

# **3D Visualization Fundamentals**

## Handbook

George Legrady © 2023  
Experimental Visualization Lab  
Media Arts & Technology  
University of California, Santa Barbara

# Lecture Topics (January 31, 2023)

- Basics of Visual Language in 3D
- Situating Data in space
- 3D visualization examples
- How to give credit: code, data, refs, etc.
- Exploratory Design process

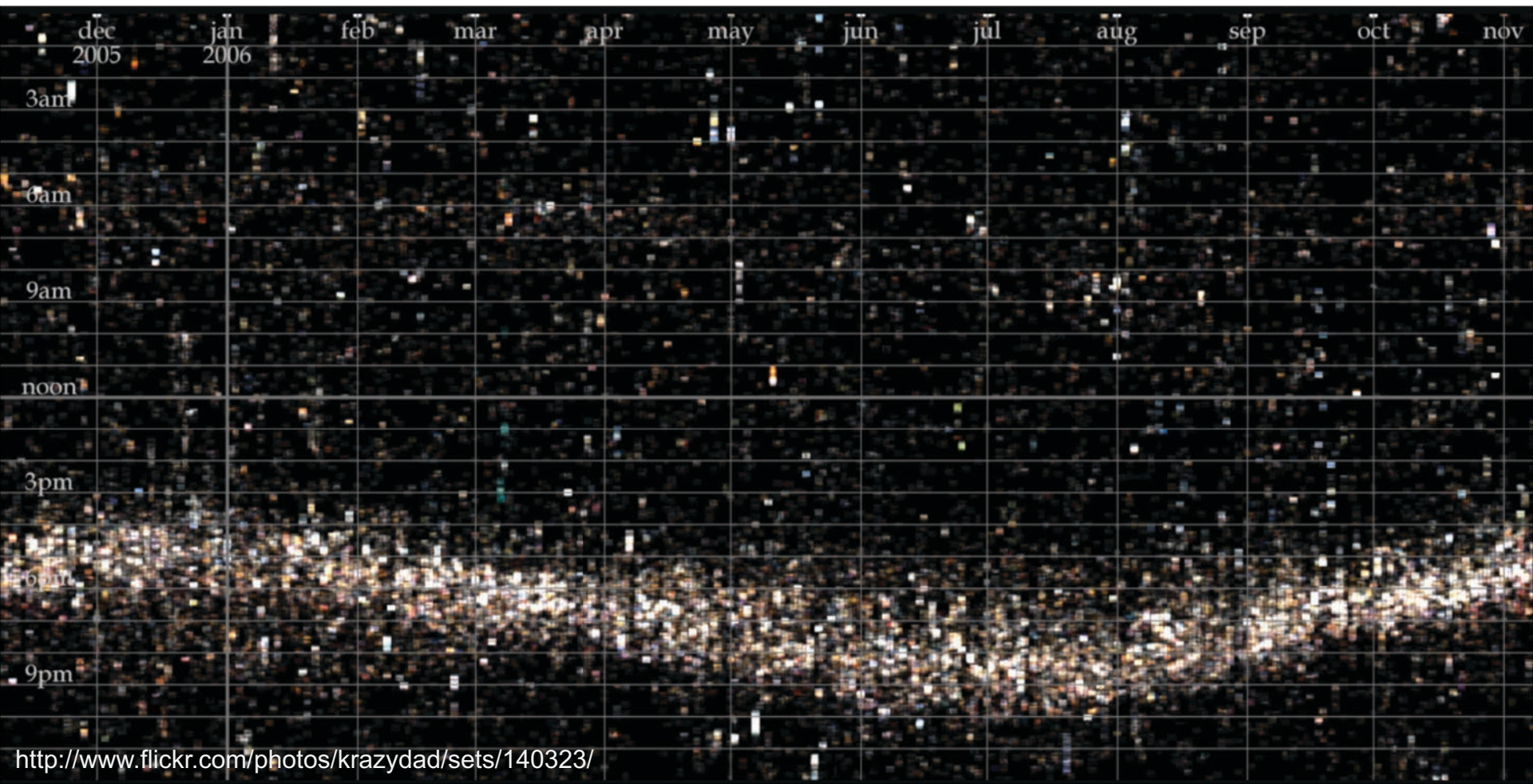
# Basics of Visual Language in 3D

- **Syntax:** a set of rules by which language is structured. In visualization this involves decisions in how to organize visual elements in space.
- **Semantic:** The study of meaning. In what ways, does visual elements convey meaning? To what degree does changing the visual elements transform meaning?

(Reference: Nelson Goodman, "Languages of Art", 1960)

# Rules in spatializing & organizing data

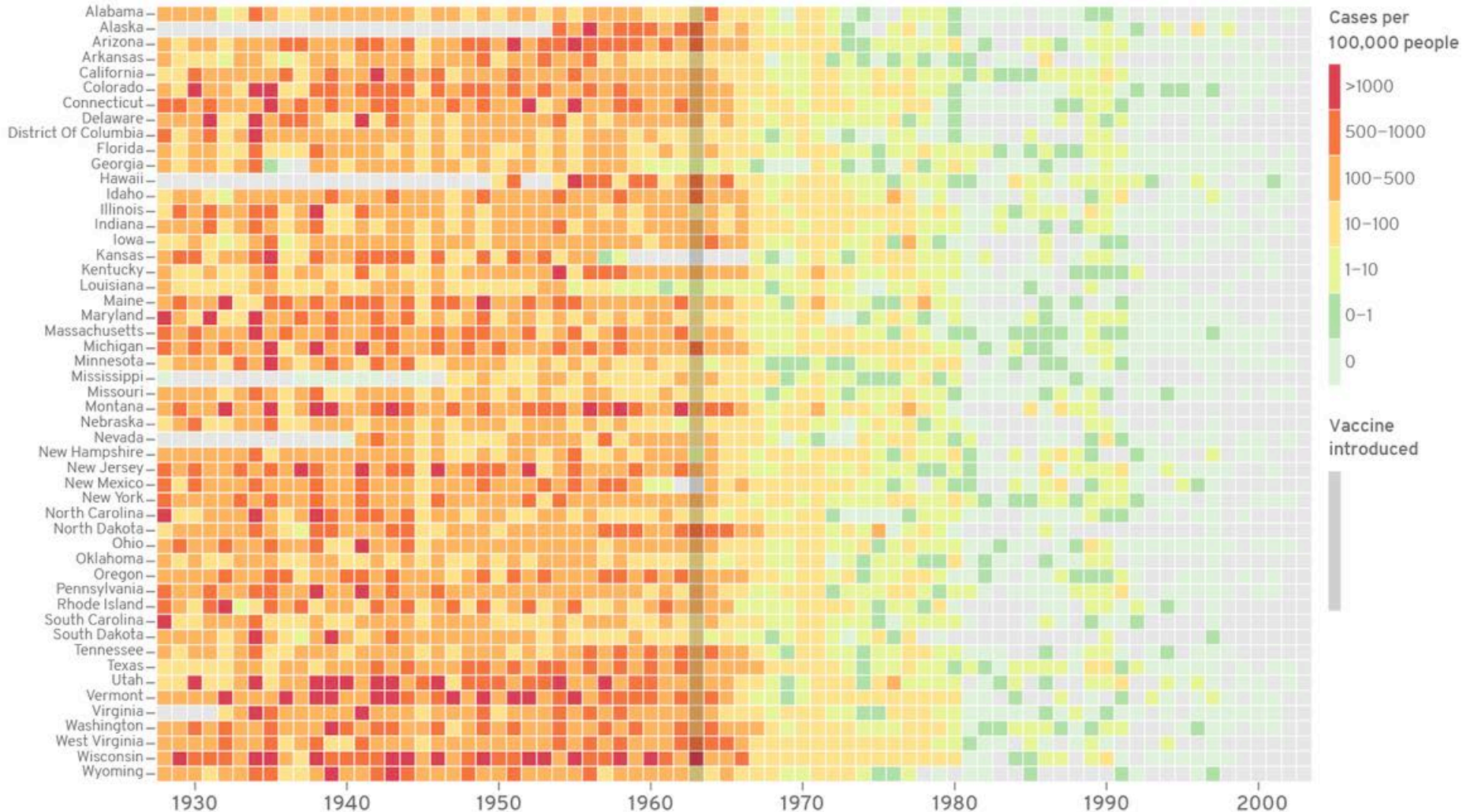
- Use full screen for final version (use small screen during development)
- In 2D, subdivide Screen (rule of thirds; or according to any set of rules)
- In 2D use invisible grid system to determine how things are placed



# Color Coding & Clustering

**Heatmap:** Magnitude of phenomenon using color either by hue or intensity

Incidence of Measles in the US



# Vis Example

## Items acquired over time

000 - 099  
Computer Science,  
Information  
& General works

100 - 199  
Philosophy  
& Psychology

200 - 299  
Religion

300 - 399  
Social Sciences

400 - 499  
Language

500 - 599  
Science

600 - 699  
Technology

700 - 799  
Arts & Recreation

800 - 899  
Literature

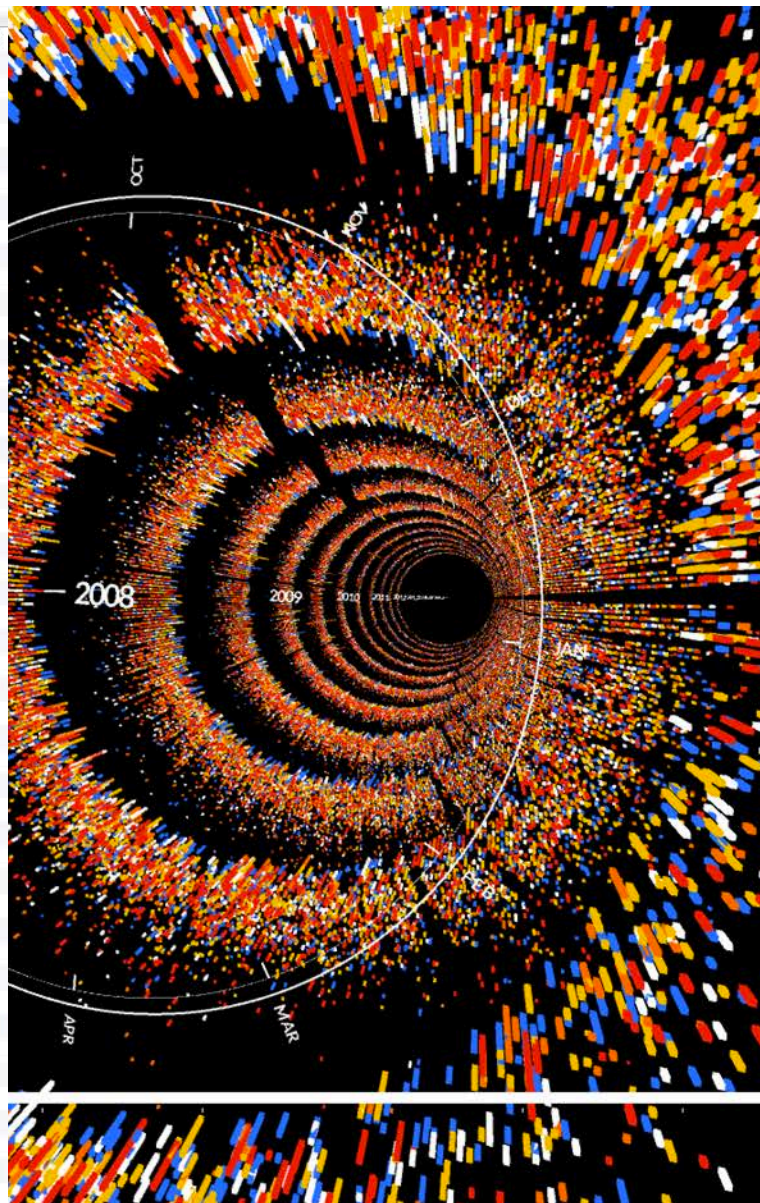
900 - 999  
History & Geography

book media misc

press 1, 2, 3 and space key to change graph, move mouse over circles to view dewey class and title.

# Multi-variate data is given visual form

collcode	itemtype	barcode	title	callNumber	deweyClass
nacd	accd	0010053294418	tigers have spoken	CD 782.421642 C2665T	782.421642
cafic	acbk	0010046075908	Heart on the line	FIC ARNOLD	NULL
nalpfc	acbk	0010047150288	Too hot to handle	FIC LOWELL	NULL
canf	acbk	0010027180271	Governing public schools new times new requirements	371.2 DANZBER 1992	371.2
cs9	acbk	0010002326972	great deception the inside story of how the Kremlin took over Cuba	972.91 M741G	972.91
canf	acbk	0010041599258	Logic or The right use of reason in the inquiry after truth with a va...	160 L793W 1996	160
cafic	acbk	0010050230746	Something about Emmaline	FIC BOYLE2005	NULL
canf	acbk	0010048238389	Understanding installation art from Duchamp to Holzer	709.04 R7277U 2003	709.04
cs9	acbk	0000103502175	Frank B Kellogg a biography	B K292 B	NULL
cs9	acbk	0010002324977	German raider Atlantis	940.953 F8517G	940.953
cafic	acbk	0010033394031	Zabelle	FIC KRICORI1998	NULL
canf	acbk	0000102981248	Reservation narrow gauge Omak Creek railroad Bow Arrow Short Li...	385.52097 L587R	385.52097
canf	acbk	0010004731641	place no one knew Glen Canyon on the Colorado	779 P833P2a	779
canf	acbk	0010002691342	Buddhism in translations passages selected from the Buddhist sacr...	294 W252B	294
canf	acbk	0010048100100	death in Washington Walter G Krivitsky and the Stalin terror	327.1247 K4592D 2003	327.1247
canf	acbk	0010054269096	101 diseases you dont want to get	614.5 P8715o 2005	614.5
nafic	acbk	0010040162363	Twilight in Texas	FIC THOMAS	NULL
nanf	acbk	0010041237933	Boundless healing meditation exercises to enlighten the mind and...	294.34435 T387B 2000	294.34435
canf	acbk	0010050859288	fragrance of faith the enlightened heart of Islam	297 R1294F 2004	297
nanf	acbk	0010053789672	How to reduce workplace conflict and stress how leaders and their...	658.1053 M327H 2005	658.1053
canf	acbk	0010034758416	home of the blizzard a true story of Antarctic survival	919.8904 MAWSON 1998	919.8904
nab	acbk	0010045761730	Lives of mothers daughters growing up with Alice Munro	B M9265M 2001	NULL
canf	acbk	0010054107684	Foxes in the henhouse how the Republicans stole the South and th...	324.70973 R29996J 2006	324.70973
canf	acbk	0010045523353	False intimacy understanding the struggle of sexual addiction	241.66 Sch196F 1997	241.66
canf	acbk	0010025511717	Lakota recollections of the Custer fight new sources of Indian milit...	973.82 LAKOTA 1991	973.82
cafic	acbk	0010020070768	Furors die a novel	FIC HOFFMAN	NULL
nanf	acbk	0010042818186	devils dictionary of business monkey business high finance and lo...	330.0207 V895D 2005	330.0207
canf	acbk	0010041330571	Running with the Buffaloes a season inside with Mark Wetmore Ad...	796.42809 C7193L 2000	796.42809
canew	acbk	0010054076608	opened grave Sherlock Holmes investigates his ultimate case	FIC JAMES2006	NULL
canf	acbk	0010028375219	Transforming vision writers on art	810.80357 TRANSFO 1994	810.80357
cs9	acbk	0000102286903	De Shazer the Doolittle raider who turned missionary a true and th...	B D459W	NULL
nchol	jcbk	0010045871109	Jothams journey a storybook for Advent	J YTREEID	NULL
cs9o	acbk	0010001512887	Burri	B B942B	NULL
ncnew	jcbk	0010050556819	Lady in the water a bedtime story	E SHYAMAL	NULL
cs6ro	arbk	0010019836690	Bullard Arms	338.76834 J241B	338.76834
canf	acbk	0010038257472	Perfect bones a six point plan to promote healthy bones	616.716 L5785P 2000	616.716
nanf	acbk	0010050592780	Satisfaction the science of finding true fulfillment	155.9 B4581S 2005	155.9
nafic	acbk	0010022410574	Fly fishing tales literary bait by angling authors	FIC FLY FIS1994	NULL
nanf	acbk	0010037361580	Chariots of the gods unsolved mysteries of the past	001.94 DANIKEN 1999	001.94
canf	acbk	0010036046778	way of agape	241.4 MISSLER 1999	241.4
canf	acbk	0010026014141	Future of medicine toward a science of prevention based on ancie...	613 DUGLISS 1993	613
canf	acbk	0010045701462	Tanker operations a handbook for the person in charge PIC	623.88245 H8627T 2001	623.88245
caesi	bcbk	0010034398809	Angliiskii iazyk prosto o slozhnom prakticheskii kurs	RUSSIAN 428.24917 L576A	428.24917
canf	acbk	0010051680022	Gorgeous disaster the tragic story of Debra LaFave	364.153 L131L 2006	364.153
nacd	accd	0010040958539	Spirituals in concert	CD784.73 B322S	784.73
capf	acbk	0010025431536	Kathy and Mo show parallel lives	812.54 GAFFNEY 1992	812.54
nafic	acbk	0010046761242	revelation	FIC LITTLE	NULL
cacd	accd	0010046200415	peaceful Christmas	CD 782.21723 P3133	782.21723
canf	acbk	0010048571573	Tauntons family home idea book	728.37 St546T 2003	728.37

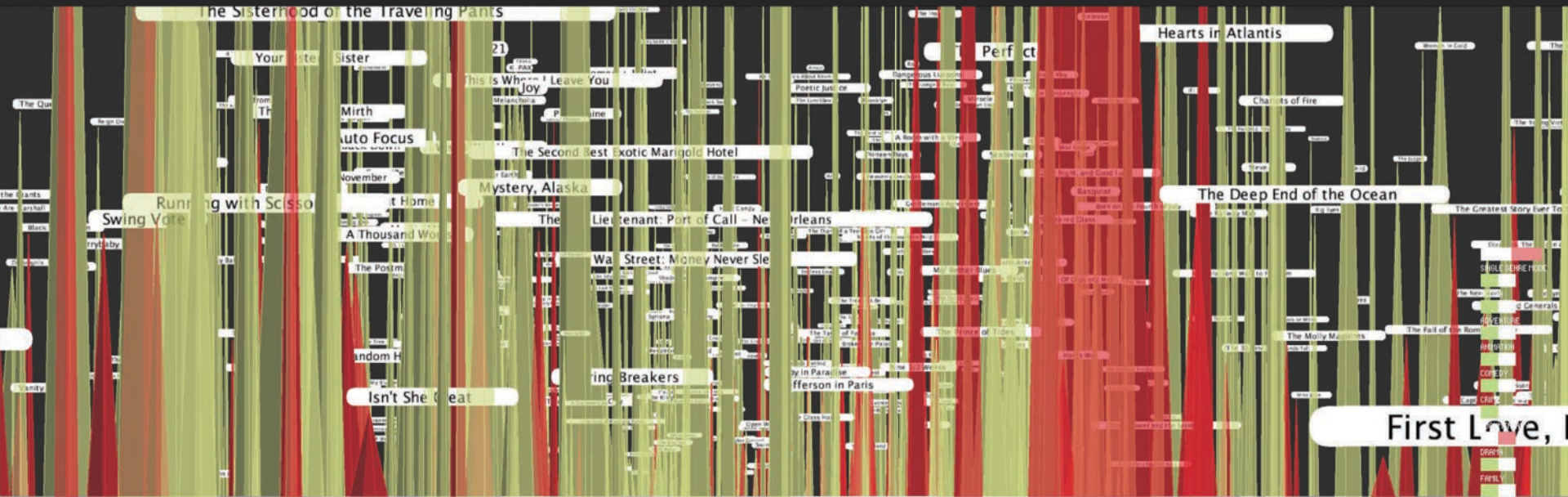


# Fundamentals in situating data in visual space

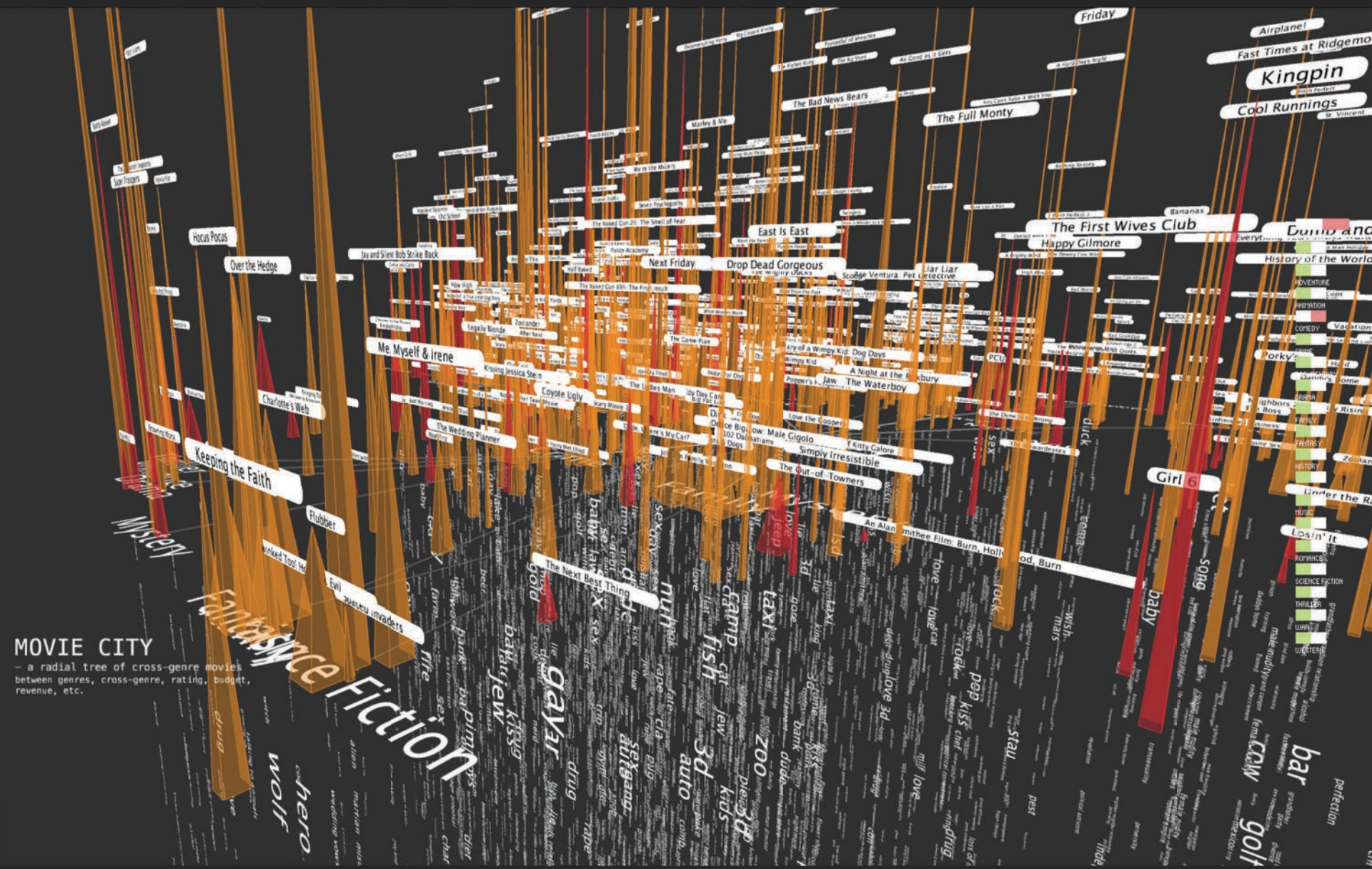
- 3D data placement requires horizontal (**x**), vertical (**y**) and depth (**z**) positions
- Location of data in 3D space may require some indicative marker (**color, scale, shape, etc.**)
- Interaction usually requires instructions through a menu.



# Movie City

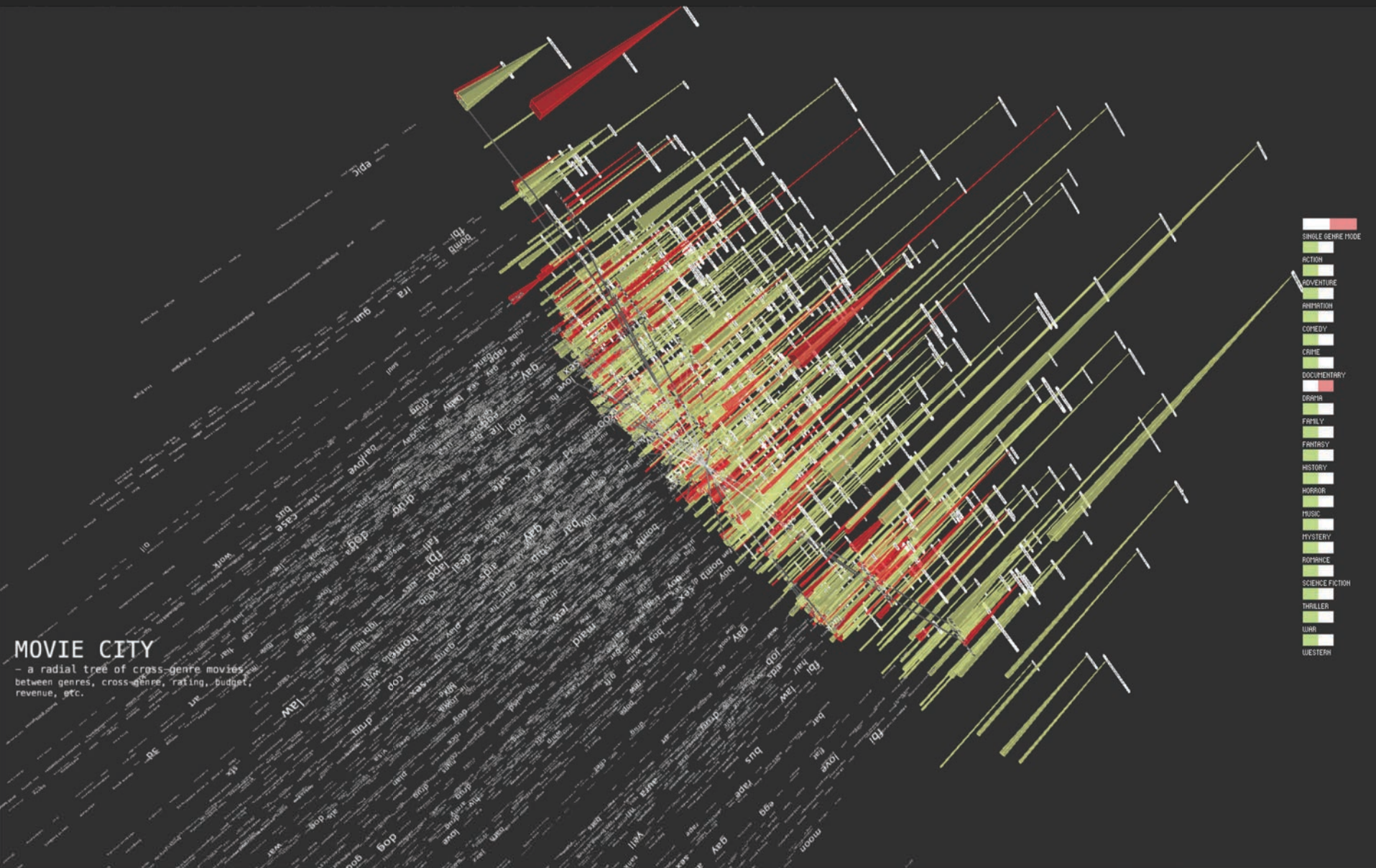


# Movie City

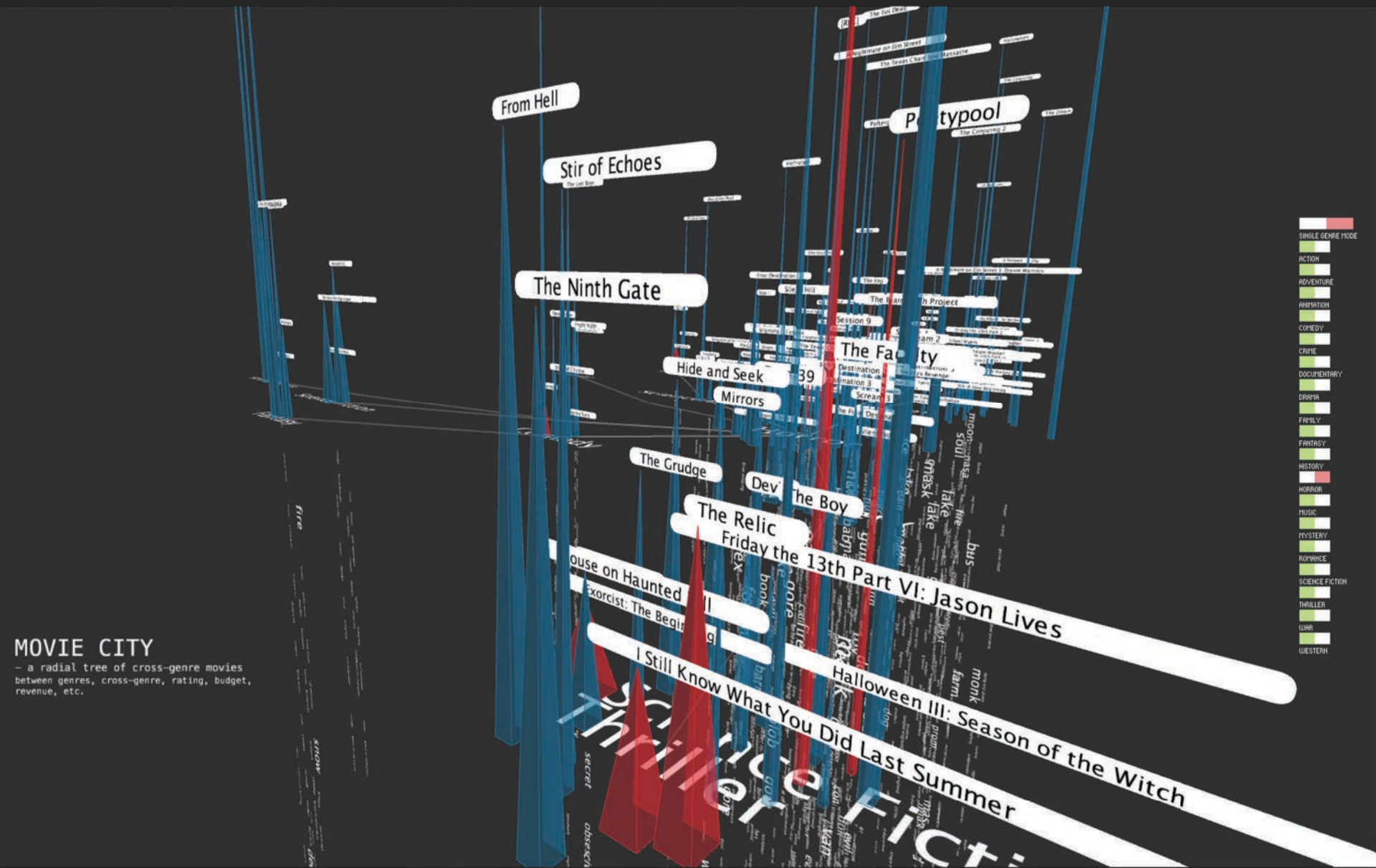


**MOVIE CITY**  
 - a radial tree of cross-genre movies  
 between genres, cross-genre, rating, budget,  
 revenue, etc.

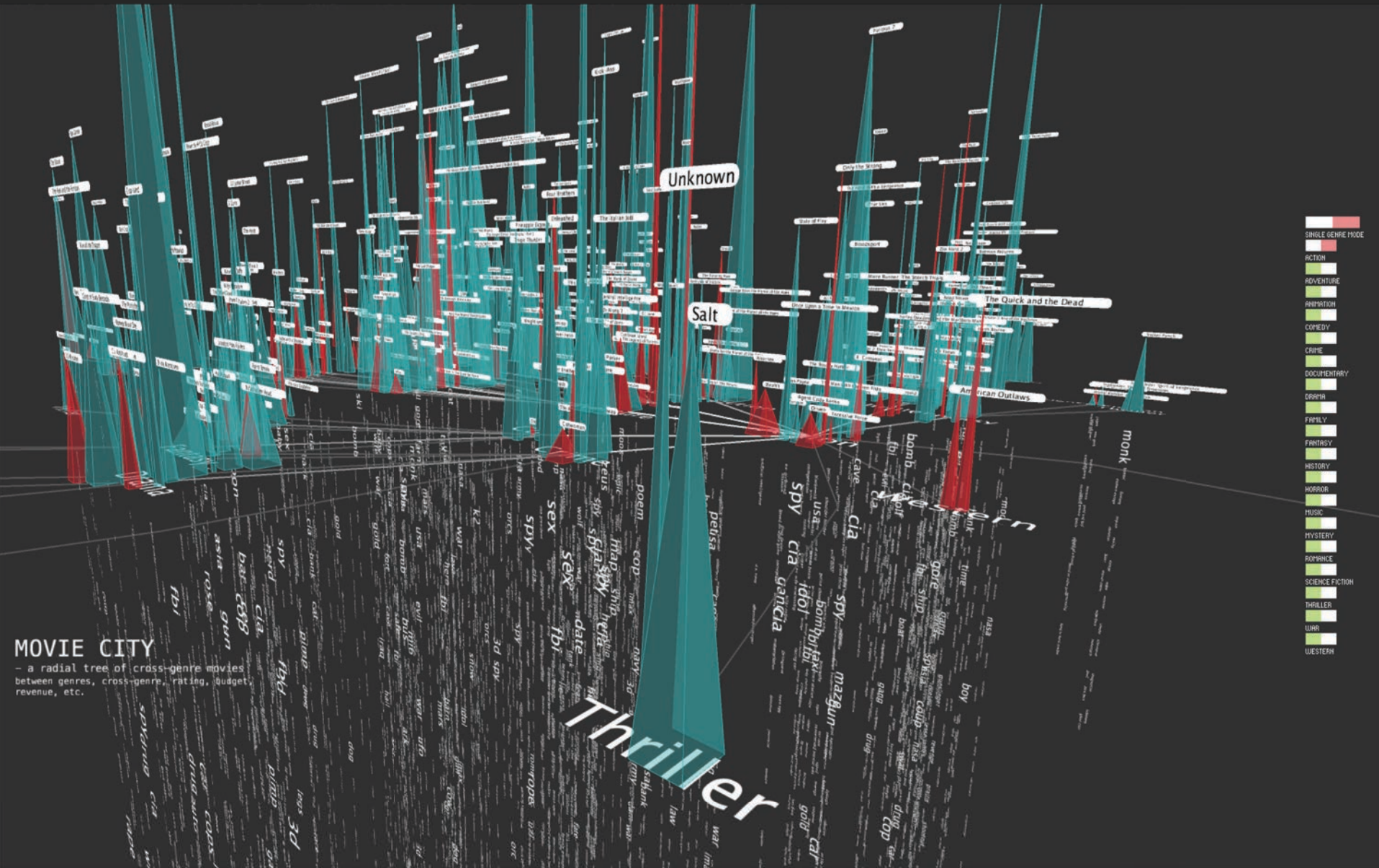
# Movie City



# Movie City



# Movie City



# Form of News

## CENTRE POMPIDOU LIBRARY NEWS

ENTER | DISPLAY DATE

- 3/13
- 3/15
- 3/16
- 3/17
- 3/18
- 3/19
- 3/20
- 3/22
- 3/23
- 3/24
- 3/25
- 3/26

TIME - 12

### NAVIGATION

- P | PERSPECTIVE
- M | VIEW MODE
- R | RESET
- RIGHT | ANTI CLOCKWISE
- LEFT | CLOCKWISE
- DOWN | ZOOM OUT
- UP | ZOOM IN



# Place Names in Semantic Space

## Place Names in the Semantic Space

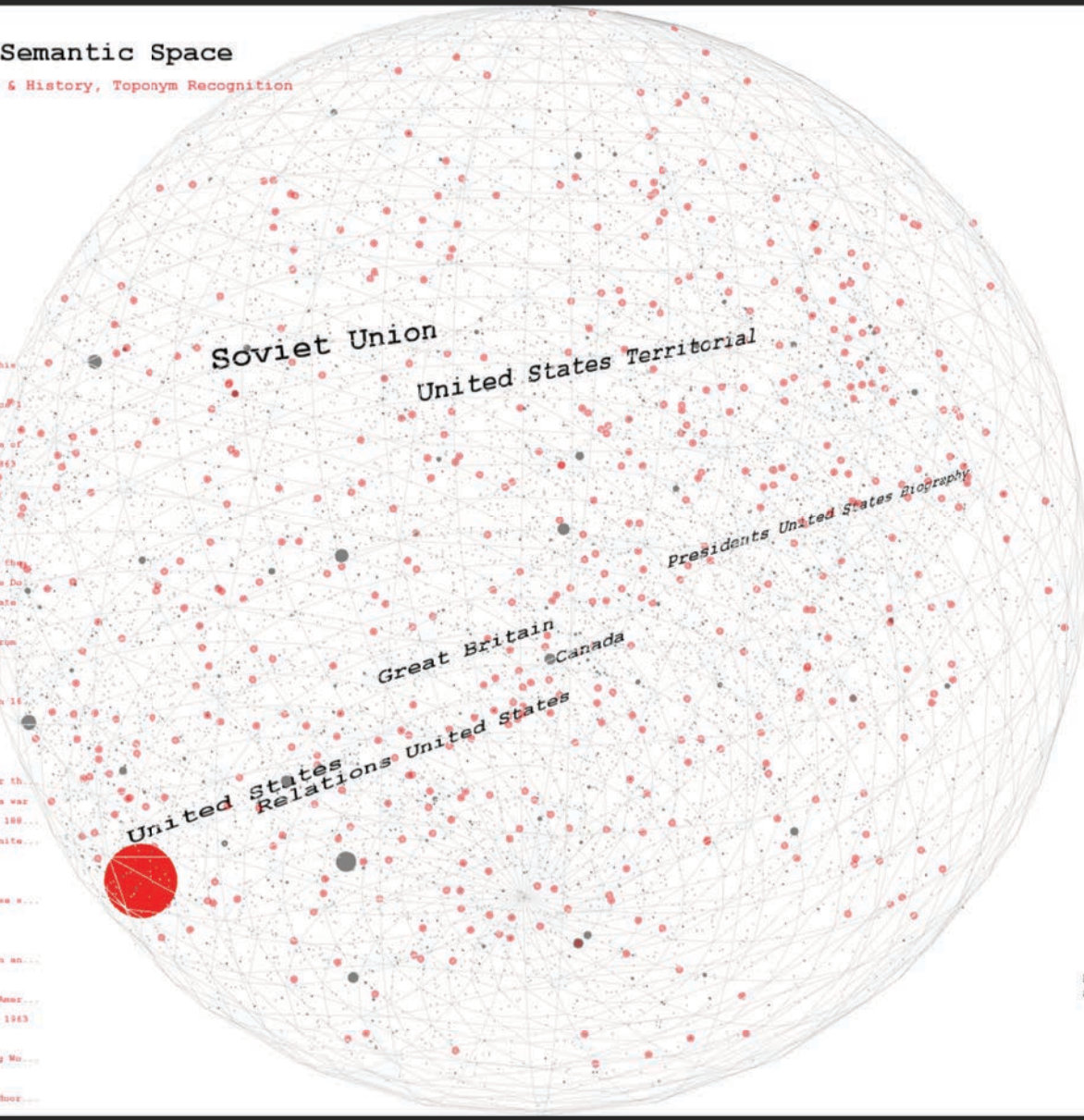
Seattle Public Library, Geography & History, Toponym Recognition

MAT 259 | Winter 2022 | Zilong Liu

### Toponym United States

Mentioned in 3876 Items ...

- American album
- All but the people Franklin D Roosevelt and his critics
- Frontier America the story of the westward movement
- East wind rain the intimate account of an intelligence of
- Lincoln and the Emancipation Proclamation January 1 1863
- Thirteen days a memoir of the Cuban missile crisis
- This fabulous century
- Wider war the struggle for Cambodia Thailand and Laos
- Intervention and negotiation the United States and the Do
- If I forget thee O Jerusalem American Jews and the State
- Moving through here
- Treaty of Washington 1871 a study in imperial history
- How the U S Cavalry saved our national parks
- ays of American society a record of social aspiration 16
- United States and Europe rivals and partners
- hidden history of the Korean War
- Points of rebellion
- Historians on the homefront American propagandists for th
- war conspiracy the secret road to the second Indochina war
- new citizenship origins of progressives in Wisconsin 188
- No clear and present danger a skeptical view of the Unite
- Our country
- Under fire the story of American war correspondents
- phantom war in the Northwest and an account of Japanese s
- red man in America
- War and society the United States 1941 1945
- Presidents was the story of the Tonkin Gulf resolution an
- Travels into North America
- Journey through a part of the United States of North Amer
- Prelude to disaster the American role in Vietnam 1940 1963
- Twenty years and twenty days
- V was for victory politics and American culture during Wo
- Beautiful Country Maine to Hawaii
- Drifting being the authors account of his voyages in door



Point Size v.s. Number of Asso



Hover over a toponym to see its co-occurrence along with the mentioned items.

# Place Names in Semantic Space

## Place Names in the Semantic Space

Seattle Public Library, Geography & History, Toponym Recognition

MAT 259 | Winter 2022 | Zilong Liu

### Toponym United States

Mentioned in Items ...

Means and ends in American abolitionism Garrison and his critics on strategy and tactics 1834, 1850

American album

All but the people Franklin D Roosevelt and his critics 1933 35

Frontier America the story of the westward movement

East wind rain the intimate account of an intelligence officer in the Pacific 1939 49

Lincoln and the Emancipation Proclamation January 1 1863 the document that turned the Civil War into a fight for freedom

Thirteen days a memoir of the Cuban missile crisis

This fabulous century

This fabulous century

Wider war the struggle for Cambodia Thailand and Laos

slightly endeavor American armed forces in the European theater in World War II

Intervention and competition the United States and the Dominican revolution

If I forget thee O Jerusalem American Jews and the State of Israel

Moving through here

fear of conspiracy images of an American subversion from the Revolution to the present

Treaty of Washington 1871 a study in imperial history

How the U S Cavalry saved our national parks

signs of American society a record of social aspiration 1807 1937

United States and Europe rivals and partners

hidden history of the Korean War

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red man in America

War and society the United States 1941 1945

Presidents was the story of the Tunkia Gulf resolution and how the nation was trapped in Vietnam

Travels into North America

Journey through a part of the United States of North America in the years 1844 to 1846

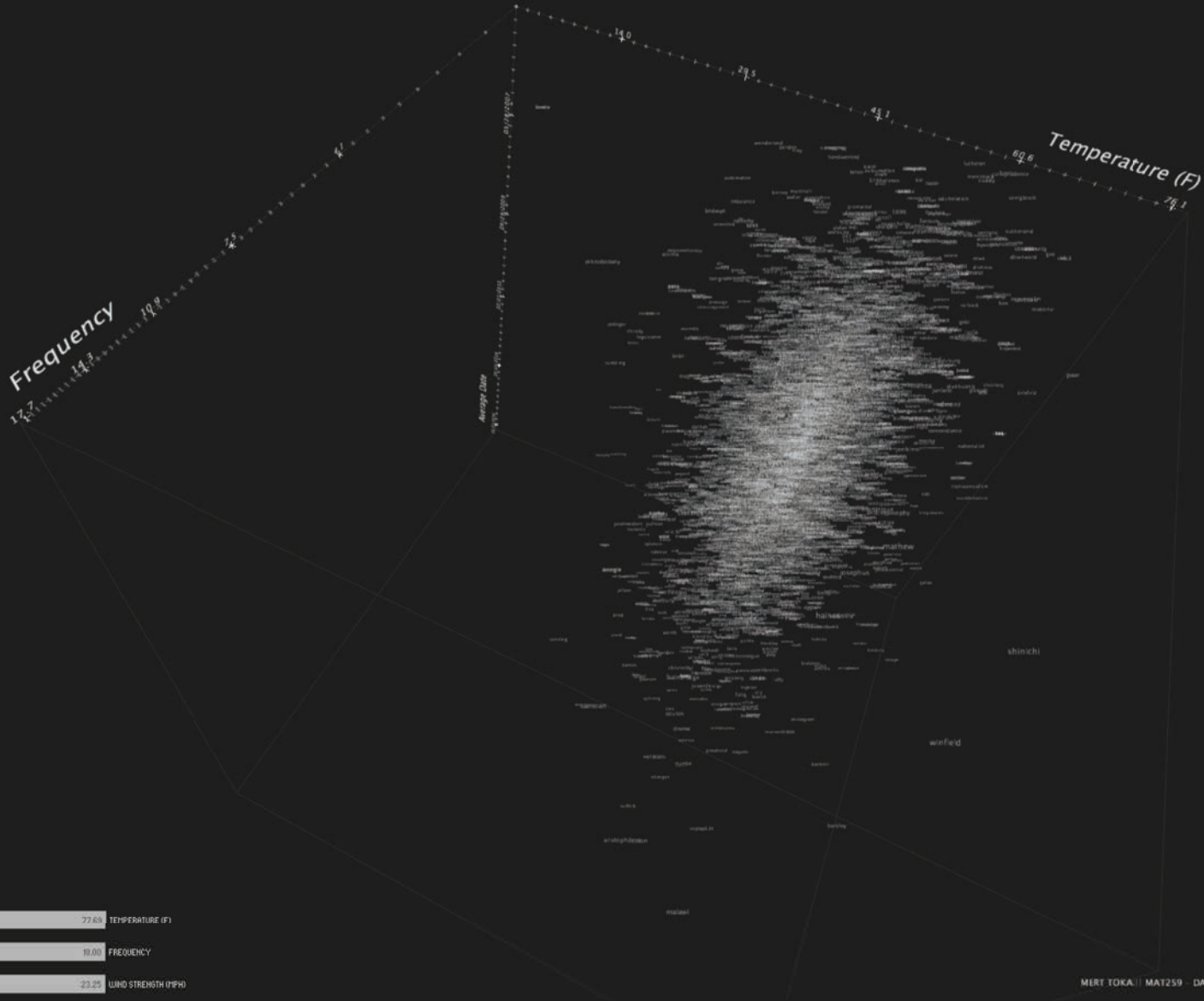
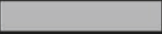
Prelude to disaster the American role in Vietnam 1940 1943

Press A or D to rotate horizon  
Press W or S to rotate vertical

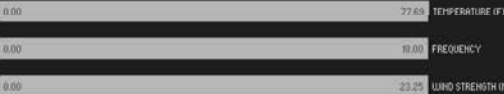


# Word Temperatures

SEATTLE PUBLIC LIBRARY CHECKOUTS  
AND HISTORICAL WEATHER DATA FUSION



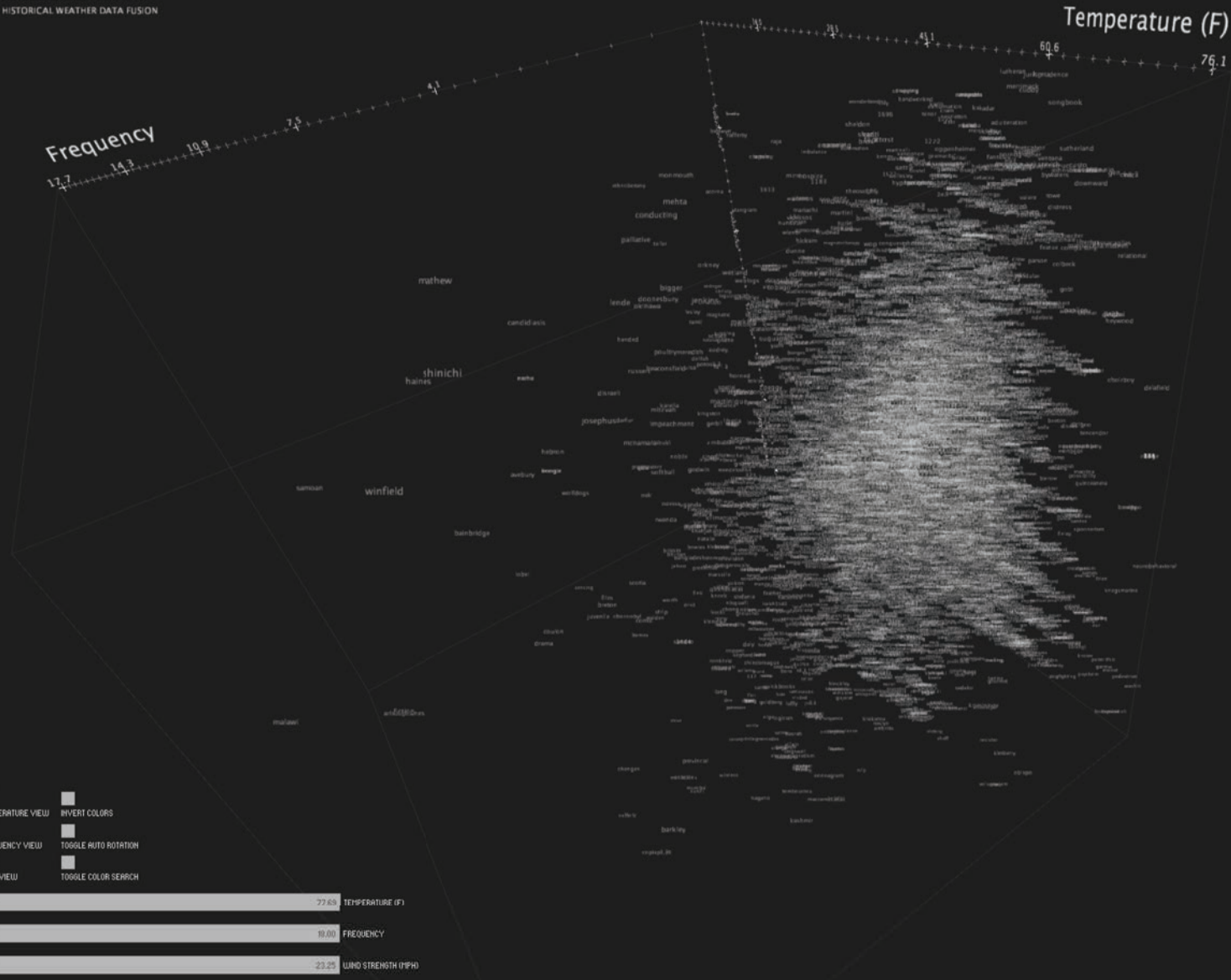
- TEMPERATURE VIEW
- INVERT COLORS
- FREQUENCY VIEW
- TOGGLE AUTO ROTATION
- DATE VIEW
- TOGGLE COLOR SEARCH



MERT TOKA | MAT259 - DATA VISUALIZATION (WINTER 2017)

# Word Temperatures

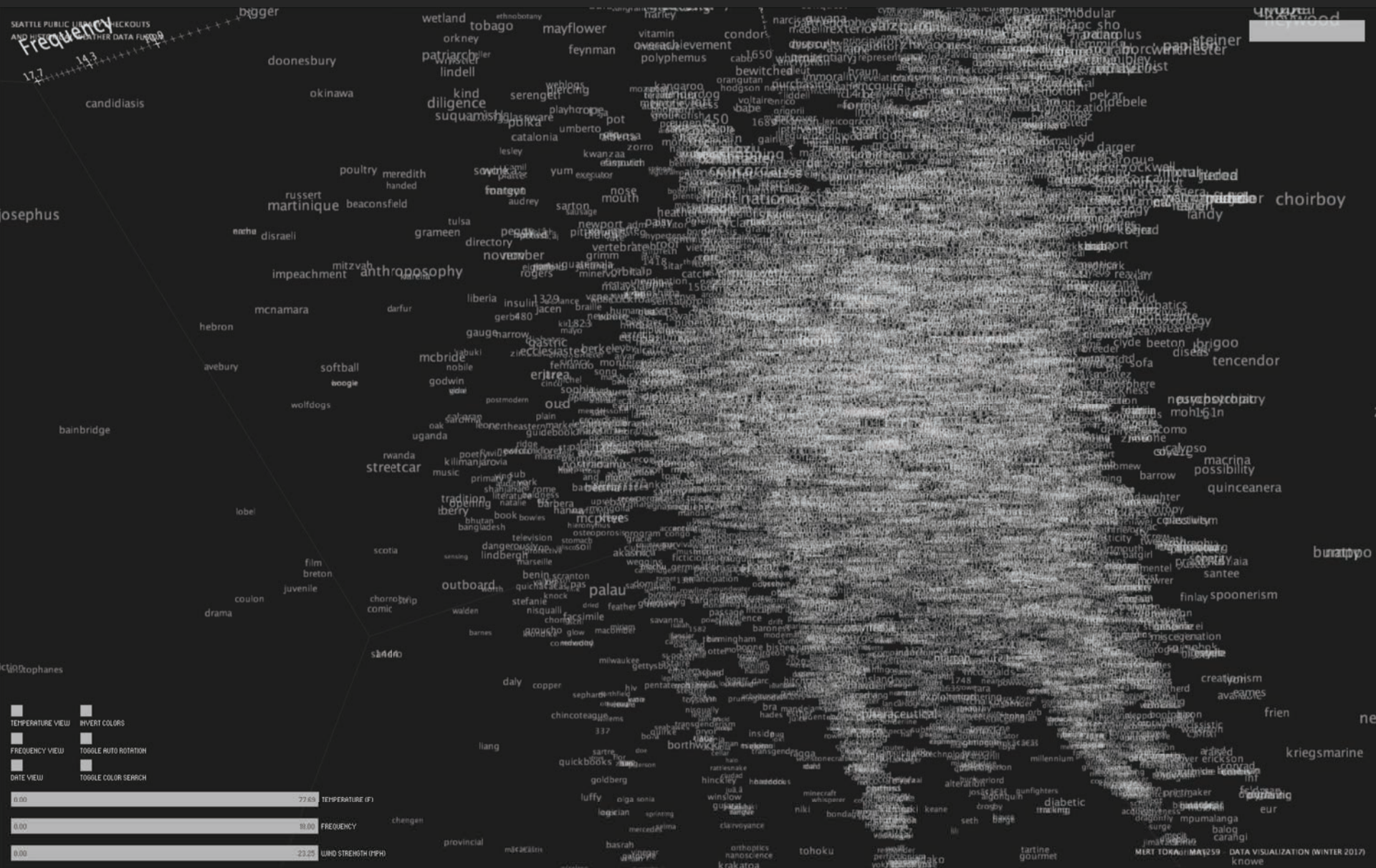
SEATTLE PUBLIC LIBRARY CHECKOUTS  
AND HISTORICAL WEATHER DATA FUSION



MERT TOKA | MAT259 - DATA VISUALIZATION (WINTER 2017)

# Word Temperatures

SEATTLE PUBLIC LIBRARY CHECKOUTS AND METRO LIBRARY DATA FROM 1977 TO 2017

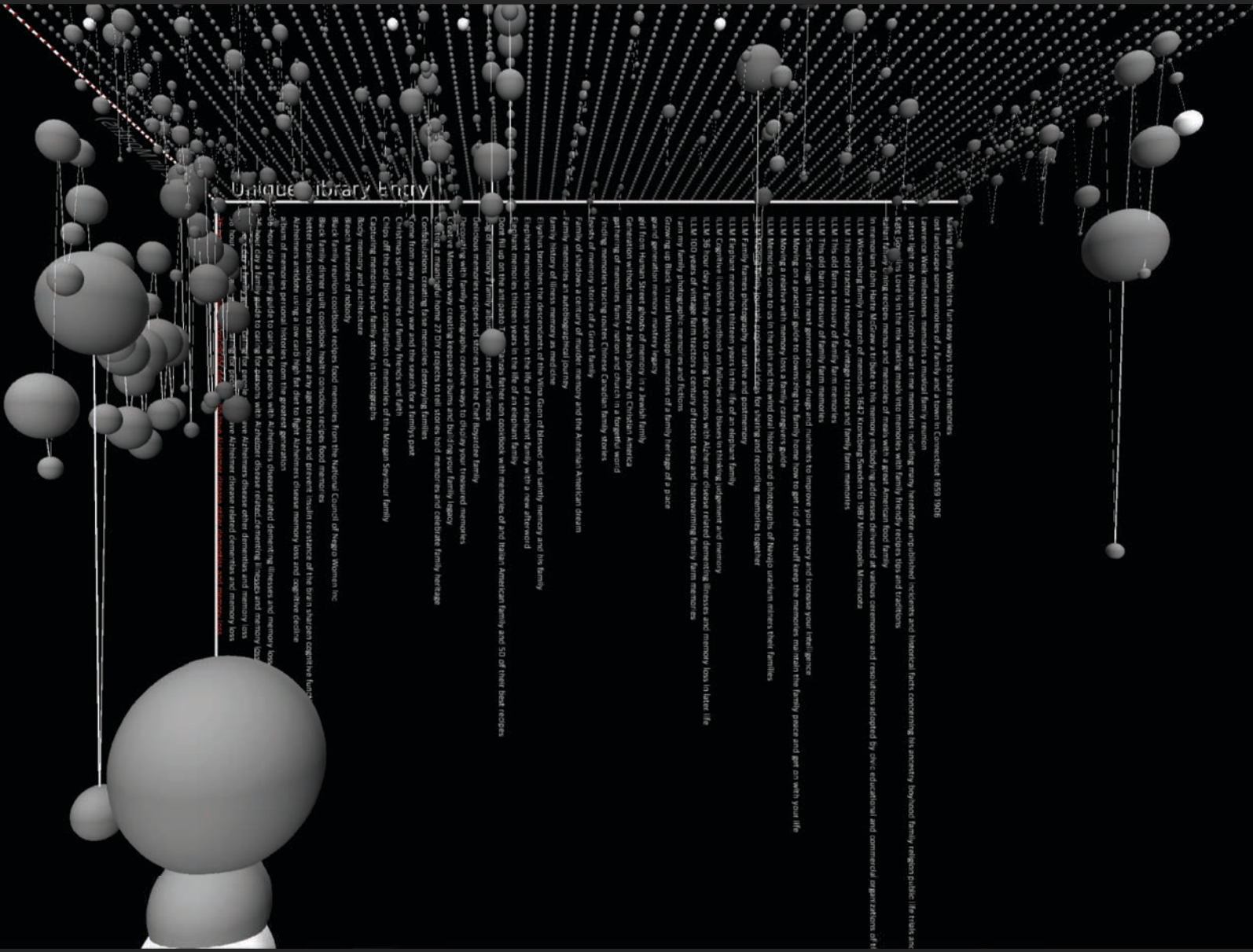


# Exploring Embodied and Generational Memory...

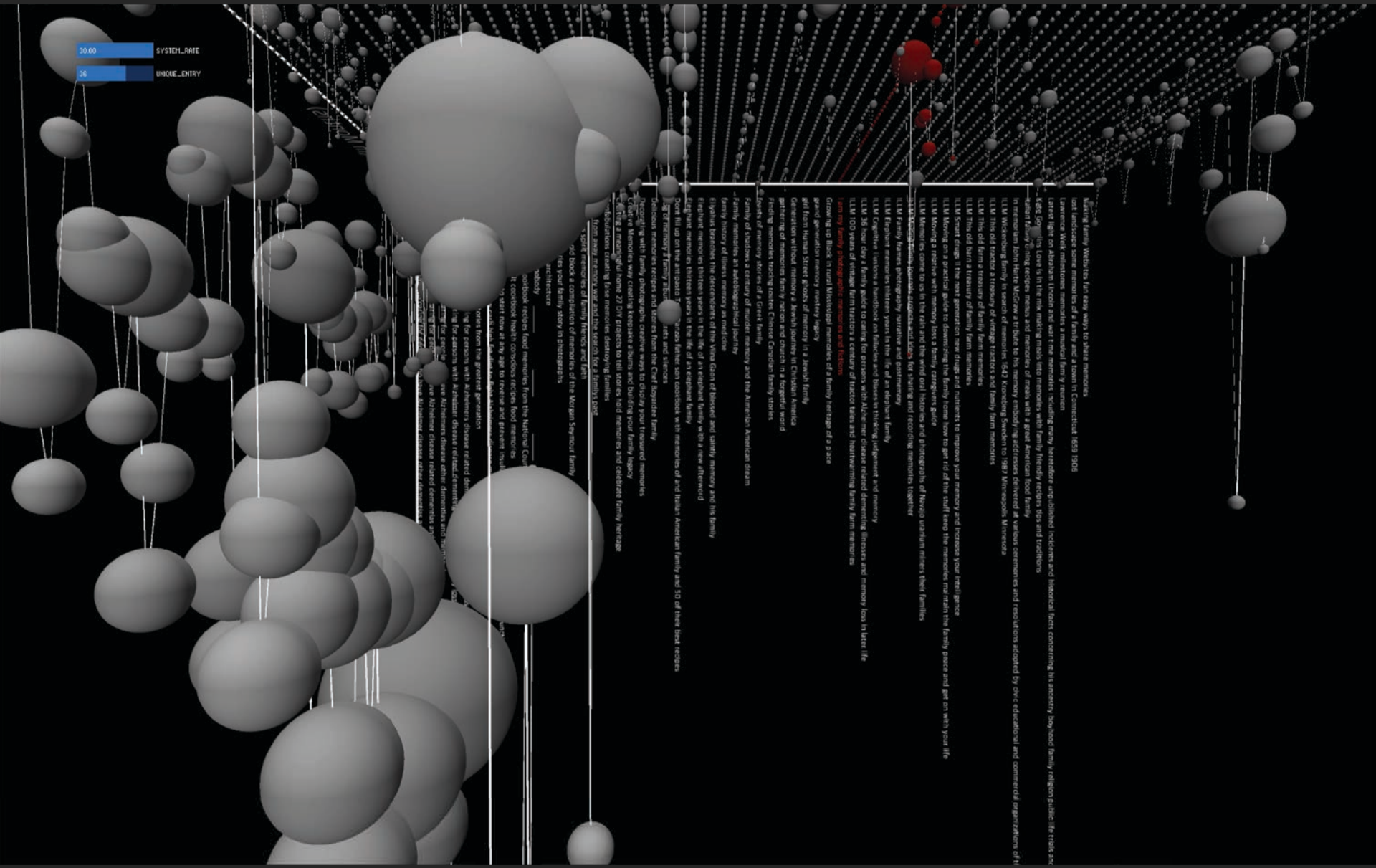
SYSTEM\_RATE  
0 UNIQUE\_ENTRY

## Unique Library Entry

Making Family Websites fun easy ways to share memories  
Last week, we explored some memories of a family and a town in Connecticut 1839-1905  
Lawrence Week mentions memories of a family and a town in Connecticut 1839-1905  
Katie Long on love is in the mix making meals into memories with family friendly recipes tips and traditions  
What Family Living recipes menus and memories of meals with a great American food family  
In memorial John Harte McGraw a tribute to the memory embodied/address delivered at various ceremonies and recollections adopted by civic educational and commercial organizations of Ft  
LLM Wisconsin family in search of memories 1847 Knochenberg Sweden to 1989 Minneapolis Minnesota  
LLM The old tractor a treasury of vintage tractors and family farm memories  
LLM This old farm a treasury of family farm memories  
LLM The old farm a treasury of family farm memories  
LLM Smart usage of the next generation new drugs and nutrients to improve your memory and increase your intelligence  
LLM Moving on a practical guide to downsizing the family home how to get rid of the stuff keep the memories that remain the family peace and get on with your life  
LLM Memories come to us in the skin and the wind oral histories and photographs of Navajo uranium miners their families  
LLM Family farms photography narrative and postmemory  
LLM Engage memories between years in the life of an elephant family  
LLM Cognitive linkages a handbook on failures and biases in thinking judgement and memory  
LLM 36 hours of family guide to caring for persons with Alzheimer disease related dementia and memory loss in later life  
LLM 100 years of heritage farm tractors a century of tractor tales and heartwarming family farm memories  
I am my family photographic memories and fiction  
Growing up Back on rural Mississippi memories of a family heritage of a place  
Grand generation memory mystery legacy  
Gift from Herman Street Spoons of memory in a Jewish family  
Generation without memory a Jewish journey in Canadian America  
Parting of memories family vacation and much in a forgotten world  
Finding memories tracing the Chinese Christian family stories  
Losses of memory stories of a Greek Family  
Family of Sweden a century of modern memory and the American American dream  
Family history of illness memory as medicine  
Enigma Remembrance the descendants of the White Rose of Minsk and family memory and the family  
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From full on the airplane To... from first son cookbook with memories of and Italian American family and 50 of first best recipes  
Staying on the ground... just and sitcom  
The road to the red eyes and the road from the Card Inspector family  
Accord to with family photographic creative ways to enjoy your husband's memories  
Active Memories why does it happen a history and the old family history  
CALLING IT HOME 27 DAY projects to fill your home and celebrate family heritage  
Contributors creating their memory's strategy families  
Come from many memory was and the search for a family past  
Christmas Spill memory of family history the light  
Cuba at the end of the book a compilation of memories of the Morgan Seymour family  
Capturing memories Your family story in photographs  
Baby memory and architecture  
Space Veterans of hobby  
Black Family reunion cookbook recipes food memories from the National Council of Negro Women Inc  
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Bette Brinn solution how to start low at any age to reverse and prevent insulin resistance of the brain's striatum cognitive function  
Alderson's method using a one card light for diet to fight Alzheimer disease memory loss and cognitive decline  
Albums of memories personal histories from the greatest generation  
Alderson's method using a one card light for diet to fight Alzheimer disease memory loss and cognitive decline  
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# Exploring Embodied and Generational Memory...



Making Family Websites Fun new ways to share memories

lost landscape some memories of a family and a town in Connecticut 1839 1905

Lawrence Week milestones memories a model farm in Tucson

Keep Log on Love is in the mix making meals into memories including many heritage acquired traditions and historical facts concerning his ancestry boyhood family religion public life trials and

what family living recipe menus and memories of meals with a great American food family

In memorial John Here McGraw a tribute to the memory embodied addresses delivered at various ceremonies and reunions adopted by civic educational and commercial organizations of the

ILLM Wisconsin Family in search of memories 1847 Knochberg Sweden to 1989 Minneapolis Minnesota

ILLM This old tractor a treasury of vintage tractors and family farm memories

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ILLM Smart crump It the next generation new drump and nutrients to improve your memory and increase your intelligence

ILLM Moving on a practical guide to downsizing the family home how to get rid of the stuff keep the memories and get on with your life

ILLM Memories come to us in the rain and the wind old histories and photographs of Navajo sutulin relatives their families

ILLM Making family journals, agendas and albums for sharing and recording memories together

ILLM Family farms photography narrative and testimony

ILLM English memories fifteen years in the life of an elephant family

ILLM 36 hour day a family guide to caring for persons with Alzheimer disease related dementing illnesses and memory loss in later life

ILLM 100 years of heritage farm tractor a century of tractor tales and heartwarming family farm memories

From my family photographic memories and traditions

Growing up Back on rural Mississippi memories of a family heritage of a place

grand generation memory making legacy

gift from Herman Street Shops of memory in a Jewish family

Generation without memory a Jewish journey in Canada America

finding memories tracing the Chinese Canadian family stories

Losses of memory stories of a Greek family

Family of Sweden a century of modern memory and the American American dream

Family history of illness memory as medicine

English memories the descendants of the White Dog of Blessed and saintly memory and the family

English memories fifteen years in the life of an elephant family

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Don't fill up the paragraphs It's a small farm son cookbook with memories of an Italian American family and 50 of their best recipes

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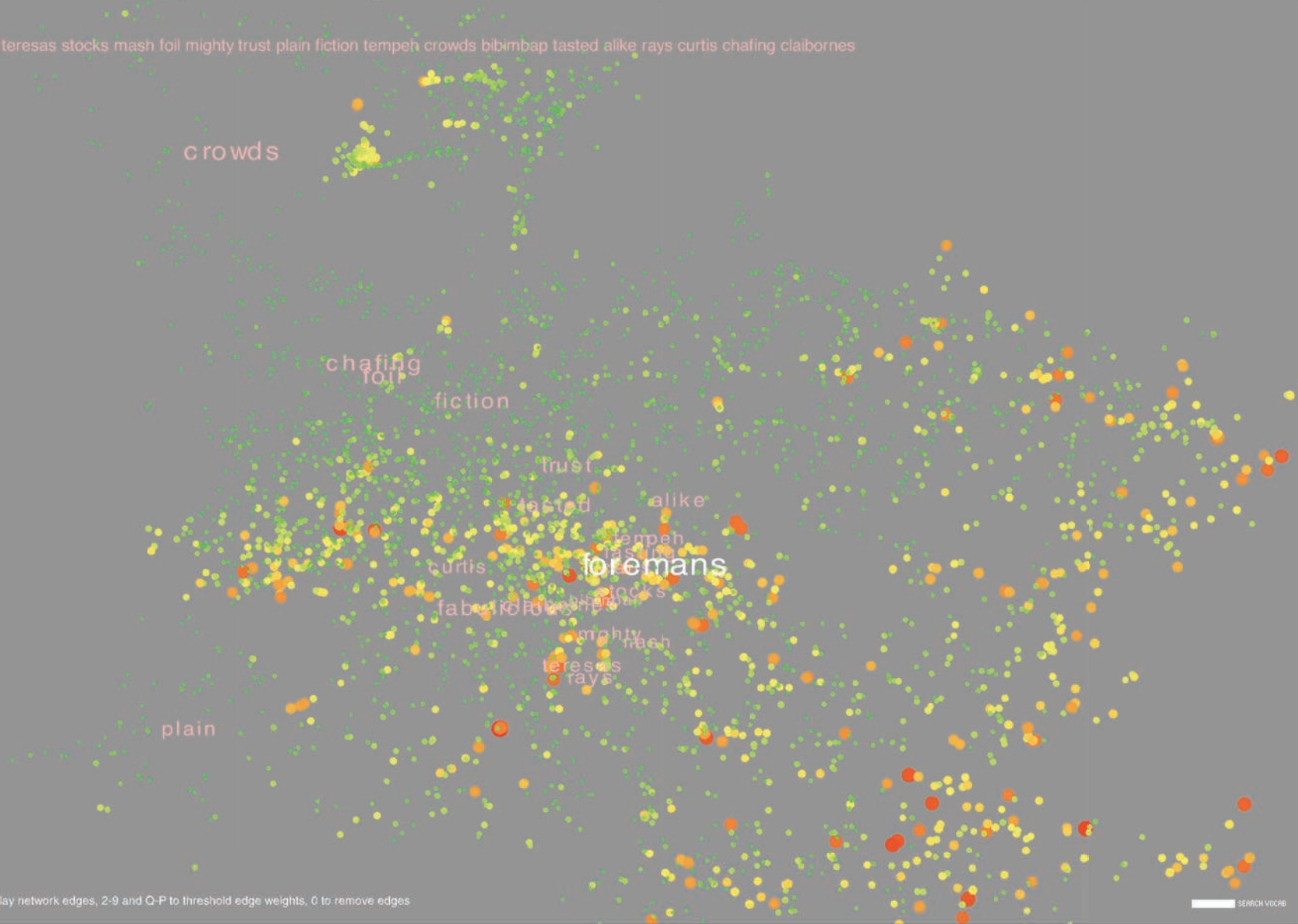
Don't fill up the paragraphs It's a small farm son cookbook with memories of an Italian American family and 50 of their best recipes



# Food & Drink Words

foremans

fabulicious cans fasting teresas stocks mash foil mighty trust plain fiction tempoh crowds bibimbap tasted alike rays curtis chafing claibornes



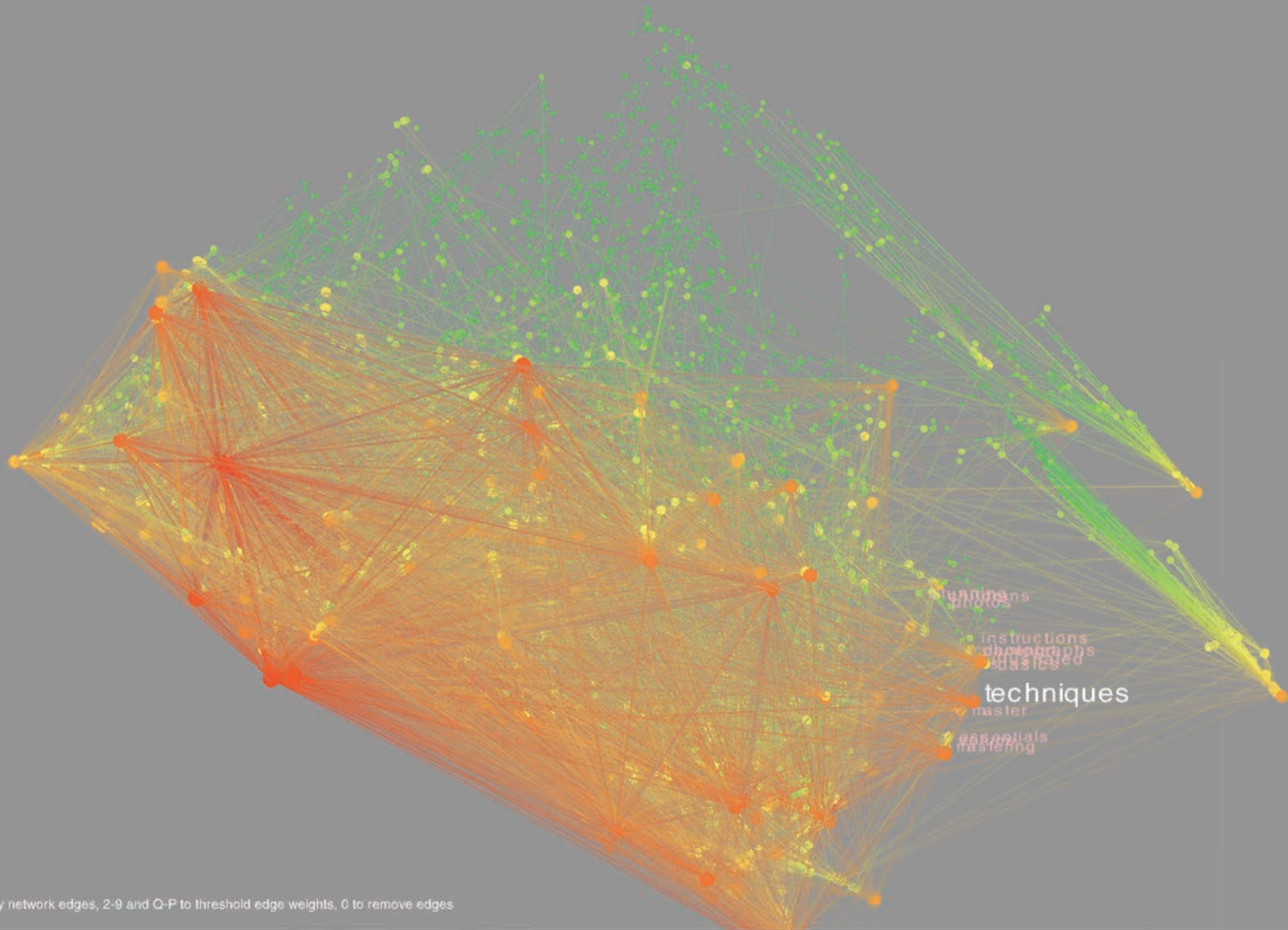
Press C to toggle colors, 1 to display network edges, 2-9 and Q-P to threshold edge weights, 0 to remove edges

SEARCH VOCAB

# Food & Drink Words

## techniques

master tips basics photographs essential illustrated ingredients instructions childrens tools equipment essentials class mastering methods volume fundamental photos practical stunning



Press C to toggle colors, 1 to display network edges, 2-9 and Q-P to threshold edge weights, 0 to remove edges

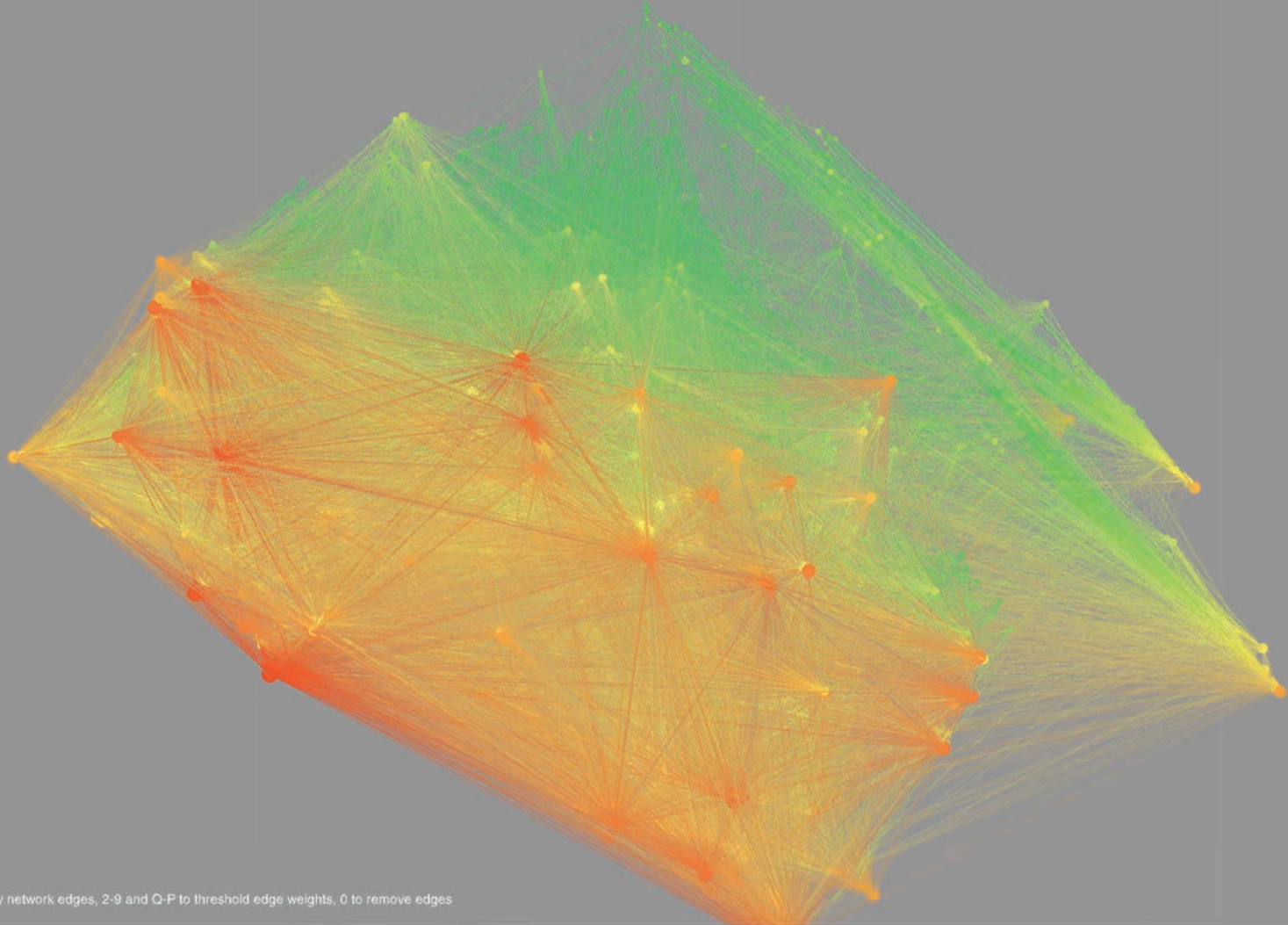
SEARCH VOCAB



# Food & Drink Words

capture

joys oriental norwegian aleppo cowgirl blending infusing influential region merchants manhattan iraqi scottish spains macaron pennsylvania magnificent kingdom provisions williamsburg



Press C to toggle colors, 1 to display network edges, 2-9 and Q-P to threshold edge weights, 0 to remove edges

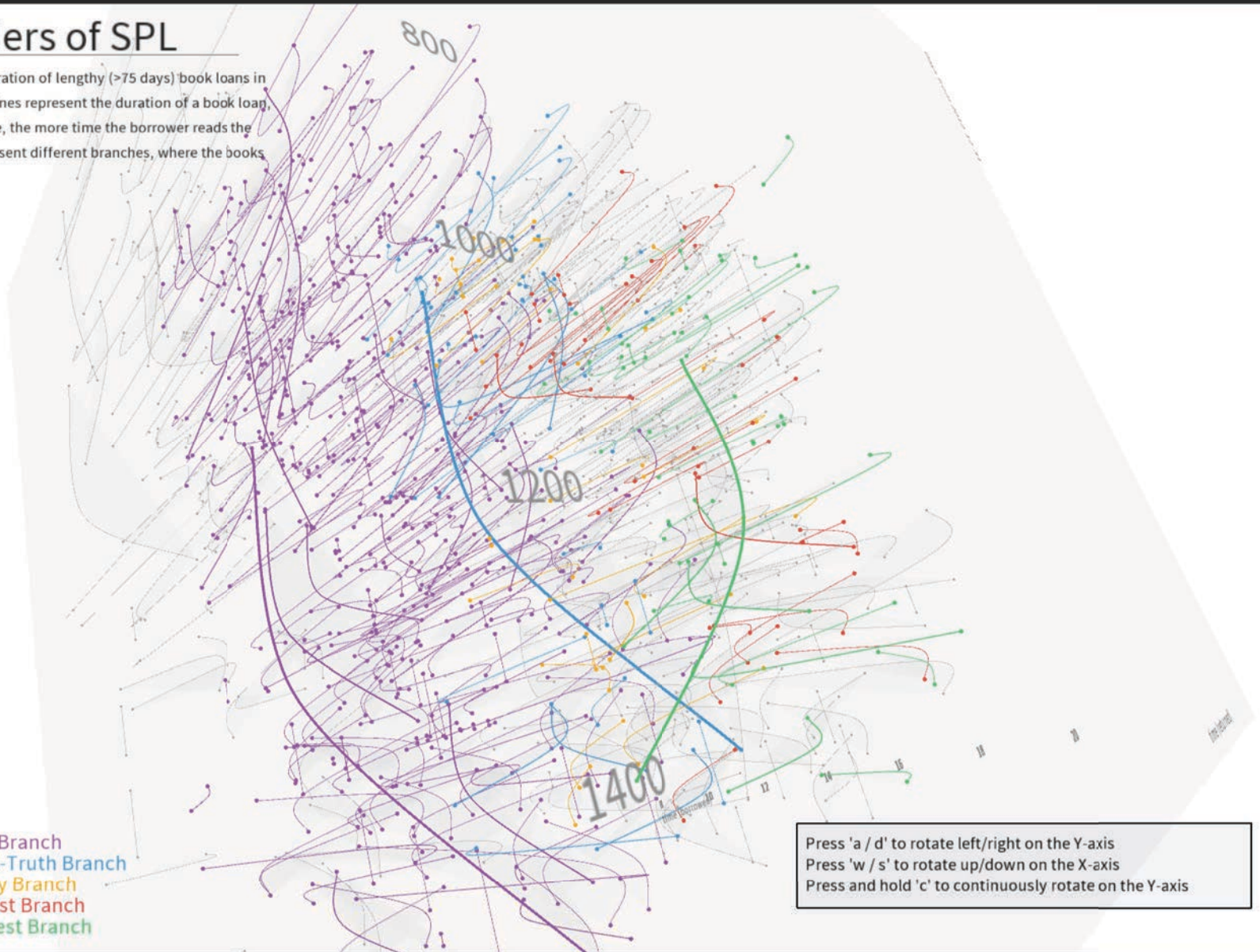
SEARCH VOCAB

# Slow Readers in SPL

## Slow Readers of SPL

This project explores the duration of lengthy (>75 days) book loans in Seattle Public Library. The lines represent the duration of a book loan, the longer and wider the line, the more time the borrower reads the book. Diverging colors represent different branches, where the books are held

MAT 259 – Evgeny Noi

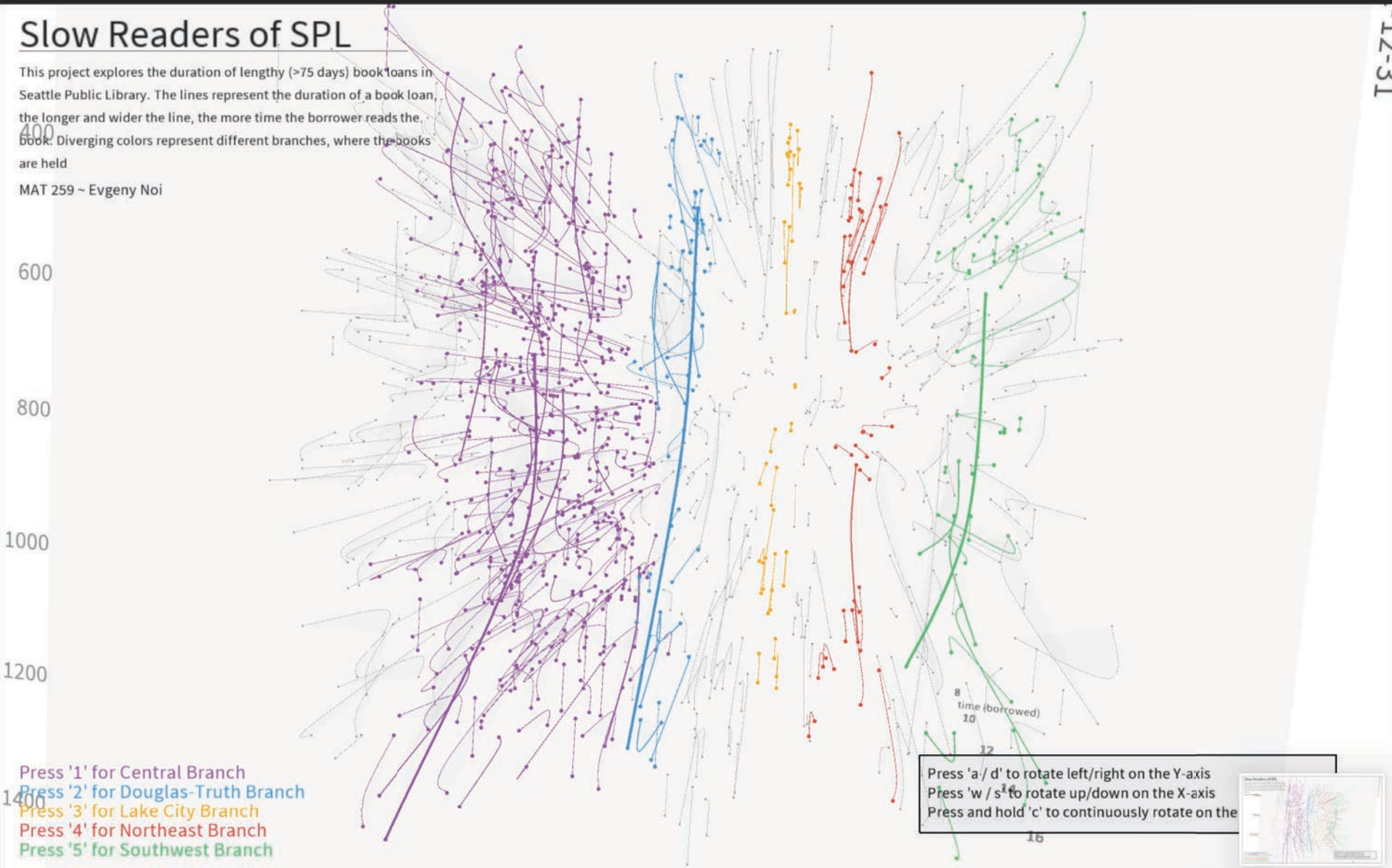


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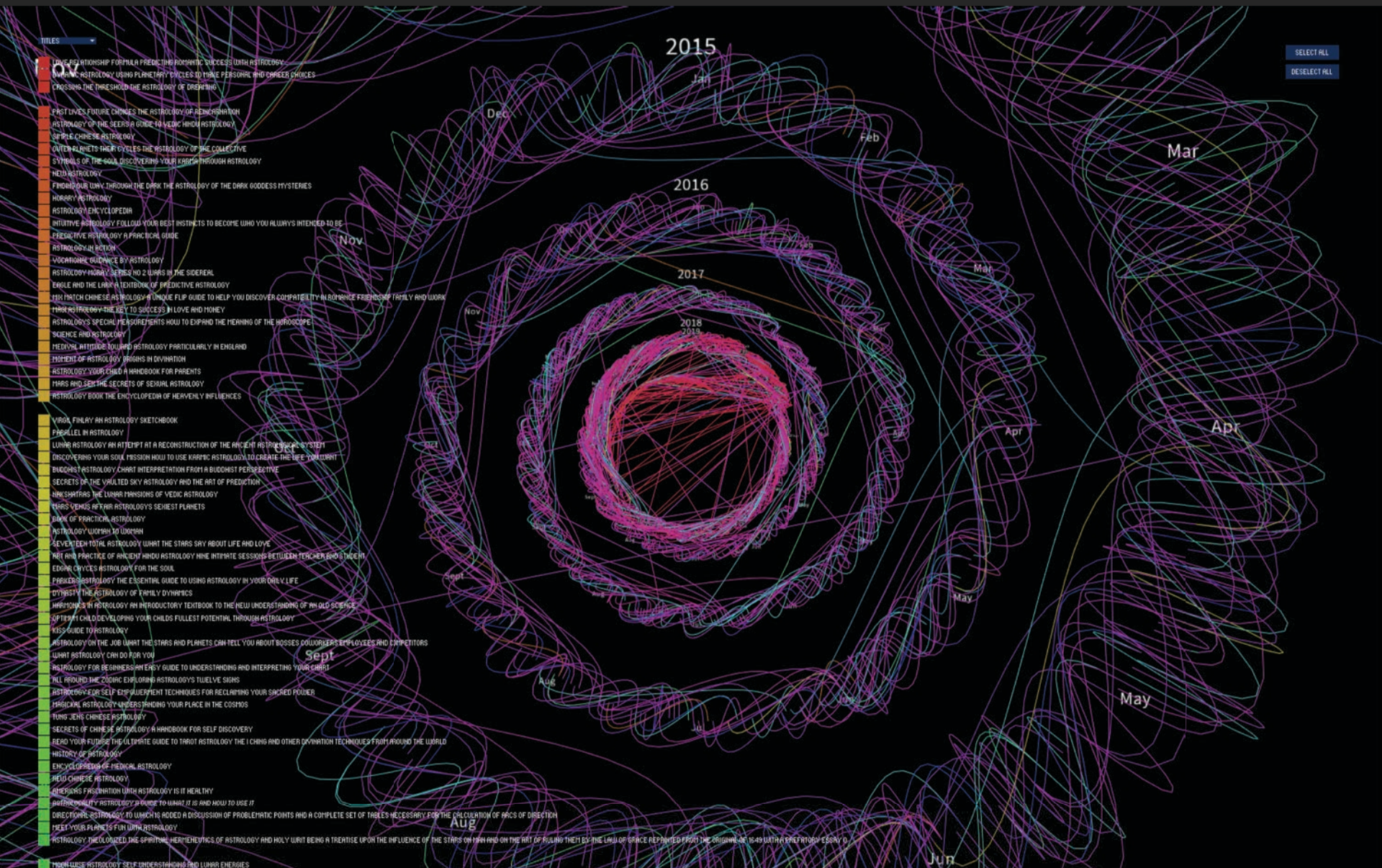
MAT 259 - Evgeny Noi



16-71-31



# Astrology



SELECT ALL  
Deselect ALL

# Astrology

TITLES

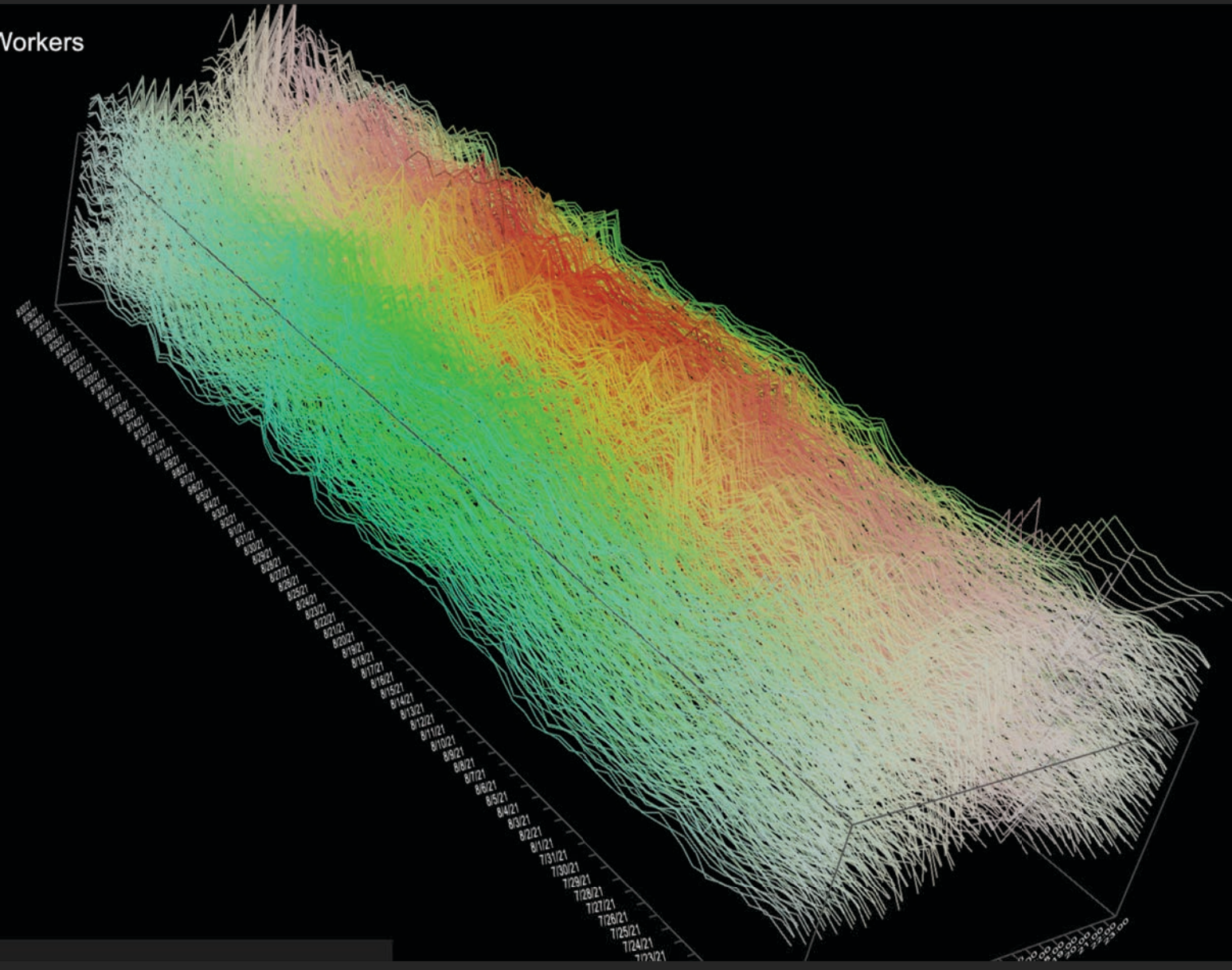
- LOVE RELATIONSHIP FORMULA PREDICTING ROMANTIC SUCCESS WITH ASTROLOGY
- DYNAMIC ASTROLOGY USING PLANETARY CYCLES TO MAKE PERSONAL AND CAREER CHOICES
- CROSSING THE THRESHOLD THE ASTROLOGY OF DREAMING
- PAST LIVES FUTURE CHOICES THE ASTROLOGY OF REINCARNATION
- ASTROLOGY OF THE SEERS A GUIDE TO VEDIC HINDU ASTROLOGY
- SIMPLE CHINESE ASTROLOGY
- OUTER PLANETS THEIR CYCLES THE ASTROLOGY OF THE COLLECTIVE
- SYMBOLS OF THE SOUL DISCOVERING YOUR KARMA THROUGH ASTROLOGY
- NEW ASTROLOGY
- FINDING OUR WAY THROUGH THE DARK THE ASTROLOGY OF THE DARK GODDESS MYSTERIES
- HORARY ASTROLOGY
- ASTROLOGY ENCYCLOPEDIA
- INTUITIVE ASTROLOGY FOLLOW YOUR BEST INSTINCTS TO BECOME WHO YOU ALWAYS INTENDED TO BE
- PREDICTIVE ASTROLOGY A PRACTICAL GUIDE
- ASTROLOGY IN ACTION
- VOCATIONAL GUIDANCE BY ASTROLOGY
- ASTROLOGY HORARY SERIES NO 2 WARMS IN THE SIDERIAL
- EROTE AND THE LARK A TEXTBOOK OF PREDICTIVE ASTROLOGY
- HOW MATCH CHINESE ASTROLOGY A UNIQUE FLIP GUIDE TO HELP YOU DISCOVER COMPATIBILITY IN ROMANCE FRIENDSHIP FAMILY AND WORK
- HINDU ASTROLOGY THE KEY TO SUCCESS IN LOVE AND MONEY
- ASTROLOGY'S SPECIAL EXPERIMENTS HOW TO EXPAND THE HORIZONS OF THE HORIZONSCOPE
- SCIENCE AND ASTROLOGY
- MEDICAL ASTROLOGY HINDU ASTROLOGY PARTICULARLY IN ENGLAND
- HORNET OF ASTROLOGY ORBITS IN EVOLUTION
- ASTROLOGY YOUR CHILD A HANDBOOK FOR PARENTS
- THIRAS AND SEALS THE SECRETS OF SERIAL ASTROLOGY
- ASTROLOGY FROM THE ENCYCLOPEDIA OF HERMETIC INFLUENCES
- VIRGIL PARVA ON ASTROLOGY SKETCHBOOK
- PARALLEL IN ASTROLOGY
- LUNAR ASTROLOGY AN ATTEMPT AT A RECONSTRUCTION OF THE ANCIENT ASTROLOGICAL SYSTEM
- DISCOVERING YOUR SOUL MISSION HOW TO USE VEDIC ASTROLOGY TO CREATE THE LIFE YOU WANT
- BUDDHIST ASTROLOGY CHART INTERPRETATION FROM A BUDDHIST PERSPECTIVE
- SECRETS OF THE VAULTED SKY ASTROLOGY AND THE ART OF PREDICTION
- NAKSHATRAS THE LUNAR MANIONS OF VEDIC ASTROLOGY
- THIRAS VENUS AFFAIR ASTROLOGY'S SEXIEST PLANETS
- BOOK OF PRACTICAL ASTROLOGY
- ASTROLOGY WOMAN TO WOMAN
- SEVENTEEN TOTAL ASTROLOGY WHAT THE STARS SAY ABOUT LIFE AND LOVE
- ART AND PRACTICE OF ANCIENT HINDU ASTROLOGY NINE INTIMATE SESSIONS BETWEEN TEACHER AND STUDENT
- EDGAR CHYCES ASTROLOGY FOR THE SOUL
- PARKERS ASTROLOGY THE ESSENTIAL GUIDE TO USING ASTROLOGY IN YOUR DAILY LIFE
- DYNASTY THE ASTROLOGY OF FAMILY DYNAMICS
- HARMONICS IN ASTROLOGY AN INTRODUCTORY TEXTBOOK TO THE NEW UNDERSTANDING OF AN OLD SCIENCE
- OPTIMUM CHILD DEVELOPING YOUR CHILD'S FULLEST POTENTIAL THROUGH ASTROLOGY
- KISS GUIDE TO ASTROLOGY
- ASTROLOGY ON THE JOB WHAT THE STARS AND PLANETS CAN TELL YOU ABOUT BOSSES COLLEAGUES EMPLOYEES AND COMPETITORS
- WHAT ASTROLOGY CAN DO FOR YOU
- ASTROLOGY FOR BEGINNERS AN EASY GUIDE TO UNDERSTANDING AND INTERPRETING YOUR CHART
- ALL AROUND THE ZODIAC EXPLORING ASTROLOGY'S TWELVE SIGNS
- ASTROLOGY FOR SELF EMPOWERMENT TECHNIQUES FOR RECLAIMING YOUR SACRED POWER
- HARACKAL ASTROLOGY UNDERSTANDING YOUR PLACE IN THE COSMOS
- TUNG JENS CHINESE ASTROLOGY
- SECRETS OF CHINESE ASTROLOGY A HANDBOOK FOR SELF DISCOVERY
- READ YOUR FUTURE THE ULTIMATE GUIDE TO TAROT ASTROLOGY THE I CHING AND OTHER DIVINATION TECHNIQUES FROM AROUND THE WORLD
- HISTORY OF ASTROLOGY
- ENCYCLOPEDIA OF MEDICAL ASTROLOGY
- NEW CHINESE ASTROLOGY
- AMERICA'S FASCINATION WITH ASTROLOGY IS IT HEALTHY
- ASTROLOGICALITY ASTROLOGY A GUIDE TO WHAT IT IS AND HOW TO USE IT
- DIRECTIONAL ASTROLOGY TO WHICH IS ADDED A DISCUSSION OF PROBLEMATIC POINTS AND A COMPLETE SET OF TABLES NECESSARY FOR THE CALCULATION OF ARCS OF DIRECTION
- MEET YOUR PLANETS FUN WITH ASTROLOGY
- ASTROLOGY THEOLOGIZED THE SPIRITUAL HERMENEUTICS OF ASTROLOGY AND HOLY WRIT BEING A TREATISE UPON THE INFLUENCE OF THE STARS ON MAN AND ON THE ART OF RULING THEM BY THE LAW OF GRACE REPRINTED FROM THE ORIGINAL OF 1649 WITH A PREFATORY ESSAY O
- FROM USE ASTROLOGY SELF UNDERSTANDING AND LUNAR ENERGIES

SELECT ALL

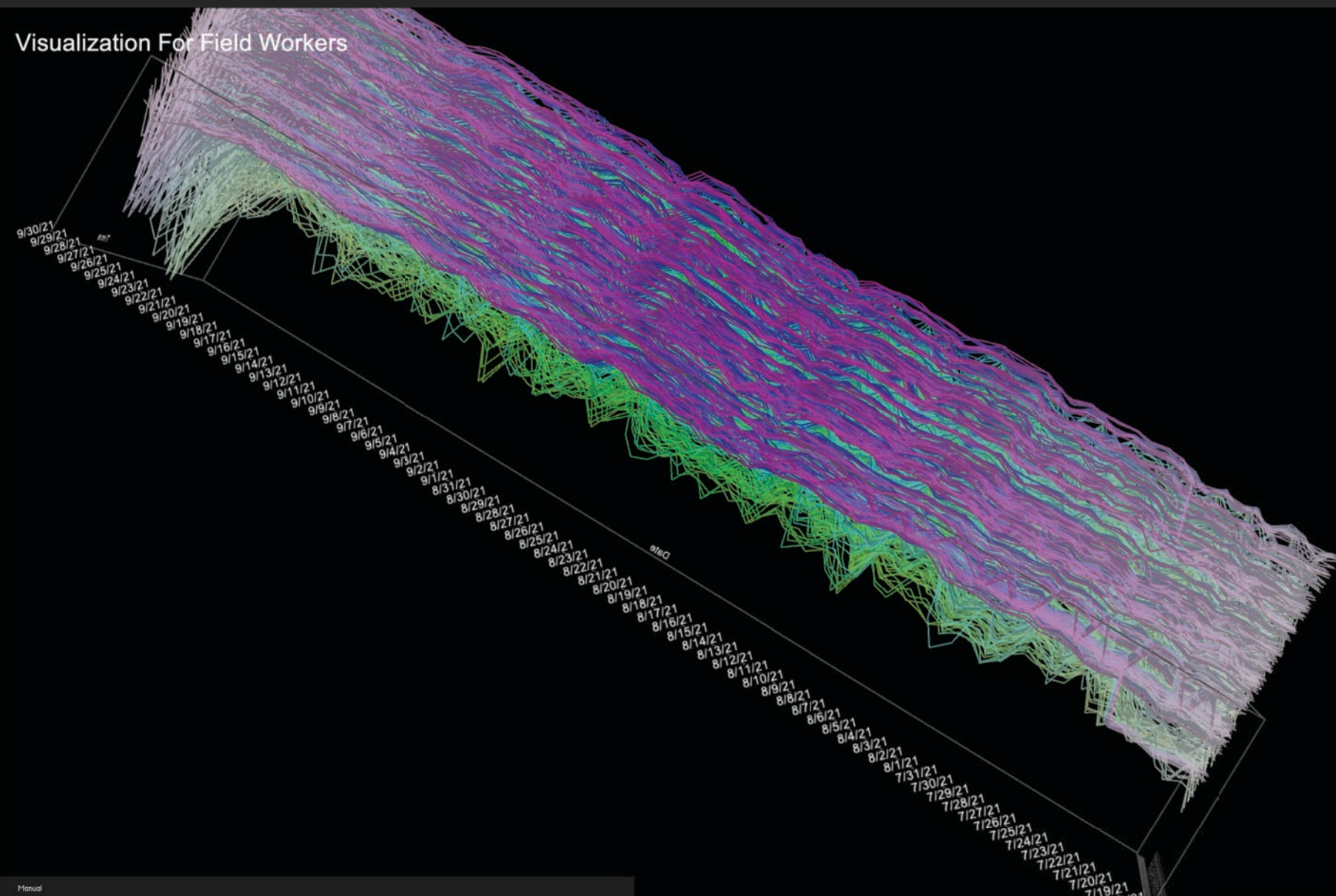
DESELECT ALL

# Visualization of Field Workers

Visualization For Field Workers

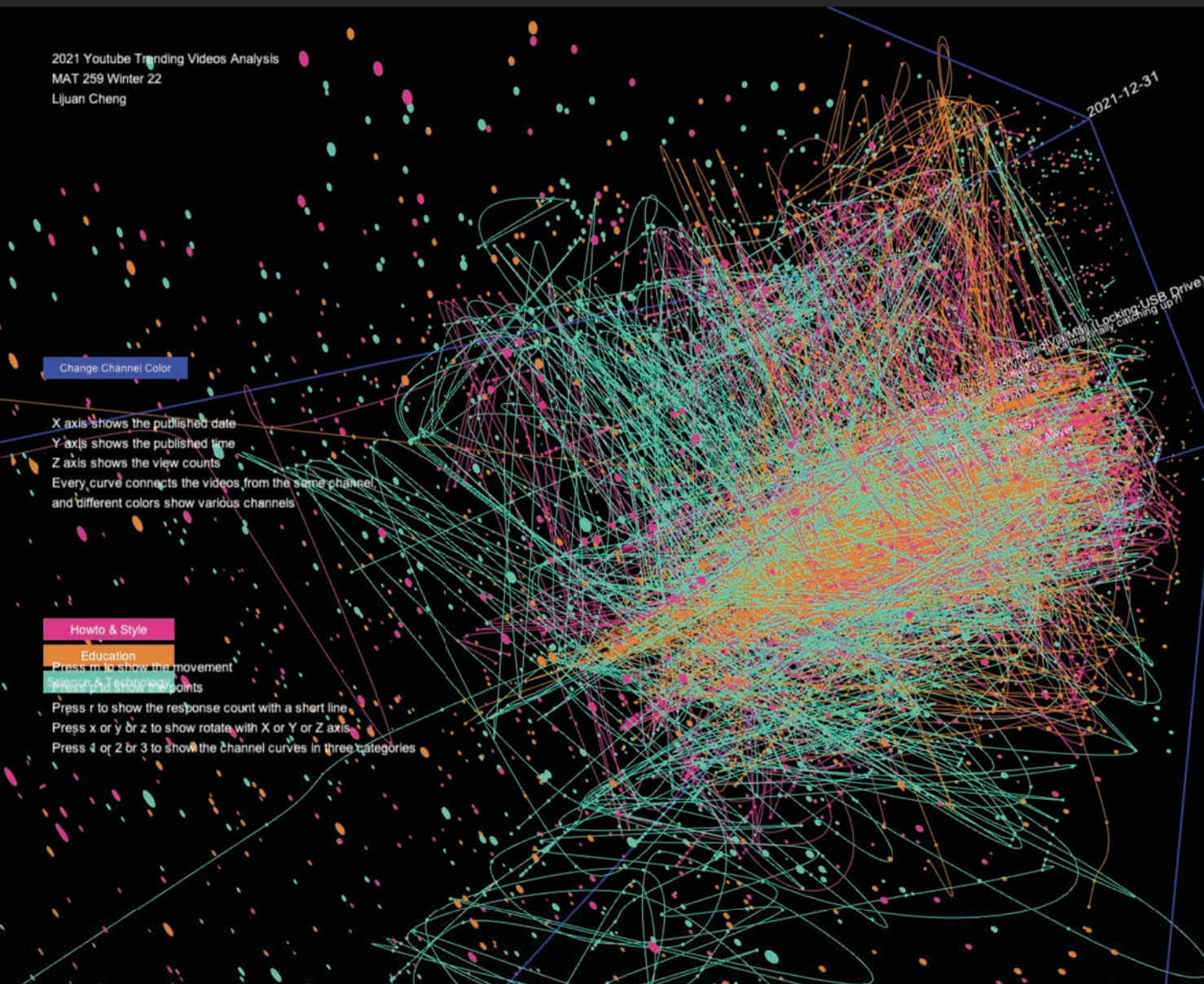


# Visualization of Field Workers



# Trending Videos in 3 Categories

2021 Youtube Trending Videos Analysis  
MAT 259 Winter 22  
Lijuan Cheng





# Trending Videos in 3 Categories

2021 Youtube Trending Videos Analysis  
MAT 259 Winter 22  
Lijuan Cheng

Change Channel Color

X axis shows the published date  
Y axis shows the published time  
Z axis shows the view counts  
Every curve connects the videos from the same channel,  
and different colors show various channels

Howto & Style

Education

Press m to show the movement  
Press n to show the points

Press r to show the response count with a short line  
Press x or y or z to show rotate with X or Y or Z axis  
Press 1 or 2 or 3 to show the channel curves in three categories



# Trending Videos in 3 Categories

2021 Youtube Trending Videos Analysis  
MAT 259 Winter 22  
Lijuan Cheng

Change Channel Color

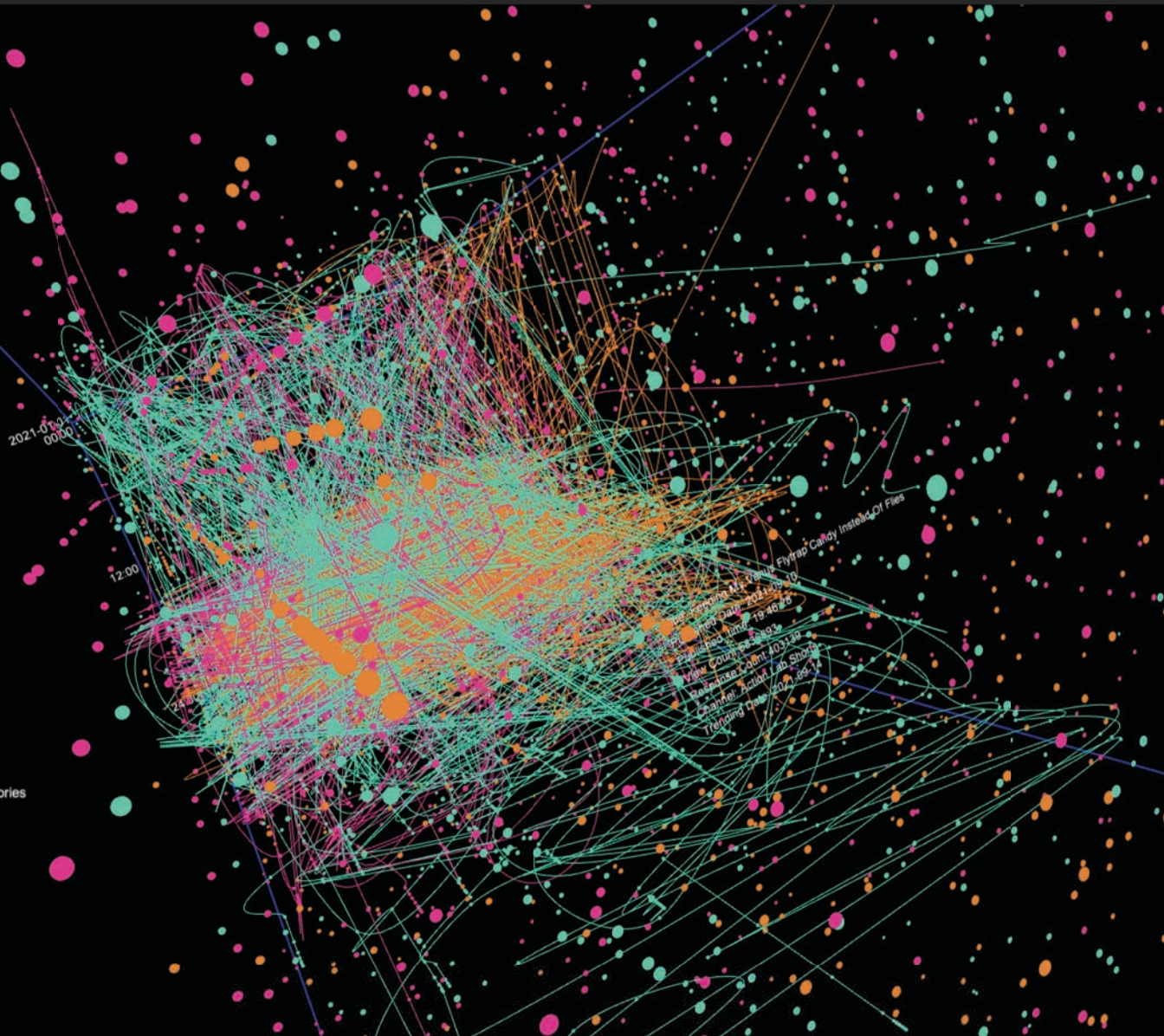
X axis shows the published date  
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Every curve connects the videos from the same channel,  
and different colors show various channels

## Howto & Style

### Education

Press m to show the movement  
Press z to show view counts

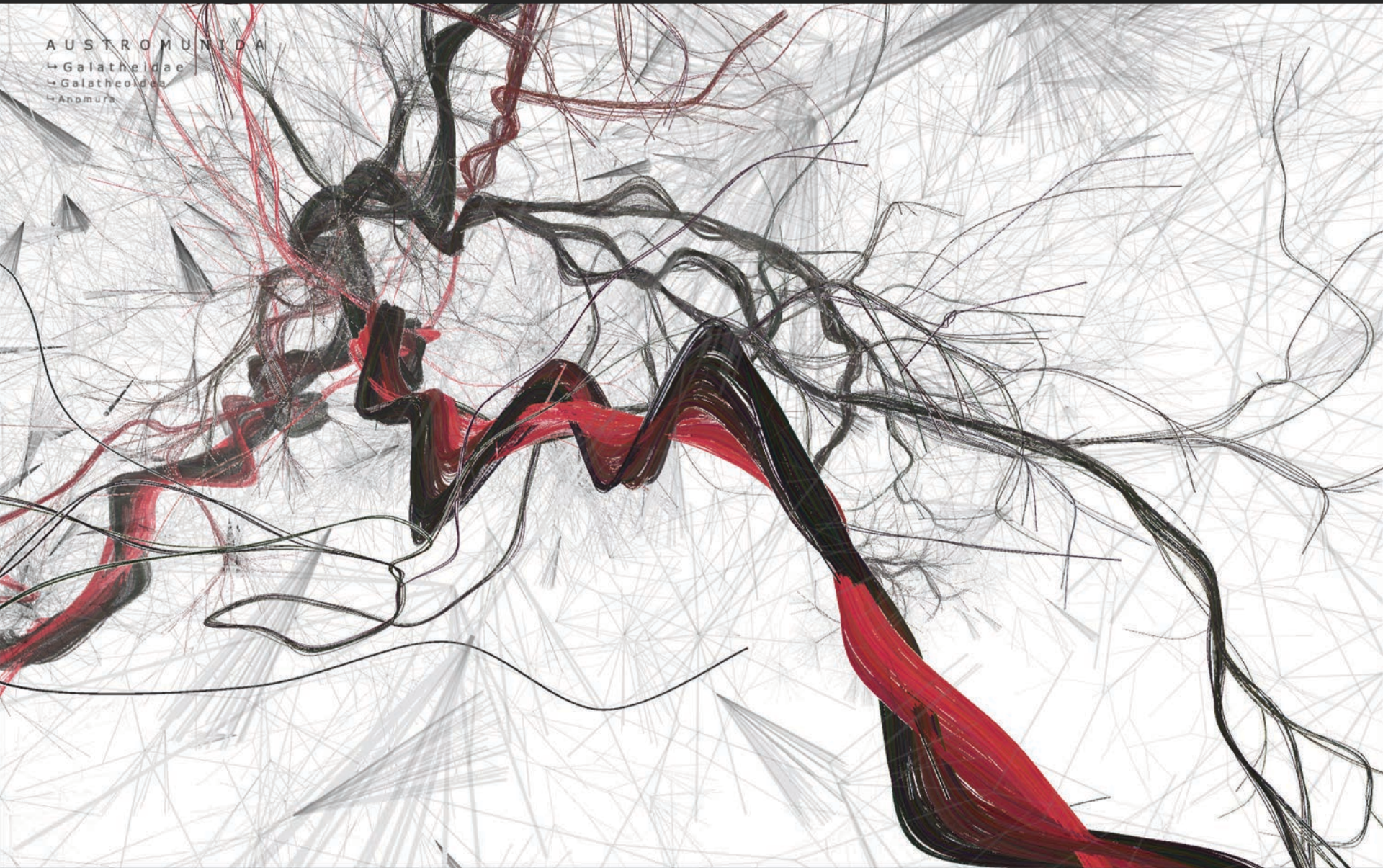
Press r to show the response count with a short line  
Press x or y or z to show rotate with X or Y or Z axis  
Press 1 or 2 or 3 to show the channel curves in three categories



# Vis Example



# Vis Example



# Vis Example



# File header provides relevant information

```
/*
 * Li Zheng work in 2014, m259 data visualization course
 * 2018 additions by George Legrady
 *
 * A 3D interactive demo that uses peasyCam, updated in Processing 3.3.6 - January 29, 2019
 *
 * It compares two data sets a) CHina (RED),b) Japan (BLUE)
 */
```

The demo introduces:

- 1) Comparing data from two csv files
- 2) HSB, hue, saturation, brightness, transparency color system
- 3) PeasyCam camera settings in conjunction with angle-of-view perspective()
- 4) BeginShape, quad, Vertex, and EndShape functions
- 5) The  $\log()$  function as a way to normalize the China and Japan heights (increase or decrease the vertical scaling)  
in this case resetting the values of the global variables chinaHeight and japanHeight, each originally set to 20

```
*****/
```

# Standard practices in giving credit in the code

```
MAT259 3DProj ChantalNguyen
1 /*****
2 3D Visualization: Food & Drink Words
3 Tested in Processing 3
4
5 Author: Chantal Nguyen
6 Supervisor: George Legrady
7
8 Purpose: Visualizes words found in titles of Dewey 641 media at the Sea
9 Library, projected into 3D space using t-SNE. Spatial proximity is dete
10 analyzing the contextual similarity between words. Toggling options des
11 allow the viewer to visualize the word co-occurrence network, where conn
12 words are determined by the number of times two words co-occur in the s
13 This represents a much more simplistic way of obtaining relationships b
14 than word2vec + t-SNE.
15
16 Usage:
17 1. A mouse left-drag will rotate the camera around the subject.
18 2. A right drag will zoom in and out.
19 3. A middle-drag (command-left-drag on mac) will pan.
20 4. A double-click restores the camera to its original position.
21 5. The shift key constrains rotation and panning to one axis or the oth
22 6. Pressing C toggles color modes:
23 [default] where color indicates frequency of the respective word, f
24 (less frequent) to red (more frequent)
25 [community] where points of the same color are within the same commu
26 the word co-occurrence network
27 7. Pressing 1 will make visible all edges between nodes in the word co-
28 occurrence network. Pressing 2-9 or C-P (corresponding to 10-19) wi
29 the edge weight such that only edges with weight greater than or equ
30 entered value will be shown.
31 8. Pressing 0 will hide the edges (default view).
32 9. Hovering over a node will show the corresponding label and the 20 c
33 words.
34 10. Search bar in lower right corner: type a word to highlight the corre
35 and show 20 closest related words (if word does not exist in dataset
36 happen)
```

// borrowed from ChantalNguyen, 3D Visualization,  
// Food & Drink Words

```
cam.beginHUD();
textAlign(LEFT, TOP);
textFont(f, 40);
fill(255);
text(selectedWord.label, 10, 10);
textFont(f, 20);
fill(242, 186, 184);
text(associationString, 7, 50);
cam.endHUD();
popMatrix();
```

# How to Pick Colors (limit to max of 12)

## 2 modes in computing:

- **RGB** (Red, Green, Blue) Additive system
- **HSB** (Hue, Saturation, Brightness) // best to use this as you can control all colors hues (0-255), or saturation (0-255)

## Color Impact greatly depends on the relationships

- **Colorpicker:** <http://tristen.ca/hcl-picker/#/hlc/6/1/20313E/EFEE68>
- **HCL Wizard:** <http://hclwizard.org/hclcolorpicker/>
- **w3Schools:** [https://www.w3schools.com/colors/colors\\_picker.asp](https://www.w3schools.com/colors/colors_picker.asp)

Some geeky discussions: <https://www.vis4.net/blog/2011/12/avoid-equidistant-hsv-colors/>



# Fonts Recommendation (Swiss Graphic Design)

## Sans Serif ()

- This is **Arial** designed for Windows but also works well on Mac
- This is **Acumin** (from Adobe designed in 1989)
- This is **Courier** (looks like industrial IBM typewriter)
- This is **Futura**, Bauhaus aesthetic from 1927
- This is **Helvetica** developed in 1957 has been adopted by industry
- **This is Univers font in bold**
- This is **Univers Condensed** often used in book publishing

# Schneiderman's Data Visualization Design

- **Overview:** Gain an overview of the entire collection
- **Zoom :** Zoom in on items of interest
- **Filter:** filter out uninteresting items
- **Details-on-demand:** Select an item or group and get details when needed
- **Relate:** View relationships among items
- **History:** Keep a history of actions to support undo, replay, and progressive refinement
- **Extract:** Allow extraction of sub-collections and of the query parameters

# Between Function & Abstraction

**PURE FUNCTION** < ----- Interesting approach is somewhere between the two ----- > **TOTAL ABSTRACTION**

# Exploratory Design Process

- Study previous projects at <https://vislab.mat.ucsb.edu/courses.html>
- Doodles (critical quick bridge from idea to image)
- Make brief code sketches
- Plan your time schedule so that you have time to REDO. **Each new version is better than the previous one!**

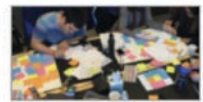
# Doodles

# Miriah Meyer (<https://miriah.github.io/projects/>)

## MODELS FOR VISUALIZATION DESIGN



**Making Data Visual**  
Practical guidance for translating data into insightful visualizations.  
*related material:* [book18]



**Rigor and Knowledge Construction**  
How visualization designers (can) construct rigorous knowledge.  
*related material:* [infovis20] [infovis19] [cga18]



**Visualization Design Research**  
Models that describe what visualization design researchers do and the design decisions they make.  
*related material:* [beliv16] [infovis14] [iv13] [leo13] [cga13] [beliv12] [infovis12] [visweek10]



**Workshops**  
Participatory design workshops for discovering visualization opportunities.  
*related material:* [beliv20] [infovis18] [methods]

## DESIGN STUDIES



Projects that target specific, real-world, data analysis challenges.  
*related material:* [Trevo] [ImplicitError] [Graffinity] [BubbleNet] [WeaVER] [Poemage] [ShotViewer] [PoemViewer] [MulleeSum] [Pathline] [Mizbee]

## CRITICAL DATA VISUALIZATION



**Words Matter**  
Critique of 'chartjunk' as misaligned and inappropriate for vis research.  
*related material:* [altvis21]



**Data Hunches**  
Valuing personal knowledge in visual analysis.  
*related material:* [preprint]

## VISUALIZATION OF PERSONAL DATA

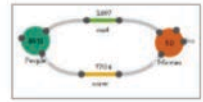


**The Personal Informatics Analysis Gap**  
Three-year study with asthmatic families that reveals opportunities for visualization.  
*related material:* [vis21] [ubicomp18] [lcn18]

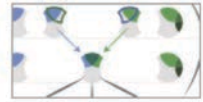


**AQ&U**  
Empowering citizens to reason about air quality using networks of low-cost sensors.  
*related material:* [enviro20] [envres20] [ubicomp18] [lcn18] [cityvis18] [website]

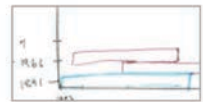
## RAPID PROTOTYPING WITH DATA



**Reshaping Graphs**  
Tool for representing, reshaping, and reimagining data as a graph.  
*related material:* [vast19] [software]



**Iterating Between Tools**  
Model that describes how to bridge between generative and drawing tools, and Hanpuku, a tool that bridges D3 and Illustrator.  
*related material:* [infovis16] [software]

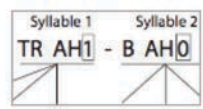


**How Designers Design with Data**  
Results of a qualitative study that describe how designers use data and existing tools to create infographics.  
*related material:* [avi14]

## DIGITAL HUMANITIES



**Visualizing Poetry**  
Visual encoding of poetic devices for poets.  
*related material:* [infovis15] [eurovis13]  
*software:* [poemage] [poemviewer]



**RhymeDesign**  
A formalism for analyzing sonic devices in poetry.  
*related material:* [cfl15] [software]

## VISUALIZATION OF BIOLOGICAL DATA



**inSite**  
Interactive viewer for comparing patterns of binding sites across multiple genomics regions.  
*related material:* [software]



**MulleeSum**  
Exploration tool that supports the comparison of multiple gene expression data sets defined both spatially and temporally.  
*related material:* [infovis10] [software]



**Pathline**  
Tool that visualizes temporal gene expression data over multiple molecular pathways and across multiple species.  
*related material:* [eurovis10] [software]



**MizBee**  
Browser that enables analysis of comparative genomics data through visualization across multiple scales.  
*related material:* [infovis09] [software]

# Data Visualization Topics

- Visualization, exploration & analytics techniques for various data types; e.g., stream, spatial, graph
- Human-in-the-loop processing
- Human-centered databases
- Data modeling, storage, indexing, caching, prefetching & query processing for interactive applications
- Interactive & human -centered machine learning
- Interactive data mining
- User -oriented visualization; e.g., recommendation, assistance, personalization
- Visualization & knowledge; e.g., storytelling
- Progressive analytics
- In-situ visual exploration & analytics
- Novel interface & interaction paradigms
- Visual representation techniques; e.g., aggregation, sampling, multi-level, filtering
- Scalable visual operations; e.g., zooming, panning, linking, brushing
- Scientific visualization; e.g., volume visualization
- Analytics in the fields of scholarly data, digital libraries, multimedia, scientific data, social data, etc.
- Immersive visualization
- Interactive computer graphics
- Setting-oriented visualization; e.g., display resolution/size, smart phones, visualization over networks
- High performance, distributed & parallel techniques
- Visualization hardware & acceleration techniques
- Linked Data & ontologies visualization
- Benchmarks for data visualization & analytics
- Case & user studies
- Systems & tools

# 3D Visualization Fundamentals

<https://www.mat.ucsb.edu/~g.legrady/academic/courses/23w259/w3/vis.pdf>

George Legrady © 2023  
Experimental Visualization Lab  
Media Arts & Technology  
University of California, Santa Barbara