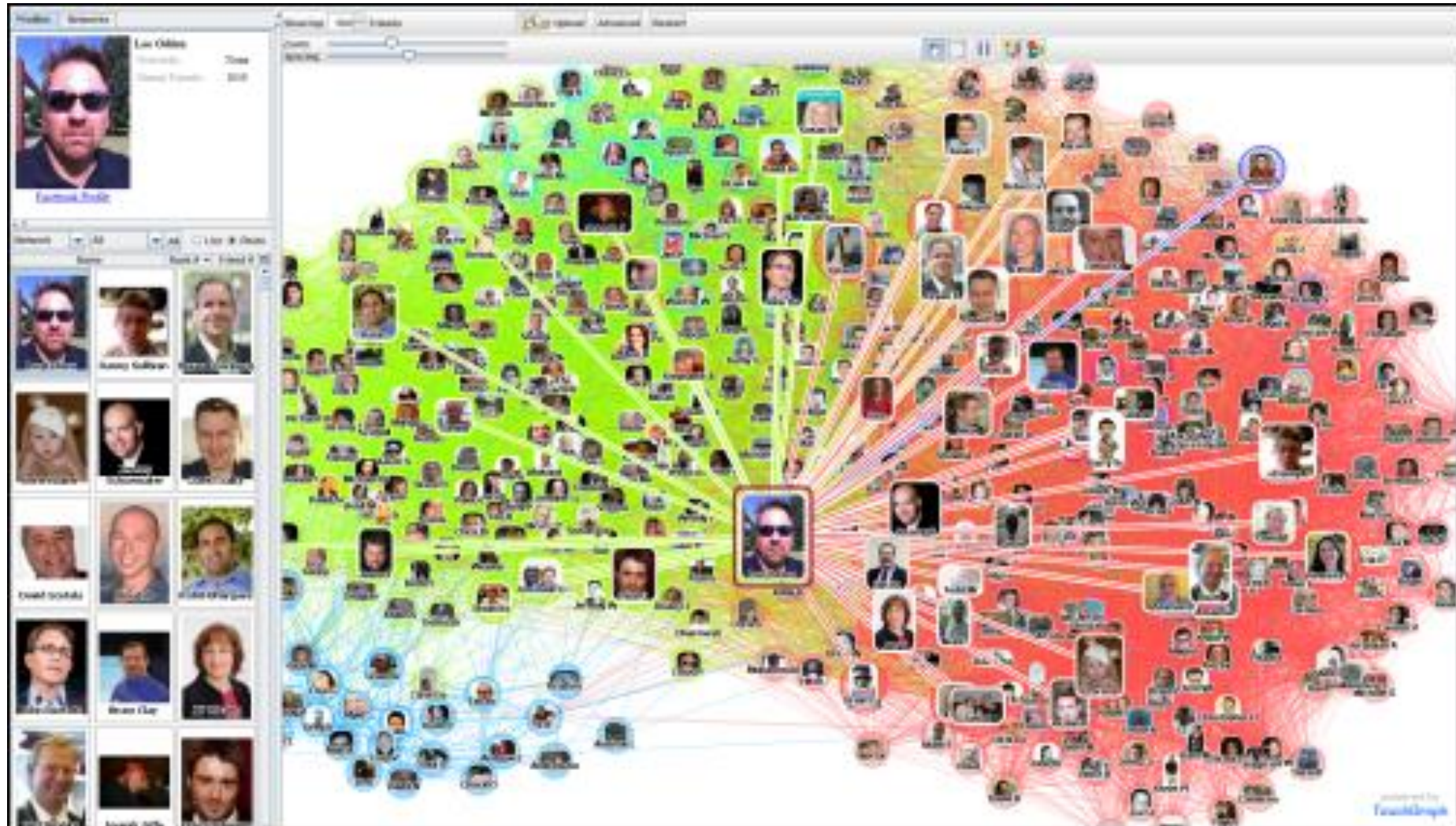


Goddard Space Flight Center's NASA Visualization Group; Helen-Nicole Kostis, Project Manager

Cartograms: Animation at: <http://www.ravi.io/us-population-trends-cartogram>



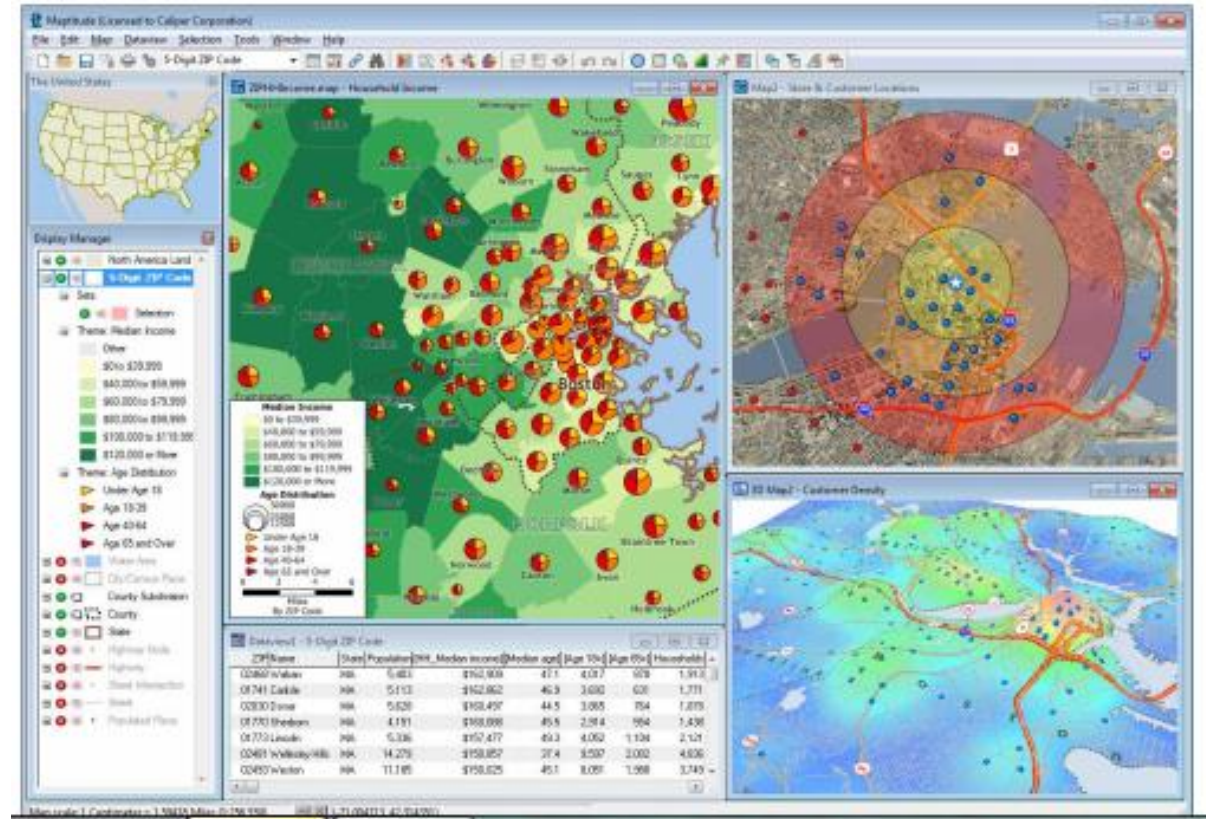
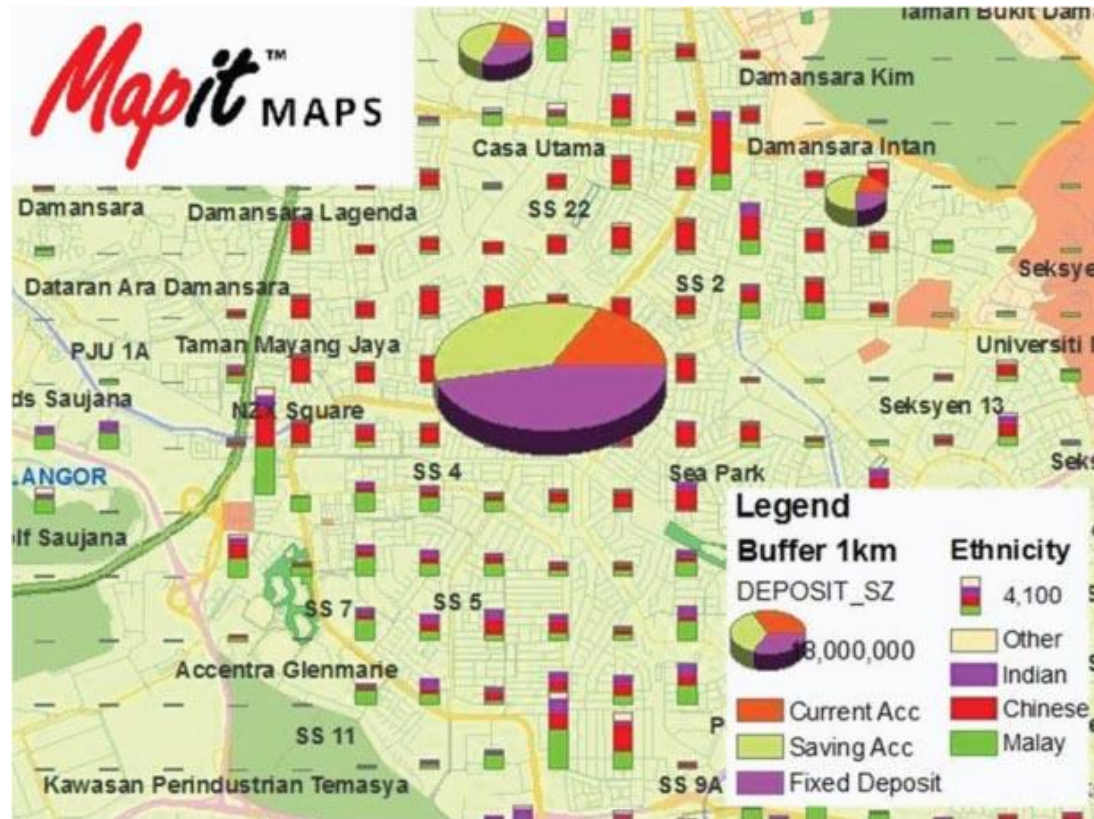
Information Viz and Social Media: Facebook Touchgraph



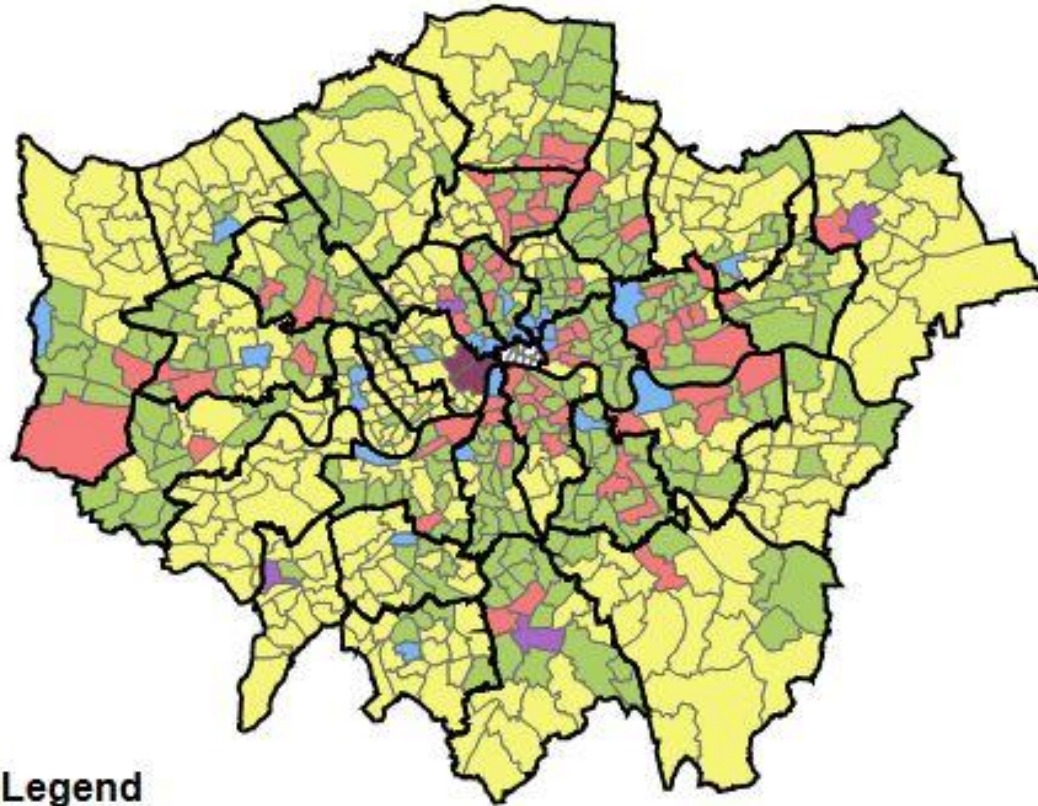
Business GeoGraphics

Maptitude®

Geographic Information System



Business Analytics--Geodemographics



Legend

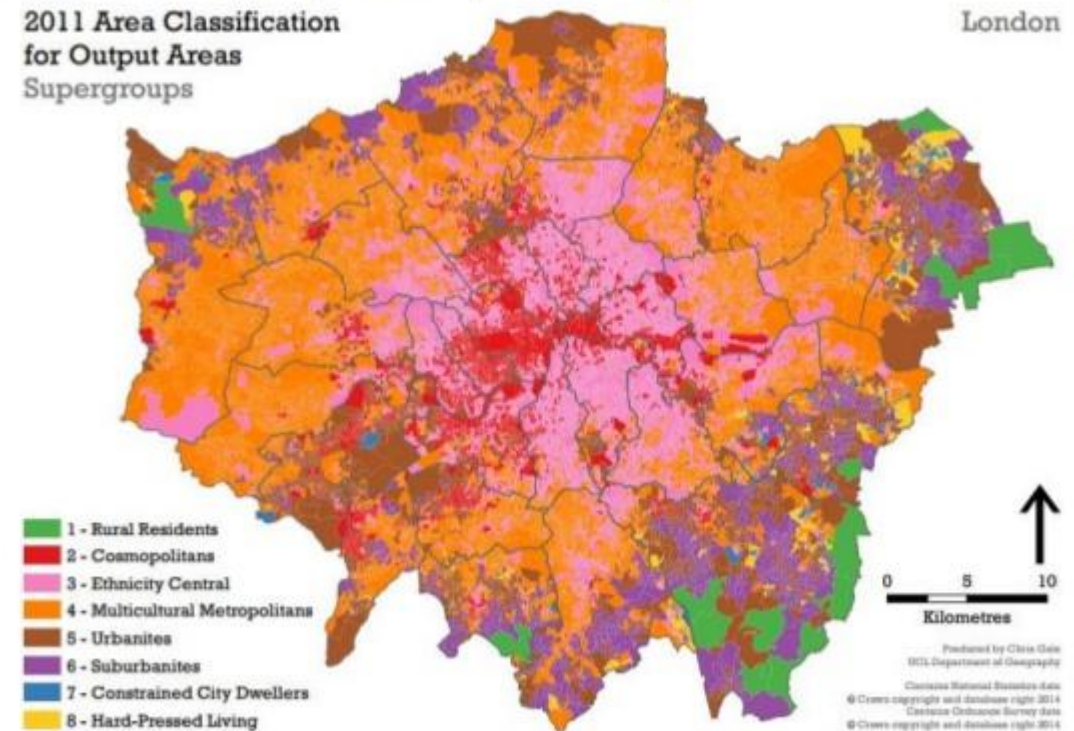
- | | |
|---|--|
| 1 | Neighbourhoods & town centres blighted by violence |
| 2 | Town centres with more than hint of violence |
| 3 | Peaceful Neighbourhoods in the main |
| 4 | Major Town centres with major weekend night time violence problems |
| 5 | Neighbourhoods with more than hint of violence |
| 6 | The West End, violence in proportion to the large crowds |

**London Wards
classified
according to
violence profiles**

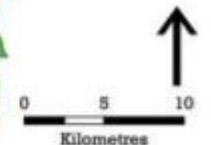
Geodemographics (London)

2011 Area Classification
for Output Areas
Supergroups

London



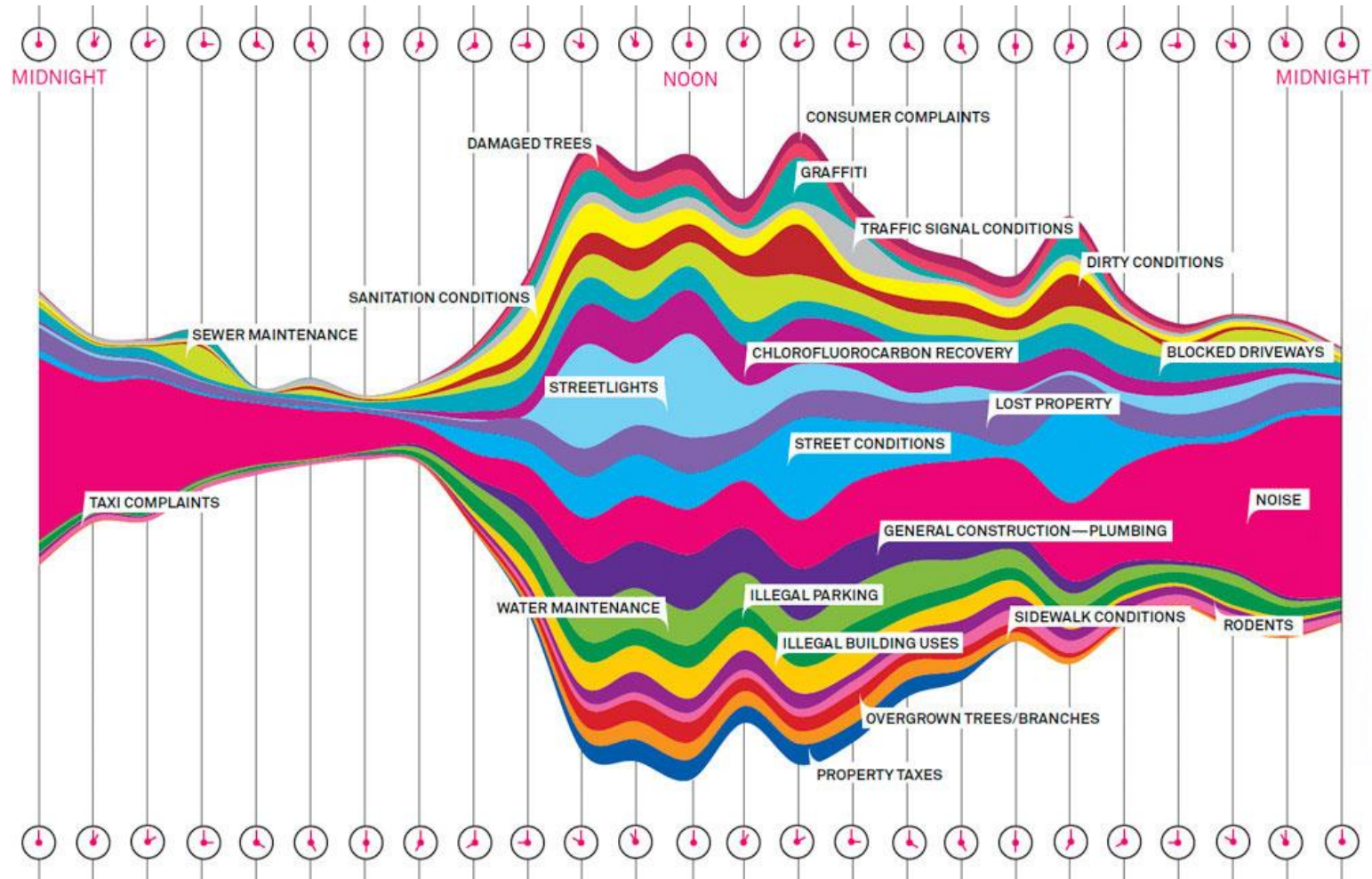
- | |
|--------------------------------|
| 1 - Rural Residents |
| 2 - Cosmopolitans |
| 3 - Ethnicity Central |
| 4 - Multicultural Metropolitan |
| 5 - Urbanites |
| 6 - Suburbanites |
| 7 - Constrained City Dwellers |
| 8 - Hard-Pressed Living |



Prepared by Chris Goss
UCL Department of Geography
© Crown copyright and database right 2014
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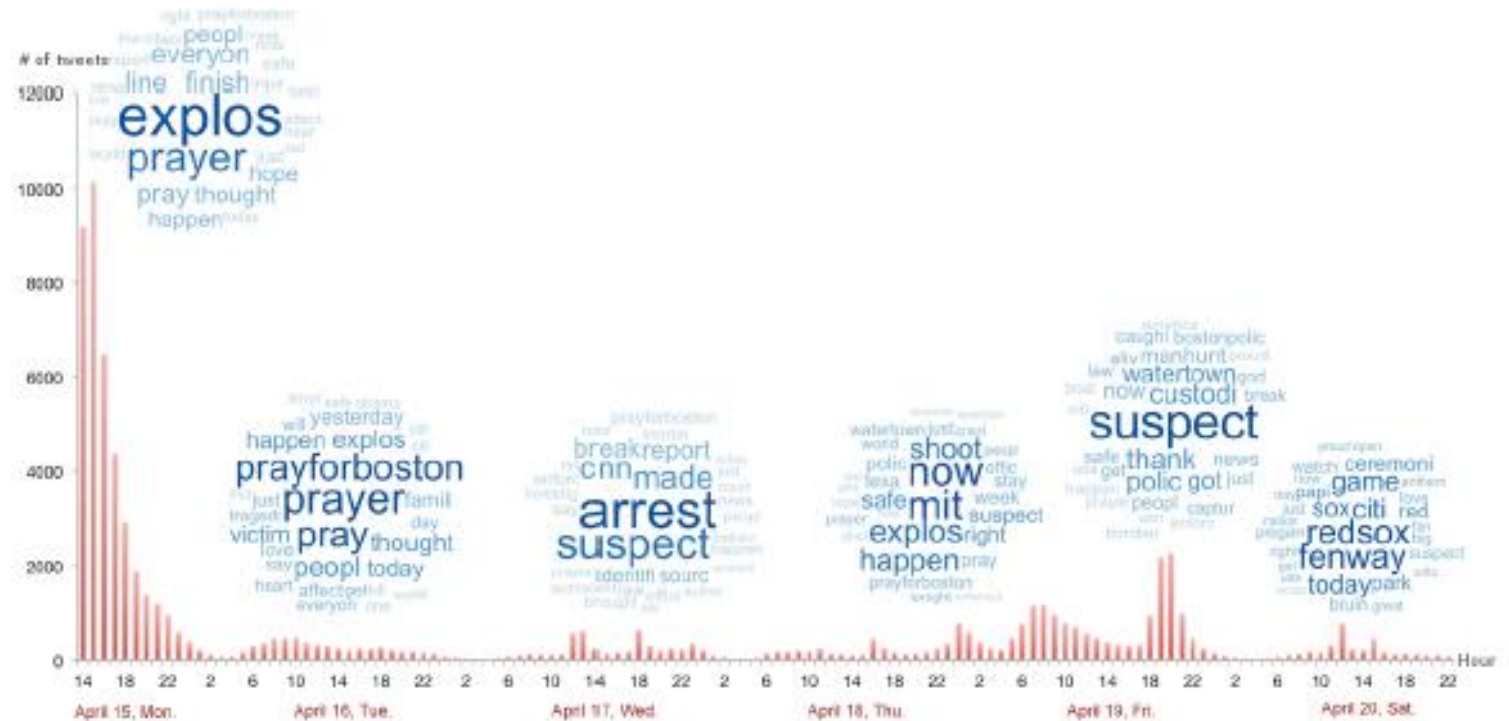
Steam Graph of 311 Data

Source: “What a Hundred Million Calls to 311 Reveal about New York” by Steven Johnson. http://www.wired.com/2010/11/ff_311_new_york/



Boston Marathon Bombings Timeline

Haiyun Ye: MA Thesis



2:49 p.m. Two explosions at Boston Marathon finish line. Three people are killed, 282 are injured.

A victim gives the FBI a description of the man who dropped a backpack near him.

Afternoon: Several media report that an arrest has been made. BPD and FBI deny the report.

10:25 p.m. An MIT police officer was allegedly shot by the suspects.

12:41 a.m. Police locate suspects' car in Watertown.
12:43 a.m. Suspects engage in a gunbattle with police and use four IEDs.

1:35 a.m. One of the suspects died.

7 a.m. Police begin a door-to-door search in Watertown.

8:46 p.m. Boston police tweet that suspect is in custody.

The Boston Red Sox honored the victims and the survivors with a pregame ceremony before a baseball game vs. Kansas City Royals at Fenway Park.

7:30 p.m. Suspect is questioned by FBI agents at the hospital.

News sources:
CNN
Boston.com
WBUR

Some more infographics

- Plotlines of novels
- <https://www.slow-journalism.com/infographics/culture/plot-lines>
- All of Star Wars <https://swanh.net/>
- R-Shiny based Genome Browser
https://gallery.shinyapps.io/genome_browser/
- Downtown Montpelier
<http://samples.mapsalive.com/1062L/page1.htm>
- Interactive Minard map <http://www.masswerk.at/minard/>

Some sources

- IEEE Visual Analytics Science and Technology (VAST) Conference
- InfoViz Annual Conference
- Now IEEE Visual Analytics Science and Technology (VAST), IEEE Information Visualization (InfoVis), IEEE Scientific Visualization (SciVis)
- Visual Analytics Digital Library (VADL)
- GeoAnalytics.net - GeoSpatial Visual Analytics, ICA Commission on GeoVizualisation
- flowingdata.com, visualization and statistics blog
- Quadrigram, a visual programming language for visual analytics
- Middlesex University Interaction Design Centre weblog, visual analytics blog and resources
- Information Visualization & Visual Analytics, Pacific Northwest National Laboratory

Summary

- Data exploration: many new means to show patterns in (big) data
- Show pattern, change in time and space
- Many software solutions
- Pretty much all cartography and GIS fits into viz
- Infoviz, geoviz, information graphics, visual analytics
- Possible to use geospatial methods on non-spatial data
- Visual analytics focus on interaction
- Building methods and theory of a discipline