

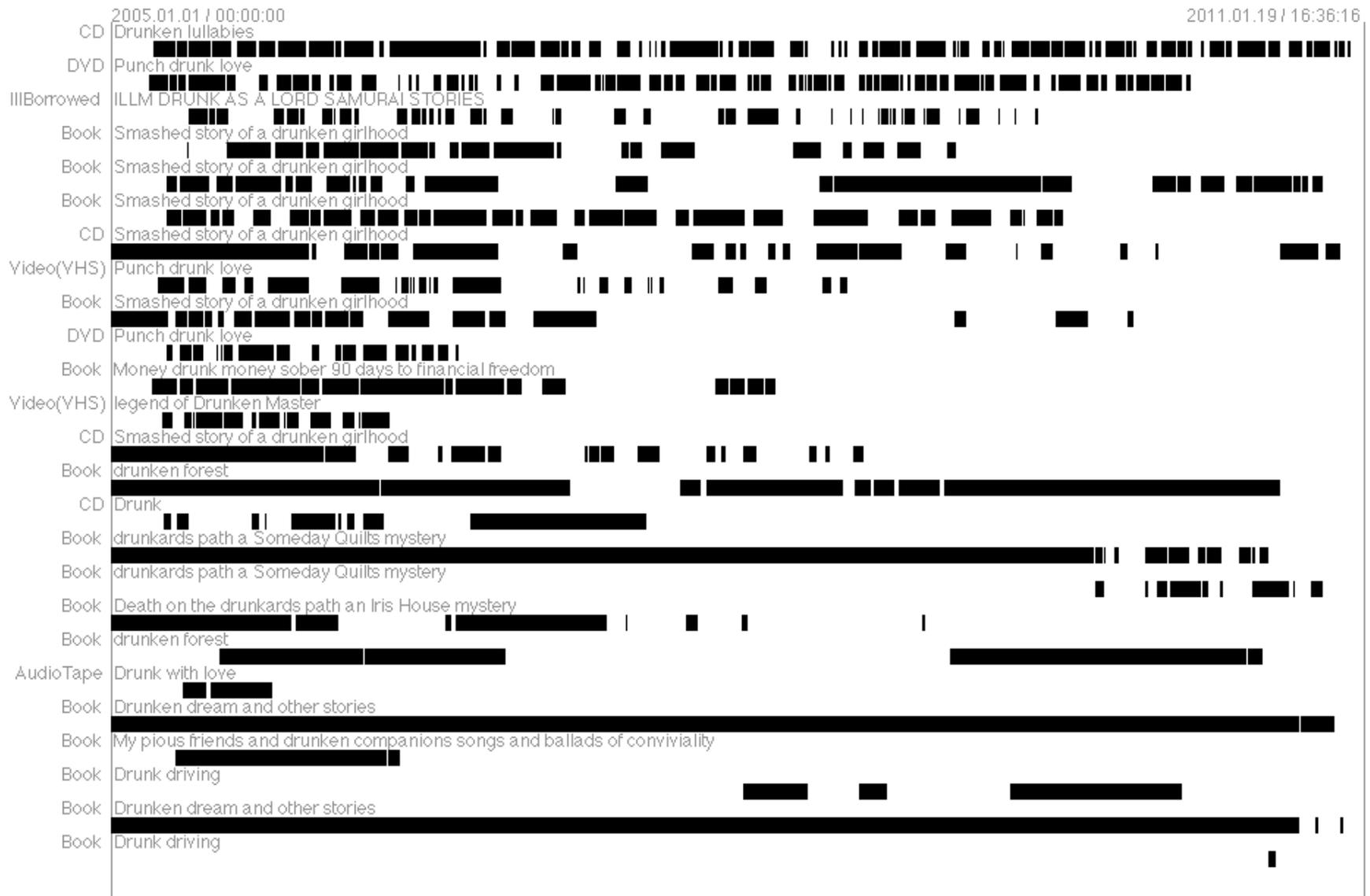
## **2D & 3D Data Visuals**

George Legrady, [legrady@mat.ucsb.edu](mailto:legrady@mat.ucsb.edu)

## 2 Kinds of 2D Maps

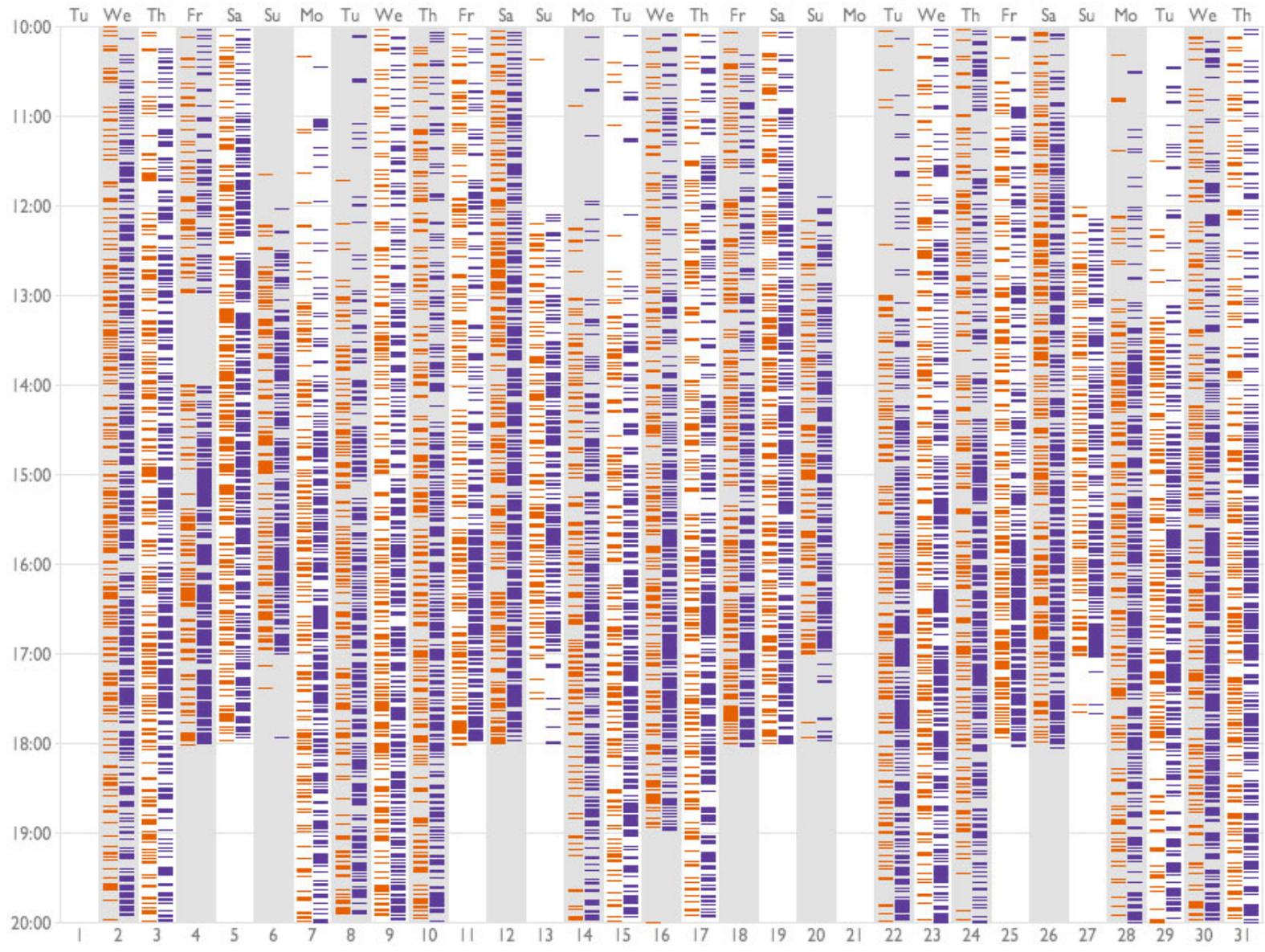
- **Synchronic:** The state of things at a specific moment in time
- **Diachronic:** Change over time

title like '%drunk%' group by collcode;

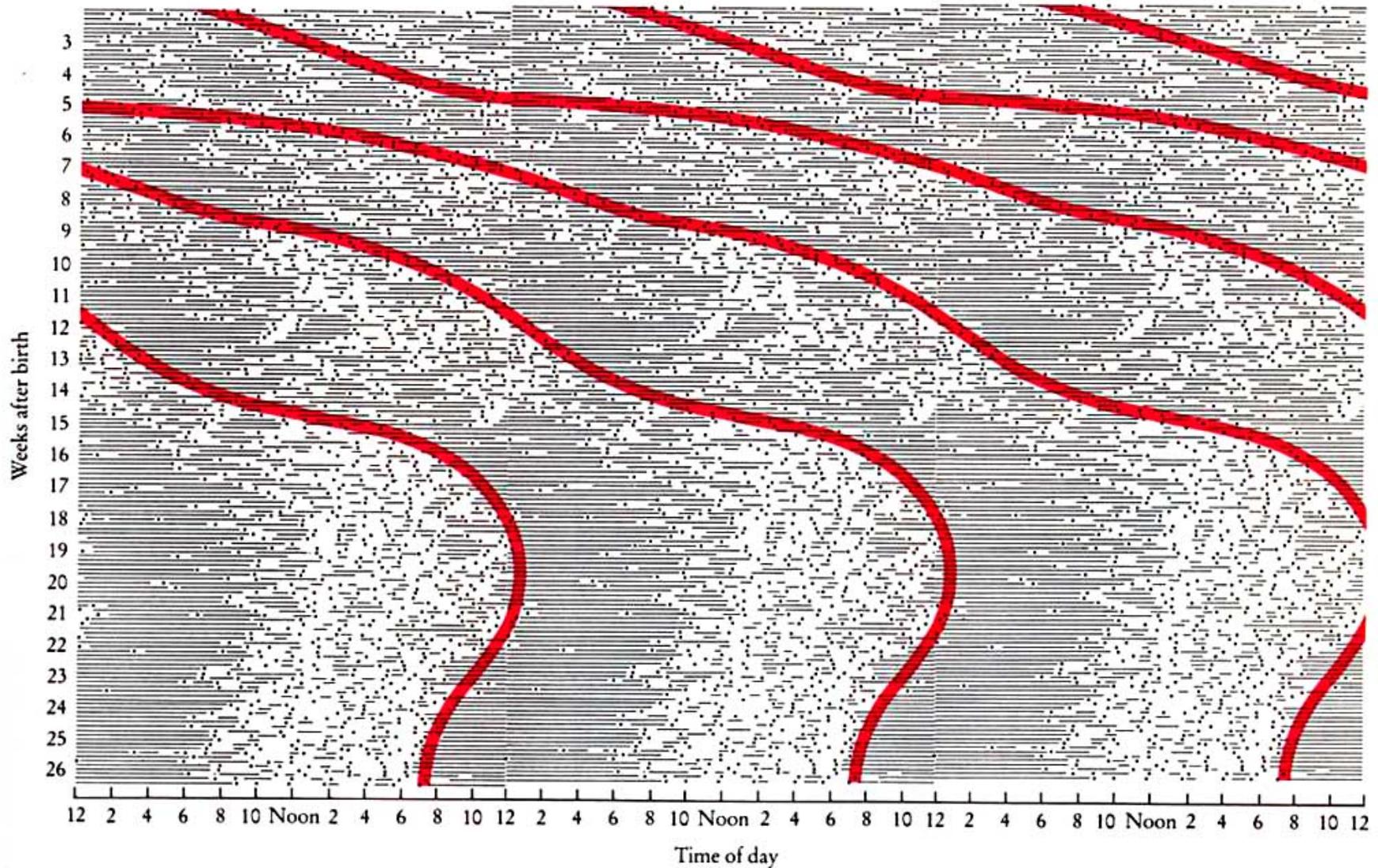


[641] [741]  
 food + drink v drawing + drawings

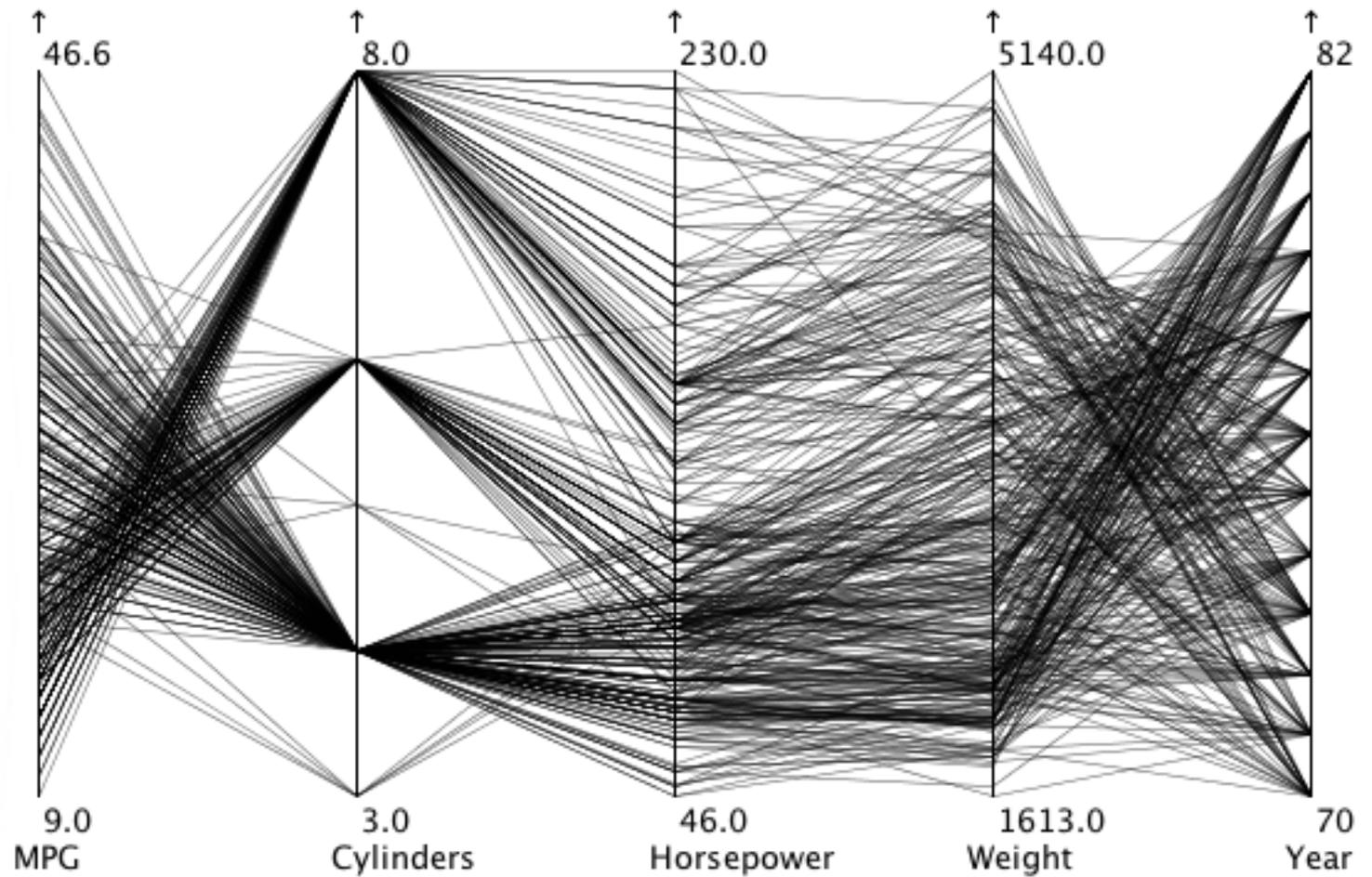
time items checked out / day  
 week of january 6



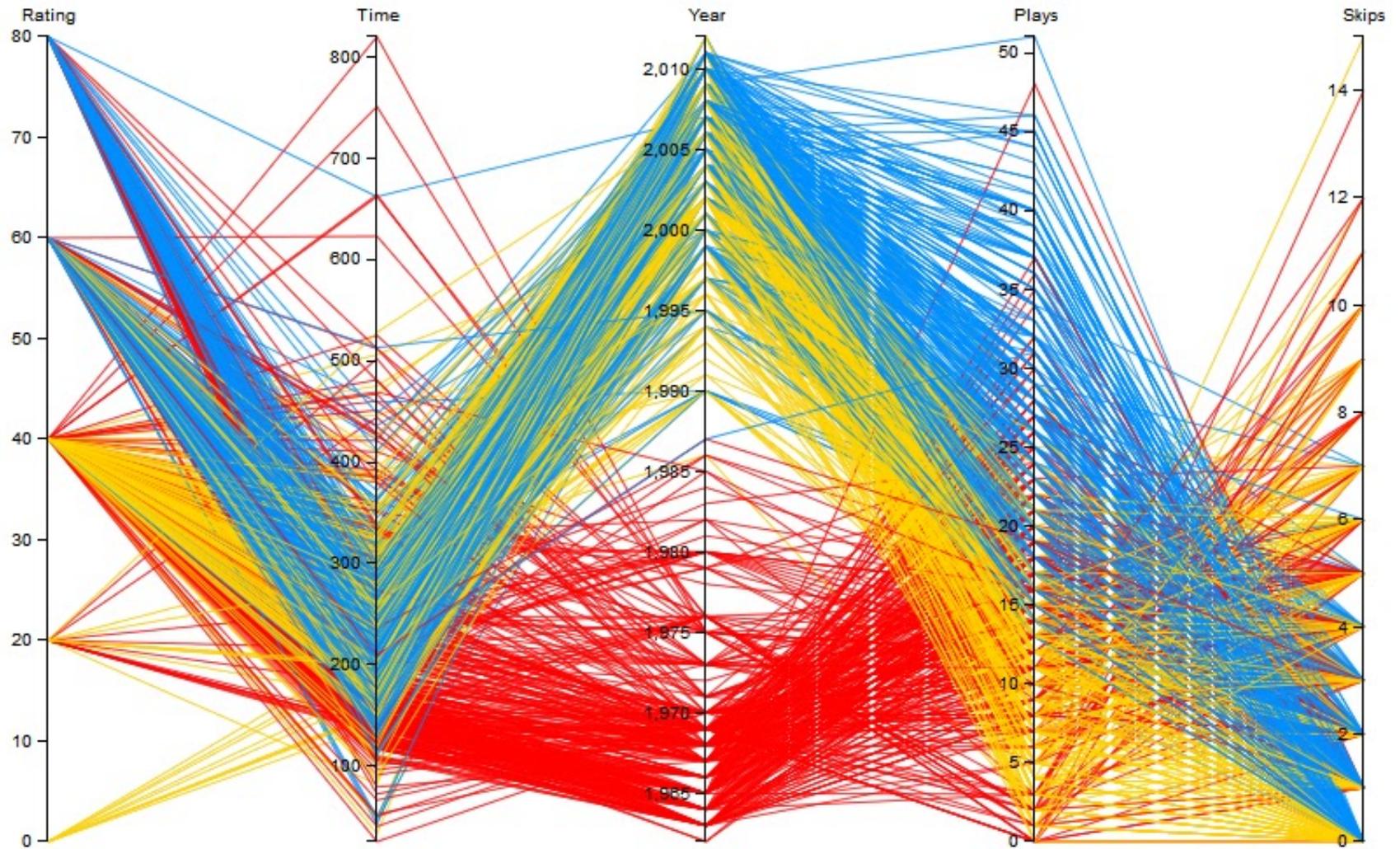
# Bio-Rhythm: Frequency Map reveals pattern



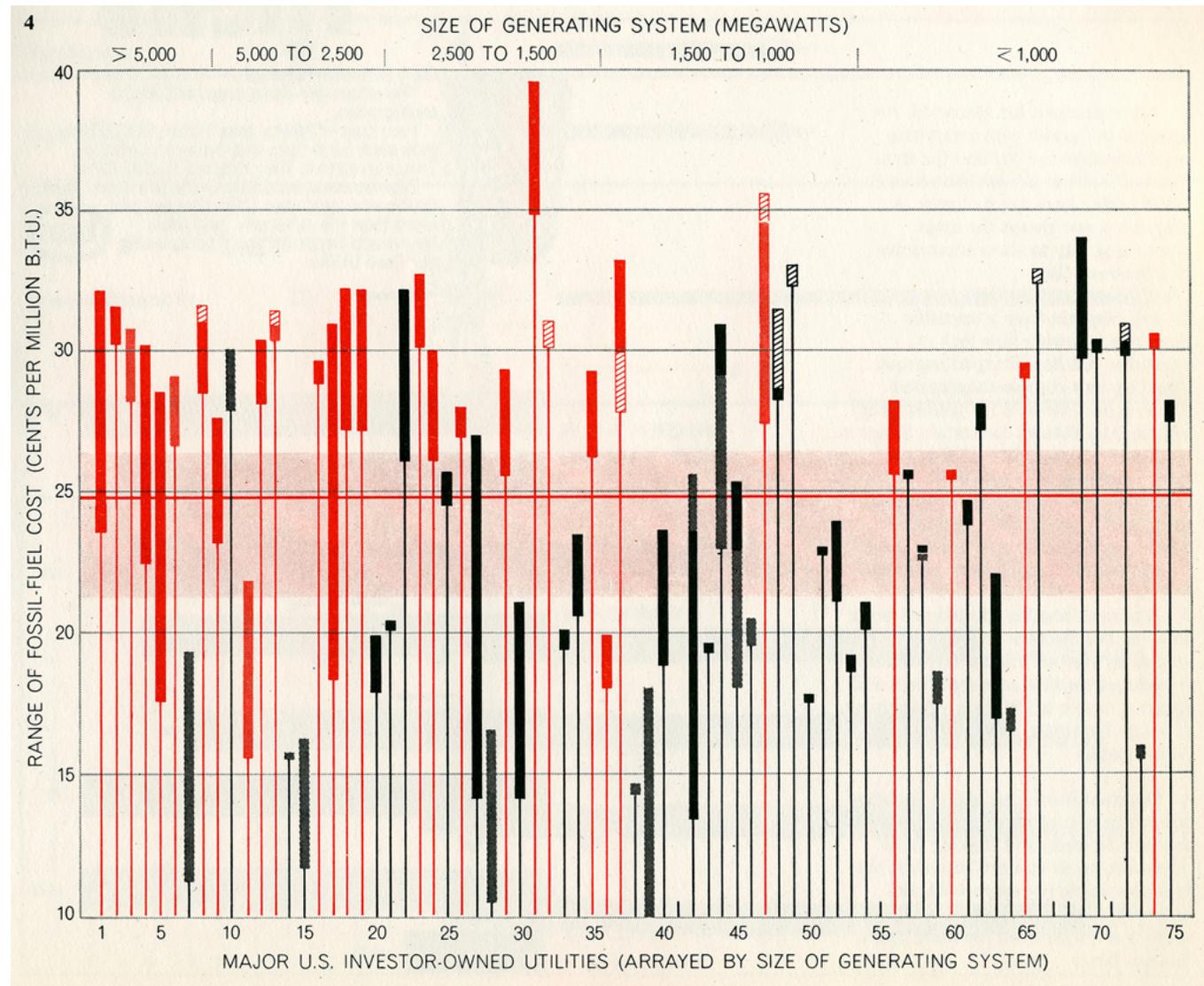
# Parallel Coordinates: Multi-dimensional Data



# Parallel Coordinates: Multi-dimensional Data

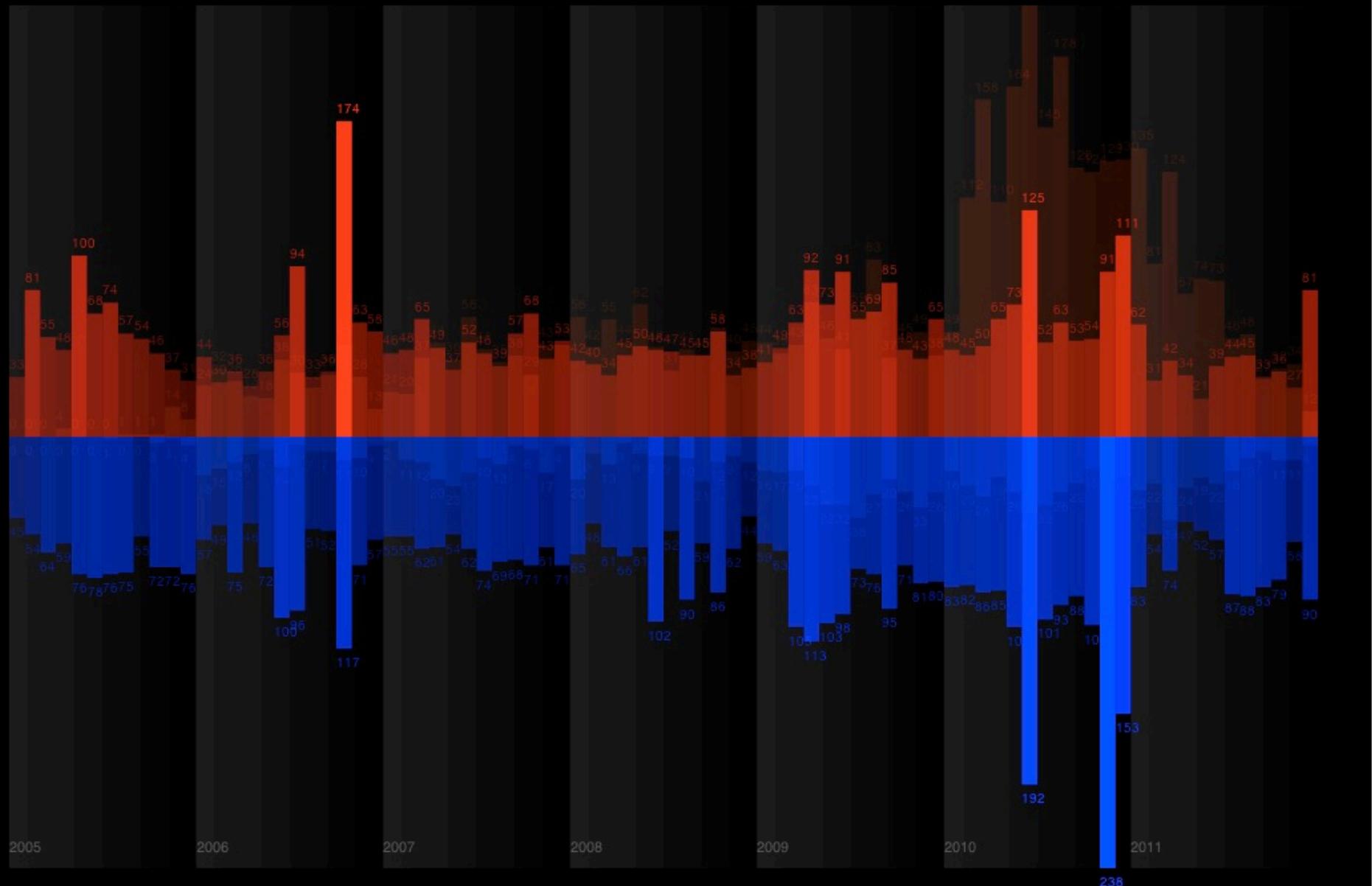


# Histogram-like map with boxplot

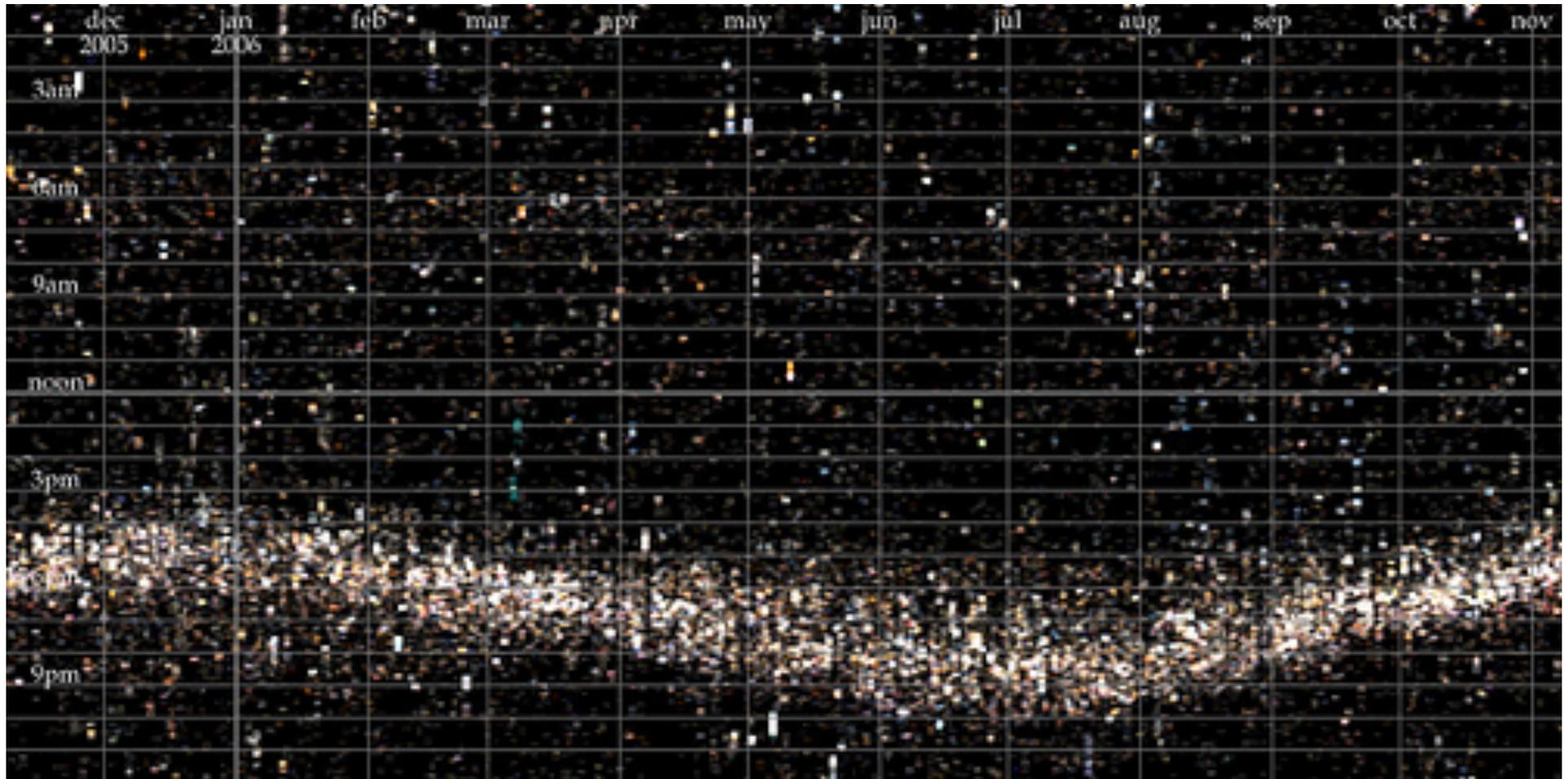


### NYTimes: South Korea | North Korea 2005-2011

SPL: South Korea | North Korea 2005-2011



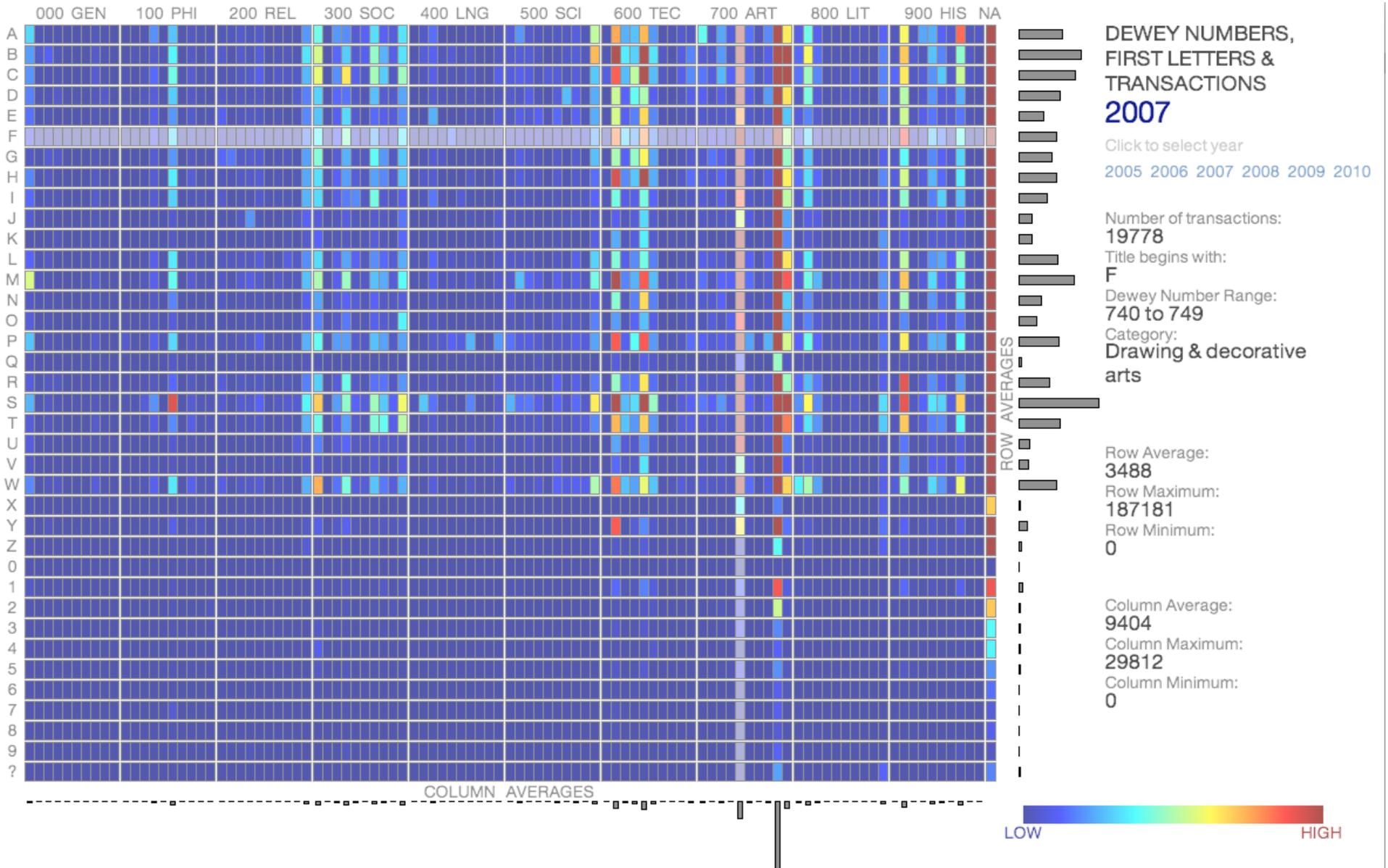
# Linear Time Graphs



# 2D Synchronic Map Visualization

Daily Checkouts with the word 'Mind' in titles throughout Dewey Decimal Range





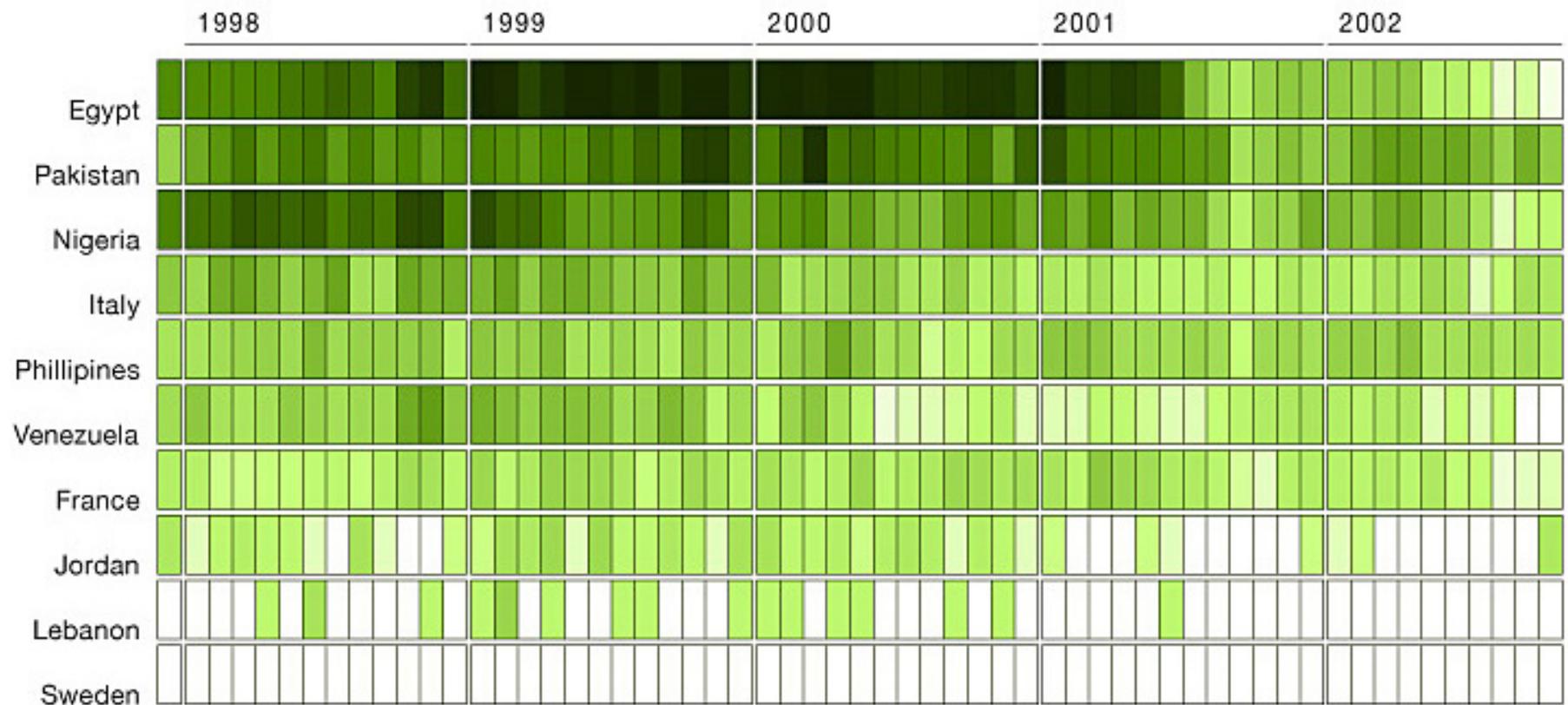
\*Considers all titles

Source: Seattle Public Library

Design: Sandeep Bhat, MAT259, Winter 2011

# Frequency Maps Can Tell a Story ([catalogtree](#))

## DIPLOMATIC PARKING VIOLATIONS



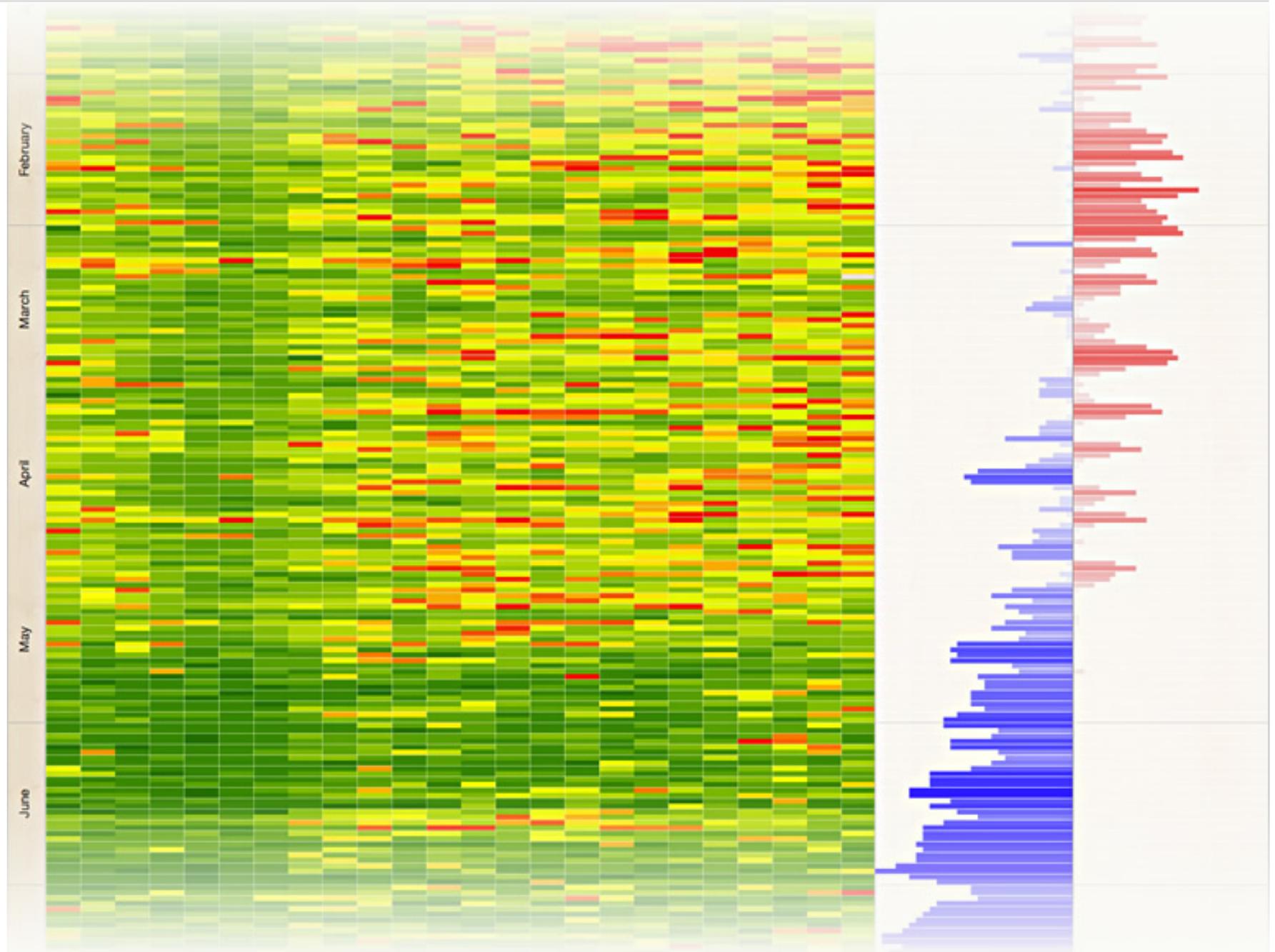
Monthly unpaid violations per diplomat from december 1997 to october 2002



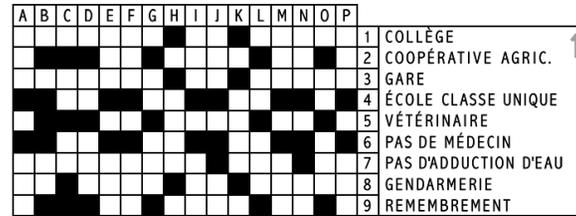
# Heat Map

PMI (manufacturing) heat map: economic scale moves from below normal (deepest red) to above normal (deepest green)

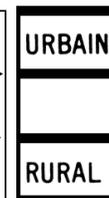
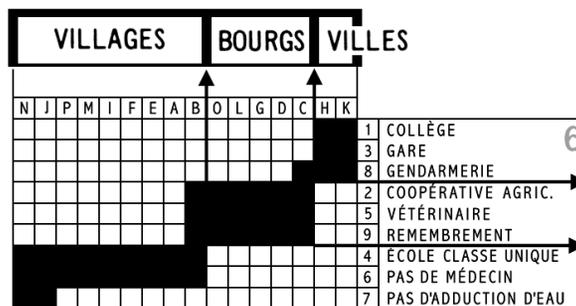
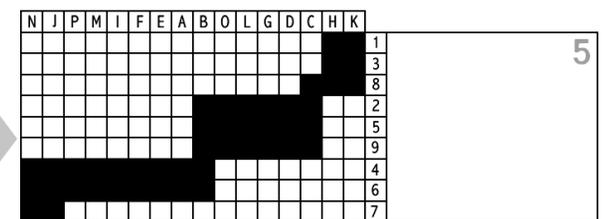
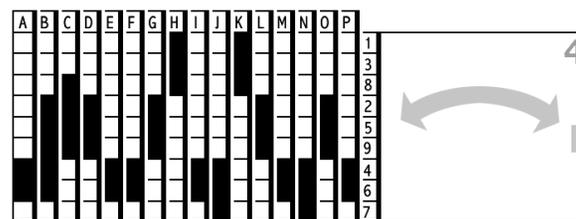
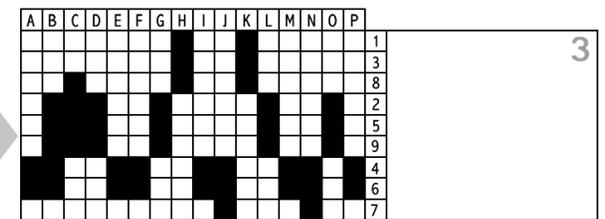
Country	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13
Canada	51.5	51.5	61.0	52.2	40.2	36.1	36.1	45.2	43.2	53.7	48.4	58.2	51.8	55.7	61.7	61.2	55.9	48.4	50.8	51.9	57.8	58.7	62.7	58.9	54.0	65.9	70.3	53.8	54.6	55.4	55.4	55.5	56.9	56.8	55.1	53.3	53.8	55.4	55.5	53.7	53.3	54.0	50.6	51.8	52.4	53.3	54.7	54.8	53.0	52.4	51.4	50.4	50.4	50.5	51.7	49.3	50.1	53.2	
Mexico	51.4	49.8	47.1	50.6	42.1	41.2	43.8	45.1	50.2	46.0	47.8	51.5	51.1	51.0	51.7	53.2	48.3	49.9	51.1	52.5	55.8	52.8	53.7	54.2	51.8	54.1	51.3	53.5	52.0	51.1	51.3	51.7	56.1	52.7	56.1	56.1	54.5	54.5	53.6	54.9	52.8	51.7	53.2	53.9	56.3	52.6	55.1	54.8	55.0	55.3	54.5	55.7	54.4	53.0	54.8	53.5	54.4	55.1	55.5
United States	50.0	49.2	44.8	38.9	36.5	33.1	34.9	35.5	36.0	36.5	41.7	45.8	49.9	53.5	54.4	56.0	54.4	55.3	56.6	55.7	59.3	58.9	57.8	56.1	56.4	57.8	56.5	57.3	58.2	57.3	59.2	59.6	58.3	59.4	53.5	55.8	52.3	53.2	53.2	51.5	52.3	52.9	53.7	51.9	53.3	54.1	52.5	50.2	50.5	50.7	51.6	51.7	49.9	50.2	53.1	54.2	51.3	50.7	49.0
China	53.3	49.2	47.7	45.2	40.9	41.2	42.3	45.1	44.8	50.1	51.2	51.8	52.8	56.1	55.0	55.4	55.7	56.1	57.4	56.8	56.7	55.2	52.7	50.4	49.4	51.9	52.9	54.8	55.3	54.4	54.5	51.7	51.8	51.8	51.6	50.1	49.3	49.9	49.9	51.0	47.7	48.7	48.8	49.6	48.3	49.3	48.4	48.2	49.3	47.6	47.9	49.5	50.5	51.5	52.3	50.4	51.6	50.4	49.2
India	52.8	52.9	57.3	52.2	45.8	44.4	46.7	47.0	49.5	53.3	55.7	55.3	56.4	53.2	55.0	54.5	53.0	55.6	57.6	58.5	57.8	57.2	59.0	57.3	57.6	57.2	55.1	57.2	58.4	56.7	56.8	57.9	57.9	58.0	57.5	56.3	53.6	52.6	50.4	52.0	51.0	54.2	57.5	56.6	54.7	54.9	54.8	55.0	52.9	52.8	52.8	52.9	53.7	54.7	53.2	54.2	52.0	51.0	50.1
Japan	47.0	46.9	44.3	42.2	38.7	38.8	39.8	37.5	33.8	41.4	46.6	48.2	50.4	53.6	54.5	54.3	52.3	53.8	52.5	52.5	52.7	53.8	54.7	53.9	52.8	50.1	49.5	47.2	47.3	48.3	51.4	52.9	46.4	45.7	51.3	50.7	52.1	51.9	49.3	50.6	49.1	50.2	50.7	50.5	51.1	50.7	50.7	49.9	47.9	47.7	48.0	46.9	46.5	45.0	47.7	48.5	50.4	51.1	51.5
Singapore	51.6	50.6	49.5	45.8	44.3	44.8	45.0	45.0	47.1	49.2	51.2	51.1	51.5	54.4	50.6	50.2	52.0	53.3	51.4	51.9	51.1	51.9	52.2	51.3	52.2	49.4	49.5	50.7	51.4	50.7	50.5	52.3	50.1	52.5	50.8	50.4	49.3	49.4	48.3	49.5	48.7	49.5	48.7	50.4	50.2	49.7	50.4	50.4	49.8	49.1	48.7	48.3	48.8	48.6	50.2	49.4	50.6	50.3	51.1
South Korea	46.7	45.4	42.3	43.0	43.0	41.7	38.7	44.9	50.7	51.2	51.2	52.0	54.0	53.6	52.7	52.5	52.6	52.8	55.6	58.2	55.6	57.1	54.6	53.3	53.2	50.9	48.8	46.7	50.2	53.9	53.5	53.4	52.8	51.7	51.2	51.1	51.3	49.7	47.5	48.0	47.1	46.4	49.2	50.7	52.0	51.9	51.0	49.4	47.2	47.5	45.7	47.4	48.2	50.1	49.9	50.9	52.0	52.6	51.1
Taiwan	47.5	49.1	44.6	38.9	31.9	22.9	33.3	47.0	50.0	50.6	52.6	52.9	53.9	55.1	57.5	59.8	58.4	58.7	61.7	62.5	63.7	60.7	57.4	53.8	50.5	49.2	49.0	48.6	51.7	54.7	59.8	55.6	55.6	58.2	54.9	49.9	46.1	45.2	44.5	43.7	43.9	47.1	48.9	52.7	54.1	51.2	50.5	49.2	47.5	46.1	45.6	47.8	47.4	50.6	51.5	50.2	51.2	50.7	47.1
Australia	46.6	45.9	45.7	40.3	32.0	36.3	36.5	30.9	33.4	31.2	37.8	38.4	44.4	50.3	51.0	49.9	50.7	46.2	51.6	56.8	50.5	59.8	56.3	52.9	54.4	51.7	47.3	49.4	47.6	46.3	46.7	51.1	47.9	48.4	47.7	52.9	43.4	43.3	42.3	47.4	47.8	50.2	51.6	51.3	49.5	43.9	42.4	47.2	46.3	45.3	43.0	42.8	44.3	44.3	40.2	45.6	44.4	36.7	43.8
Brazil	53.5	51.1	50.4	45.7	41.6	40.8	38.1	41.0	42.2	44.8	47.8	48.1	48.0	50.6	52.3	53.7	55.5	55.8	57.8	55.8	55.4	53.8	52.4	52.7	51.8	49.5	50.4	49.5	49.9	52.4	53.1	54.6	53.2	50.7	50.8	49.0	47.8	46.0	45.5	46.5	48.7	49.1	50.6	51.4	51.1	49.3	49.3	48.5	48.7	49.3	49.8	50.2	52.2	51.1	53.2	52.5	51.8	50.8	50.4
South Africa	46.5	49.6	47.6	45.1	38.6	40.2	38.0	37.2	35.0	34.8	37.4	40.5	40.4	41.6	47.9	47.6	49.2	52.3	51.3	56.1	52.9	53.0	51.1	51.4	53.3	53.1	50.4	50.9	52.5	52.2	53.0	52.6	54.3	54.3	54.0	55.0	46.4	48.9	52.5	51.2	51.8	50.3	52.7	55.4	53.4	52.6	52.7	48.8	51.1	50.8	48.3	47.1	49.5	47.4	49.1	53.6	49.3	50.5	50.4
Austria	47.0	48.6	46.0	43.4	38.3	35.0	33.1	34.8	33.7	39.0	39.3	42.0	46.5	49.9	50.3	51.1	49.9	50.8	51.8	55.4	56.7	60.3	58.2	59.0	58.5	55.9	56.1	56.0	55.2	57.7	60.3	61.8	60.5	57.0	55.6	53.0	50.8	50.1	48.7	48.0	47.6	49.0	51.8	52.0	51.5	51.2	50.2	50.1	47.4	46.7	45.1	44.8	49.3	48.1	48.6	48.3	48.1	47.8	48.2
France	47.1	45.8	43.0	40.6	37.3	34.8	37.8	36.8	36.5	40.1	43.3	45.9	48.1	50.8	53.0	55.6	54.4	54.7	55.4	54.9	55.5	56.6	55.8	54.8	53.9	55.1	56.0	55.2	57.9	57.2	54.9	55.7	55.4	57.5	54.9	52.5	50.5	49.1	48.2	48.5	47.3	48.9	48.5	50.0	46.7	46.9	44.7	45.2	43.4	46.0	42.7	43.7	44.5	44.6	42.9	43.9	44.0	44.4	46.4
Germany	50.9	49.7	47.4	42.9	38.7	32.7	32.0	32.1	32.4	36.4	39.6	40.8	45.6	49.2	49.6	51.0	52.4	52.7	53.7	57.2	60.2	61.8	58.4	58.4	61.2	58.2	55.1	56.6	58.1	60.7	60.5	62.7	60.9	62.0	57.7	54.6	52.0	50.9	50.3	49.1	47.9	48.4	51.0	50.2	48.4	46.2	45.2	45.0	43.0	44.7	47.4	46.0	46.8	46.0	49.8	50.3	49.0	48.1	49.4
Netherlands	48.0	49.8	48.3	45.3	38.7	38.4	36.3	35.5	36.9	38.8	41.2	44.4	46.6	50.5	50.0	50.5	51.9	53.1	54.8	55.2	57.8	56.9	56.5	55.9	55.7	54.3	52.9	55.4	56.5	57.5	57.5	60.7	58.1	59.2	55.1	52.1	51.4	50.7	48.9	48.0	45.0	45.2	49.0	50.3	49.6	49.0	47.6	48.9	48.9	49.7	50.7	48.9	48.2	49.6	50.2	49.0	48.0	48.2	48.7
Switzerland	54.2	51.5	47.9	46.2	38.3	34.7	36.1	33.3	32.7	36.1	39.9	42.2	45.3	49.6	54.1	54.4	54.5	54.5	56.2	57.1	63.6	65.4	64.9	65.0	67.3	62.0	61.2	60.5	61.8	60.5	60.4	62.1	58.3	58.9	58.5	54.0	53.4	52.4	49.8	47.9	45.4	49.0	47.8	48.9	49.9	47.4	45.9	48.0	48.2	47.0	44.3	46.4	48.2	49.2	52.5	50.8	48.3	50.2	52.2
United Kingdom	43.2	44.8	41.4	41.8	35.8	36.9	36.3	34.6	36.5	42.6	44.9	47.0	50.4	51.2	50.9	54.6	53.4	54.7	54.6	55.2	56.5	57.3	58.0	57.4	57.2	55.0	54.1	57.4	59.2	57.7	59.6	59.2	55.4	54.0	52.4	51.6	50.3	49.7	51.3	48.9	47.9	49.2	50.7	51.1	51.8	49.9	46.1	48.3	45.6	49.7	48.9	47.7	49.0	50.9	50.9	48.2	49.0	50.2	51.3
Greece	51.6	52.5	50.8	48.1	42.3	41.0	40.0	38.9	39.2	40.8	46.1	47.7	48.8	51.1	48.5	48.0	47.3	48.8	46.8	44.2	42.9	43.6	41.8	42.2	45.3	43.0	44.7	43.6	43.9	43.1	42.8	42.8	45.4	46.8	44.5	45.5	45.2	43.3	43.2	40.5	40.9	42.0	41.0	37.7	41.3	40.7	43.1	45.1	41.9	42.1	42.2	41.0	41.8	41.4	41.7	43.0	42.1	45.0	45.3
Italy	45.3	47.1	44.4	39.7	34.8	35.5	36.1	36.0	34.8	37.2	41.1	42.7	45.4	44.2	47.6	49.2	50.1	50.8	51.7	51.6	53.7	54.3	54.0	54.3	54.4	52.8	52.6	53.0	52.0	54.7	56.6	58.0	56.2	55.5	52.8	49.9	50.1	47.0	48.3	43.3	44.0	44.3	46.8	47.8	47.9	43.8	44.8	44.6	44.3	43.6	45.7	45.5	45.1	46.7	47.8	45.8	44.5	45.5	47.3
Spain	39.2	42.4	38.3	34.8	29.4	28.5	31.6	31.8	32.8	34.8	38.8	42.8	47.3	47.2	45.8	46.3	45.3	45.2	45.3	49.1	51.8	53.3	51.5	51.2	51.6	51.2	49.6	51.2	50.0	51.5	52.0	52.1	51.6	50.6	48.2	47.3	45.6	45.3	43.7	43.9	43.8	43.7	45.1	45.0	44.5	43.5	42.0	41.1	42.3	44.0	44.5	43.5	45.3	44.6	46.1	46.8	44.2	44.7	48.1
Euro Area	47.4	47.6	45.9	41.1	35.6	33.5	34.4	33.5	33.3	36.8	40.7	42.6	46.2	49.2	48.3	50.7	51.2	51.8	52.4	54.2	56.6	57.6	55.8																																				



# Bertin: Reorderable Matrix

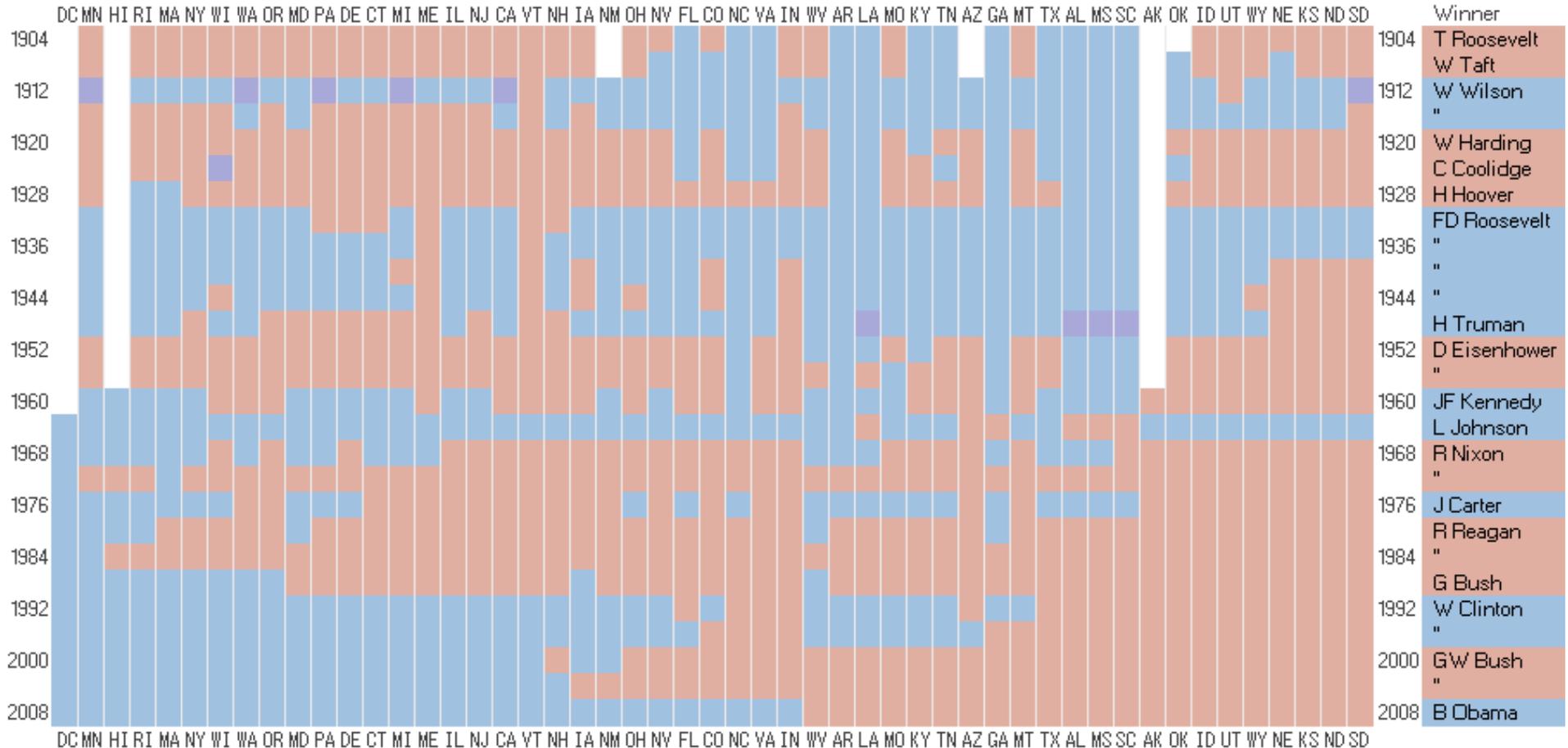


## LA MATRICE ORDONNABLE

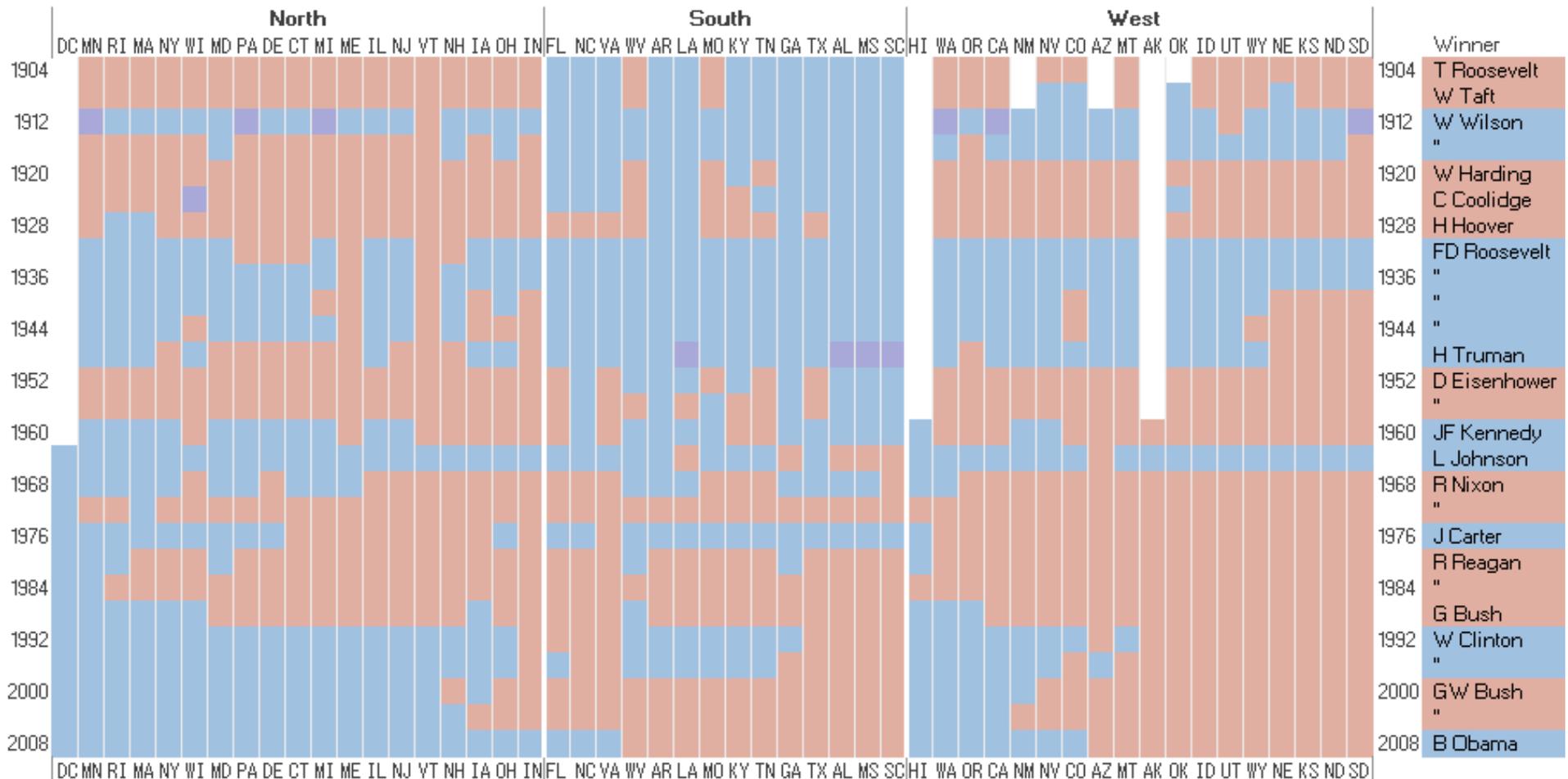




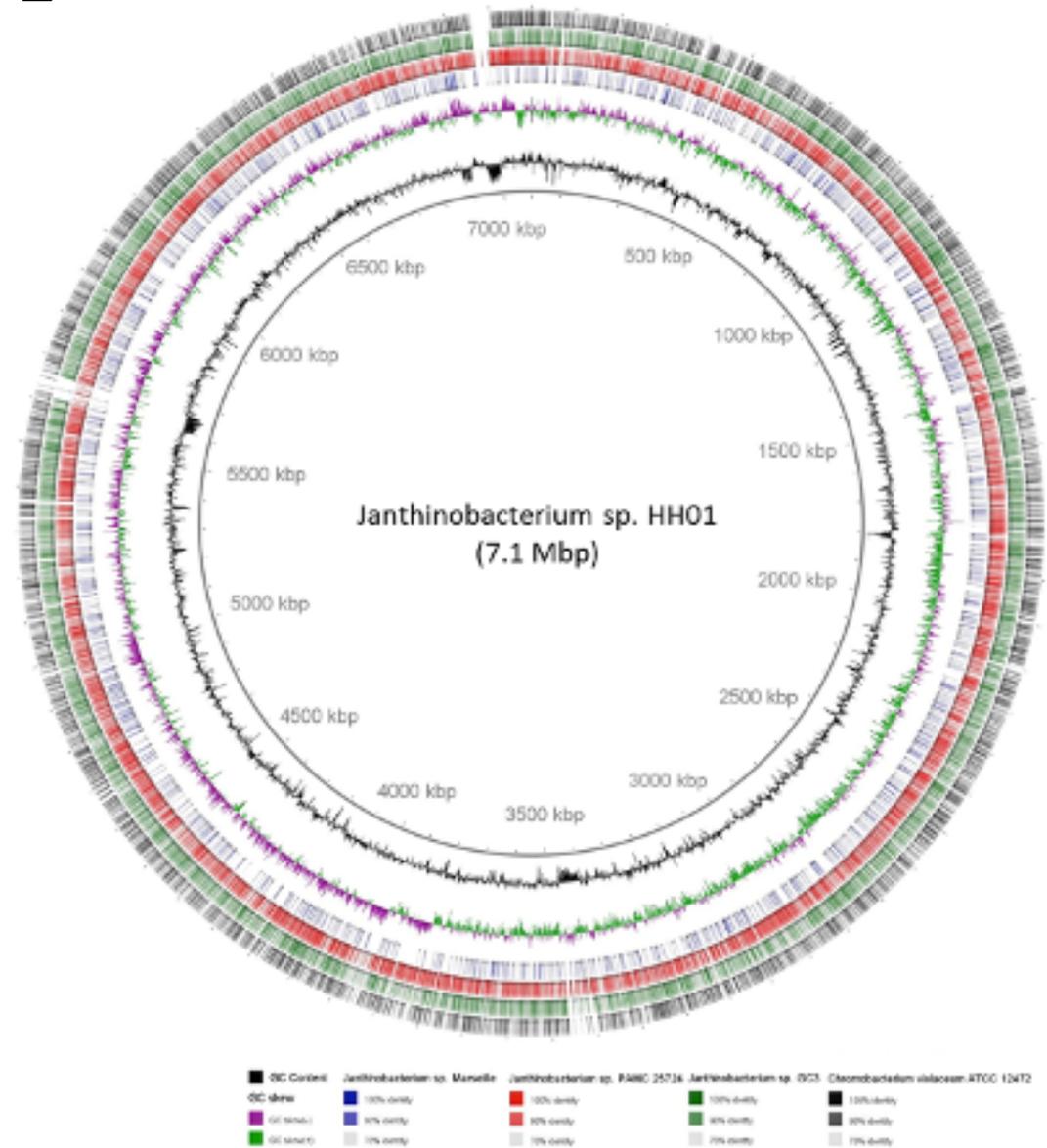
# US Political History: Most recent results

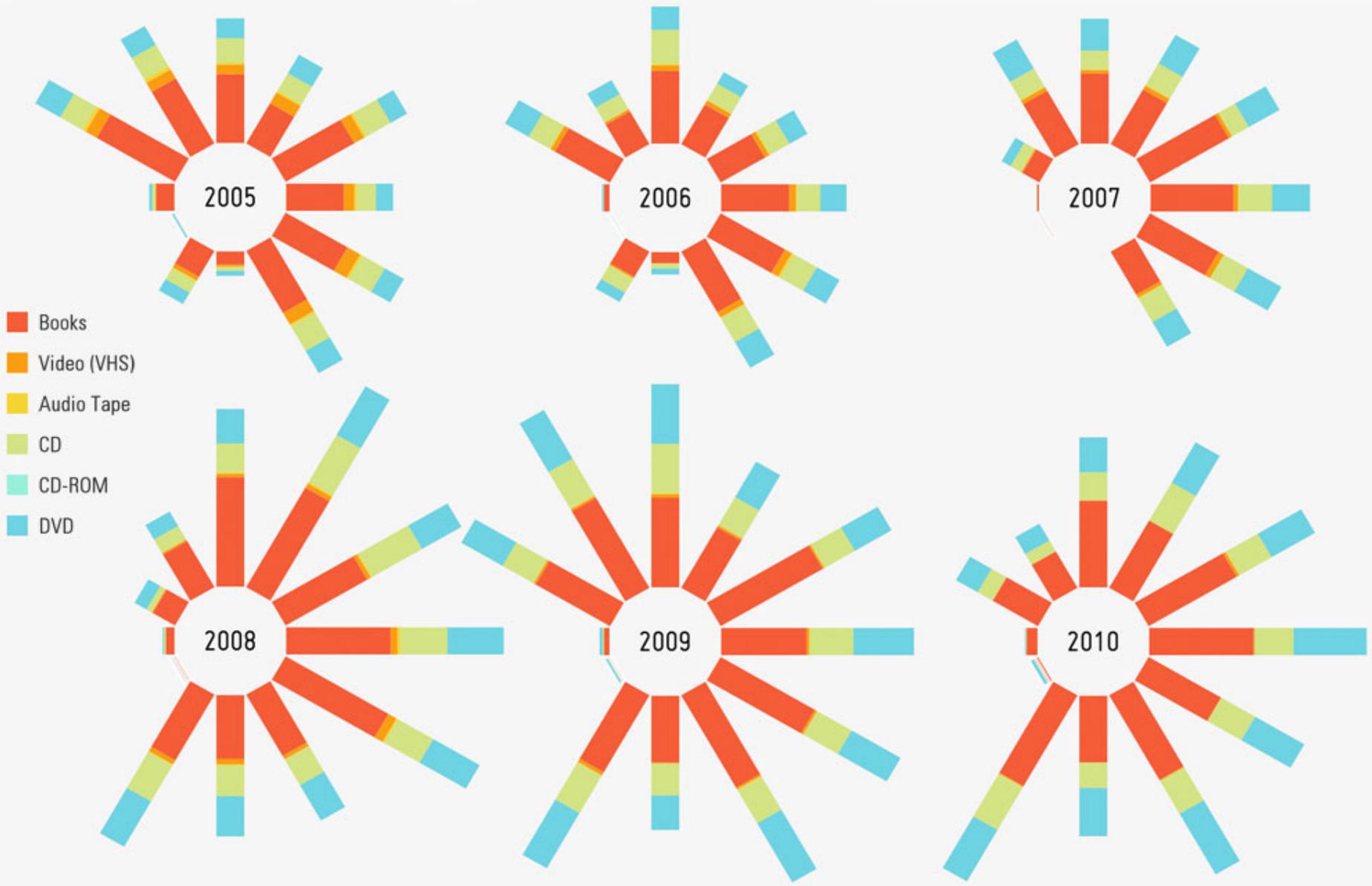


# US Political History: 3 regions



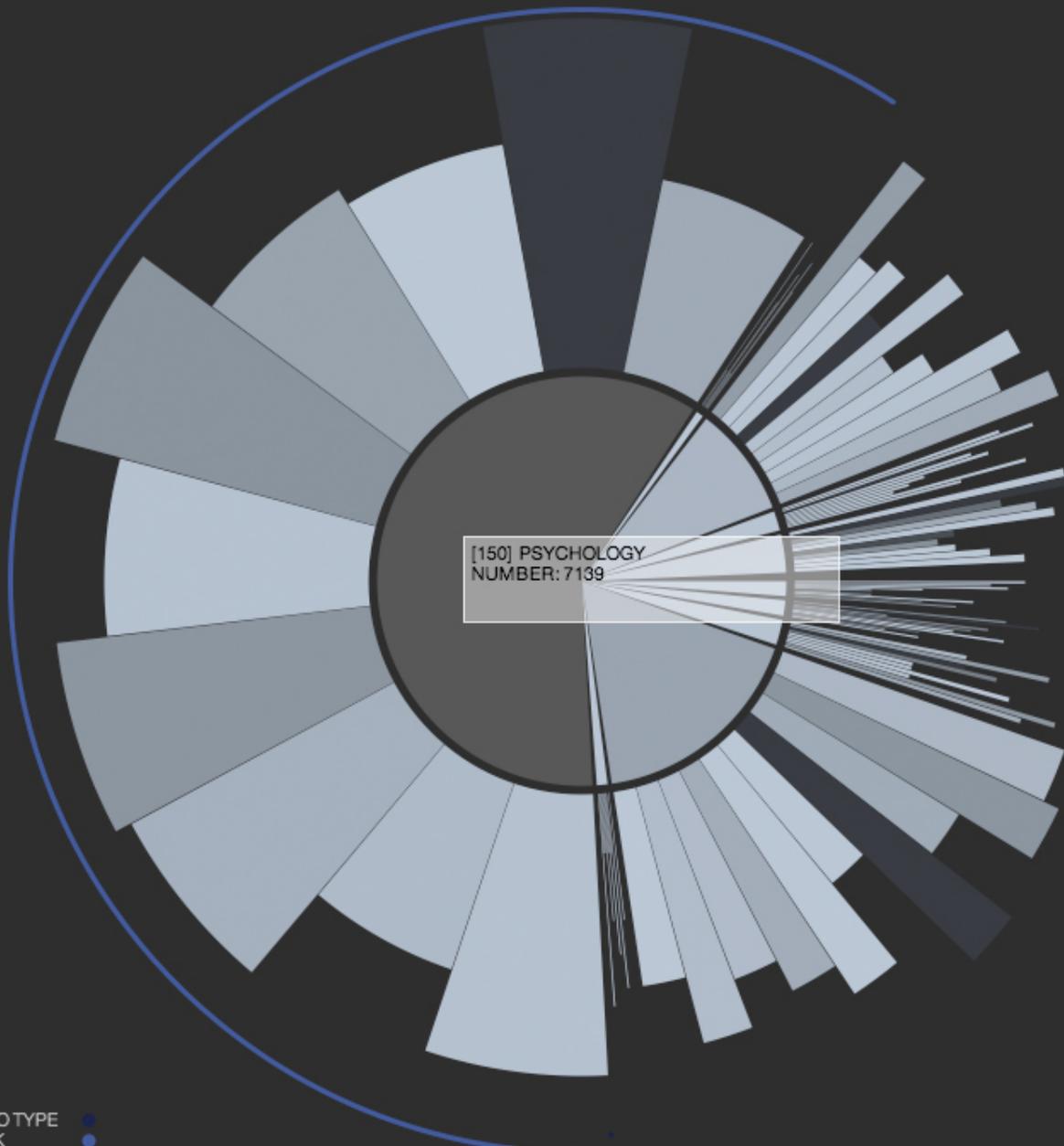
# Spherical Data Mapping





November 10, 9am to 8pm, 2005, 2006, 2007, 2008, 2009, 2010

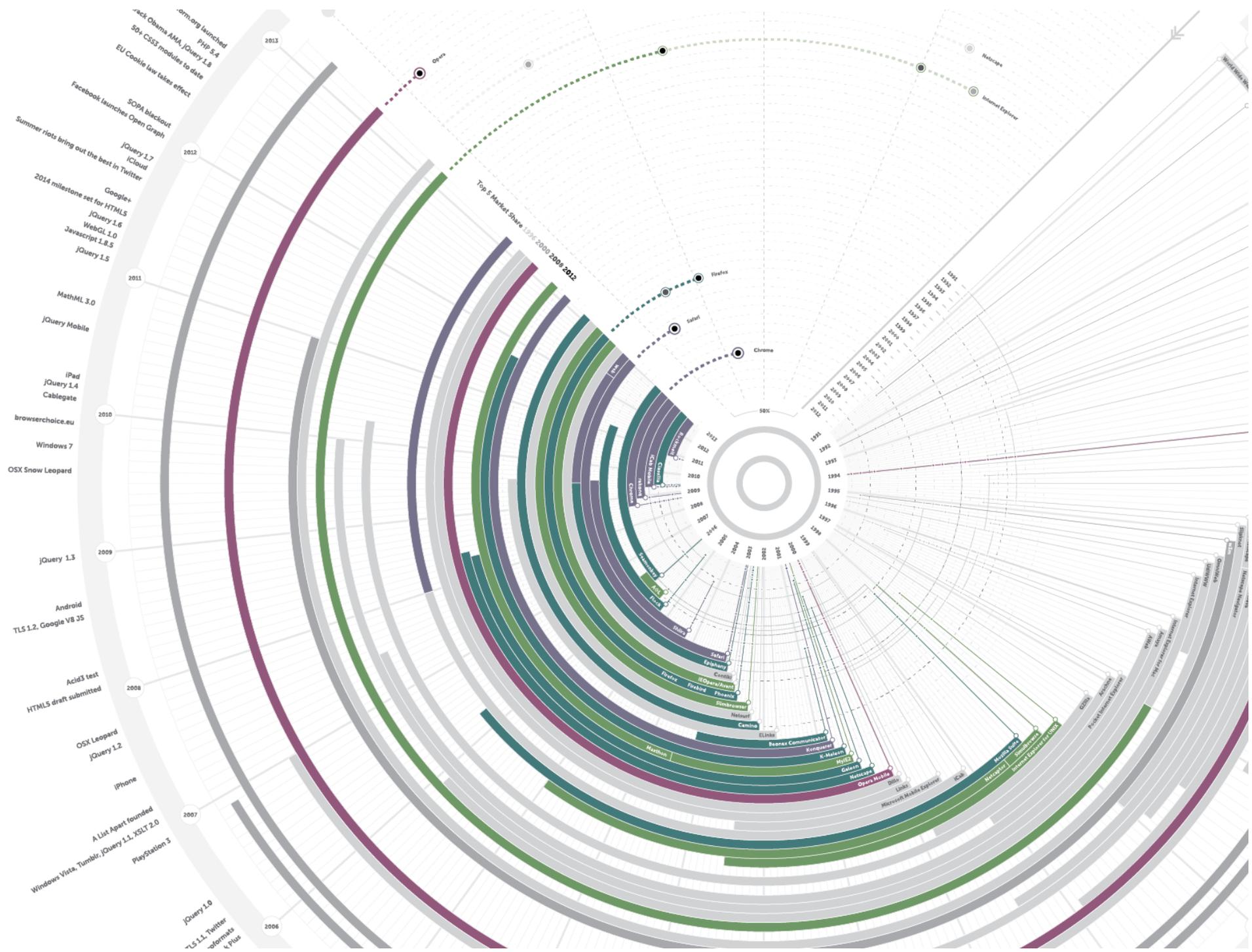
THE HOTTEST BOOK  
QIAN LIU | CIRCULAR TREE MAP



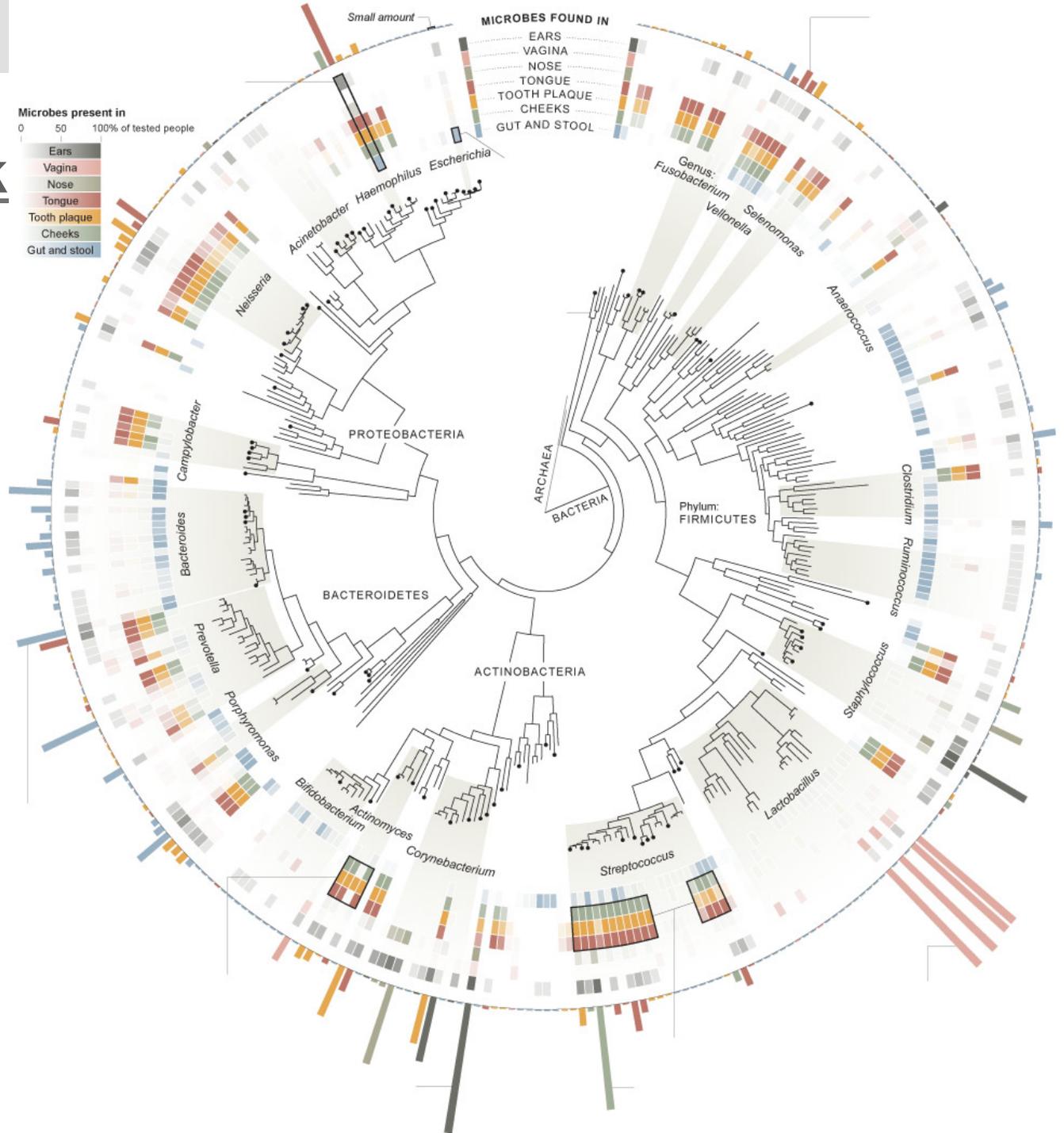
**TOP 10 BOOK'S NUMBER, CATEGORY AND TITLE**

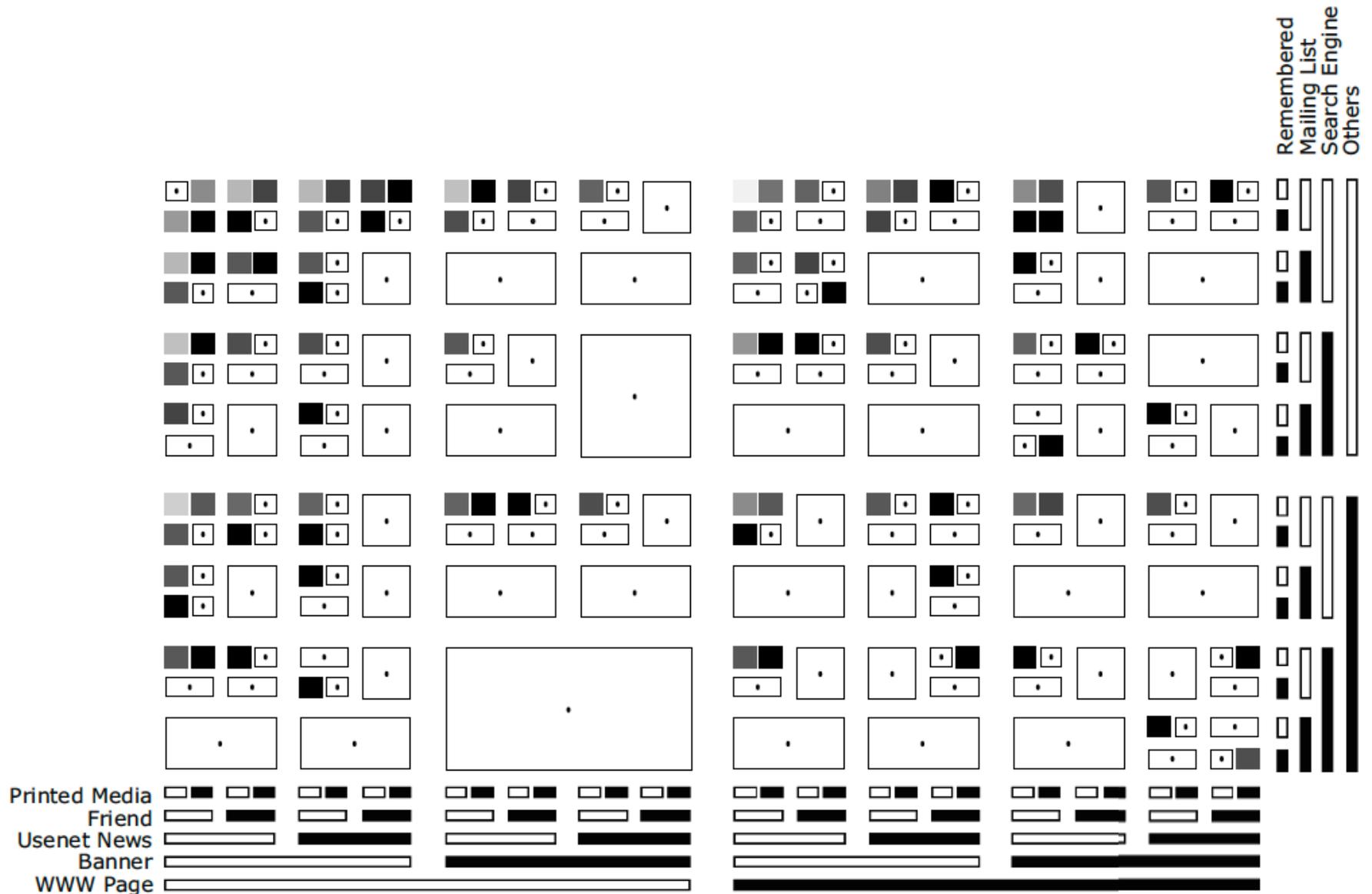
96522	[158]	Maximum achievement the proven syst...
44466	[158]	fundamentals 8 plays for winning th...
24764	[158]	Get anyone to do anything and never...
14086	[152]	Emotions revealed recognizing faces...
14041	[153]	Blink the power of thinking without...
12781	[170]	Caught in the act reflections on be...
11459	[155]	Learned optimism
10828	[153]	artists way a spiritual path to hig...
10409	[158]	Emotional alchemy how the mind can ...
9828	[155]	needs of the dying a guide for brin...

AUDIO TYPE ●  
BOOK ●



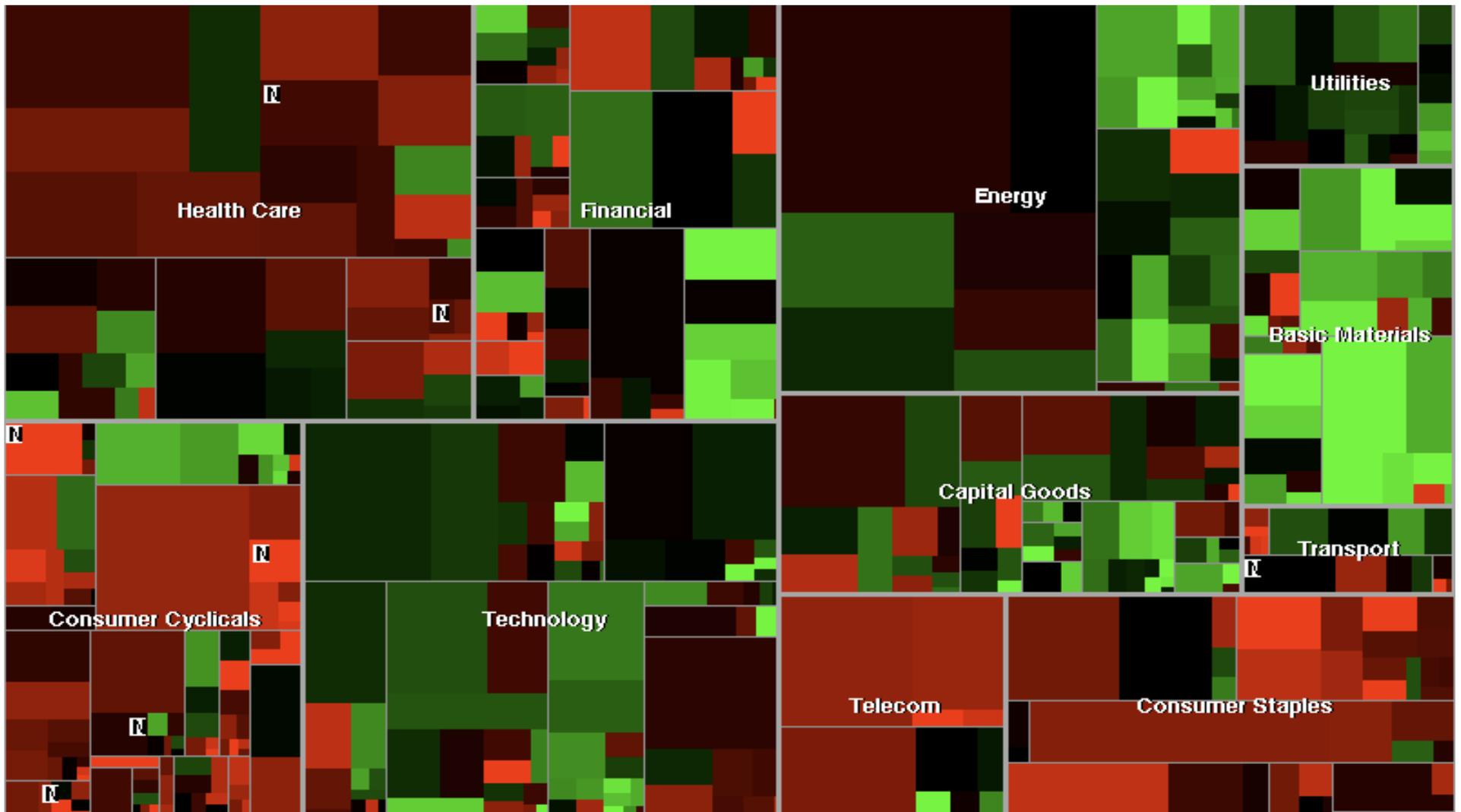
# Visual Network



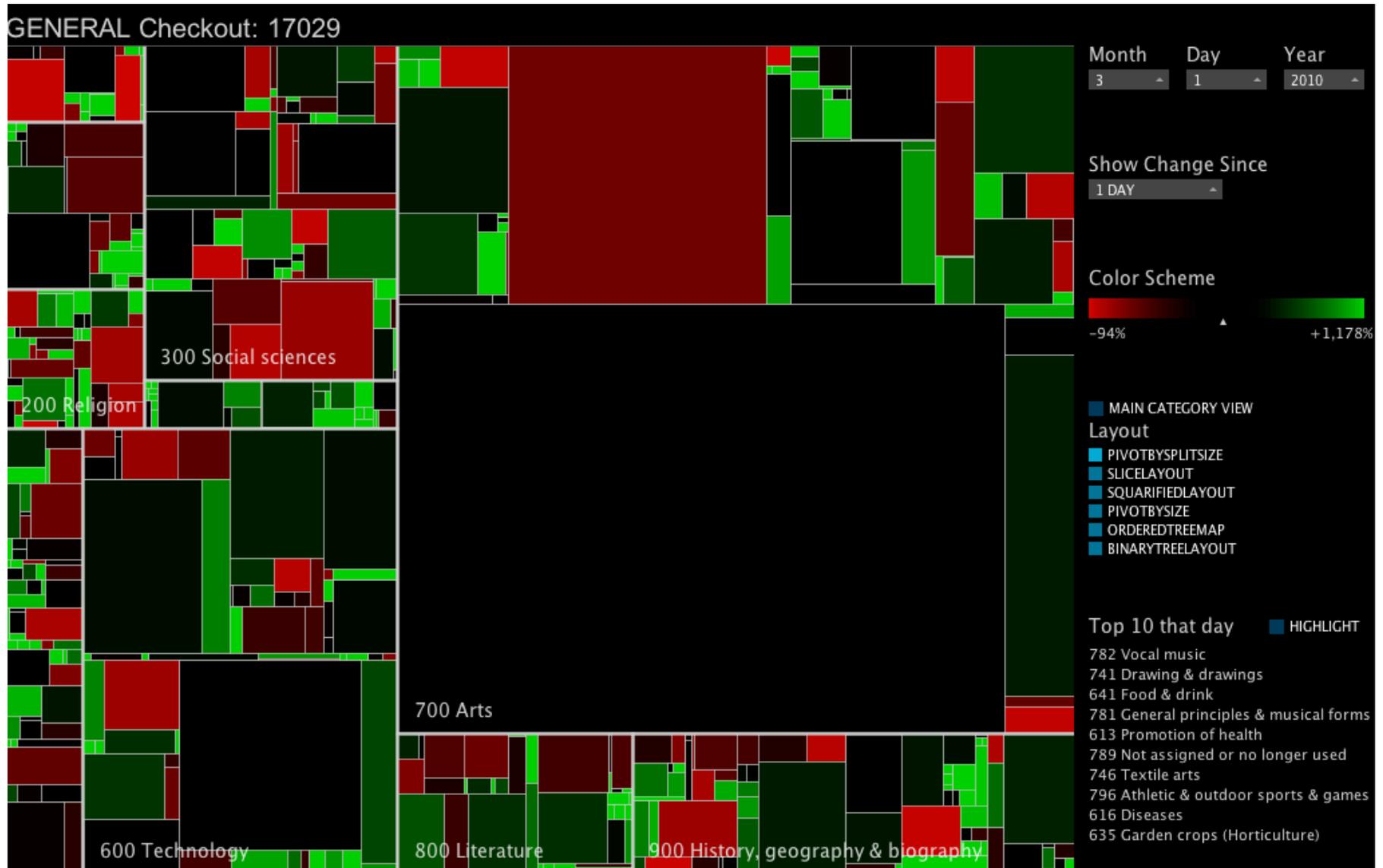


**Fig. 5.13.** *Mosaic Plots of all possibilities of “How you Heard about the Survey?” Gray-shading has been used to mark cell sizes. Empty cells are combined where possible and tagged by a circle. 112 of the possible 512 combinations are empty.*

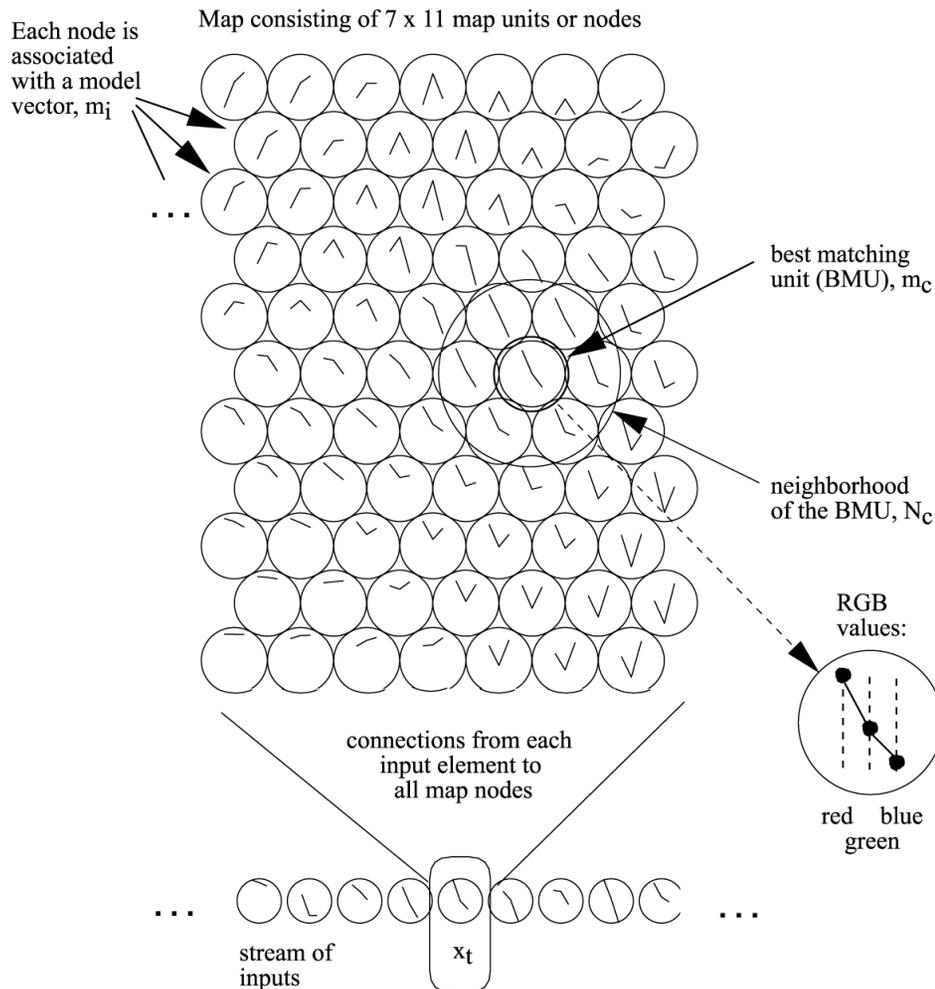
# TreeMap: SmartMoney (Schneiderman/Wattenberg)



# Yun Teng Treemap [\[link\]](#)



# Kohonen Self-Organizing Map Algorithm

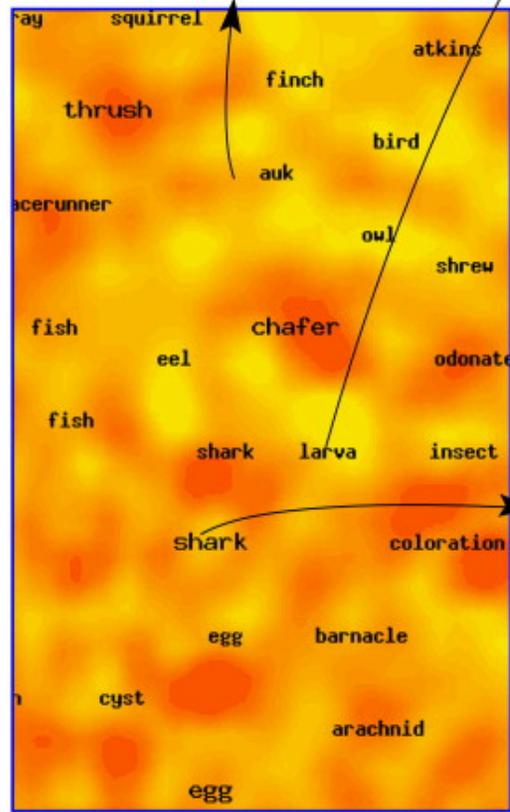


**Descriptive words:**  
bird, yellow, species, black, kingbird, hawaiian, bill, inch, family, have

**Articles:**  
cacique  
guira  
Hawaiian honeycreeper  
siskin  
kingbird  
chickadee

**Descriptive words:**  
larva, egg, female, species, aphid, insect, adult, lay, other, water

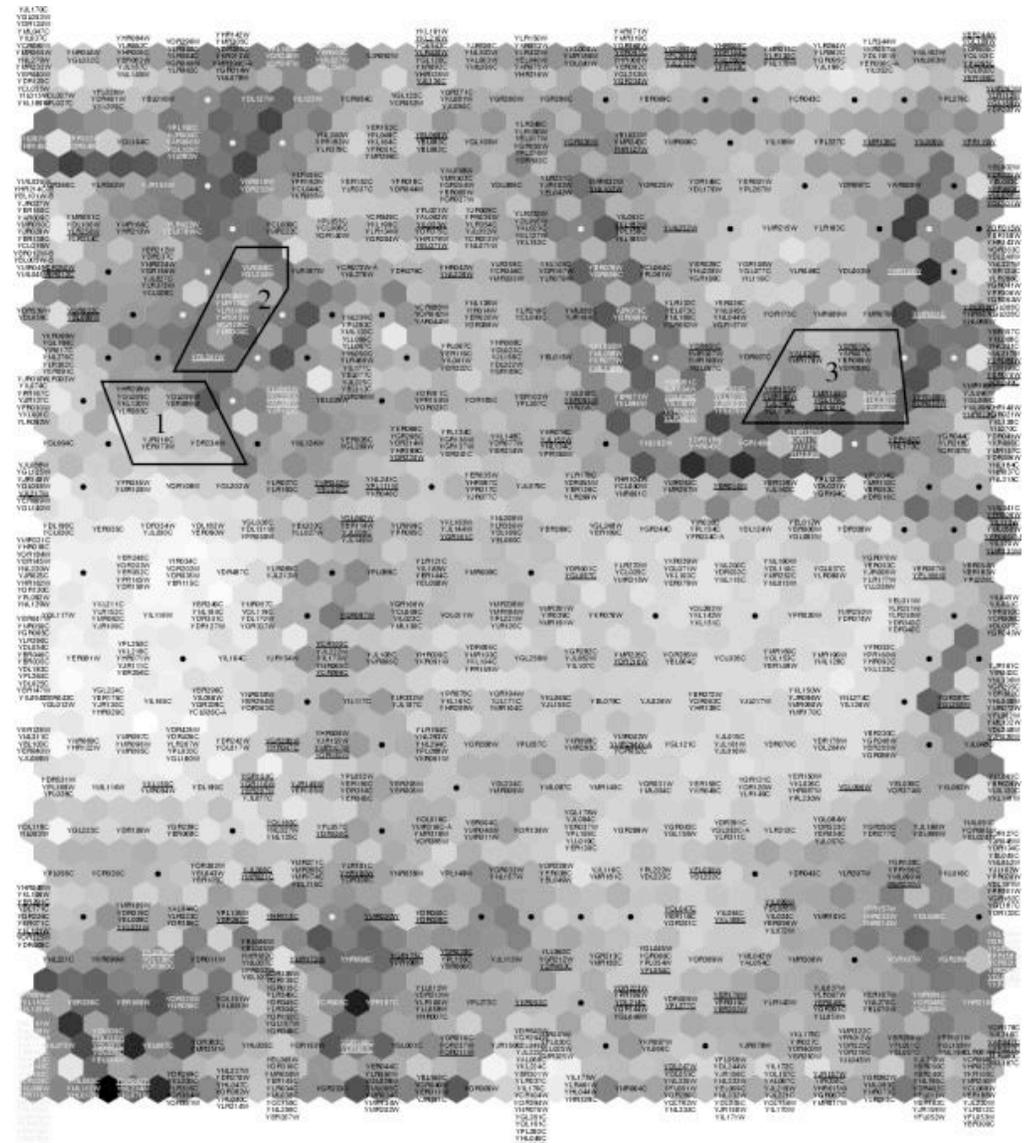
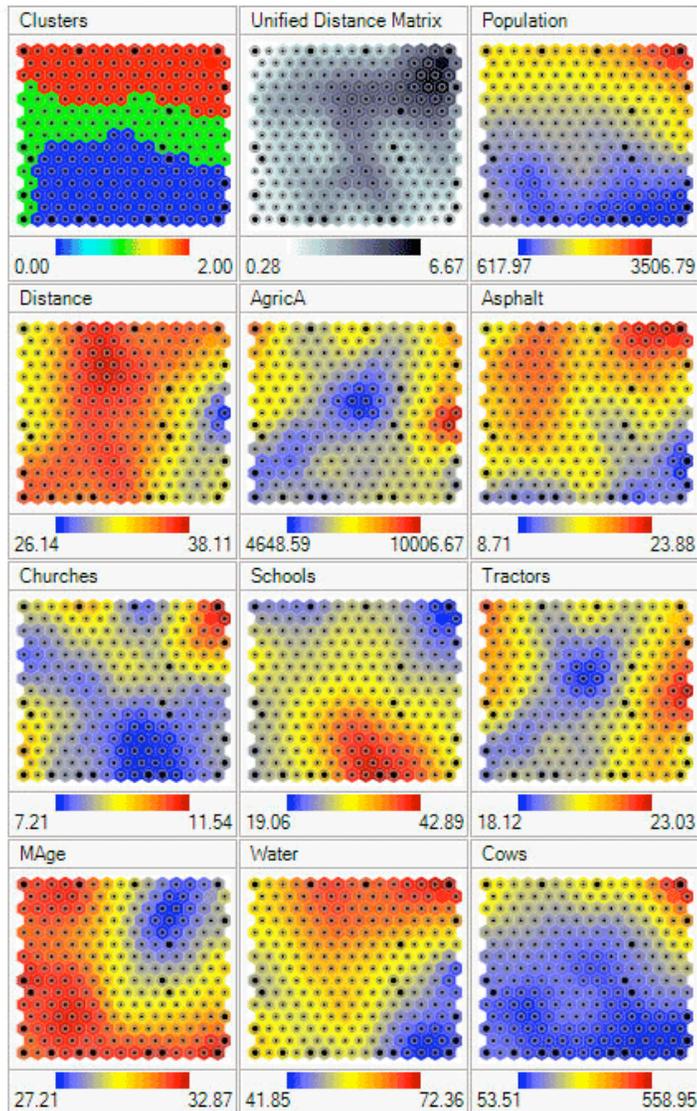
**Articles:**  
homopteran : Formation of galls  
strepsipteran  
mantispid  
neuropteran : Natural history  
lacewing  
damselfly  
caddisfly : Natural history  
bagworm moth  
glowworm



**Descriptive words:**  
shark, fish, species, ray, many, water, feed, have, attack, use

**Articles:**  
fox shark  
chondrichthian : General features  
leopard shark  
soupfin shark  
shark  
chondrichthian : Economic value of rays  
bull shark  
blacktip shark  
chondrichthian : Natural history  
Cambyes I  
shark : Description and habits.  
shark : Hazards to humans.

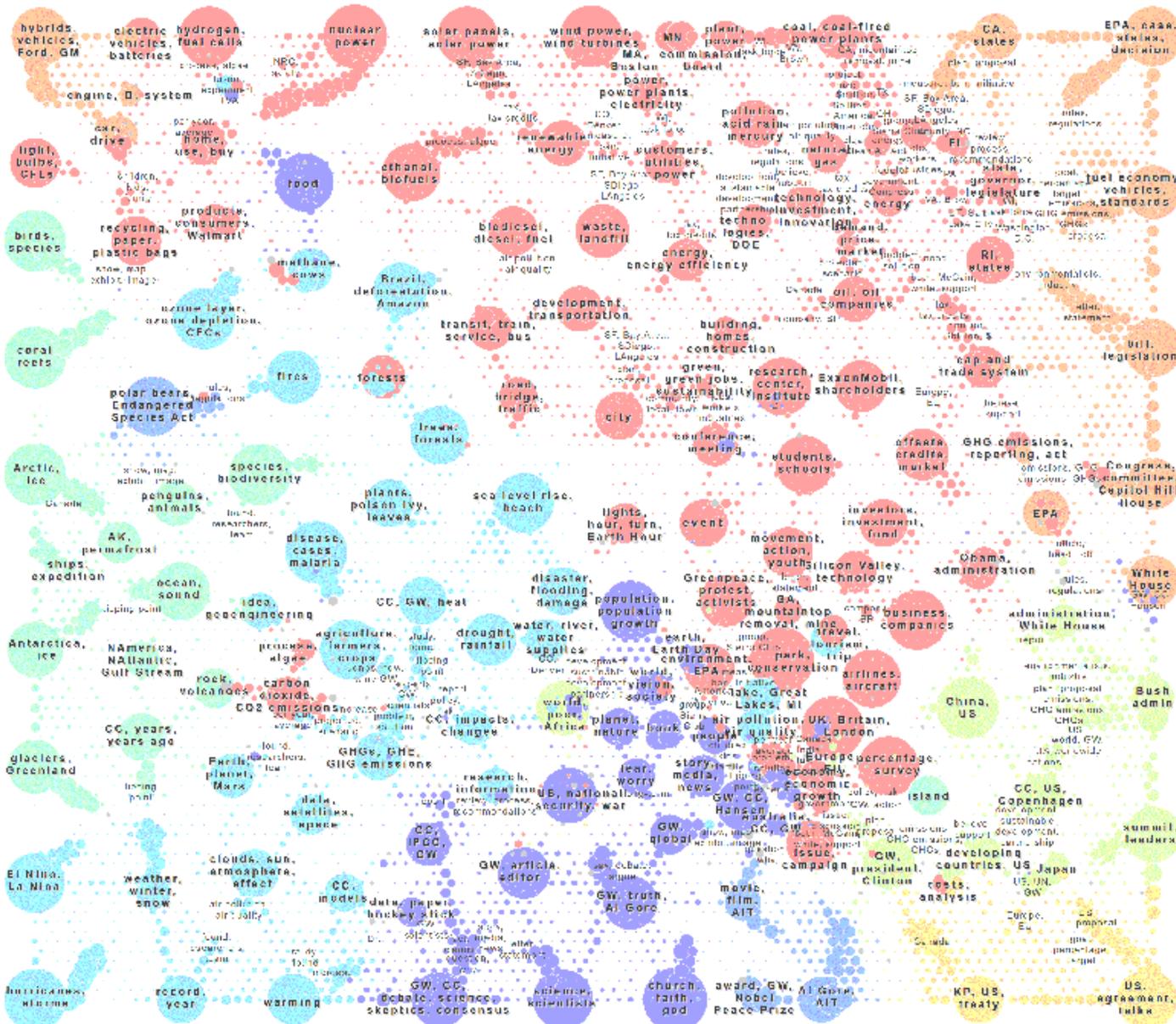
# SOM Unified-Distance Matrix [\[link\]](#)





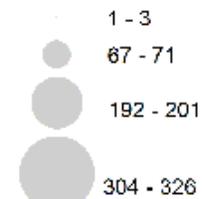
# Self-Organizing Map with Hierarchical K-Means Clustering for Minimum Error Classification Outputs

This SOM is a representation of document relatedness and topic dominance. Circle sizes represent the number of documents contained within a neuron, and in general, closer circles are more thematically related than more distant circles. Circle colors correspond to hierarchical K-means cluster membership and provide information about cases in which the neighborhood-relatedness metaphor breaks down.

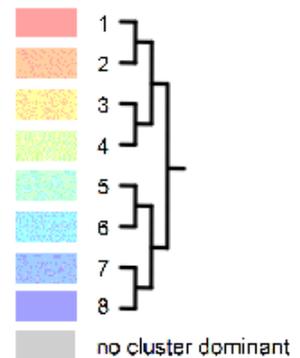


Text labels indicate the dominant topics in each region. Topic labels in boldface are strongly dominant in the associated regions.

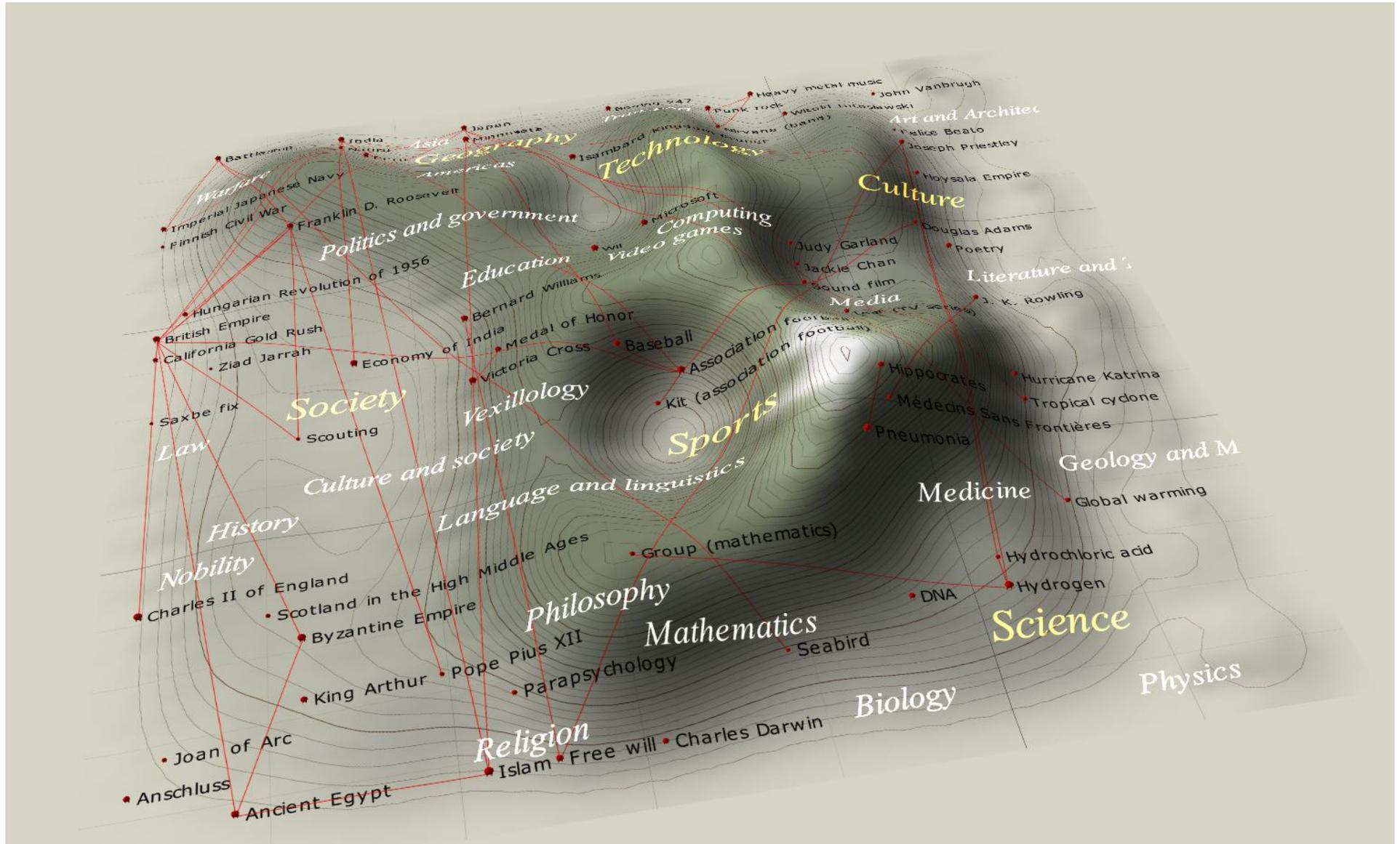
## Number of Documents Per Neuron



## Cluster Membership for Hierarchical 8-Cluster K-Means Solution



# SOM in 3D



# **Kohonen Maps & Spatial Metaphor**

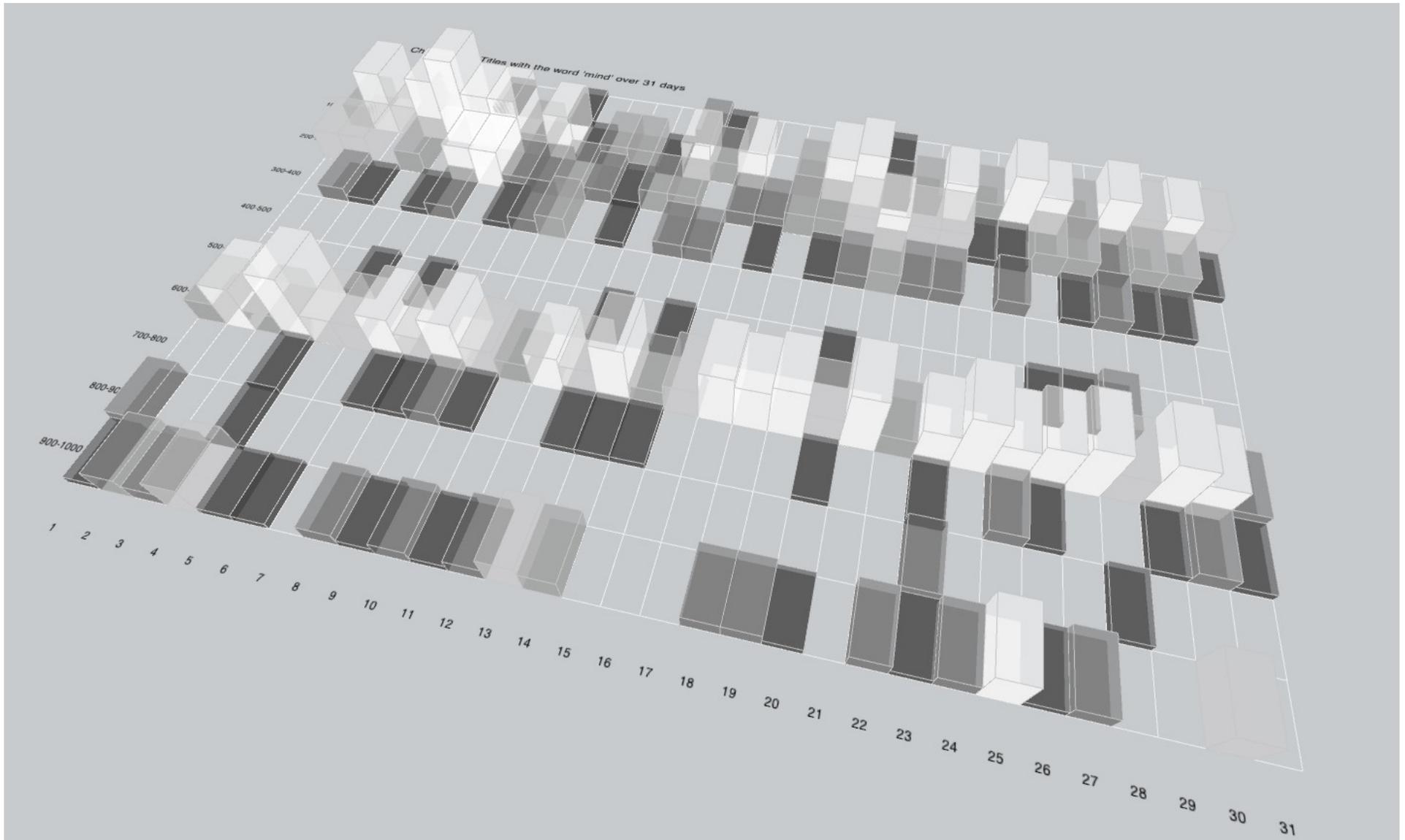
**Stacy Hespanha**

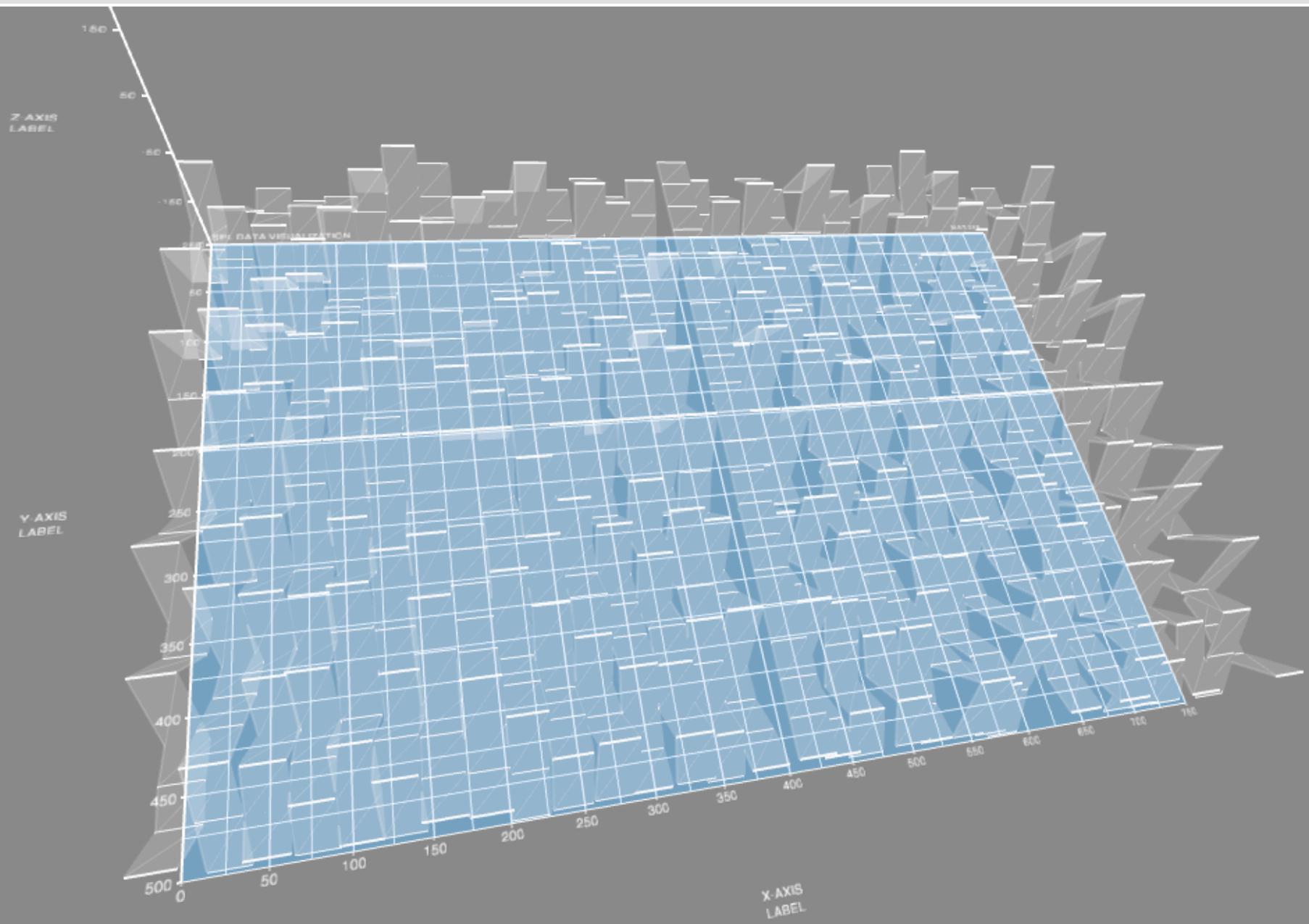
**Mike Godwin**

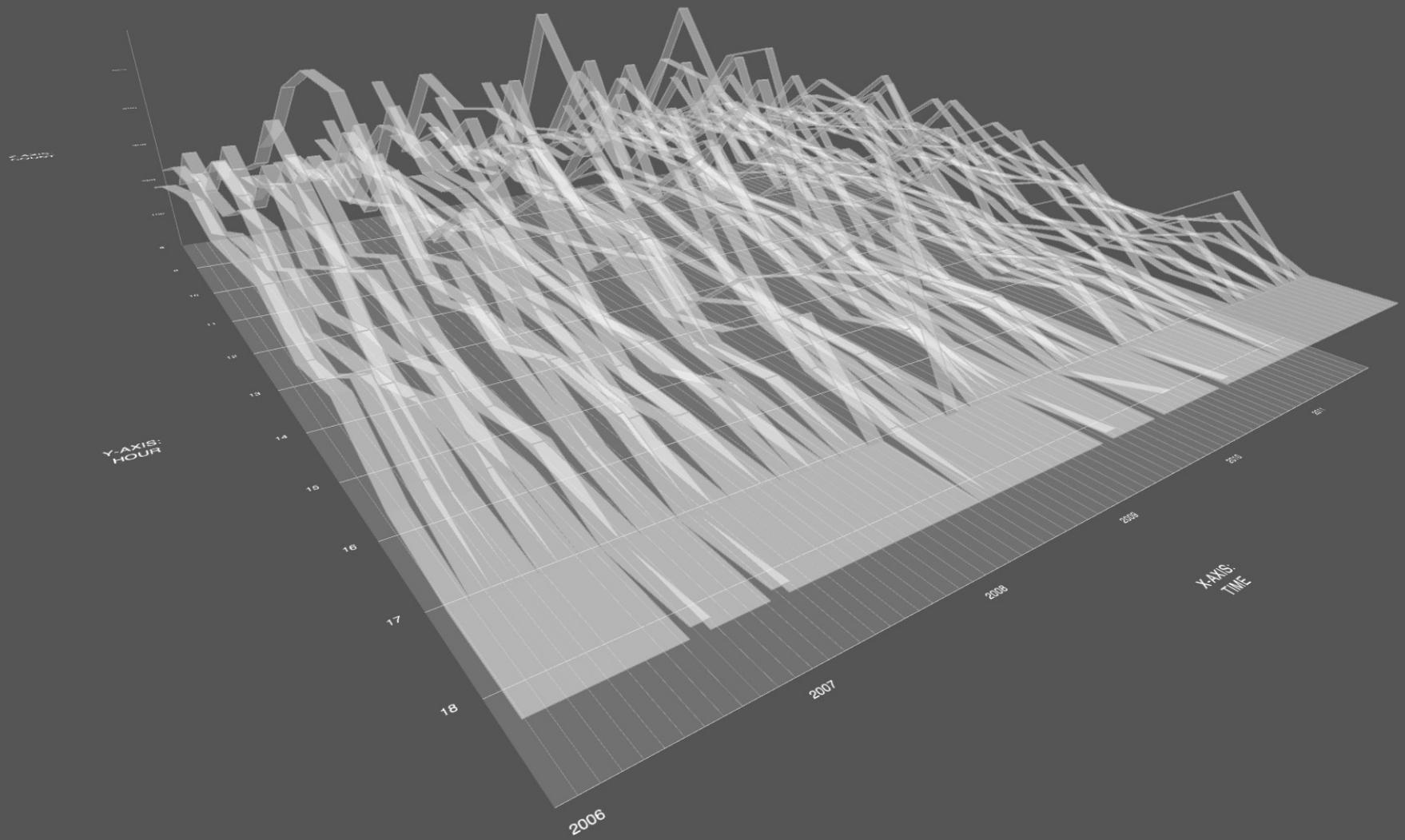
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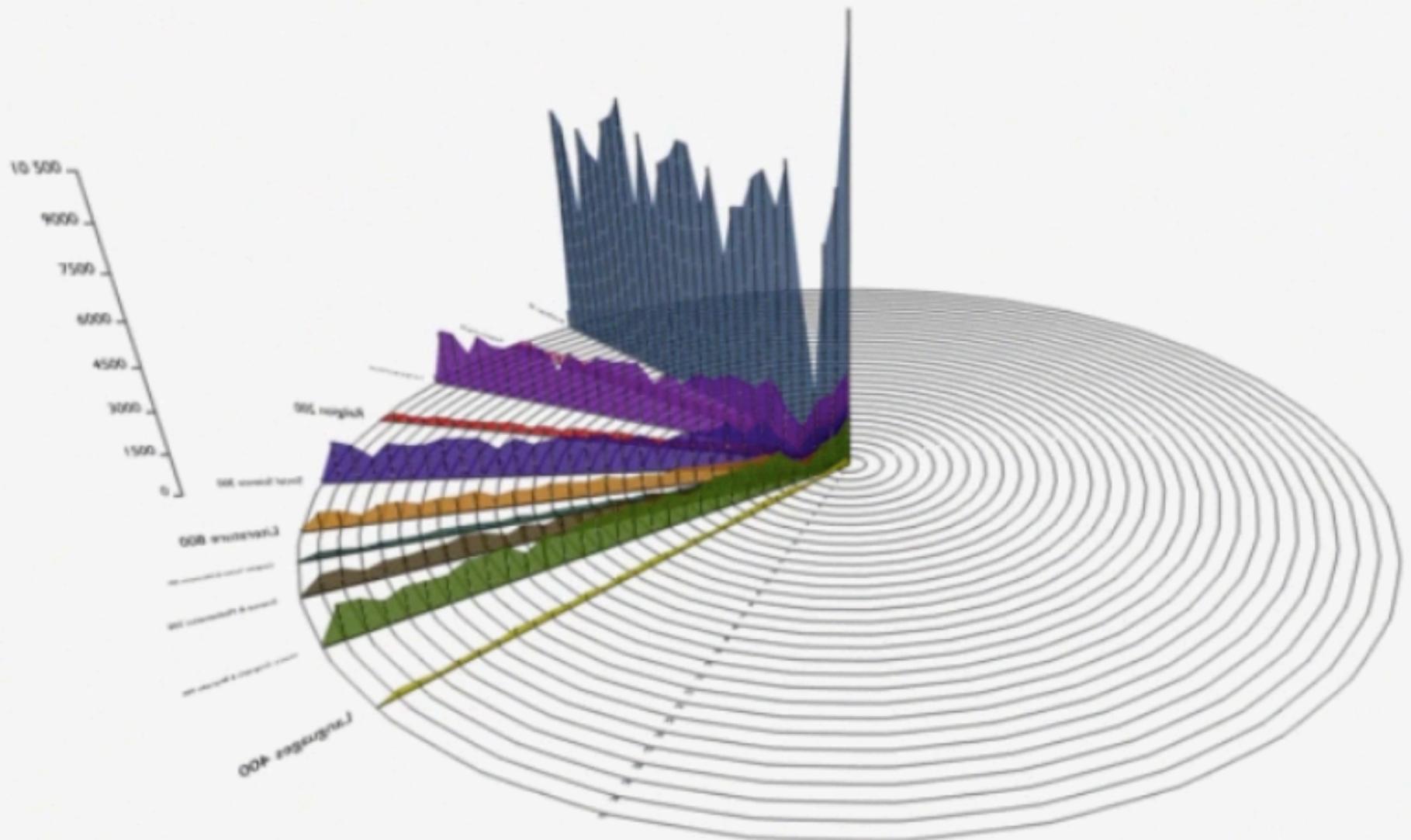
**Andre Skupin**

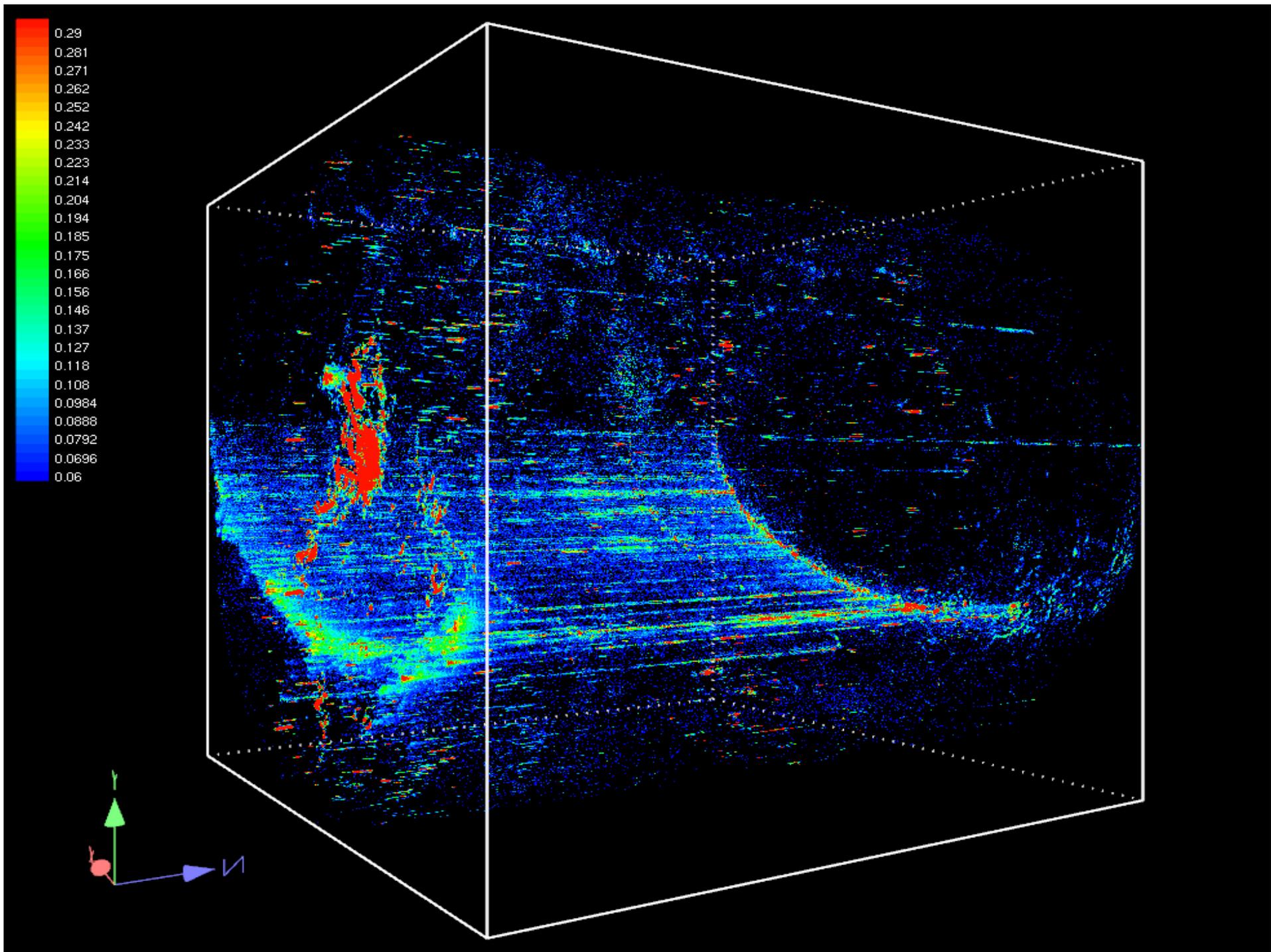
# 3D Visualization / Change Over Time-Space

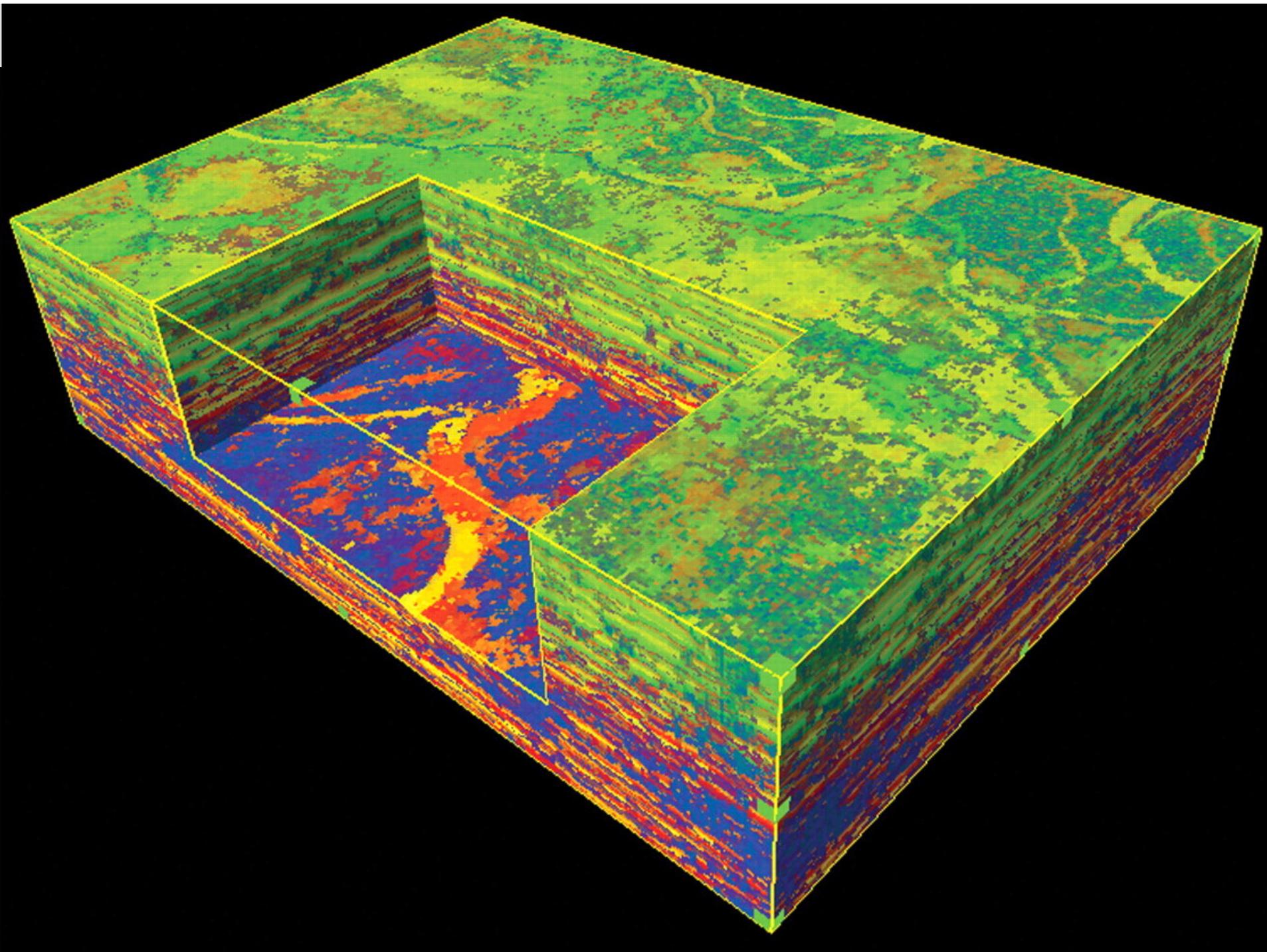


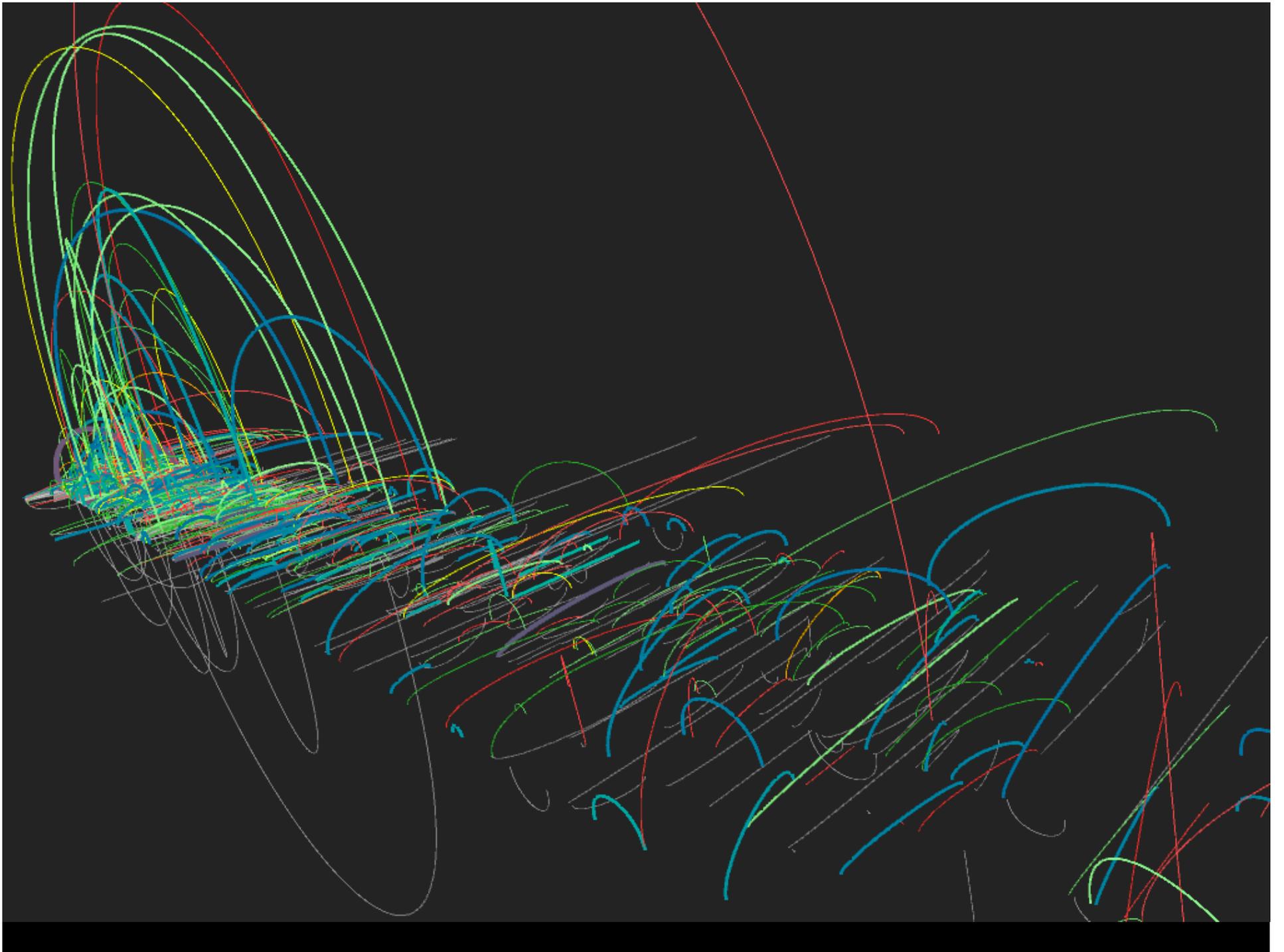


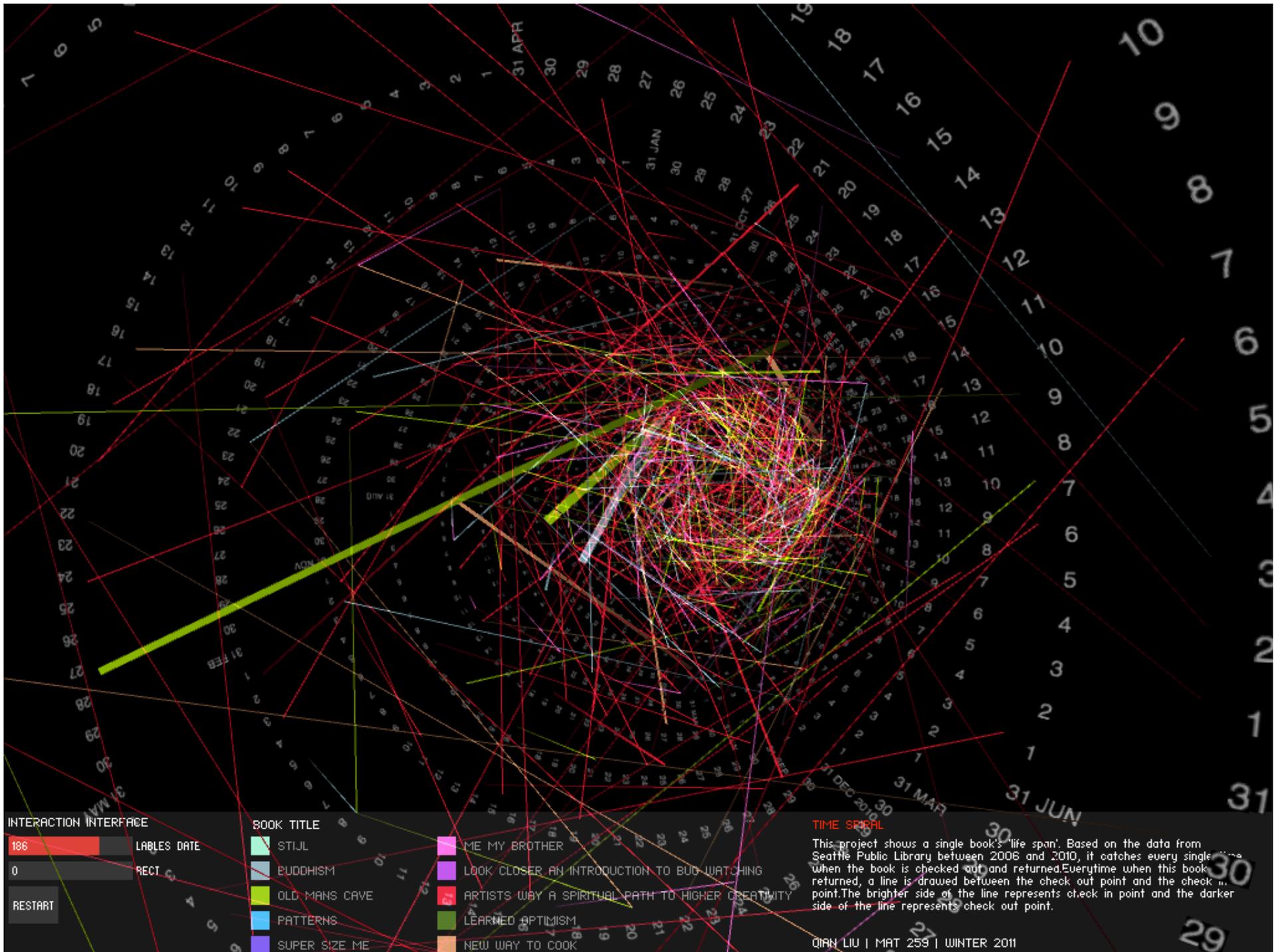












# 3D Frequency Pattern Algorithm

