

Making Visible the Invisible

DataVis at the Seattle Public Library

Culture Analytics Conference

Institute for Pure & Applied Mathematics, UCLA

Tuesday, March 22, 2016, 2:00-2:50

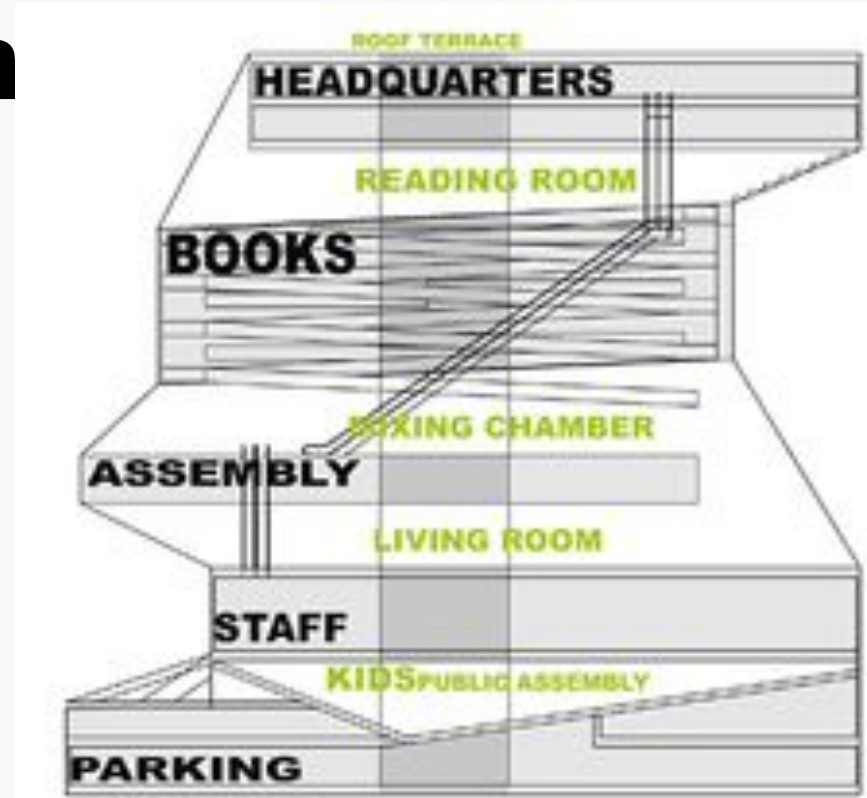
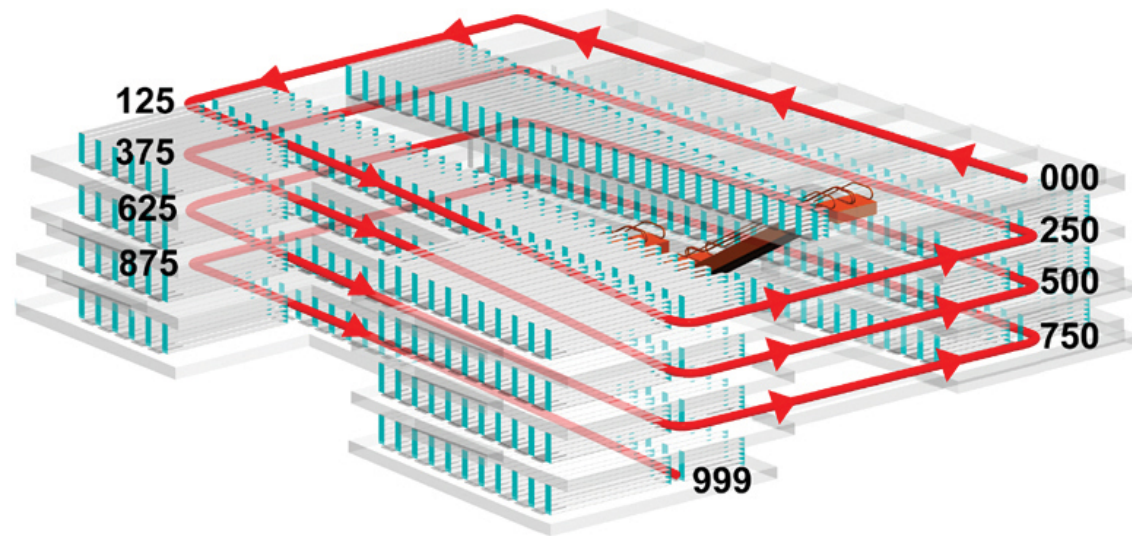
George Legrady, Experimental Visualization Lab

Media Arts & Technology Program, UC Santa Barbara





Architectural Design



Art Commission Project History

- Winter 2004 – OnSite visit for artwork finalists
- May 2004 – Building completed by Rem Koolhaas, his 1st US commission
- Nov 2004 – Artwork contract signed
Clarification with legal, library staff
- Sept 2005 – Artwork installed
- 2004-Fall 2005 – 1.5 years research, negotiation with IT, legal, library staff, etc.
- PROJECT DEVELOPMENT TEAM:
 - **Rama Hoetzlein**, software + design engineer
 - **August Black, Andreas Schlegel**, design studies

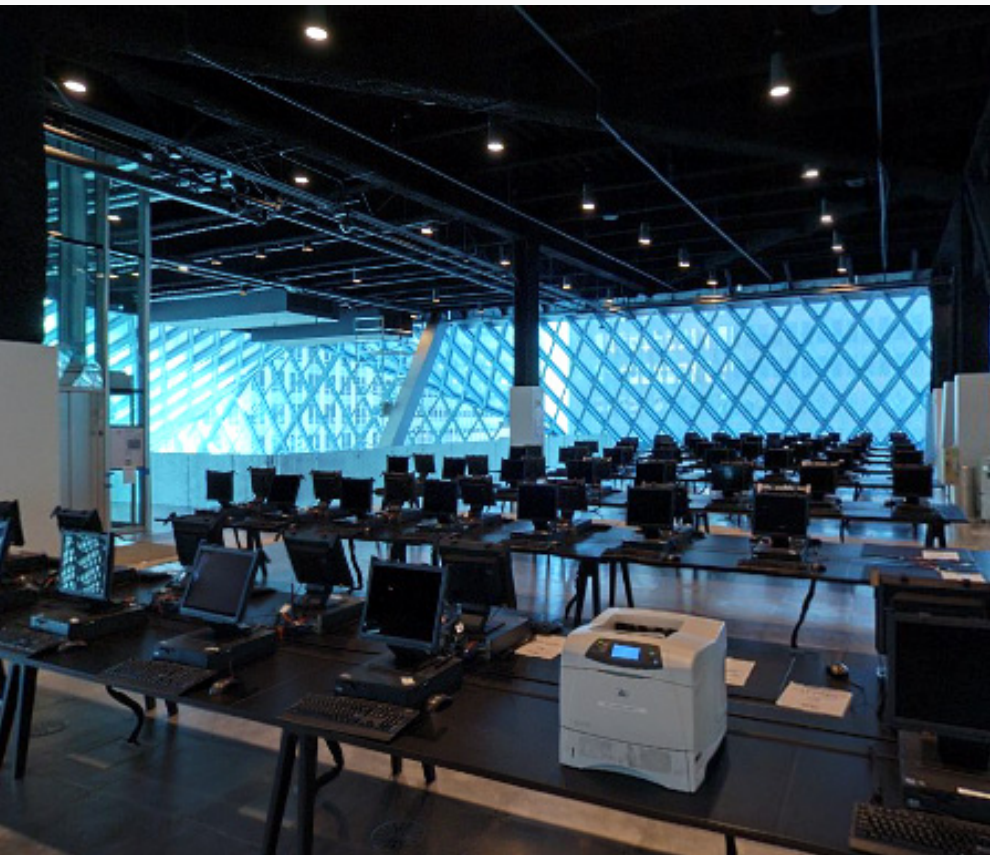




Data & Metadata

- Data is multivariate. Each transaction includes numeric, ordinal, interval scale (time, date), string, and other classification data of objects retrieved from collection:
 - **ItemNumber**: Collection acquisition time-stamp
 - **bibNumber**: Each topic-specific item in collection
 - **Barcode**: Each item has a unique rfid sticker
 - **Check-out/check-in hour/day**: In/out interaction with database
 - **ItemType**: books, cds, dvds, music sheets, etc.
 - **Title**
 - **Dewey Classification** (Dewey numeric, or other)
 - **Subjects**: Keywords (arbitrary labeling)

Mixing Chamber: Trading Floor



Rem Koolhaas Concept



Concept: Emergent System

- **Emergence driven:** Local individual actions (checking out and returning items) result in **collective picture!**
- **Visualization as Feedback:**
Animations provide statistical sampling of community interests!
- A form of **feedback** and **browsing**

Total Items
2005.09.12 16:43:40

12433 Total Items
in circulation today

2088

Dewey Items
2005.09.12 16:43:40

5116 Dewey Items
in circulation today

887

Non-Dewey Items
2005.09.12 16:43:40

7317 Non-Dewey Items
in circulation today

1201

Books
2005.09.12 16:43:40

6881 Books
in circulation today

1152

DVDs
2005.09.12 16:43:40

1932 DVDs
in circulation today

353

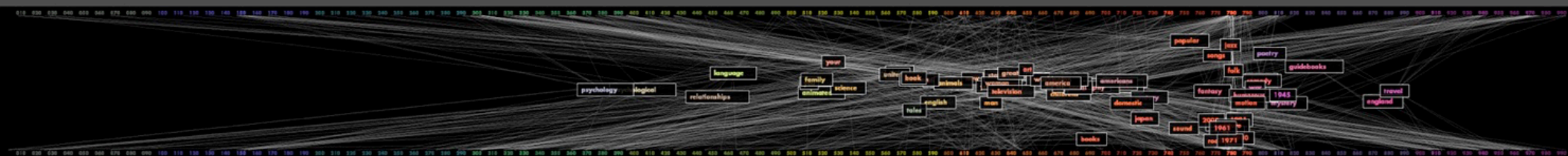
Other Media (cd, video, etc.)
2005.09.12 16:43:40

1226 Other Media
in circulation today

201



0-99	100-199	200-299	300-399	400-499	500-599	600-699	700-799	800-899	900-999
Look out kindergarten here I come	My woman falling	Cyberless the coffee snail	motorcycle stories	like per Willie		What's the sound of it	Lessons from the 10 step guide to living with your monster	Orange Blossom	Orange Blossom
Ancient ones	ILUM PLANET WINE A GRAPE BY GRAPE VINTAGE	Deviant ways	Baby road trip Beach	Maurice	Finding Haverland	What's a score Jess Bear	Shark tale	Orange Blossom	Orange Blossom
Steady Don meets the Box Brothers	Deadly paper of Horvath	bed makes my back a bit	Wigfield the cat	Seconds of pleasure stories	Enduring love	Apocalypse's	Shark tale	Orange Blossom	Orange Blossom
Golden snail	Dark on the run	Max Kravitz Big story	Freemason Perry	Survivor in death	Long Beach and beyond	How meaningful happens	Shark tale	Orange Blossom	Orange Blossom
	Building precision in Unfield and Proust novel		Black and White Star Drink Myths Pandemonia Box		My mother's life	John Teller the life and death of	Shark tale	Orange Blossom	Orange Blossom



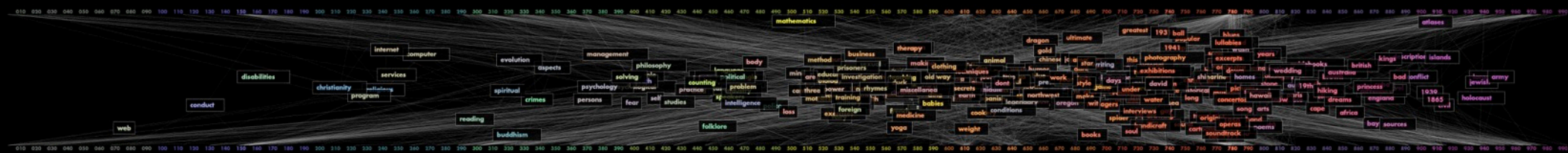
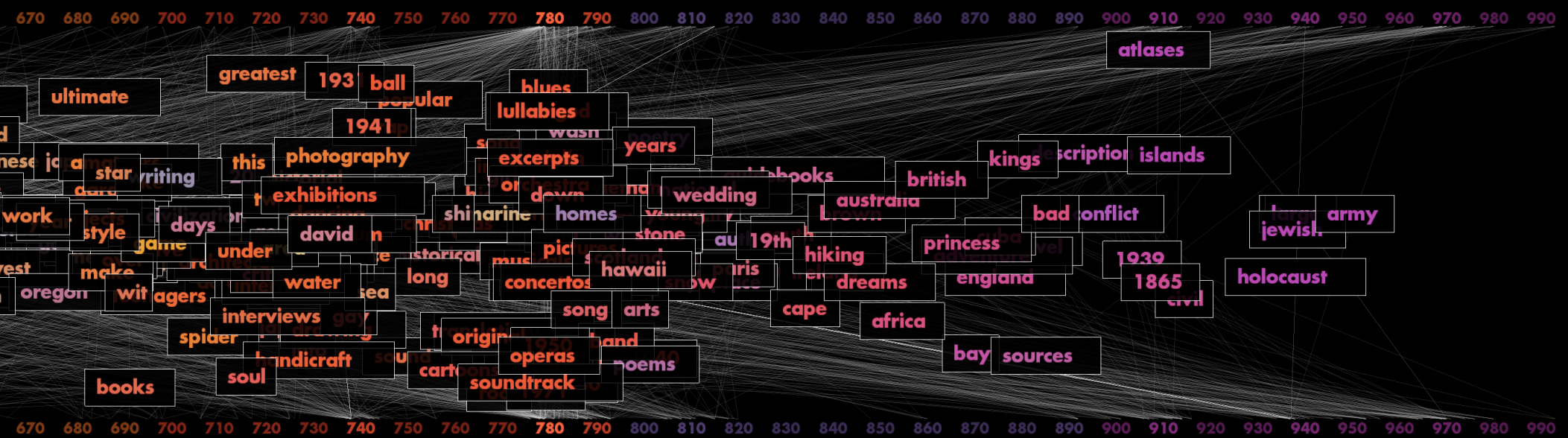
Making Visible the Invisible

- 4 animations, visualizing checkout activities of the past hour
- Approximately 20,000 – 36,000 per day
- 77 million transactions to-date
- Possibly the longest running, dynamic data visualization artwork
- Located behind Information Desk in the Mixing Chamber



Evaluation - Outcomes

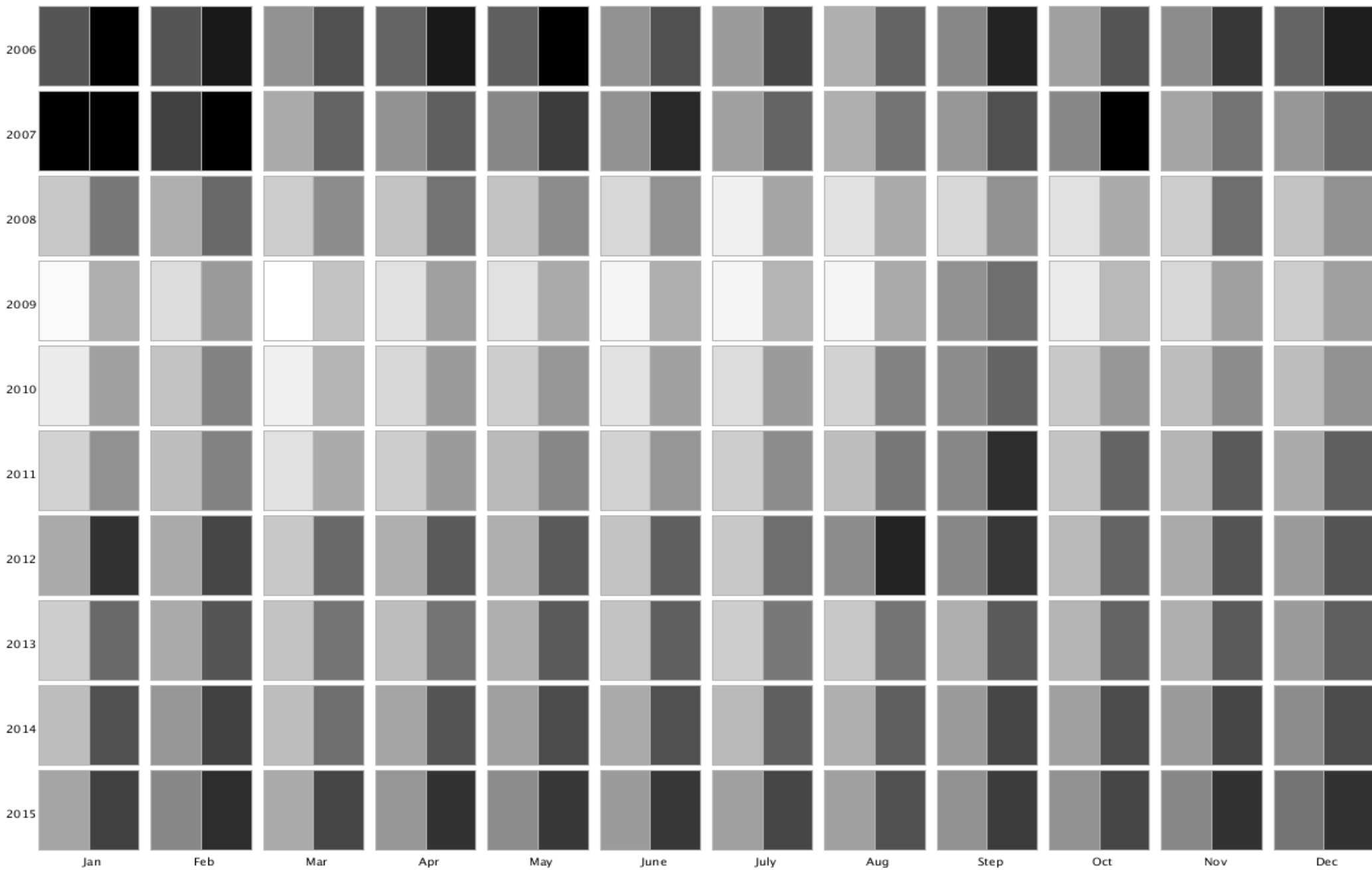
- **Operational** since Sept 2005. May be longest running public datavis project in continuous operation
- Visualization design without much data testing
- **Outcome:** No matter how much the data changes, the visualization contains the data
- Project Collects data



10 year total checkouts = 77,856,242 (Calculated Monthly)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Step	Oct	Nov	Dec
2006	481575	478548	579392	499041	490553	583272	603621	640620	566284	610833	571664	504349
2007	360215	451549	628896	581427	563444	579779	611375	637697	586472	559498	620872	588258
2008	694188	642625	708550	686924	681179	723843	786944	758010	730903	755749	705538	681019
2009	812720	735863	824191	759579	753066	798365	810646	808458	586011	779558	728422	711199
2010	774934	686823	788273	723888	711273	756606	735736	712638	574629	695844	673989	675026
2011	723507	668372	759801	701320	665225	721813	704303	675285	561388	679389	653694	631262
2012	635527	631673	693354	639442	637131	681908	697269	575747	561461	664798	635199	604637
2013	707827	632427	687704	677989	637117	684134	703952	694254	643568	653713	643828	598642
2014	668817	590302	672736	619317	612771	633637	660992	639024	603406	615242	600292	574234
2015	617581	560991	629029	589622	568160	597359	613290	613173	581629	582091	561996	529448

10 year check-outs – Check-ins [2006-2015]



Data as Cultural Analysis

- Patrons check out books, cds, dvds from the Seattle Public Library
- Each time someone checks out a movie, book, cd, a cultural choice is made
- Visualization receives data by the hour
- Appx 30000 per day; 10 million annually
- Over 77 million datasets since September 2005
- Data a significant resource: Can be mined for a broad range of cultural trends
- Can be correlated with library site or other sources: NYTimes, etc.

Data & Metadata

itemNumber	cout	collcode	itemtype	barcode	title	callNumber	deweyClass	subj
2124890	2007-01-02 09:20:00	nacd	accd	0010053294418	tigers have spoken	CD 782.421642 C2665T	782.421642	Rock music 2001 2010^Country music 2001 2010
1963406	2007-01-02 09:12:00	cafic	acbk	0010046075908	Heart on the line	FIC ARNOLD	NULL	Love stories^Women television producers and directors New York State N...
1348064	2007-01-02 09:03:00	nalpfc	acbk	0010047150288	Too hot to handle	FIC LOWELL	NULL	Love stories^Large type books^Ranch life Fiction
264450	2007-01-02 09:13:00	canf	acbk	0010027180271	Governing public schools new times new requirements	371.2 DANZBER 1992	371.2	School boards Rating of
436074	2007-01-02 09:13:00	cs9	acbk	0010002326972	great deception the inside story of how the Kremlin took over Cuba	972.91 M741G	972.91	Cuba History 1959^Communism Cuba^Soviet Union Foreign relations Cu...
660741	2007-01-02 09:13:00	canf	acbk	0010041599258	Logic or The right use of reason in the inquiry after truth with a va...	160 L793W 1996	160	Locke John 1632 1704^Logic Early works to 1800^Conduct of life Early w...
2225714	2007-01-02 09:12:00	cafic	acbk	0010050230746	Something about Emmaline	FIC BOYLE2005	NULL	Love stories^Historical fiction^Regency fiction^London England Fiction
860548	2007-01-02 09:14:00	canf	acbk	0010048238389	Understanding installation art from Duchamp to Holzer	709.04 R7277U 2003	709.04	Installations Art^Art Modern 20th century
15316	2007-01-02 09:12:00	cs9	acbk	0000103502175	Frank B Kellogg a biography	B K292 B	NULL	Kellogg Frank B Frank Billings 1856 1937^Statesmen United States Biography
418329	2007-01-02 09:13:00	cs9	acbk	0010002324977	German raider Atlantis	940.953 F8517G	940.953	World War 1939 1945 Naval operations German^Atlantis Ship
745716	2007-01-02 09:13:00	cafic	acbk	0010033394031	Zabelle	FIC KRICORI1998	NULL	Armenian American women Massachusetts Boston Fiction
1529347	2007-01-02 09:14:00	canf	acbk	0000102981248	Reservation narrow gauge Omak Creek railroad Bow Arrow Short Li...	385.52097 L587R	385.52097	Biles Coleman Lumber Company History^Logging railroads Washington St...
1558007	2007-01-02 09:13:00	canf	acbk	0010004731641	place no one knew Glen Canyon on the Colorado	779 P83P2a	779	Glen Canyon Utah and Ariz^Glen Canyon Utah and Ariz Pictorial works
1681487	2007-01-02 09:12:00	canf	acbk	0010002691342	Buddhism in translations passages selected from the Buddhist sacr...	294 W252B	294	Buddhism Sacred books
1688675	2007-01-02 09:14:00	canf	acbk	0010048100100	death in Washington Walter G Krivitsky and the Stalin terror	327.1247 K4592D 2003	327.1247	Krivitsky W G Walter G 1899 1941^Espionage American^Espionage Soviet...
2424499	2007-01-02 09:13:00	canf	acbk	0010054269096	101 diseases you dont want to get	614.5 P8715o 2005	614.5	Epidemiology Popular works^Diseases Popular works
27939	2007-01-02 09:09:00	nafic	acbk	0010040162363	Twilight in Texas	FIC THOMAS	NULL	Love stories^Texas Fiction^Texas Rangers Fiction
1534336	2007-01-02 09:00:00	nanf	acbk	0010041237933	Boundless healing meditation exercises to enlighten the mind and...	294.34435 T387B 2000	294.34435	Mind and body^Meditation Buddhism^Healing Religious aspects Buddhism
2205408	2007-01-02 09:14:00	canf	acbk	0010050859288	fragrance of faith the enlightened heart of Islam	297 R1294F 2004	297	Islam
2631813	2007-01-02 09:14:00	nanf	acbk	0010053789672	How to reduce workplace conflict and stress how leaders and their...	658.1053 M327H 2005	658.1053	Teams in the workplace^Interpersonal conflict^Mediation^Negotiation^O...
702785	2007-01-02 09:13:00	canf	acbk	0010034758416	home of the blizzard a true story of Antarctic survival	919.8904 MAWSON 1998	919.8904	Antarctica Discovery and exploration^Australasian Antarctic Expedition 1...
1168659	2007-01-02 08:58:00	nab	acbk	0010045761730	Lives of mothers daughters growing up with Alice Munro	B M9265M 2001	NULL	Novelists Canadian 20th century Family relationships^Novelists Canadian...
2498965	2007-01-02 09:14:00	canf	acbk	0010054107684	Foxes in the henhouse how the Republicans stole the South and th...	324.70973 R29996J 2006	324.70973	Democratic Party U S^Republican Party U S 1854^Politics Practical United...
1076021	2007-01-02 09:13:00	canf	acbk	0010045523353	False intimacy understanding the struggle of sexual addiction	241.66 Sch196F 1997	241.66	Sex addicts Rehabilitation^Intimacy Psychology Religious aspects Christia...
1703576	2007-01-02 09:12:00	canf	acbk	0010025511717	Lakota recollections of the Custer fight new sources of Indian milit...	973.82 LAKOTA 1991	973.82	Dakota Indians Wars 1876^Little Bighorn Battle of the Mont 1876 Person...
2033121	2007-01-02 09:13:00	cafic	acbk	0010020070768	Furors die a novel	FIC HOFFMAN	NULL	NULL
2633117	2007-01-02 09:06:00	nanf	acbk	0010042818186	devils dictionary of business monkey business high finance and lo...	330.0207 V895D 2005	330.0207	Finance Dictionaries^Business Dictionaries
295289	2007-01-02 09:13:00	canf	acbk	0010041330571	Running with the Buffaloes a season inside with Mark Wetmore Ad...	796.42809 C7193L 2000	796.42809	Colorado Buffaloes Cross country team^Cross country running Colorado...
2684484	2007-01-02 09:13:00	canew	acbk	0010054076608	opened grave Sherlock Holmes investigates his ultimate case	FIC JAMES2006	NULL	Mystery fiction^Holmes Sherlock Fictitious character Fiction^Missing pers...
756568	2007-01-02 09:14:00	canf	acbk	0010028375219	Transforming vision writers on art	810.80357 TRANSFO 1994	810.80357	Art^American poetry 20th century^Art Poetry
1437750	2007-01-02 09:13:00	cs9	acbk	0000102286903	De Shazer the Doolittle raider who turned missionary a true and th...	B D459W	NULL	Missions Japan^De Shazer Jacob 1912
67201	2007-01-02 09:45:00	nchol	jcbk	0010045871109	Jothams journey a storybook for Advent	J YTREEID	NULL	Family Prayer books and devotions English^Advent Prayer books and dev...
1336766	2007-01-02 09:44:00	cs9o	acbk	0010001512887	Burri	B B942B	NULL	Burri Alberto 1915
2582486	2007-01-02 09:44:00	ncnew	jcbk	0010050556819	Lady in the water a bedtime story	E SHYAMAL	NULL	Imaginary creatures Fiction
1978356	2007-01-02 09:45:00	cs6ro	arbk	0010019836690	Bullard Arms	338.76834 J241B	338.76834	Bullard James Herbert 1842 1914^Bullard Repeating Arms Company Hist...
1404338	2007-01-02 09:44:00	canf	acbk	0010038257472	Perfect bones a six point plan to promote healthy bones	616.716 L5785P 2000	616.716	Osteoporosis Popular works^Women Nutrition
2347671	2007-01-02 09:44:00	nanf	acbk	0010050592780	Satisfaction the science of finding true fulfillment	155.9 B4581S 2005	155.9	Satisfaction
468341	2007-01-02 09:41:00	nafic	acbk	0010022410574	Fly fishing tales literary bait by angling authors	FIC FLY FIS1994	NULL	Fishing stories American^Fly fishing Fiction
1558499	2007-01-02 10:02:00	nanf	acbk	0010037361580	Chariots of the gods unsolved mysteries of the past	001.94 DANIKEN 1999	001.94	Archaeology^Life on other planets^Civilization Ancient Extraterrestrial in...
2064174	2007-01-02 09:41:00	canf	acbk	0010036046778	way of agape	241.4 MISSLER 1999	241.4	Agape^Love Religious aspects Christianity
18430	2007-01-02 09:41:00	canf	acbk	0010026014141	Future of medicine toward a science of prevention based on ancie...	613 DUGLISS 1993	613	Medical care United States^Medicine Preventive United States
614085	2007-01-02 09:41:00	canf	acbk	0010045701462	Tanker operations a handbook for the person in charge PIC	623.88245 H8627T 2001	623.88245	Tankers Handbooks manuals etc
1591175	2007-01-02 09:39:00	caesi	bcbk	0010034398809	Angliiskii iazyk prosto o slozhnom prakticheskii kurs	RUSSIAN 428.24917 L576A	428.24917	English language Textbooks for foreign speakers Russian
2670845	2007-01-02 08:48:00	canf	acbk	0010051680022	Gorgeous disaster the tragic story of Debra LaFave	364.153 L131L 2006	364.153	Sexual abuse victims United States Case studies^Female sex offenders U...
1064531	2007-01-02 10:16:00	nacd	accd	0010040958539	Spirituals in concert	CD784.73 B322S	784.73	Spirituals Songs^Songs High voice with instrumental ensemble^Songs Hi...
965750	2007-01-02 09:38:00	capf	acbk	0010025431536	Kathy and Mo show parallel lives	812.54 GAFFNEY 1992	812.54	Women Drama
1970799	2007-01-02 09:39:00	nafic	acbk	0010046761242	revelation	FIC LITTLE	NULL	Horror fiction
1006825	2007-01-02 10:17:00	cacd	accd	0010046200415	peaceful Christmas	CD 782.21723 P3133	782.21723	Christmas music^New Age music
1831232	2007-01-02 10:17:00	canf	acbk	0010048571573	Tauntons family home idea book	728.37 St546T 2003	728.37	Architecture Domestic United States^Interior architecture United States^R...

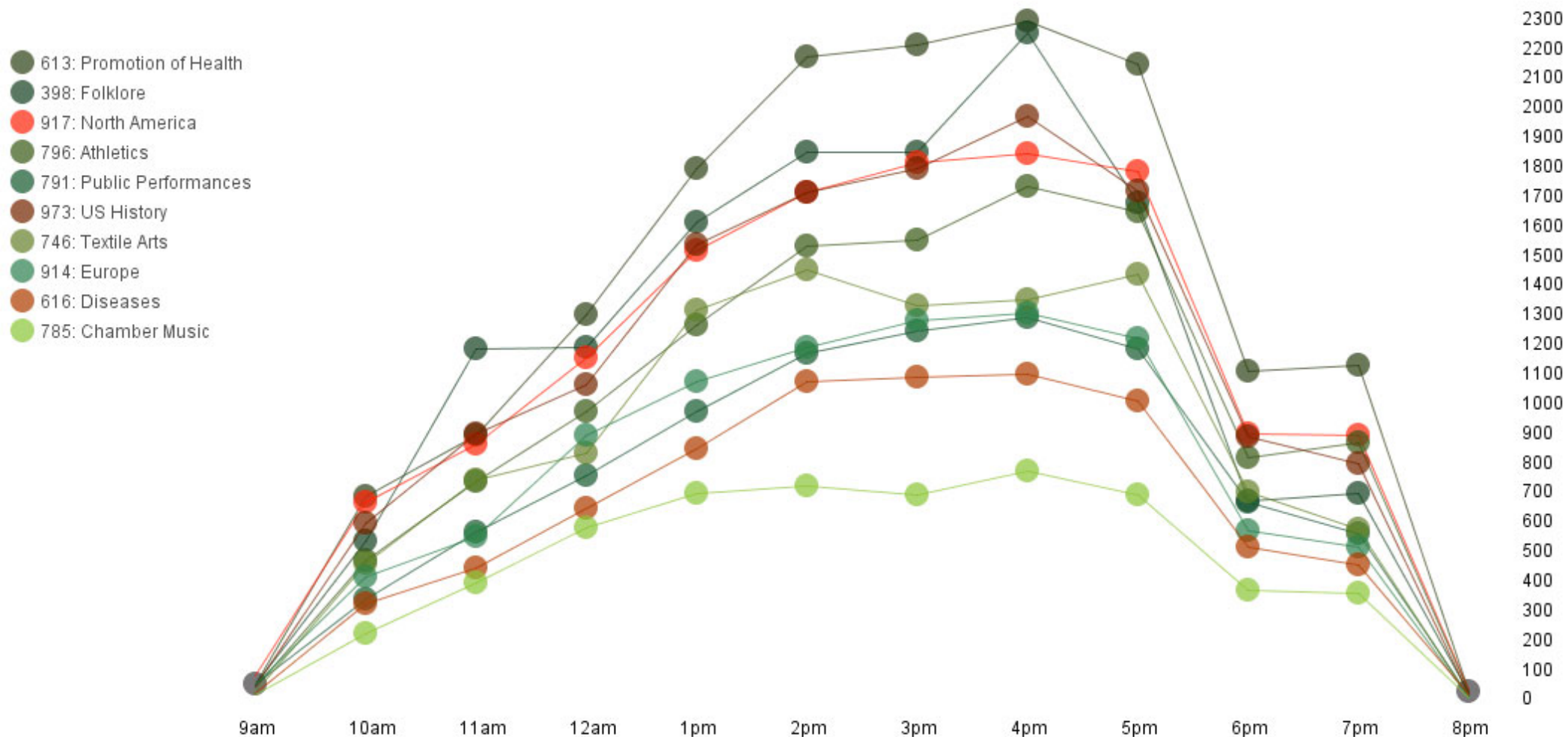
Typical daily Dewey activity

20 most active

hour	789	613	784	917	746	973	796	398	616	914	791	306	332	305	158	792	811	658	635	895	
0	0	0	0	0	8	0	4	12	1	0	0	0	1	0	0	1	0	5	0	0	4
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
7	1	2	0	5	0	1	1	0	0	1	0	0	0	0	2	1	0	1	0	0	2
8	15	58	57	109	38	90	39	73	25	50	41	34	20	31	13	33	33	33	14	24	42
9	27	71	48	134	40	87	62	73	41	70	78	36	35	42	12	32	52	14	28	45	
10	1192	942	812	777	619	632	582	515	465	472	440	383	466	394	429	362	420	370	402	396	
11	1560	1149	1125	969	880	1006	786	966	702	701	567	610	453	556	542	526	628	488	532	560	
12	2185	1683	1878	1177	1025	1108	1156	889	881	935	782	706	779	700	715	625	788	680	647	960	
13	3266	2334	2085	1769	1717	1615	1462	1324	1181	1275	972	1117	1175	1025	1025	997	968	967	986	987	
14	3336	2698	2227	1811	1890	1744	1685	1487	1421	1271	1144	1146	1059	1044	1062	1041	990	962	1105	1140	
15	3995	2810	2426	1870	1850	1813	1703	1417	1444	1360	1388	1142	1187	1172	1073	1143	1139	1074	1139	1044	
16	3959	2855	2599	2068	1857	1867	1904	1798	1520	1449	1411	1390	1250	1306	1321	1265	1101	1126	1110	1119	
17	4322	2870	2547	2203	1992	1817	1904	1374	1438	1416	1322	1402	1366	1317	1346	1359	1152	1248	1045	798	
18	2398	1574	1381	1012	1024	1034	1059	630	756	615	719	682	678	680	677	685	604	562	532	280	
19	2233	1557	1284	1050	845	942	1027	643	612	524	595	713	706	594	623	645	562	651	497	341	
20	48	18	17	35	9	15	25	18	9	6	15	4	3	3	4	6	11	17	22	4	
21	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
22	0	2	2	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	
23	6	1	2	5	1	0	6	0	0	0	4	2	2	0	2	7	1	1	0	0	

Typical daily Dewey activity

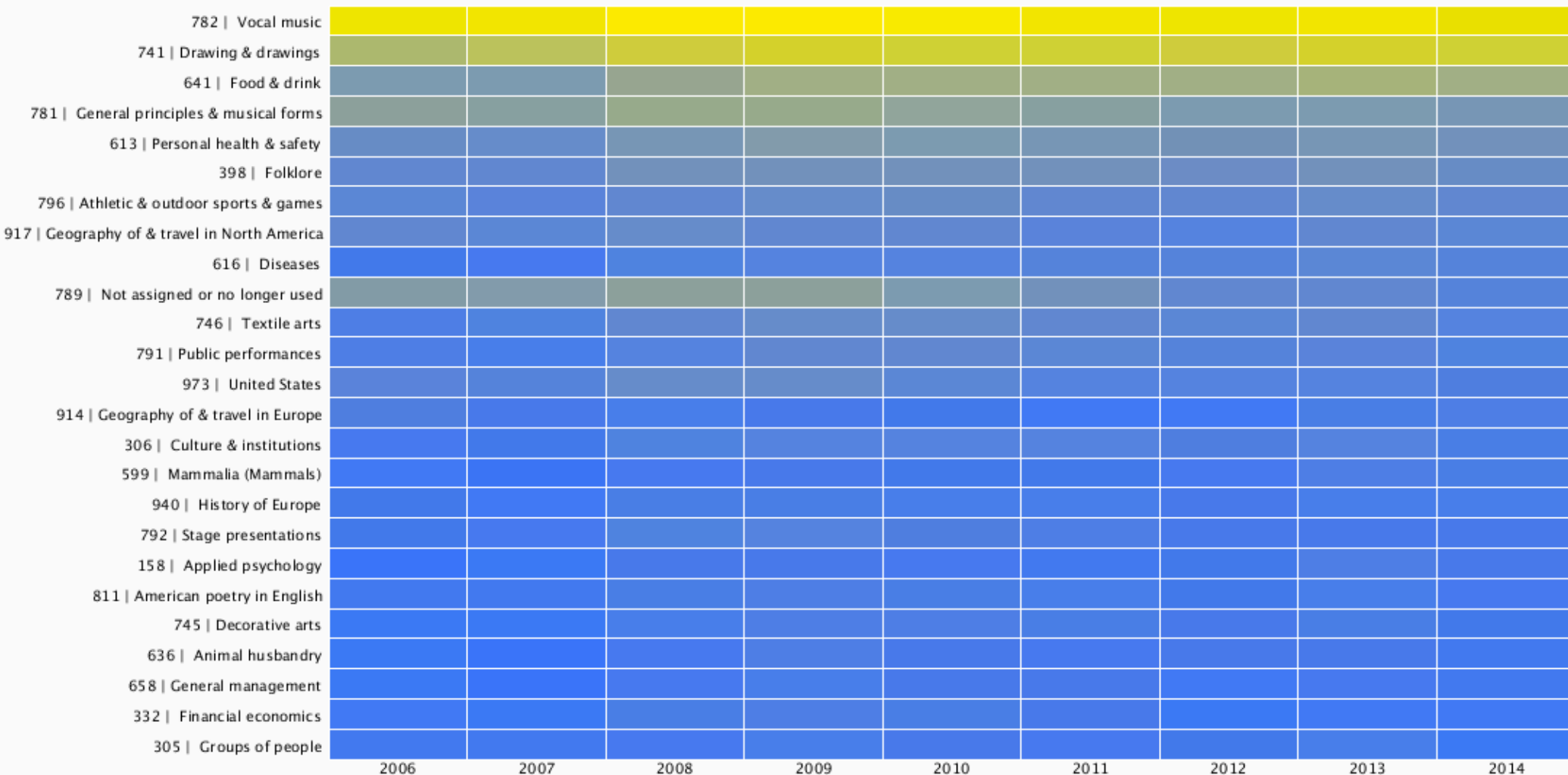
Total Num Items Checked-out per Hour: January 2007 through April 2007



Top 25 Dewey categories 2006-2014

		2006	2007	2008	2009	2010	2011	2012	2013	2014
782	Vocal music	657750	721853	1006571	1060888	868834	774273	665173	700986	593881
741	Drawing & drawings	158295	201324	312239	354992	323449	330355	315883	366327	334448
641	Food & drink	65057	67695	99965	121586	125332	121088	116785	137652	125462
781	General principles & musical forms	82066	79529	107747	109614	90869	75959	62922	66173	61207
613	Personal health & safety	45227	43632	61698	69461	65593	61935	56773	61824	50671
398	Folklore	39845	38035	50875	52707	53403	50482	46519	51337	45293
796	Athletic & outdoor sports & games	34380	32561	38817	42247	44010	39552	37113	40243	39833
917	Geography of South America	39684	35096	40760	39546	35287	32660	30101	35325	34345
616	Diseases	20419	21025	27711	29572	30783	31993	30817	34247	31410
789	Not assigned or no longer used	73223	68907	81785	82129	65317	53936	39824	36572	30845
746	Textile arts	25431	27902	39846	42885	40551	39058	34315	36683	29033
791	Public performances	25355	23240	30165	37187	35966	34799	31029	32736	28085
973	United States	32823	31155	42087	42253	33891	29942	28671	30198	25967
914	Geography of & travel in Europe	26029	21671	22858	22489	20251	18843	18709	24124	25444
306	Culture & institutions	20867	20265	27332	29848	29218	28702	25989	28742	24006
599	Mammalia (Mammals)	18354	16843	21175	22274	20500	20242	21384	25018	23832
940	History of Europe	19949	18692	23822	24143	23512	22826	21790	22787	22698
792	Stage presentations	20546	21101	27299	28246	26509	25376	22394	22098	22229
158	Applied psychology	15175	17365	21914	22247	21172	19775	20593	25702	22020
811	American poetry in English	19182	19333	24485	25675	23911	22671	20281	23207	21159
745	Decorative arts	17982	17718	23134	25661	25695	24278	22567	23684	20007
636	Animal husbandry	17494	16494	21404	24755	21680	21436	21963	22178	19135
658	General management	17487	15602	20868	23521	22493	21660	18913	20892	19050
332	Financial economics	18573	17640	24030	25262	23902	22333	17976	18527	18254
305	Groups of people	19305	19014	21563	22664	22339	21106	19896	22861	18054

Top 25 Dewey categories 2006-2014



Project Collects Data

- Ideal study: Systematic data 2nd accumulation (hourly over ten years)
- 2nd decade of the internet
- Can track the impact of the internet on the library

Data as Visualization Study

- A data visualization course that studies the SPL data (since 2007)
- Creative Approach: Knowledge Discovery: Open approach to exploring data
- Students learn:
 - Data retrieval
 - Asking interesting questions about a dataset
 - Learn to translate abstract data into visualization
 - Acquire programming, design skills

An Interdisciplinary Process

Expertise Differentiations:

- Analytical: theoretical, cultural, information analysis(*social scientist*)
- Technical: Statistical aggregation and computational processes (*engineer, scientific*)
- Aesthetic: Visual design, expression (*artist, designer, architect*)
- Students: MAT(visual, spatial, audio, multimedia) and
- CS, engineering, CCS, Geography, Bren, Art, Statistics, Political Science

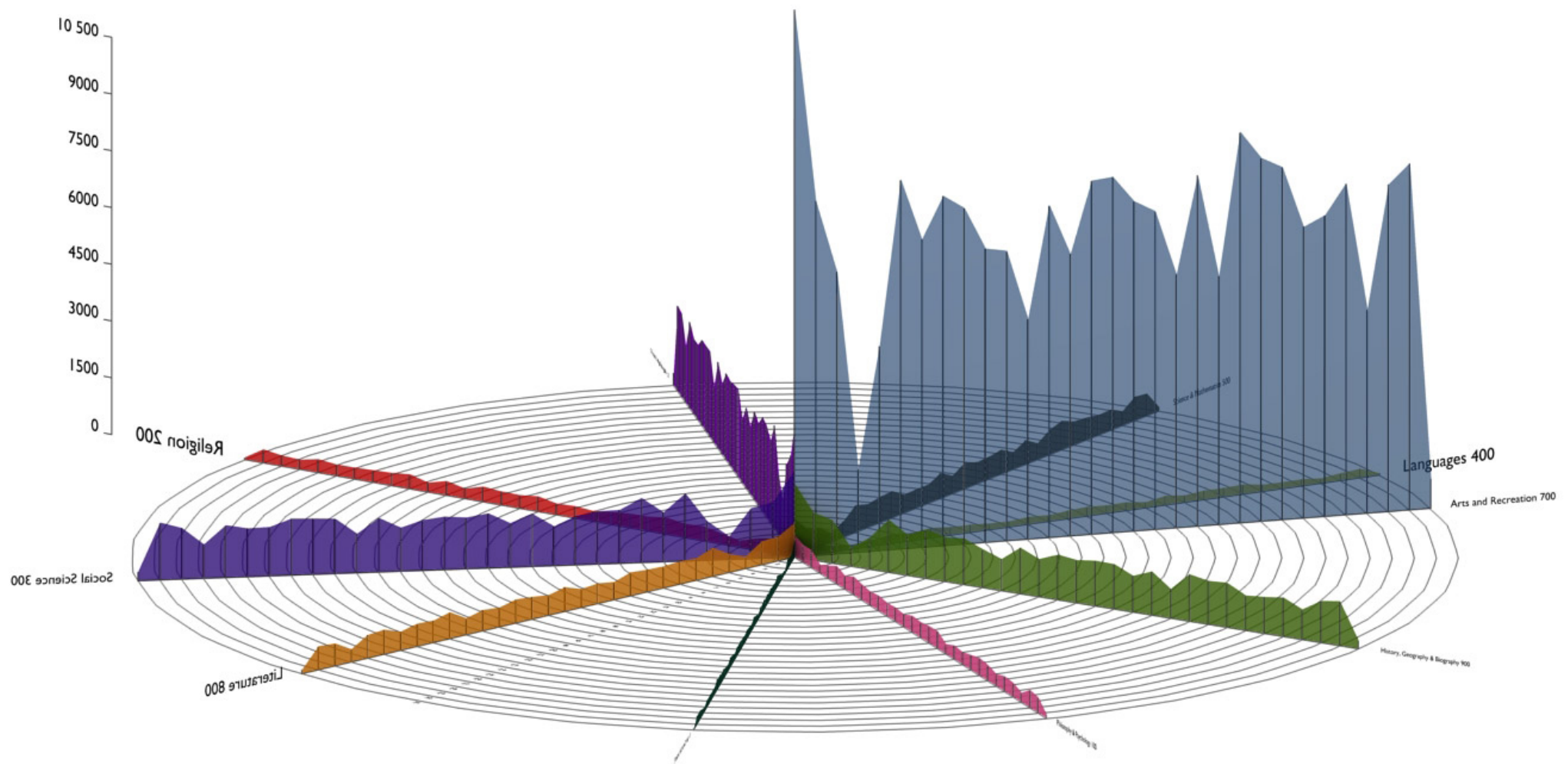
Course Structure (10 weeks)

- **Wk 1-3:** Data Analysis (MySQL)
- **Wk 3-6:** 2D and 3D interactive visualization (java-based Processing)
- **Wk 7-10:** Student defined project (JSON and APIs for correlating data)

Frequency Patterns

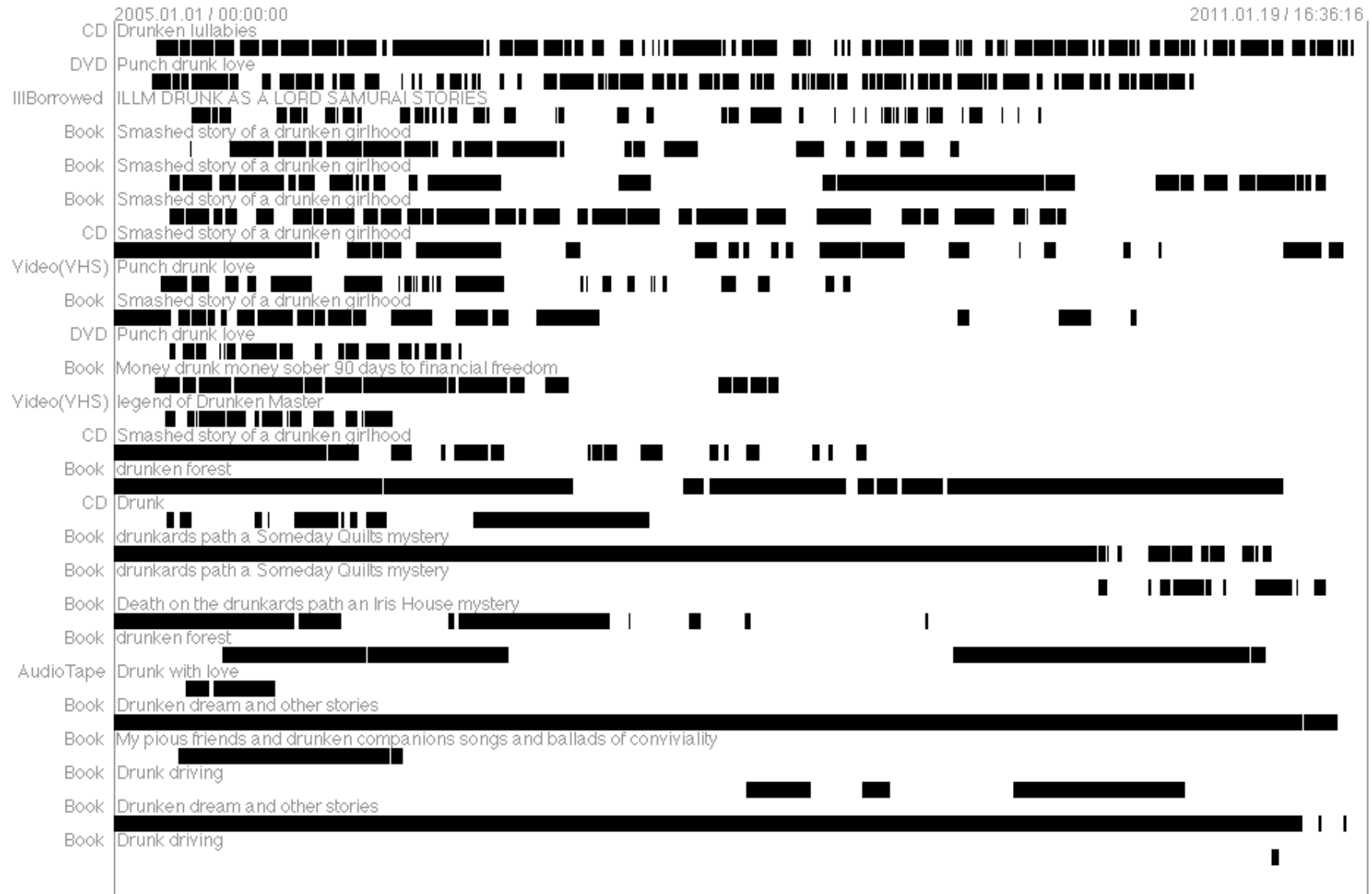
- Finding statistically relevant patterns between data examples where the values are delivered in a sequence

Volume of Dewey Activities



Checkin-Checkout Sample

title like '%drunk%' group by collcode;

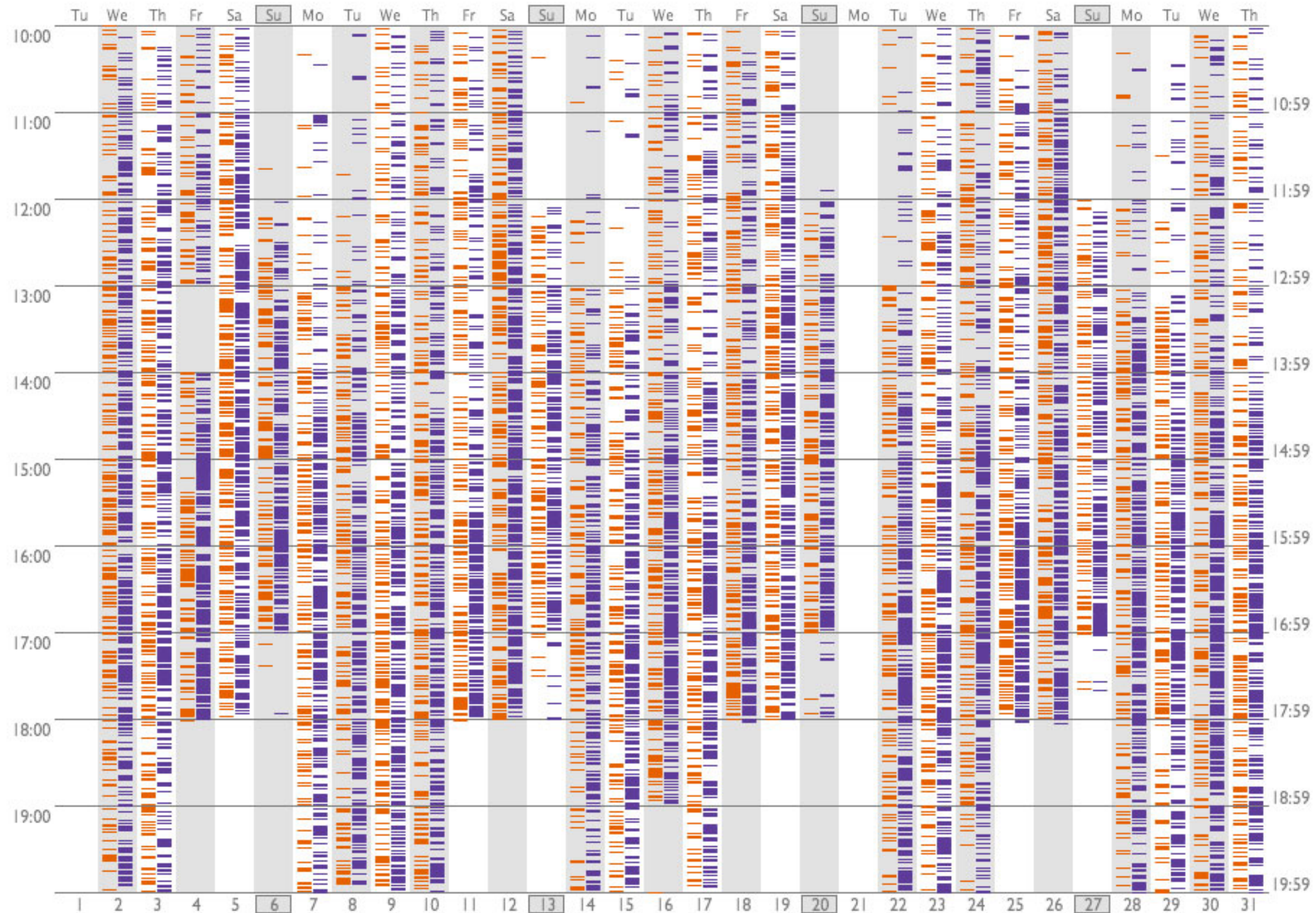


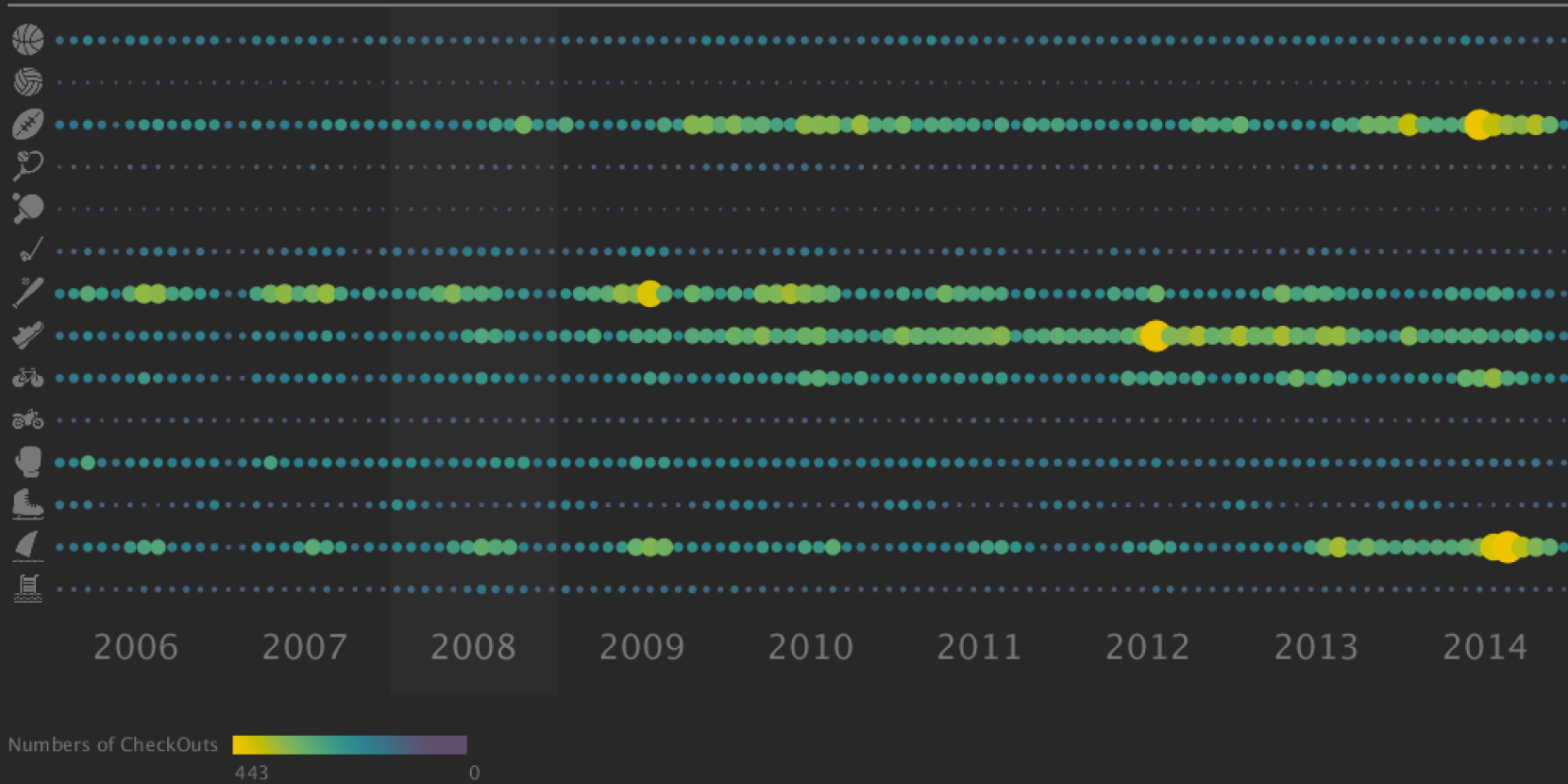
title like '%happiness%' group by title limit 12;



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

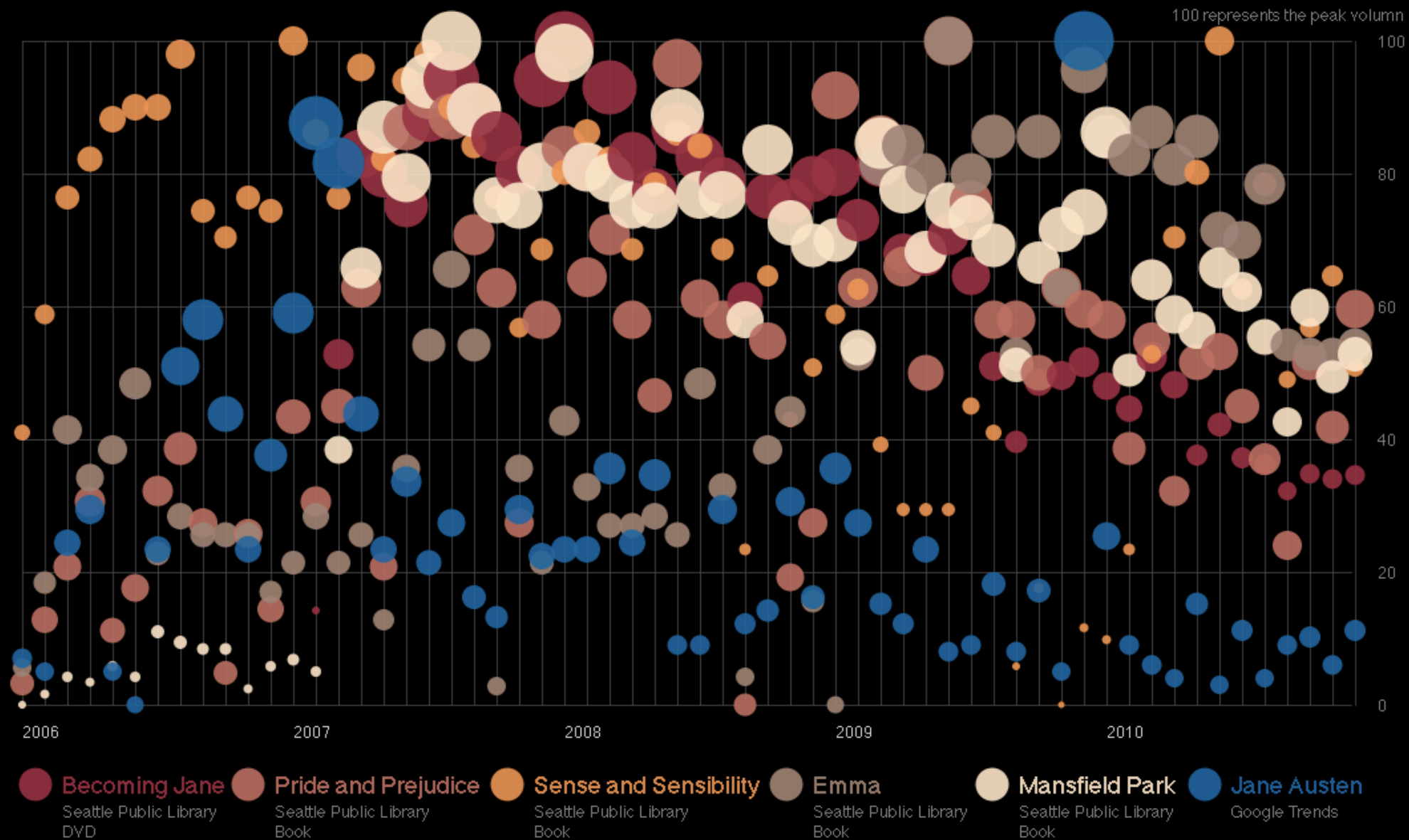
time items checked out / day
month of january





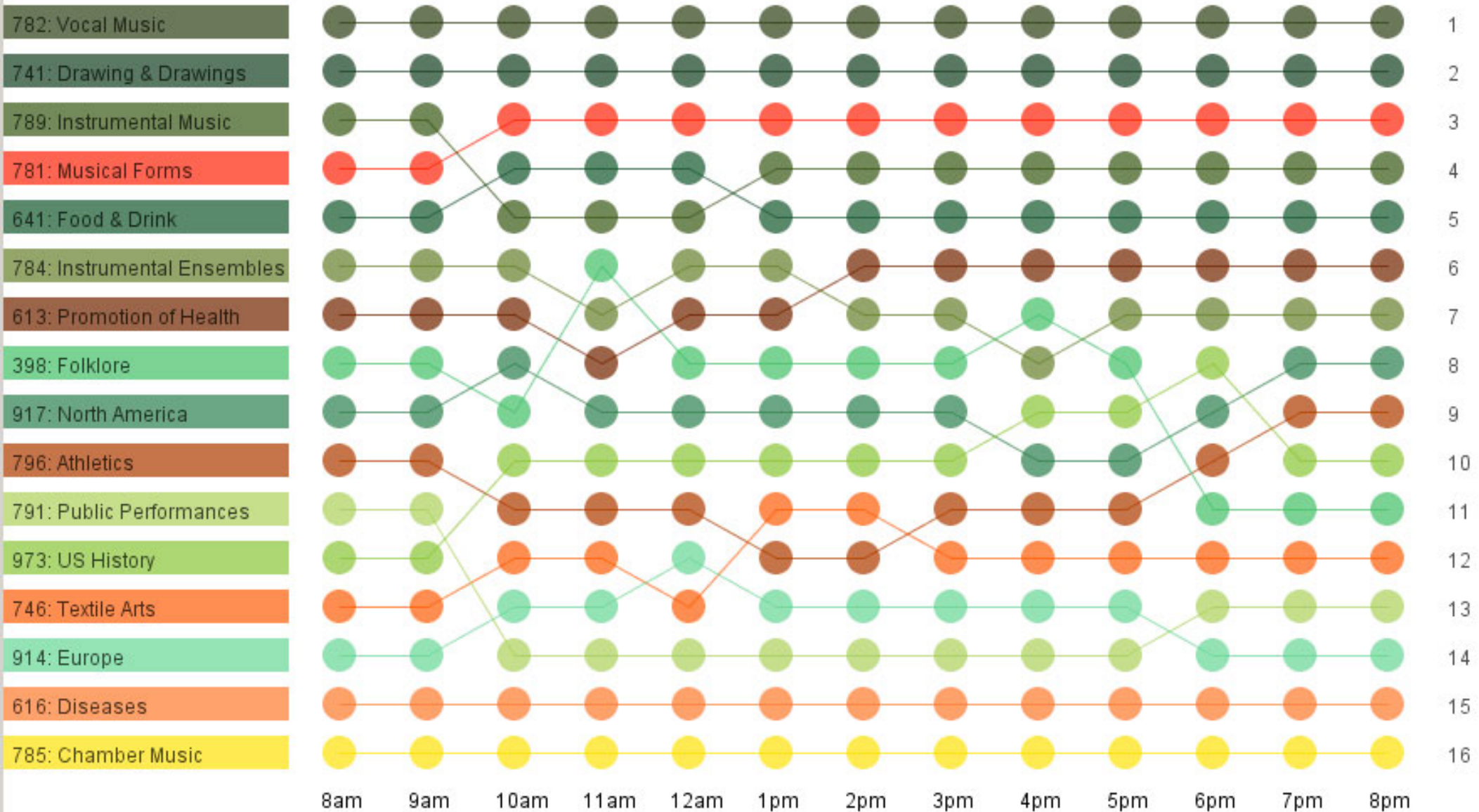
JANE AUSTEN WITH HER NOVELS

CHECKOUT NUMBERS OF JANE AUSTEN'S NOVELS IN SEATTLE PUBLIC LIBRARY 2007-2010
WEB SEARCH NUMBER OF "JANE AUSTEN" ON GOOGLE 2007-2010



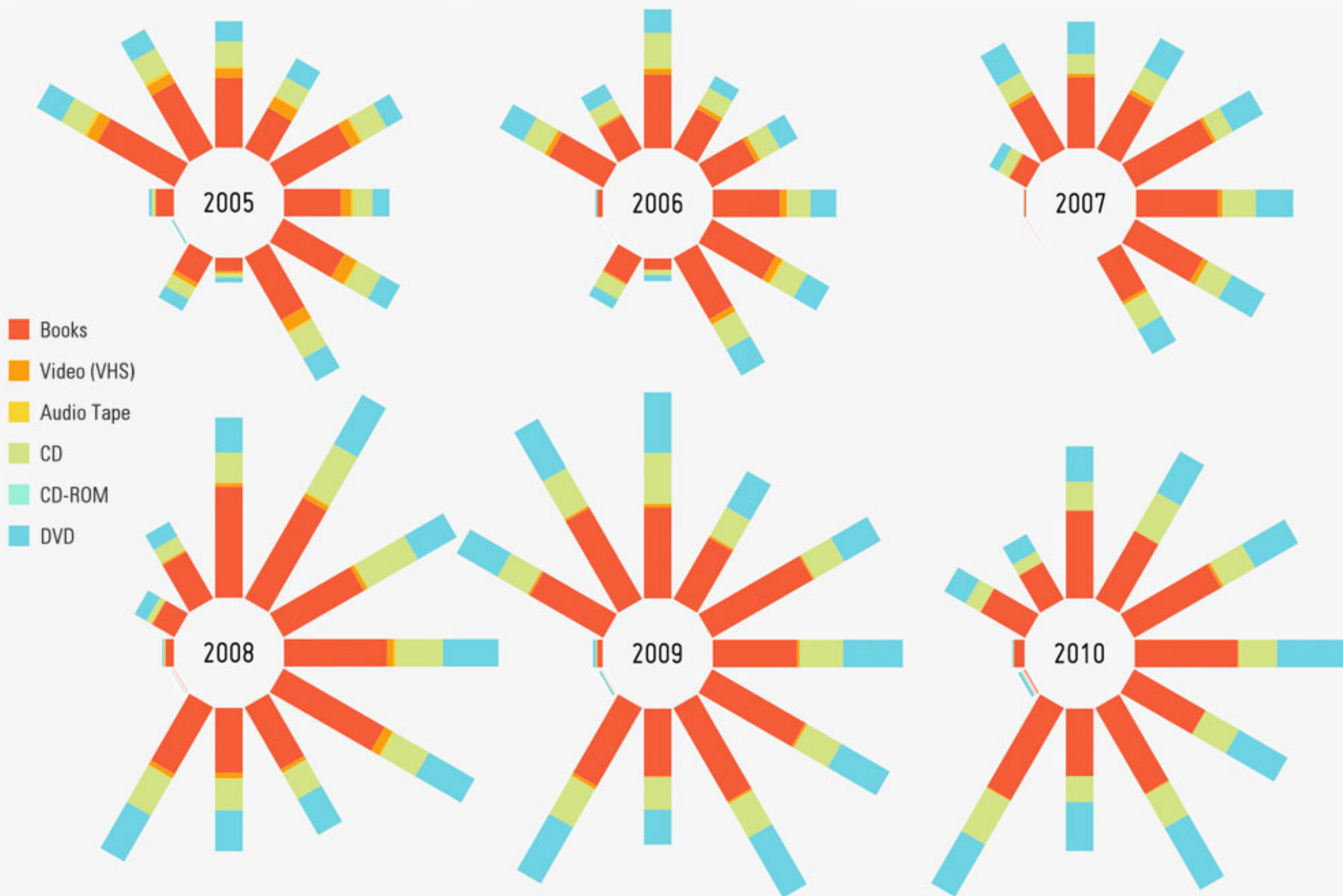
Typical daily Dewey activity

Average Rank of Category by Hour: January 2007 through April 2007



Change Over Time

- Public interaction with the library holdings reveal fluctuations in cultural interests and trends
- How media perform (VHS, CDs, DVD)
- Reveals social trends



November 10, 9am to 8pm, 2005, 2006, 2007, 1008, 2009, 2010

900
Geography & History

800
Literature

700
Arts

600
Technology

500
Nat. Sciences & Math

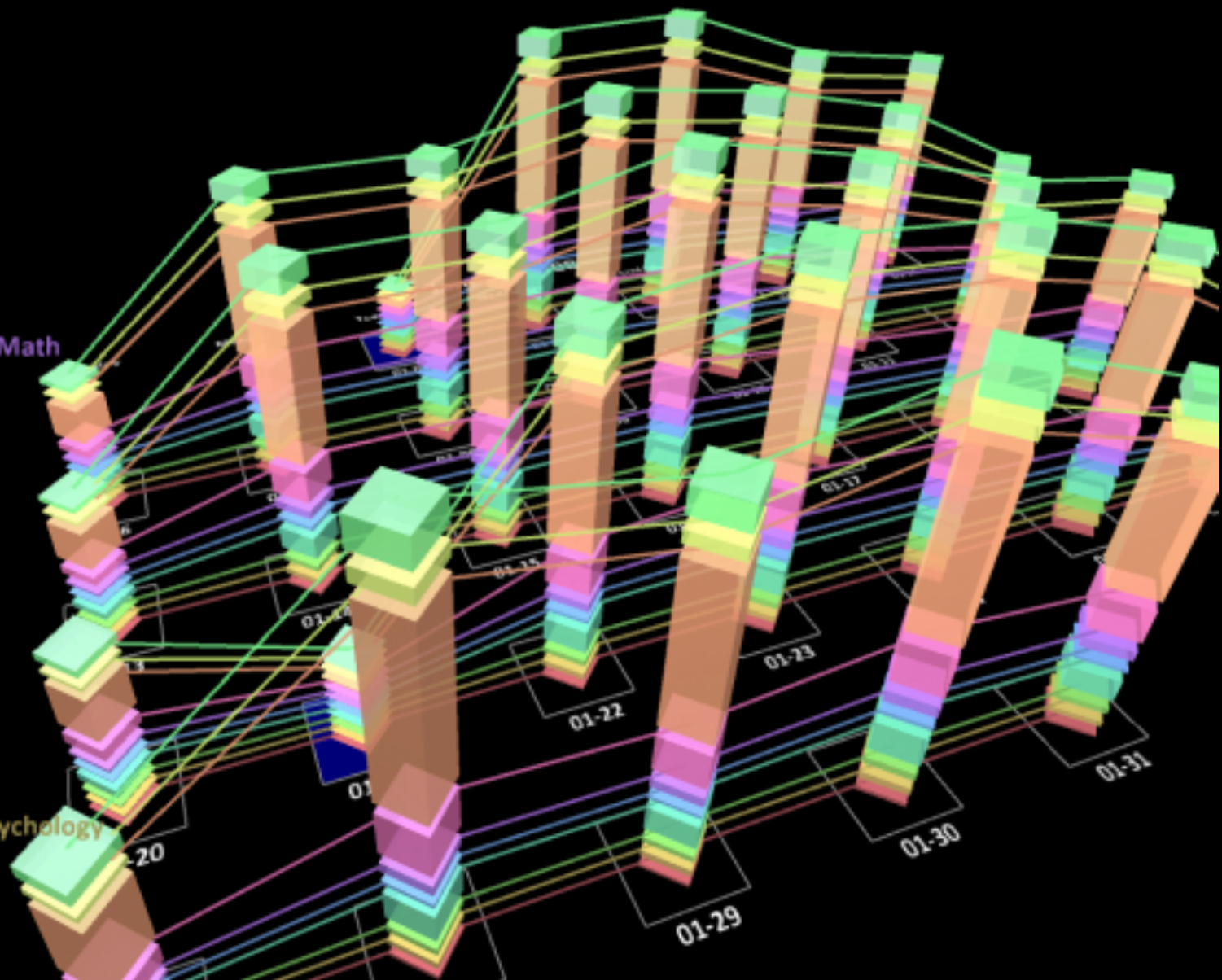
400
Language

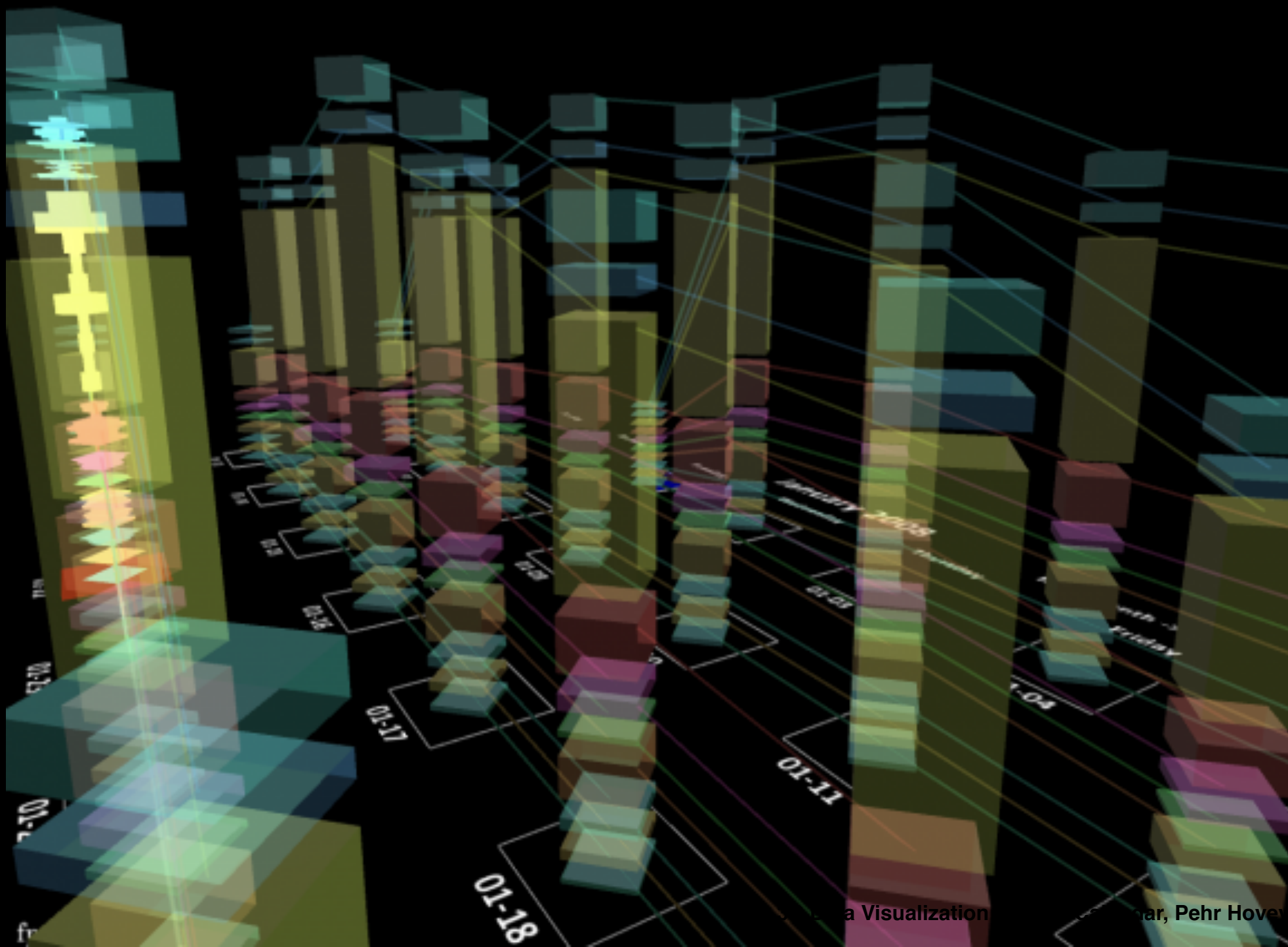
300
Social Sciences

200
Religion

100
Philosophy & Psychology

000
Generalities

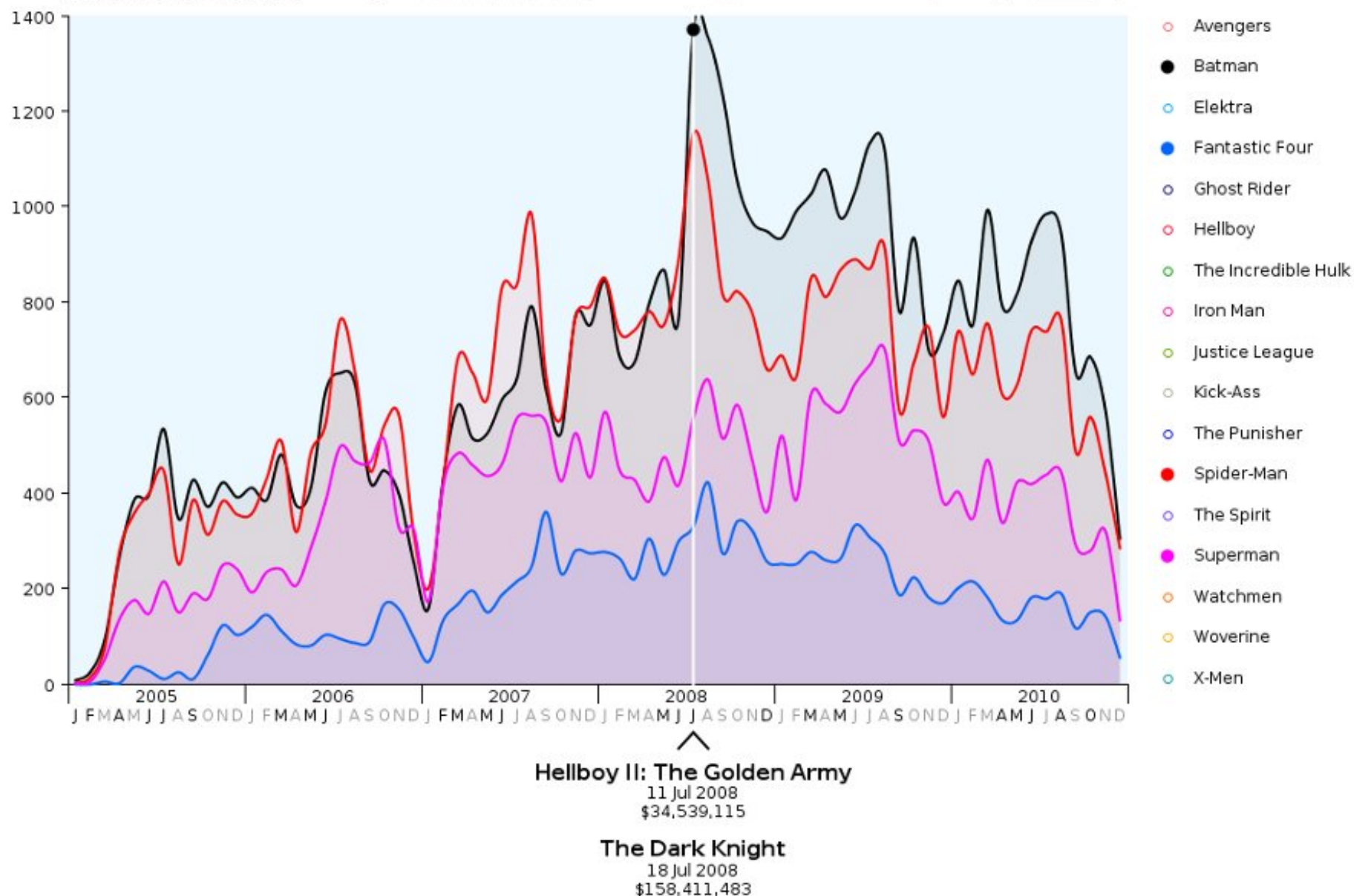




Batman

Batman the Dark Knight returns	78	Batman year one	28
Batman the resurrection of Ras A...	47	Batman the story of the Dark Kn...	28
Batman The killing joke	42	Batman chronicles Volume 1	24
Batman vs Two Face	39	Superman and Batman versus Ali...	24
Batman dark victory	38	Batman secrets of the Batcave	23
Batman The Jokers last laugh	38	Batman the long Halloween	22
All Star Batman Robin the Boy Wo...	36	Batman turning points	21
Batman the man who laughs	32	Batman Harley and Ivy	21

1370 CHECKOUTS
112 TITLES



STAR WARS NEBULA

Using Data of Checkout Times and Duration Times of the Former 6 in This Movie Series in Seattle Public Library

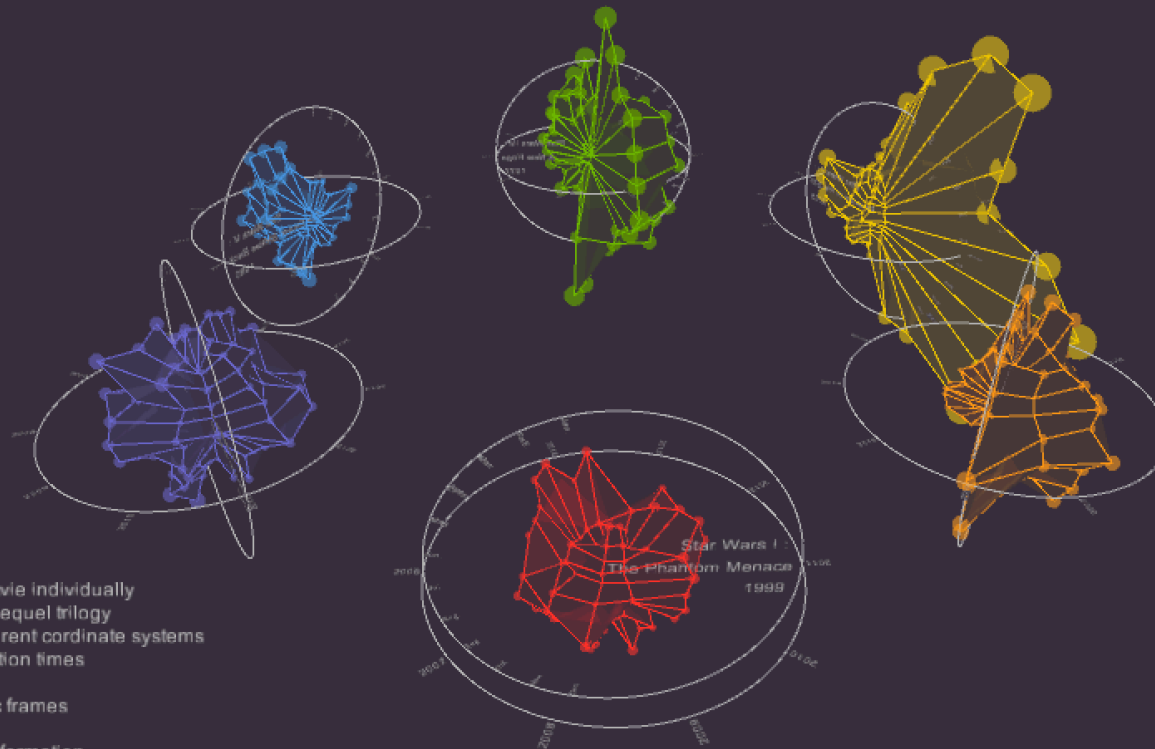
Year	Month
2006	January
2007	February
2008	March
2009	April
2010	May
2011	June
2012	July
2013	August
2014	September
2015	October
	November
	December

Reset

Years
Months
All

Keyboard Control

Press 1 / 2 / 3 / 4 / 5 / 6 to check movie individually
Press 7 / 8 to check the original / prequel trilogy
Press 9 / 0 to check all in one / different coordinate systems
Press D to show / hide dots of duration times
Press S to show / hide the solids
Press N to show / hide the chromatic frames
Press F to show / hide grey frames
Press T to show / hide the verbal information
Press L to show / hide the coordinate axis and labels

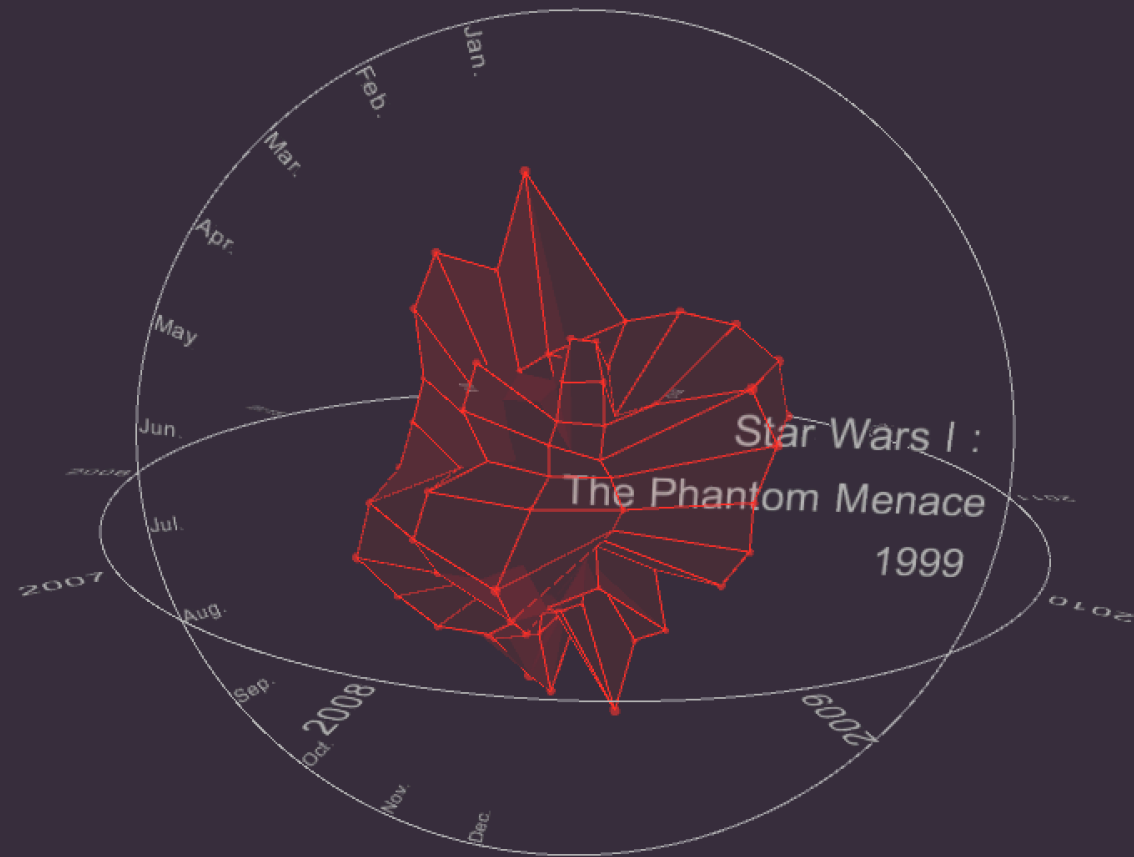


Junxiang Yao
MAT259 PROJ 2
3D Interaction & Change Over Time

The radius of the circular coordinate axis is 200 checkout times.

Duration time scaling:





STAR WARS NEBULA

Using Data of Checkout Times and Duration Times of the Former 6 in This Movie Series in Seattle Public Library

Year	Month
2006	January
2007	February
2008	March
2009	April
2010	May
2011	June
2012	July
2013	August
2014	September
2015	October
	November
	December

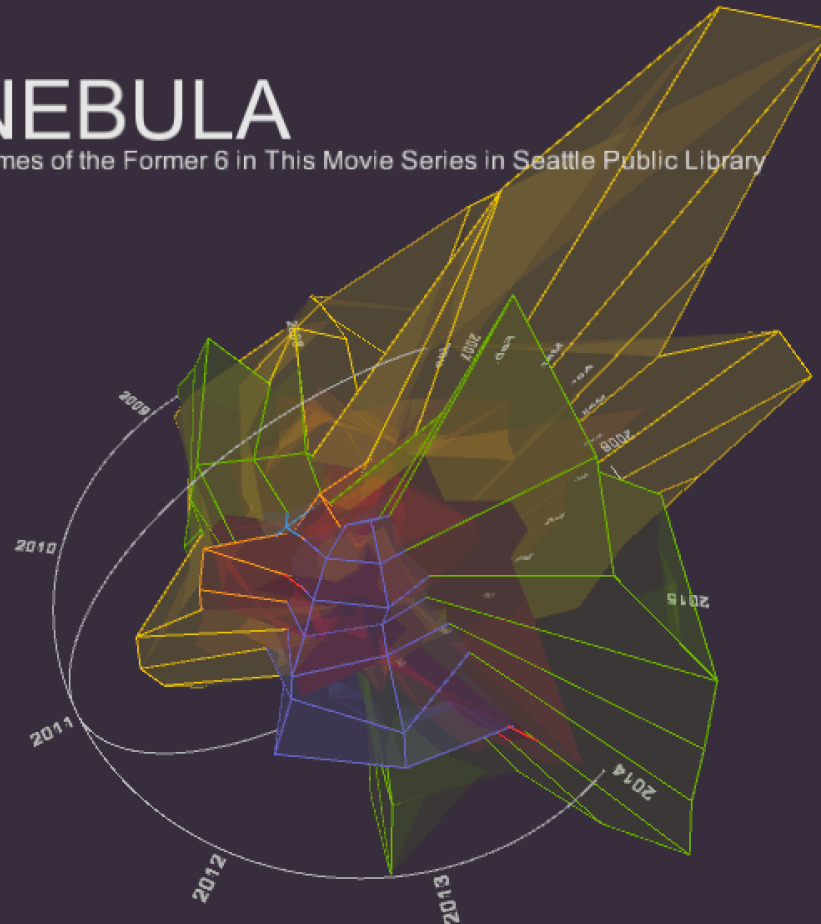
Reset

Years
Months
All

Star Wars IV (1977)	Star Wars I (1999)
Star Wars V (1980)	Star Wars II (2002)
Star Wars VI (1983)	Star Wars III (2005)

Keyboard Control

Press 1 / 2 / 3 / 4 / 5 / 6 to check movie individually
Press 7 / 8 to check the original / prequel trilogy
Press 9 / 0 to check all in one / different coordinate systems
Press D to show / hide dots of duration times
Press S to show / hide the solids
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Junxiang Yao
MAT259 PROJ 2
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The radius of the circular coordinate axis is 200 checkout times.

Duration time scaling:

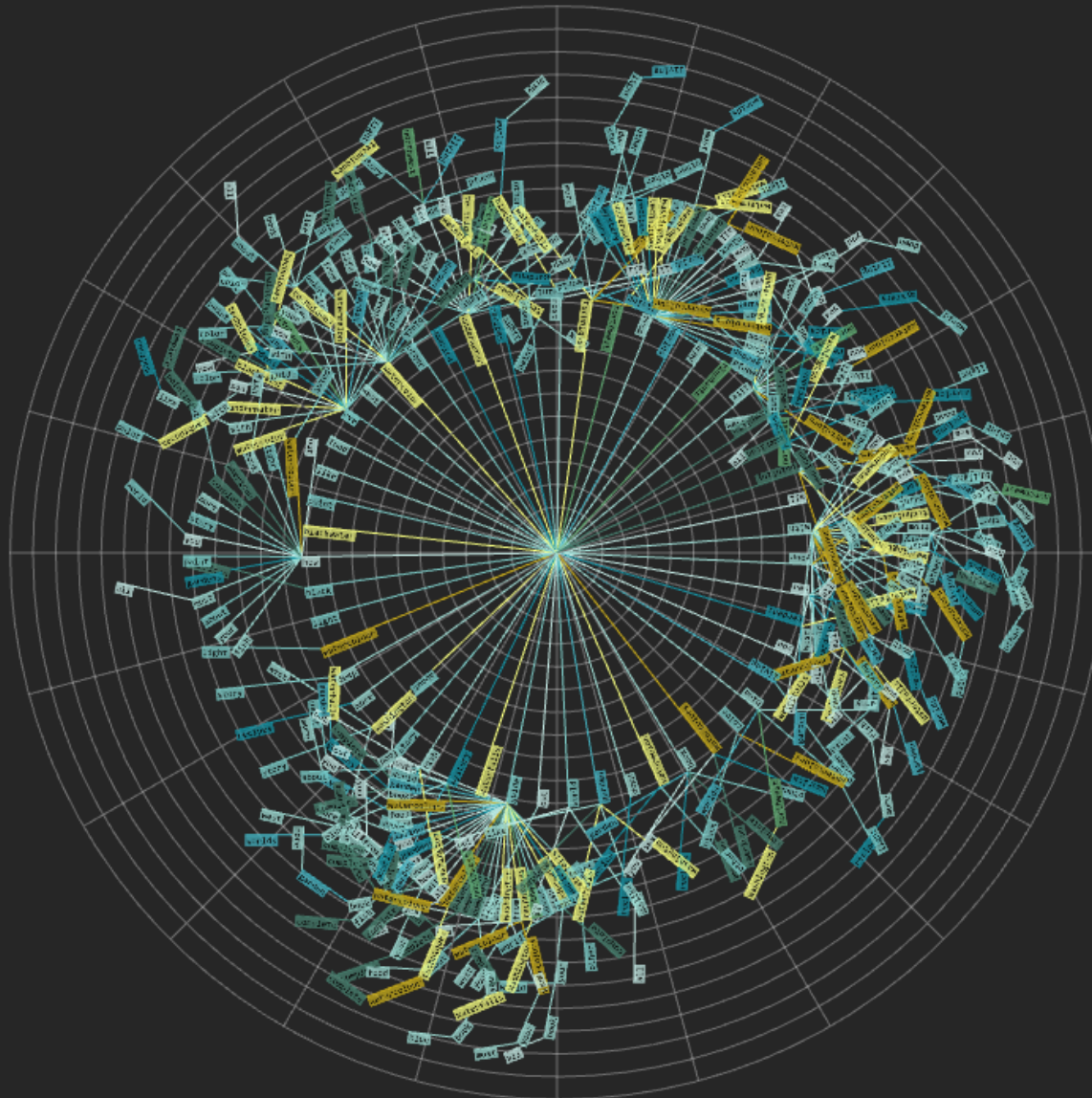


Associative Relationships

- Association rule learning (Dependency modelling)
- Searches for relationships between variables. For example, a supermarket might gather data on customer purchasing habits, which products are frequently bought together.
- **FP-Growth Algorithm:** Frequency-Pattern uses recursive-built tree structure to show paired occurrences

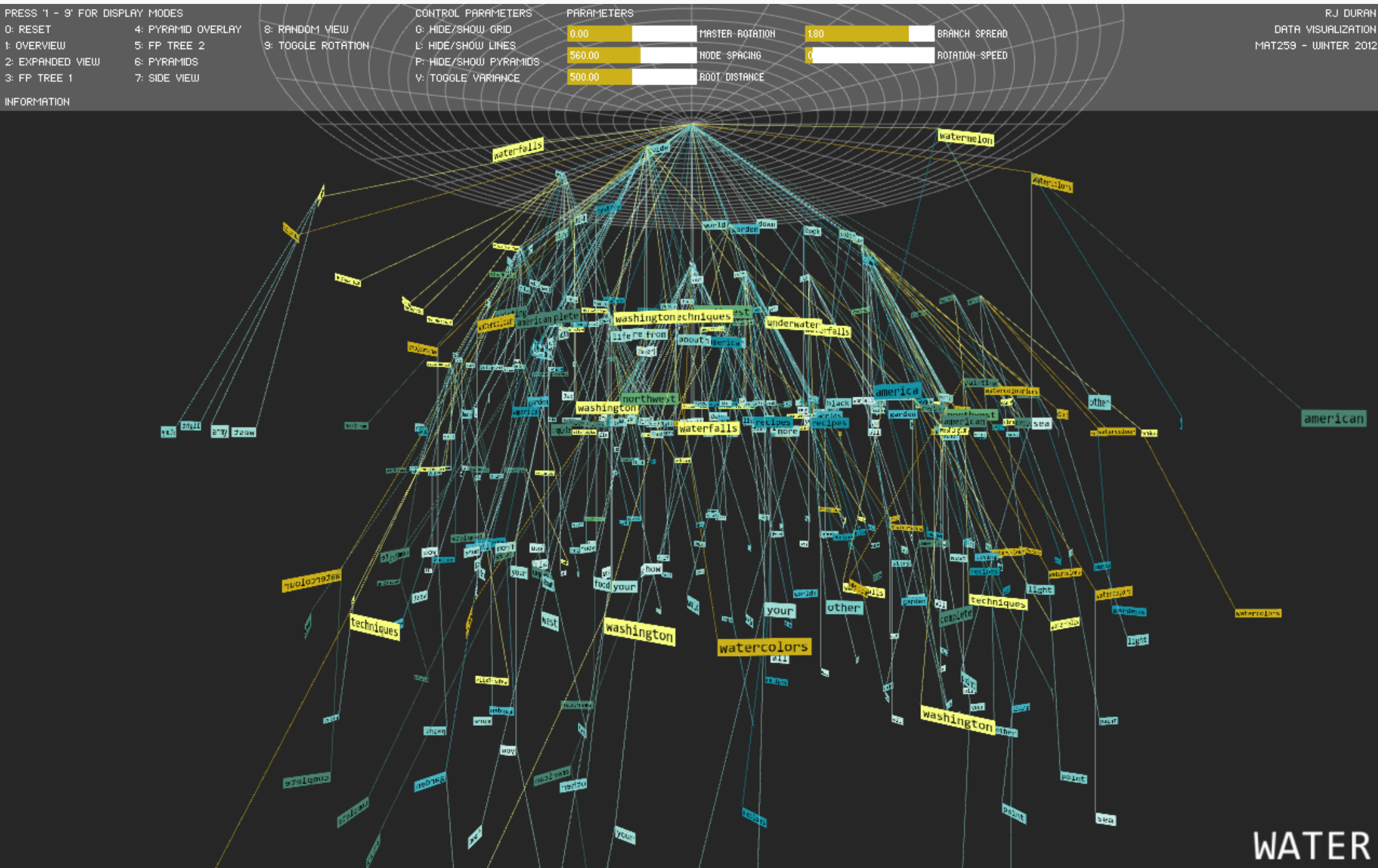
Associative (FPTree Algorithm)

INFORMATION

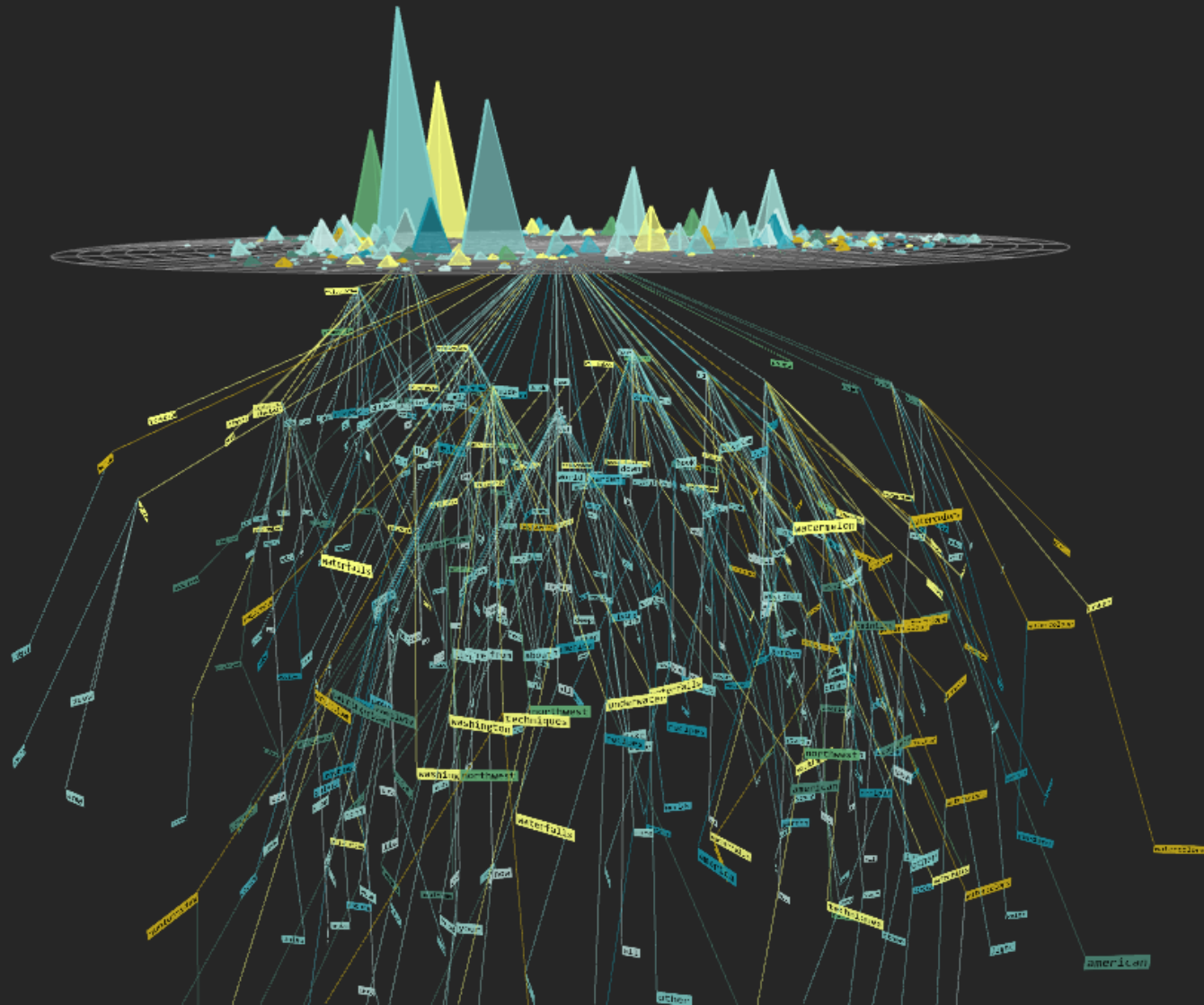


WATER

Associative (FPTree Algorithm)



Associative (FPTree Algorithm)



Fiction to Non-Fiction Comparison

Into The Wild

Comparing Seattle's Interests in Fiction and Non-fiction

MOST CHECKED OUT TITLES

- ENTIRE LIBRARY
- WITHIN DEWEY

-115.63

666.66

- FLIP LABELS
- TOGGLE LABELS

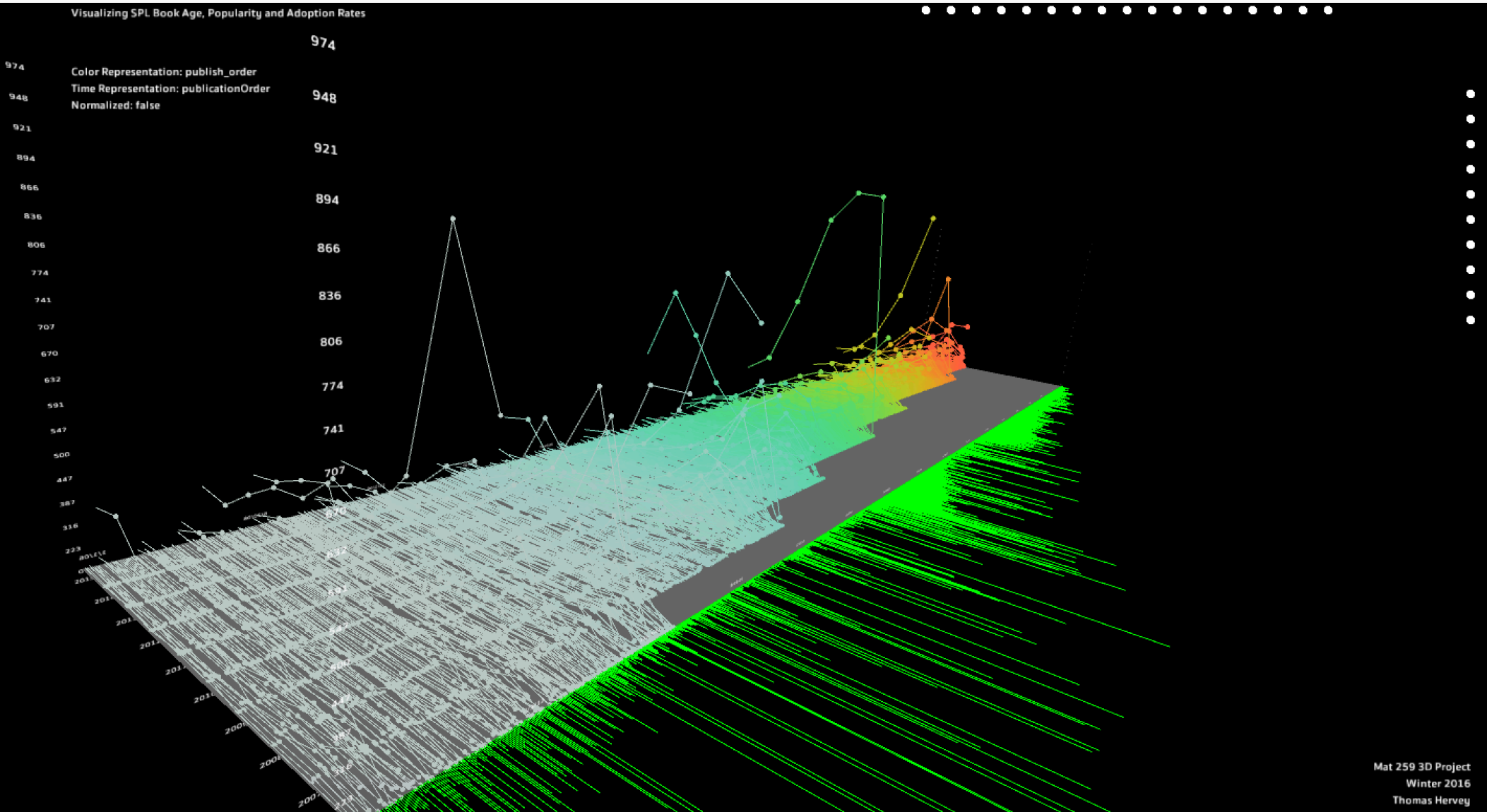
ROTATE

SEPARATE

* One block = one week



Book Adoption & Popularity



● ● ● ● ● ● ● ●

Color Representation: dewey_number
 Time Representation: publicationOrder
 Normalized: false
 Title: Bombay Anna the
 Dewey Number: 303
 Dewey Category: Social processes
 Total Checkouts: 61
 _ _ 25 10 4 3 5 6 5 3
 Adoption [days]: 7.0

Clustering & Classification

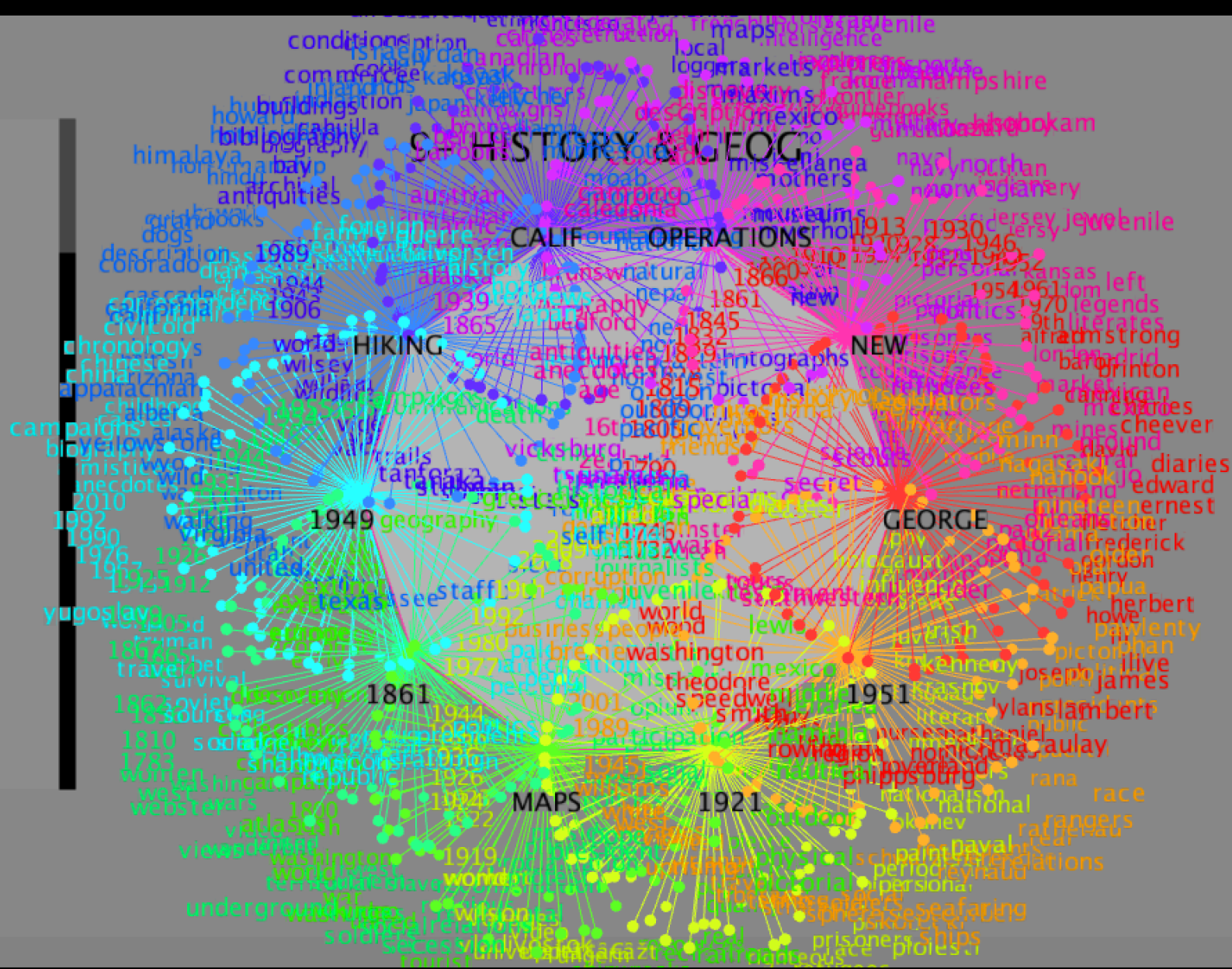
- Clustering – is the task of discovering groups and structures in the data that are in some way or another "similar", without using known structures in the data.
- The task of generalizing known structure to apply to new data.
- Followed by sorting data according to classification outcomes

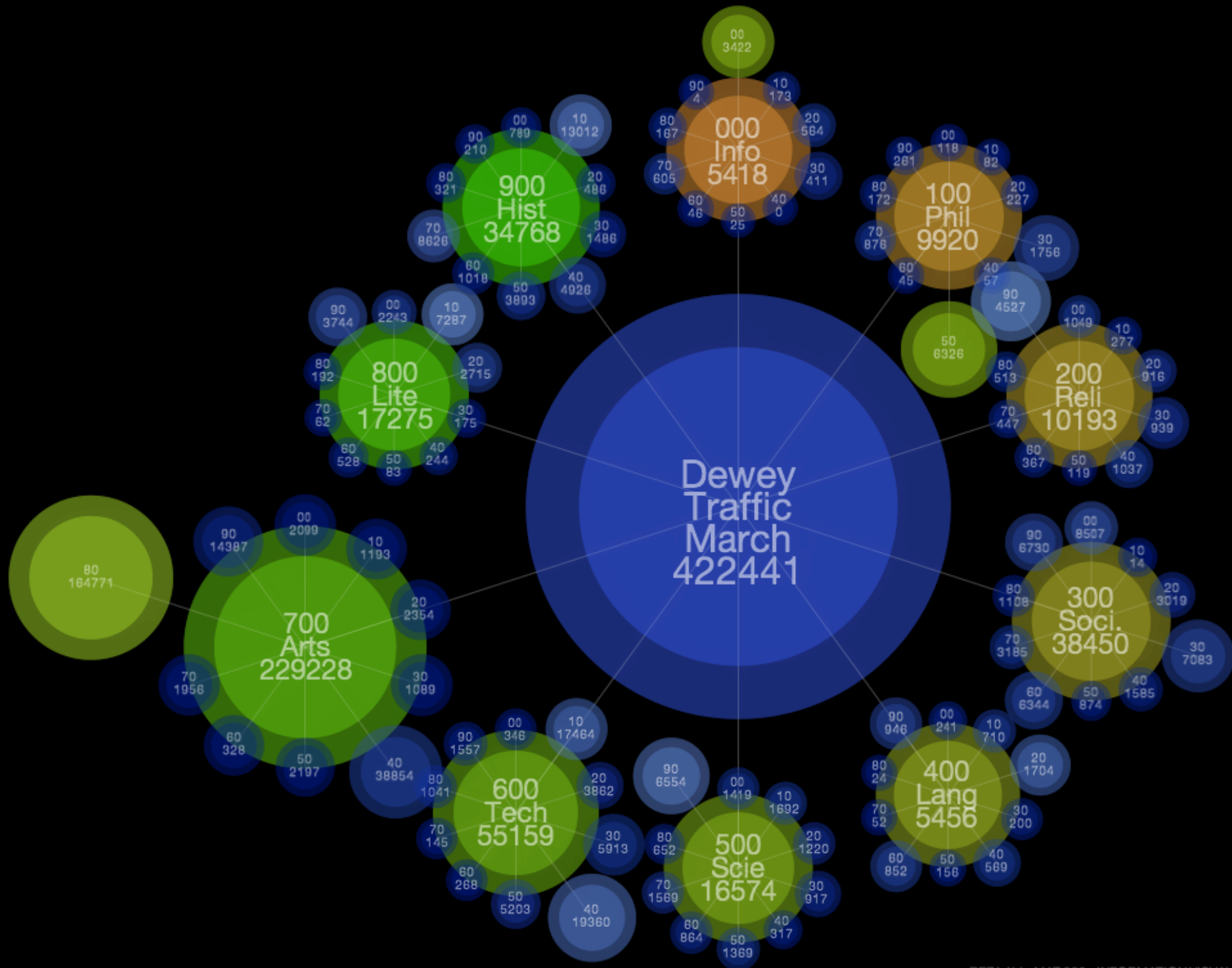
Clustering & Classification

- Clustering – is the task of discovering groups and structures in the data that are in some way or another "similar", without using known structures in the data.
- The task of generalizing known structure to apply to new data.
- Followed by sorting data according to classification outcomes

In the SPL,
(maps) is
associated with:

- 11th
- 1800
- atlases
- campaigns
- cartography
- catalogs
- children
- collectibles
- description
- discovery
- early
- economic
- ethnology
- europe
- excavations
- explorers





Correlate Data with another

API: Application from source to acquire data

JSON: Language independent format to transmit data

Projects correlate APIs from :

- NY Times
- Instagram
- iTunes & Apple
- Twitter
- Google Books
- etc

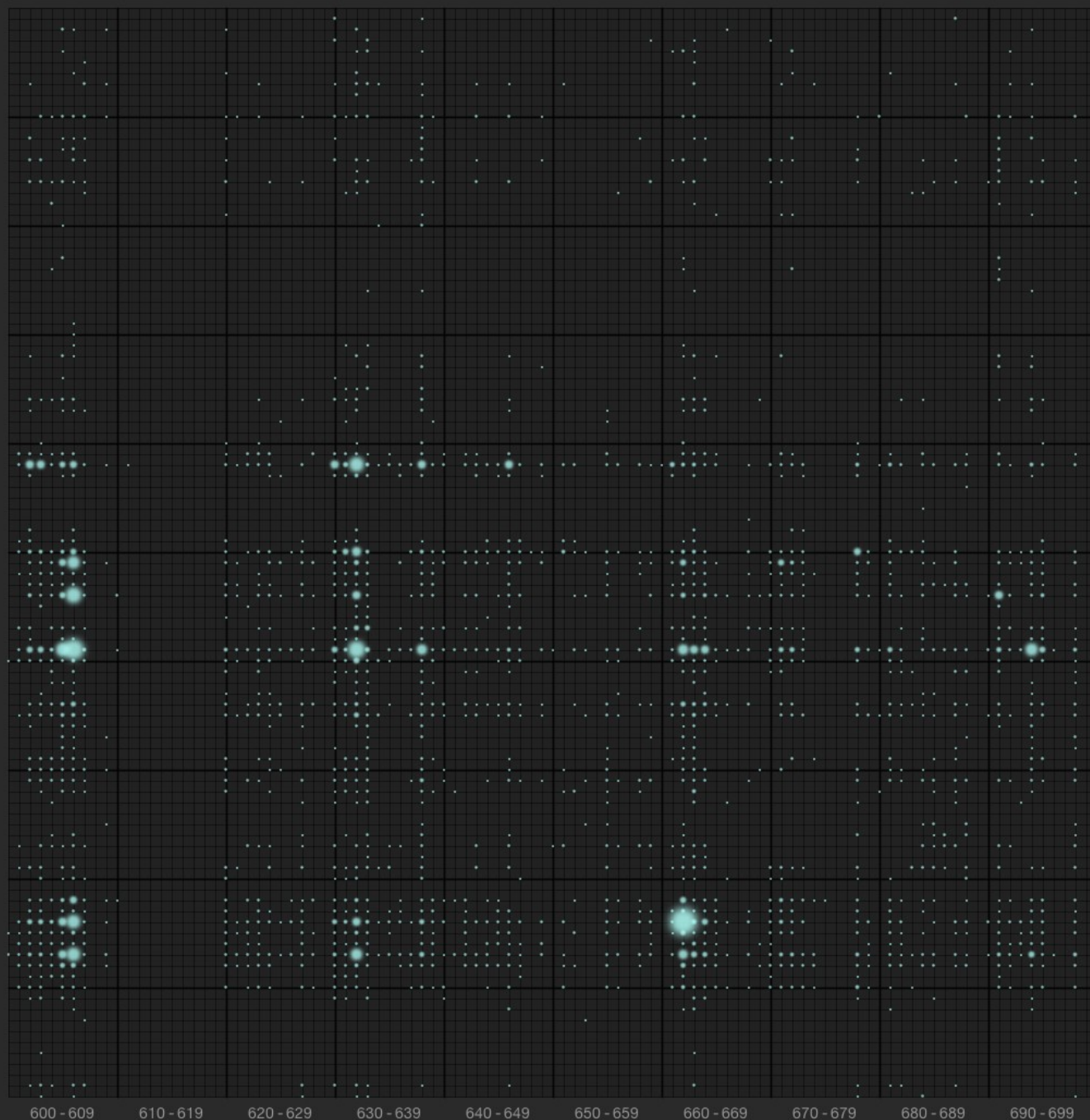
Frequently Borrowed Together

use the radio buttons to zoom

- ☐ 000 - 099 Computer science, information & general works
- ☐ 100 - 199 Philosophy and 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

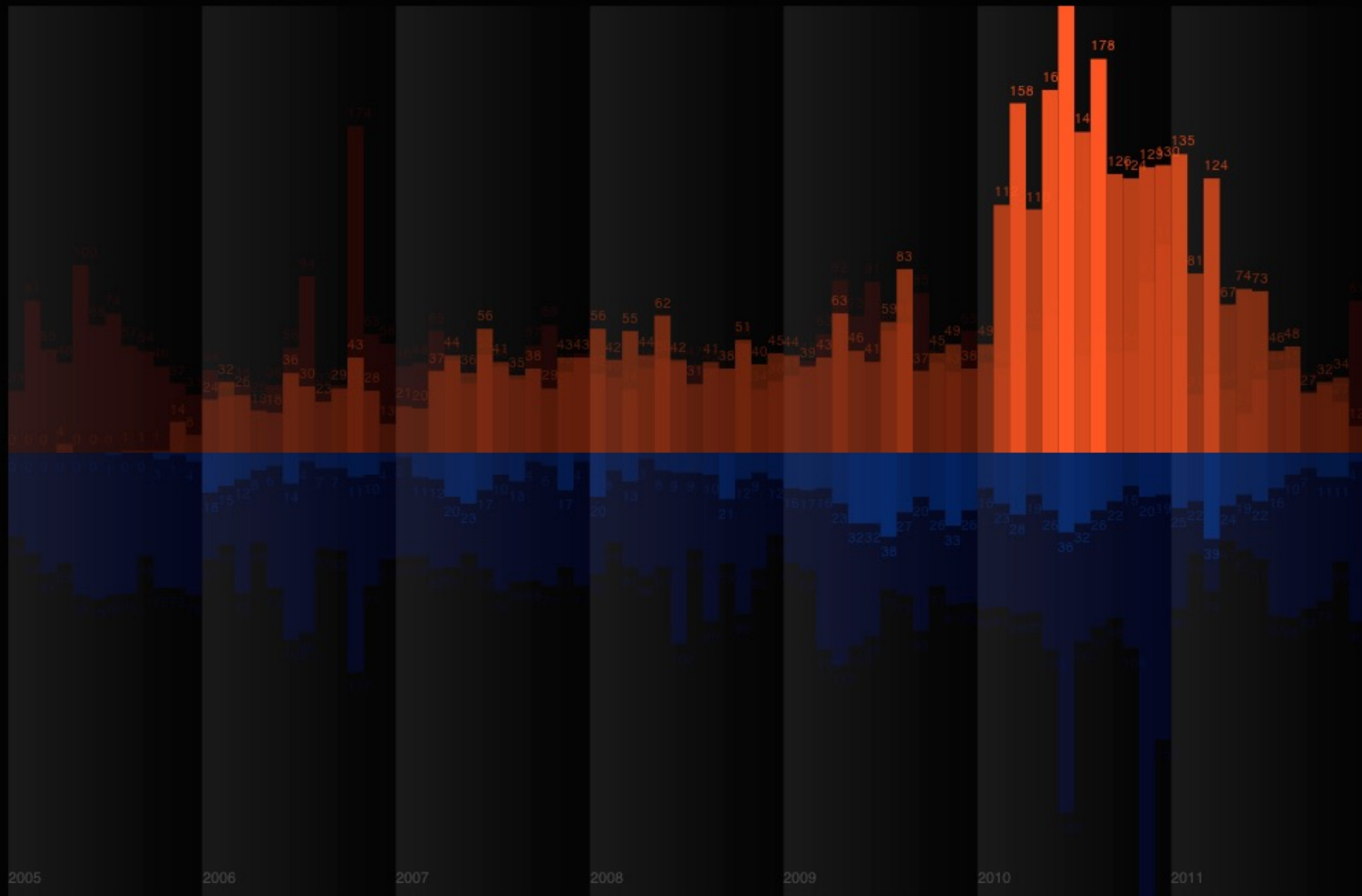
- 300 - 309 Social sciences, sociology & anthropology
- 310 - 319 Statistics
- 320 - 329 Political science
- 330 - 339 Economics
- 340 - 349 Law
- 350 - 359 Public administration & military science
- 360 - 369 Social problems & social services
- 370 - 379 Education
- 380 - 389 Commerce, communications, & transportation
- 390 - 399 Customs, etiquette, & folklore

- 600 - 609 Technology
- 610 - 619 Medicine & health
- 620 - 629 Engineering
- 630 - 639 Agriculture
- 640 - 649 Home & family management
- 650 - 659 Management & public relations
- 660 - 669 Chemical engineering
- 670 - 679 Manufacturing
- 680 - 689 Manufacture for specific uses
- 690 - 699 Construction of buildings

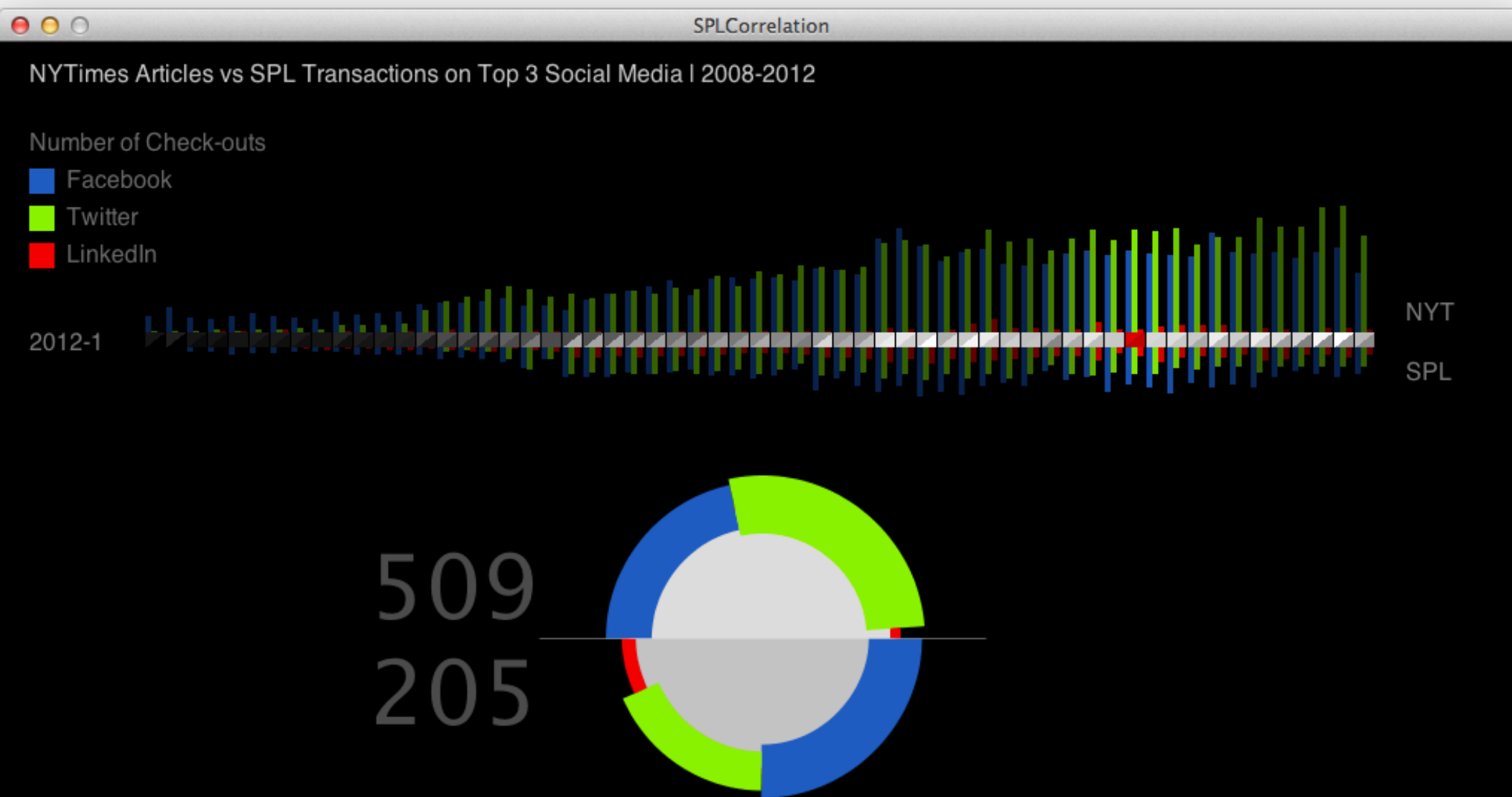


NYTimes: South Korea | North Korea 2005-2011

SPL: South Korea | North Korea 2005-2011



Correlate Data with another



Correlate Data with another

SKYSCRAPERS

Seattle Public Library Data Set 2009-2012

- 000: Computer Science
- 100: Philosophy
- 200: Religion
- 300: Social Science
- 400: Language
- 500: Science
- 600: Technology & Applied Science
- 700: Arts & Recreation
- 800: Literature
- 900: History & Geography

FACEBOOK

TWITTER

LINKEDIN

15247

-CONTROLS-

[1-4] Camera Modes

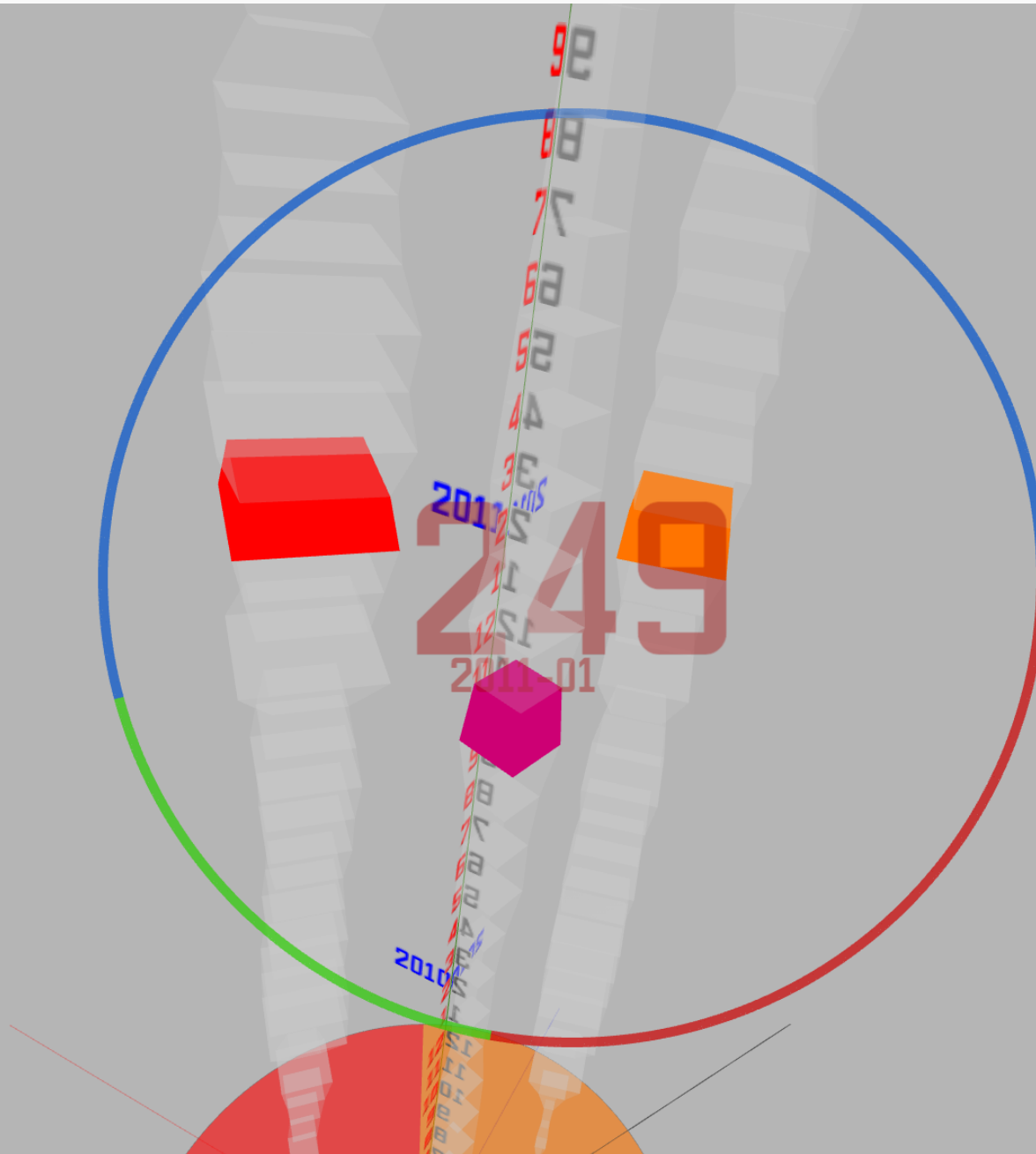
[c/x] change colors

[l] stroke on/off

[s] stat on/off

[d] dewey particles

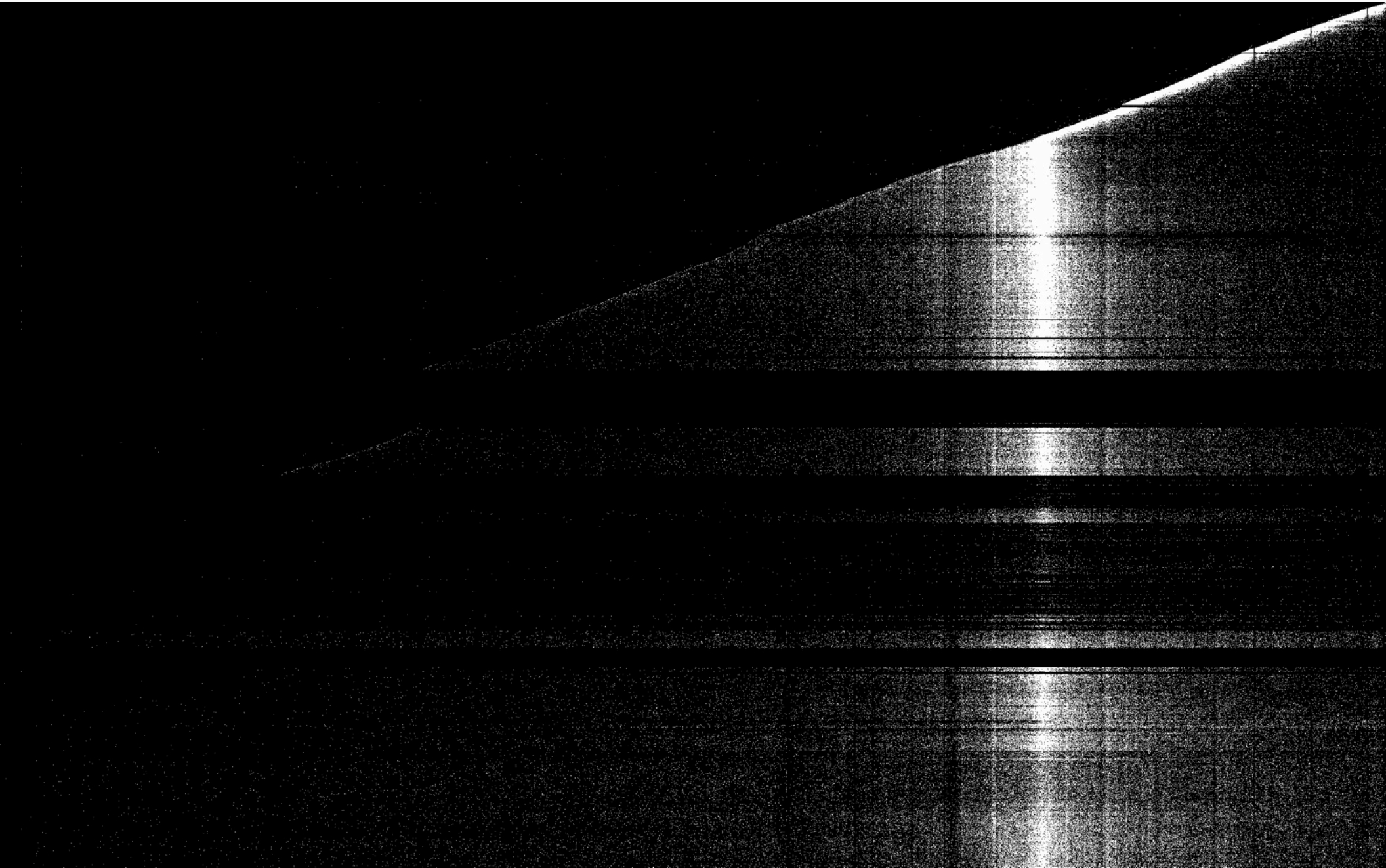
[p] pyramids



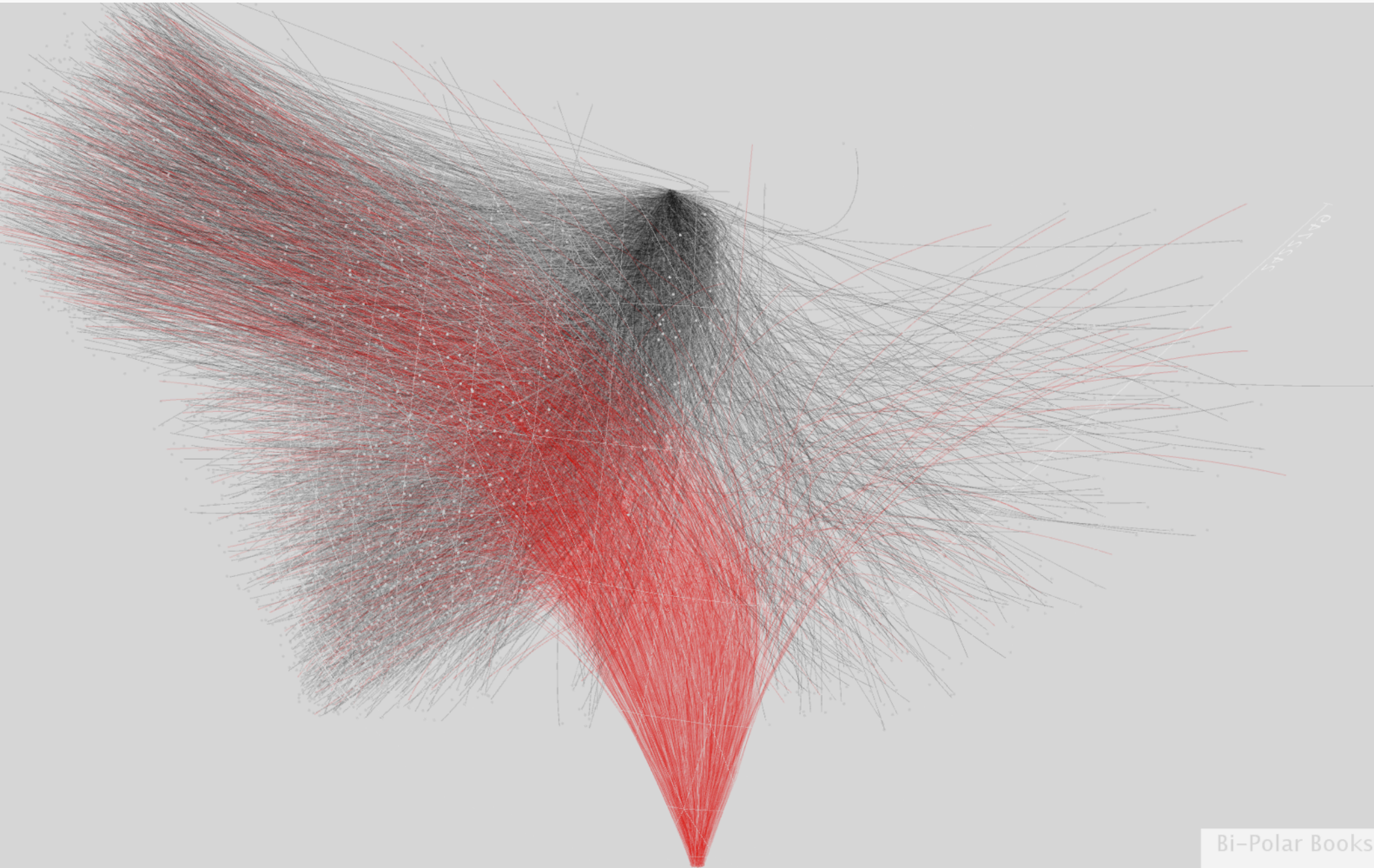
Anomaly Detection

- (Outlier/change/deviation detection)
- The identification of unusual data records, that might be interesting or
- data errors that require further investigation

Collection Code (scalar numeric code maps acquisition history)



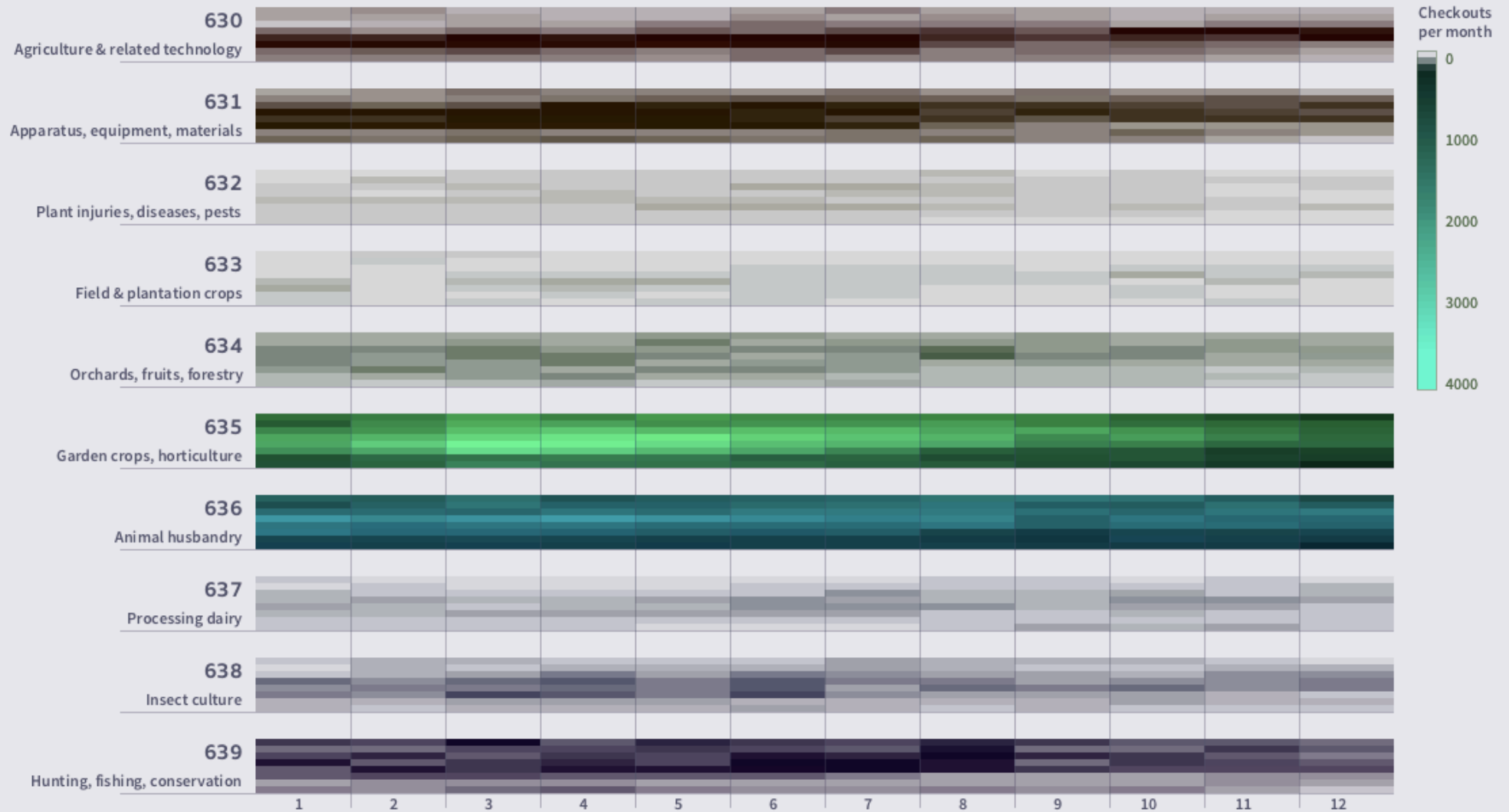
Anomaly Detection



Cultural Trends

- Visualizing how cultural artifacts perform

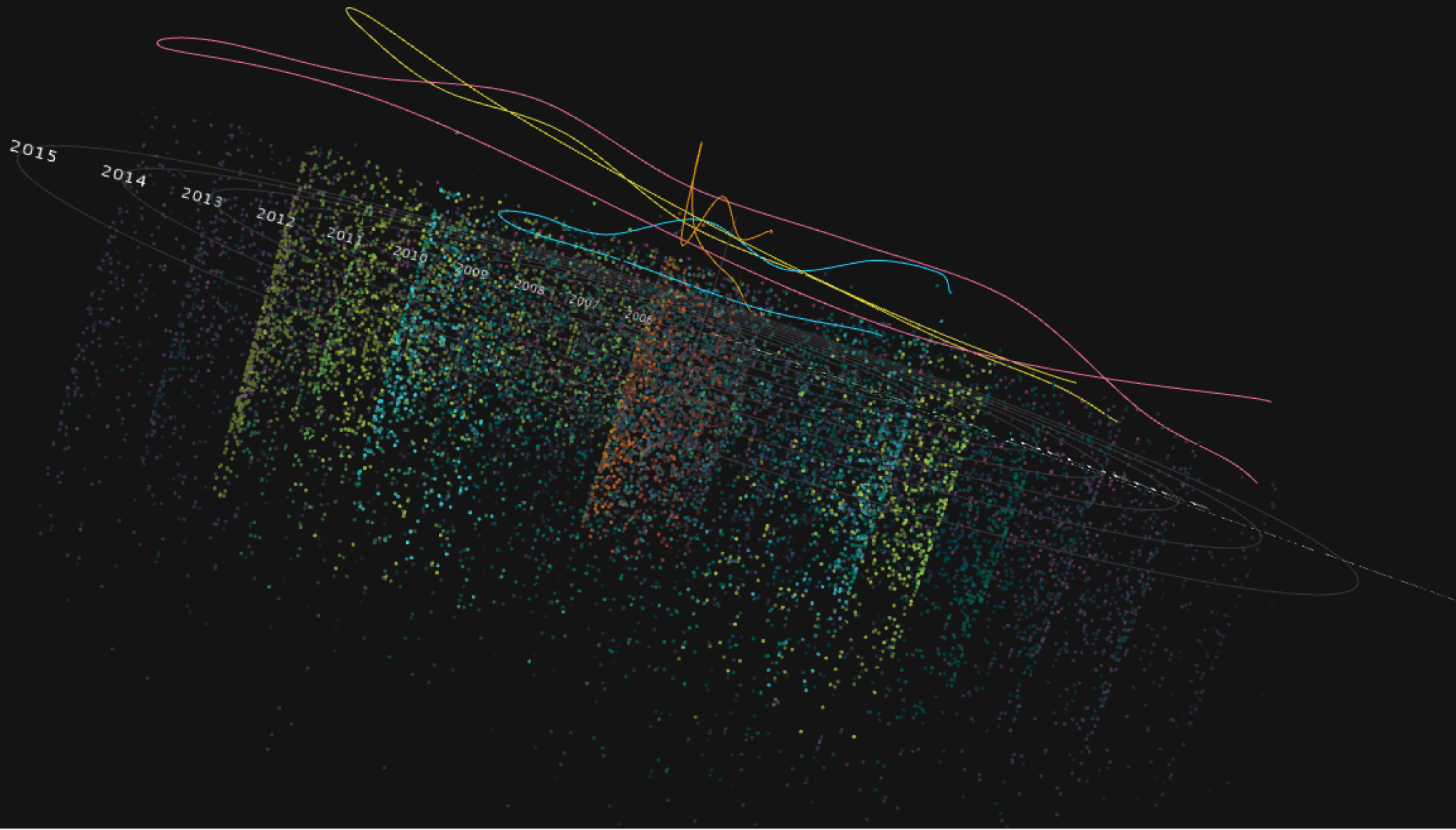
Number of items checked out monthly with Dewey Decimal classification 630: Agriculture, 2006-2013



Cultural Trends



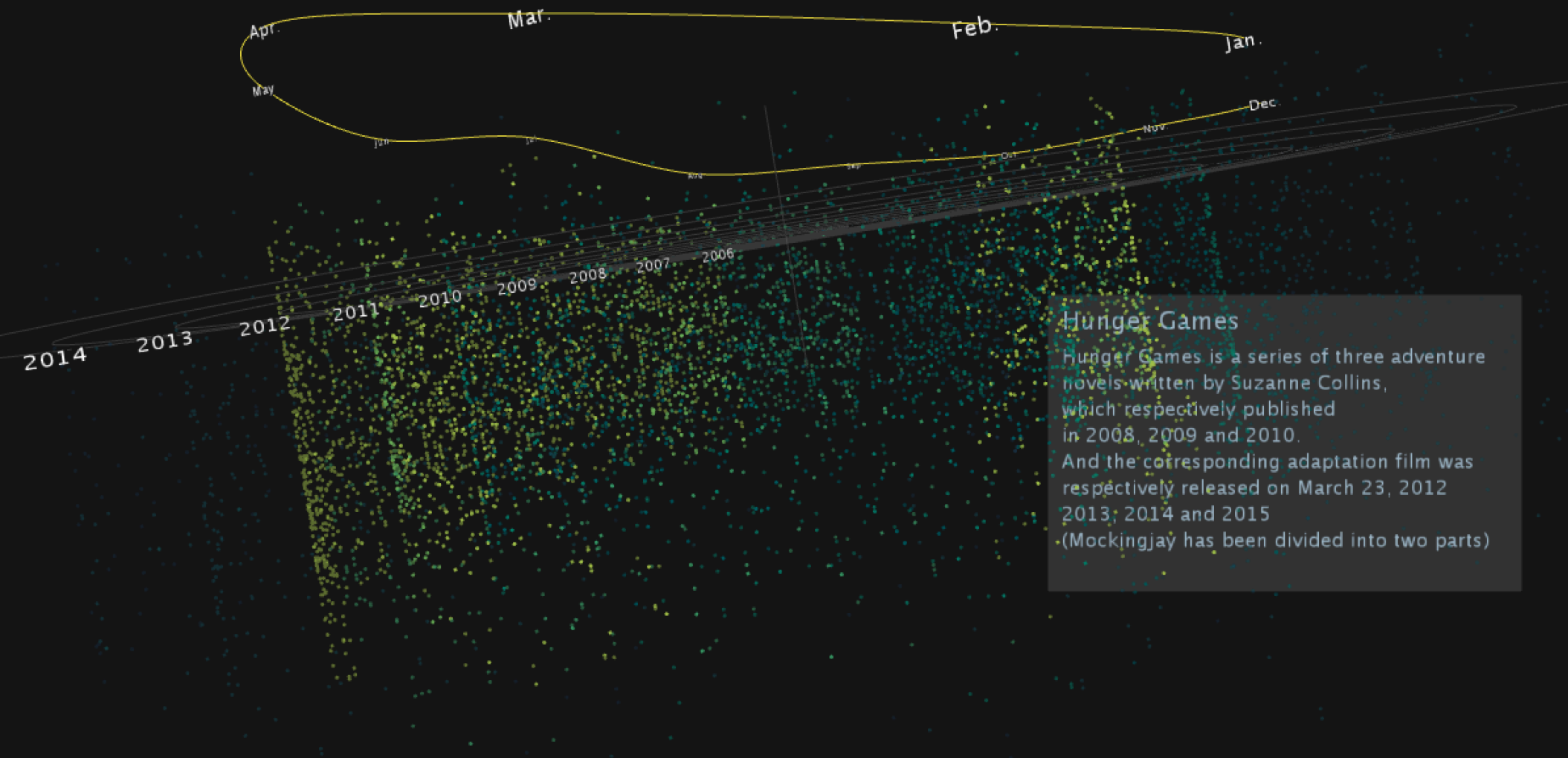
Cultural Trends



Cultural Trends

Search Details

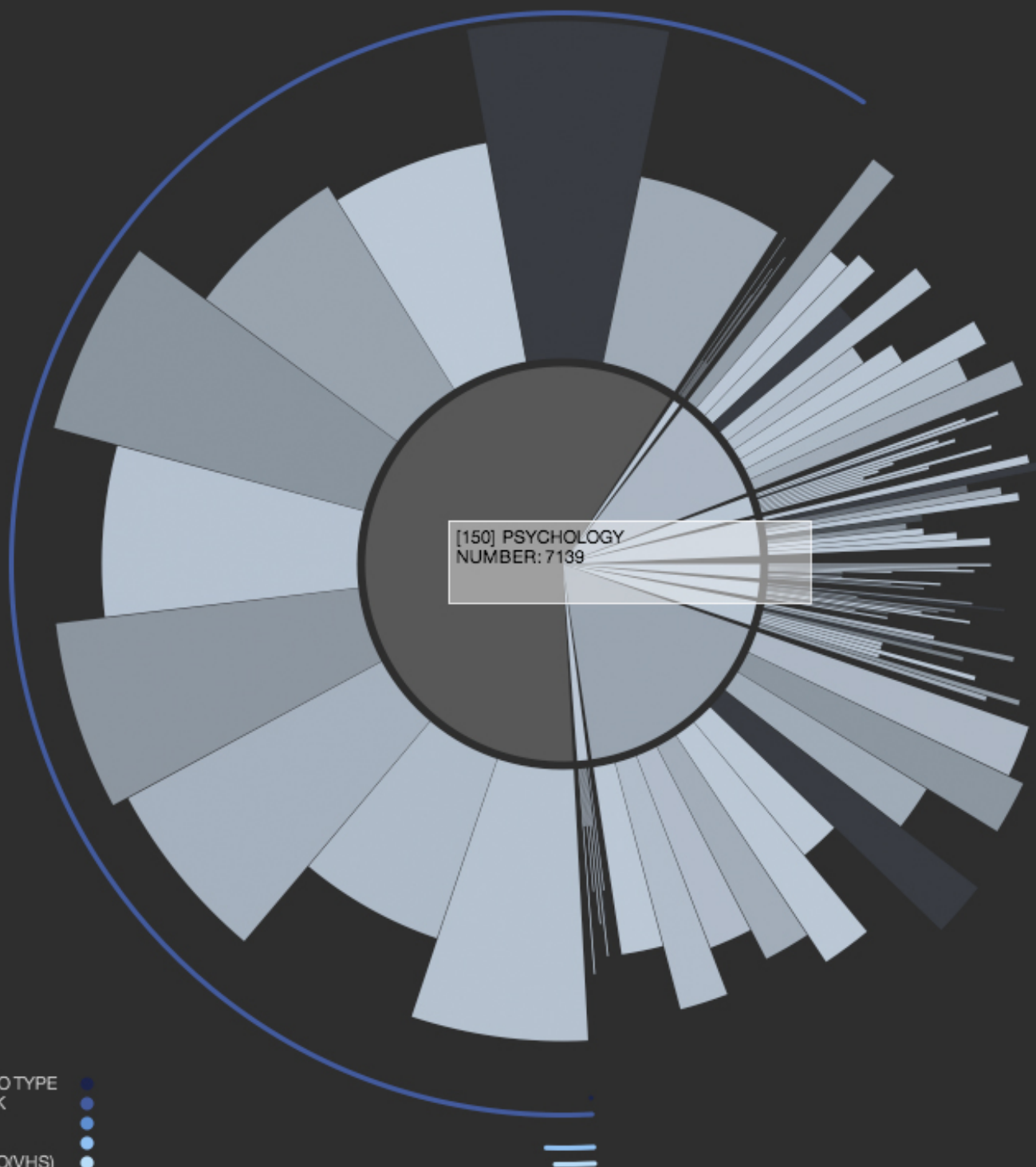
- The Da Vinci Code
- The Time Traveler's Wife
- Hunger Games
- Fault in Our Stars



Hunger Games

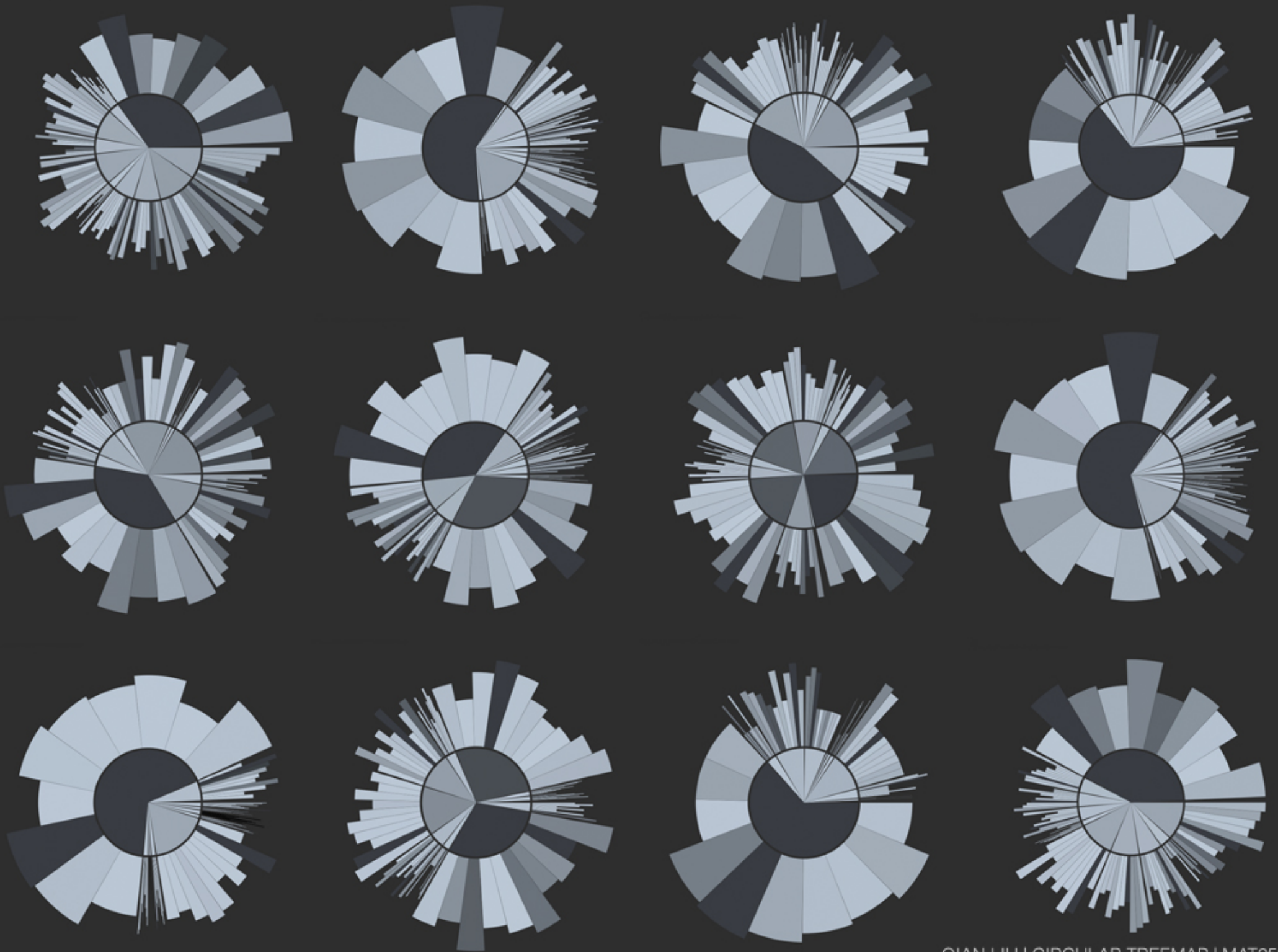
Hunger Games is a series of three adventure novels written by Suzanne Collins, which respectively published in 2008, 2009 and 2010.

And the corresponding adaptation film was respectively released on March 23, 2012, 2013, 2014 and 2015 (Mockingjay has been divided into two parts)



TOP 10 BOOKS 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...

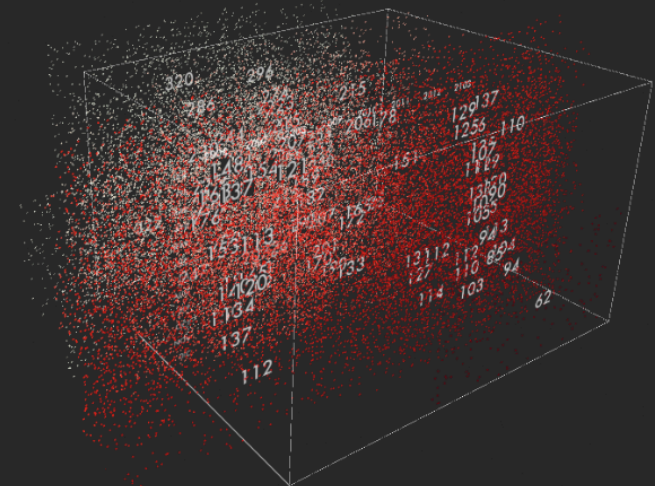
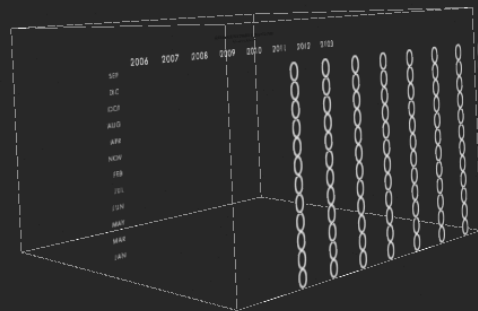
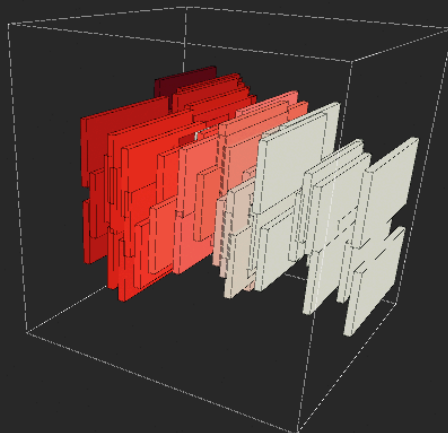
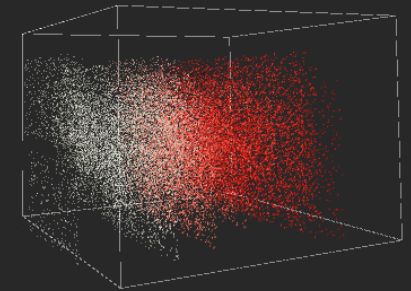
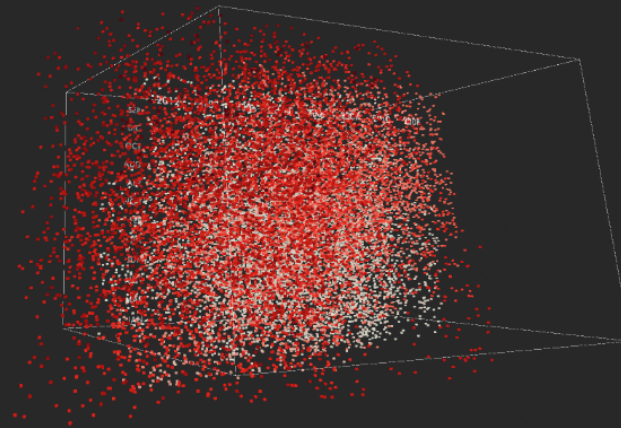


Multidimensional Visual Forms

- The intent to arrive at new forms by which to feature data to:
 - Reveal insights into the data
 - Advance visualization techniques

2006





2013

2014

2015

TITLES

Length of white lines: loan days
Upper layer: new fiction books

BOOKTITLE

CLEAR

How Do New Books Behave

Seattle Public Library Data Visualization

Hilda Chang HE

2016 winter

2013

2014

2015

TITLES

Length of white lines: loan days

Upper layer: new fiction books

Lower layer: non-fiction books

husband list

CLEAR

BOOKTITLE

Book: husband list

Published in: 2013

Copies: 12

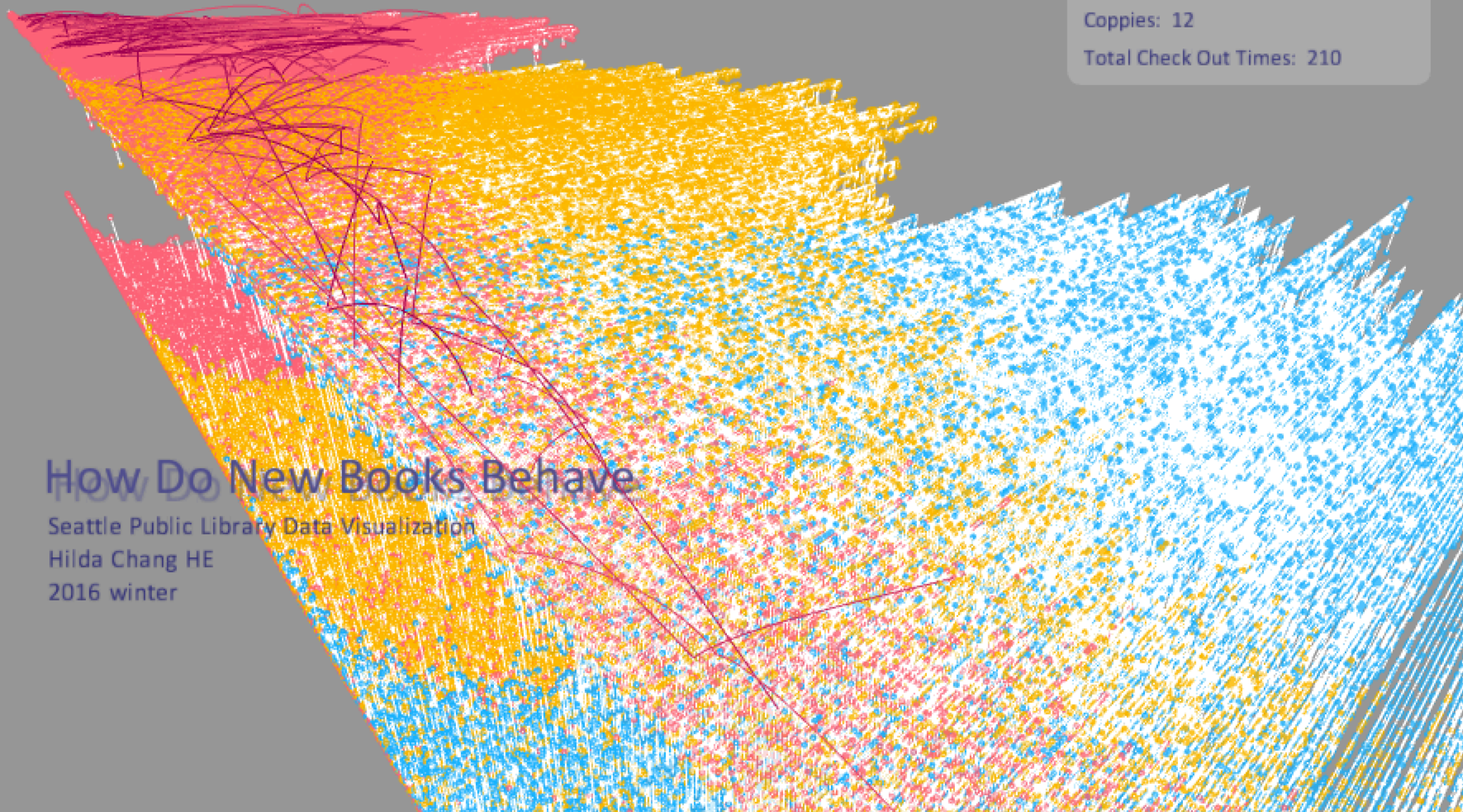
Total Check Out Times: 210

How Do New Books Behave

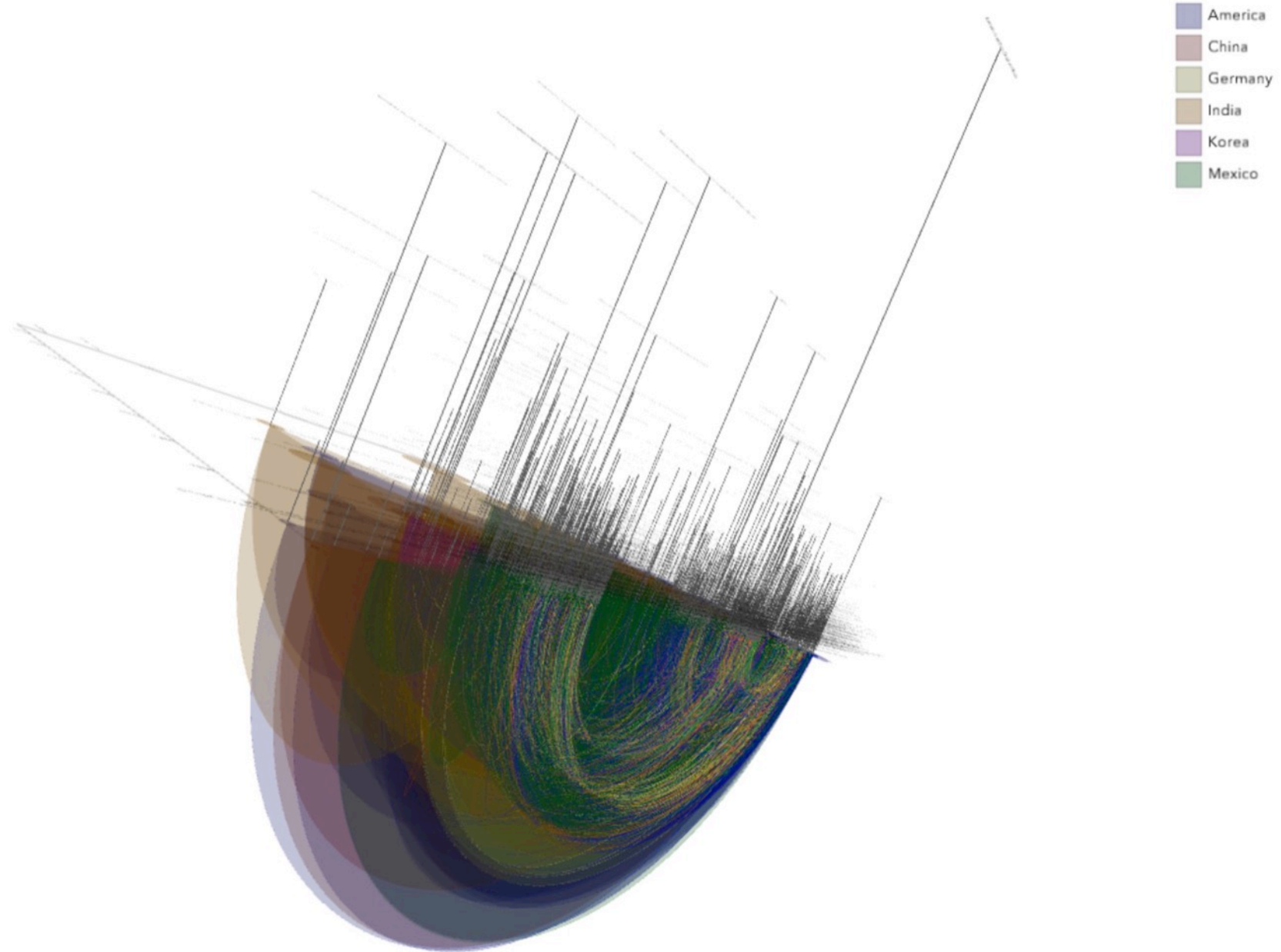
Seattle Public Library Data Visualization

Hilda Chang HE

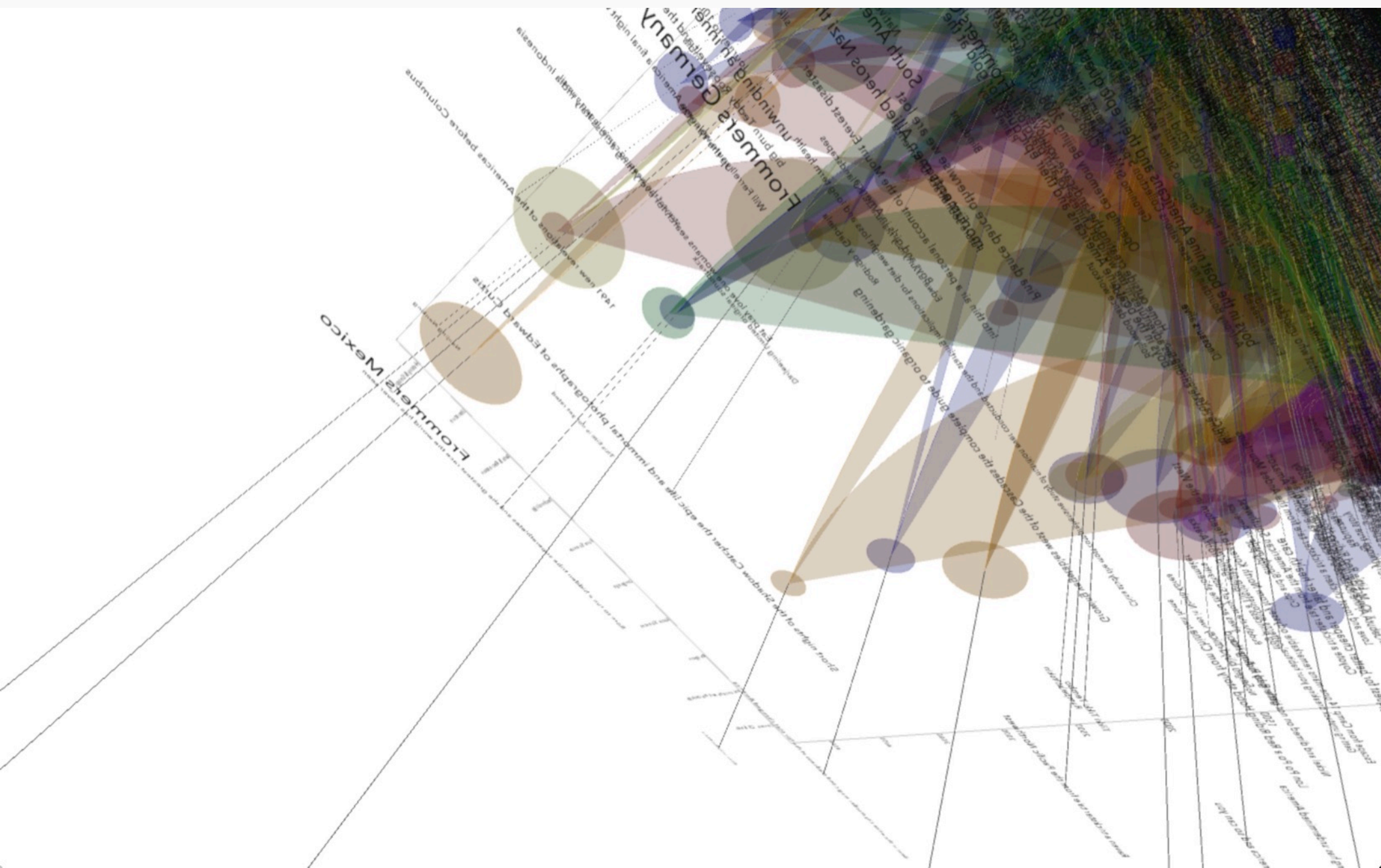
2016 winter

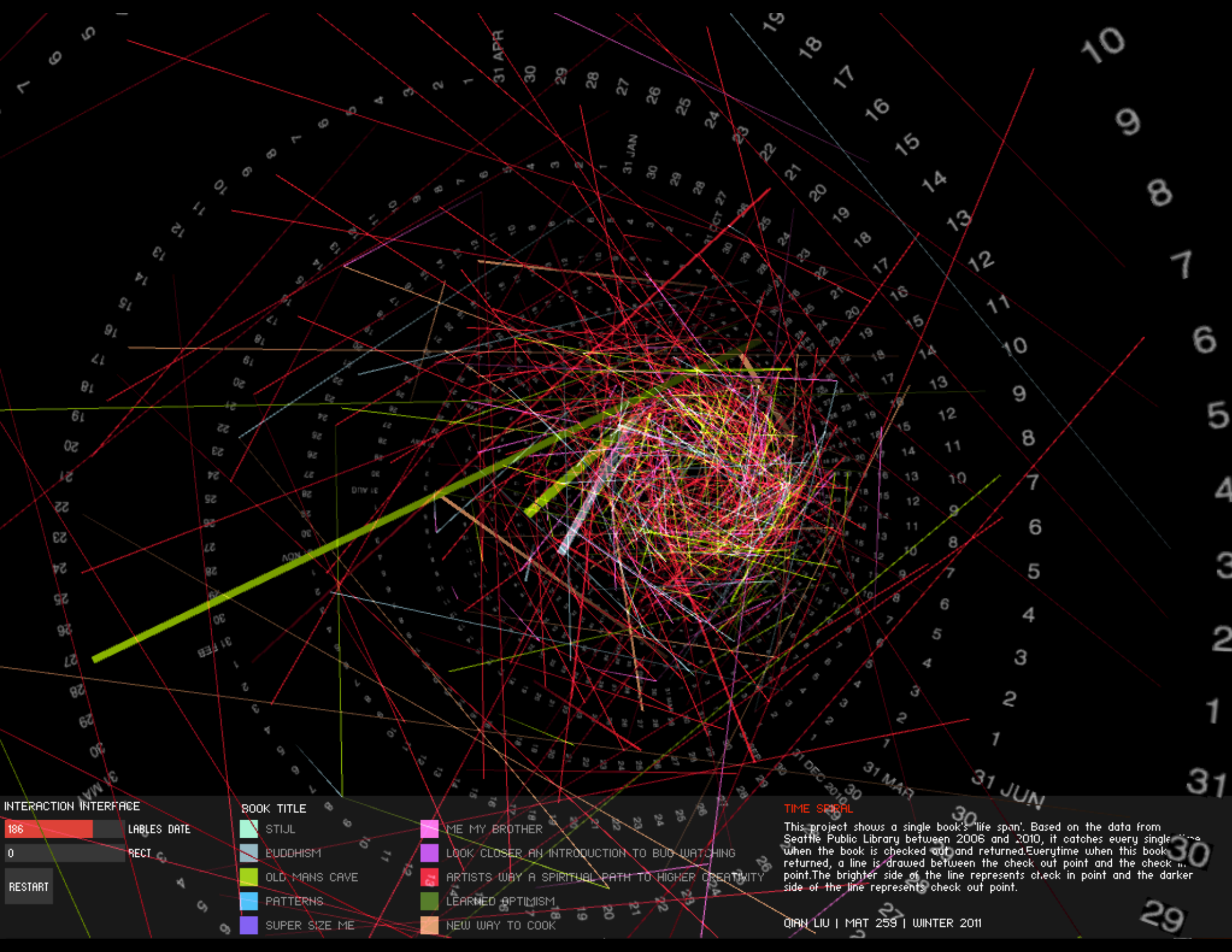


3D Spatial – Time Matrix



3D Spatial – Time Matrix





INTERACTION INTERFACE

186
0
RESTART

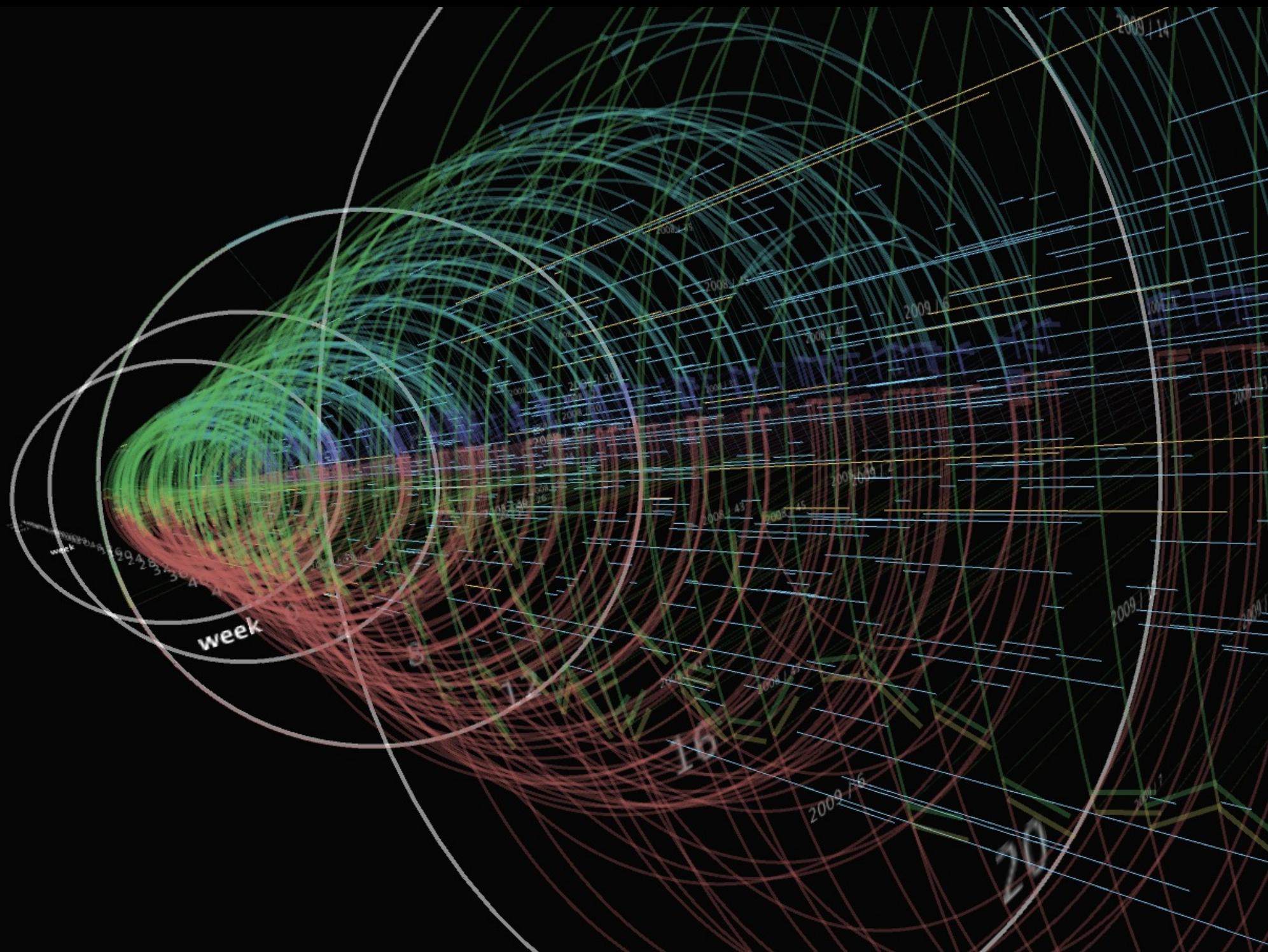
LABELS DATE
RECT

BOOK TITLE

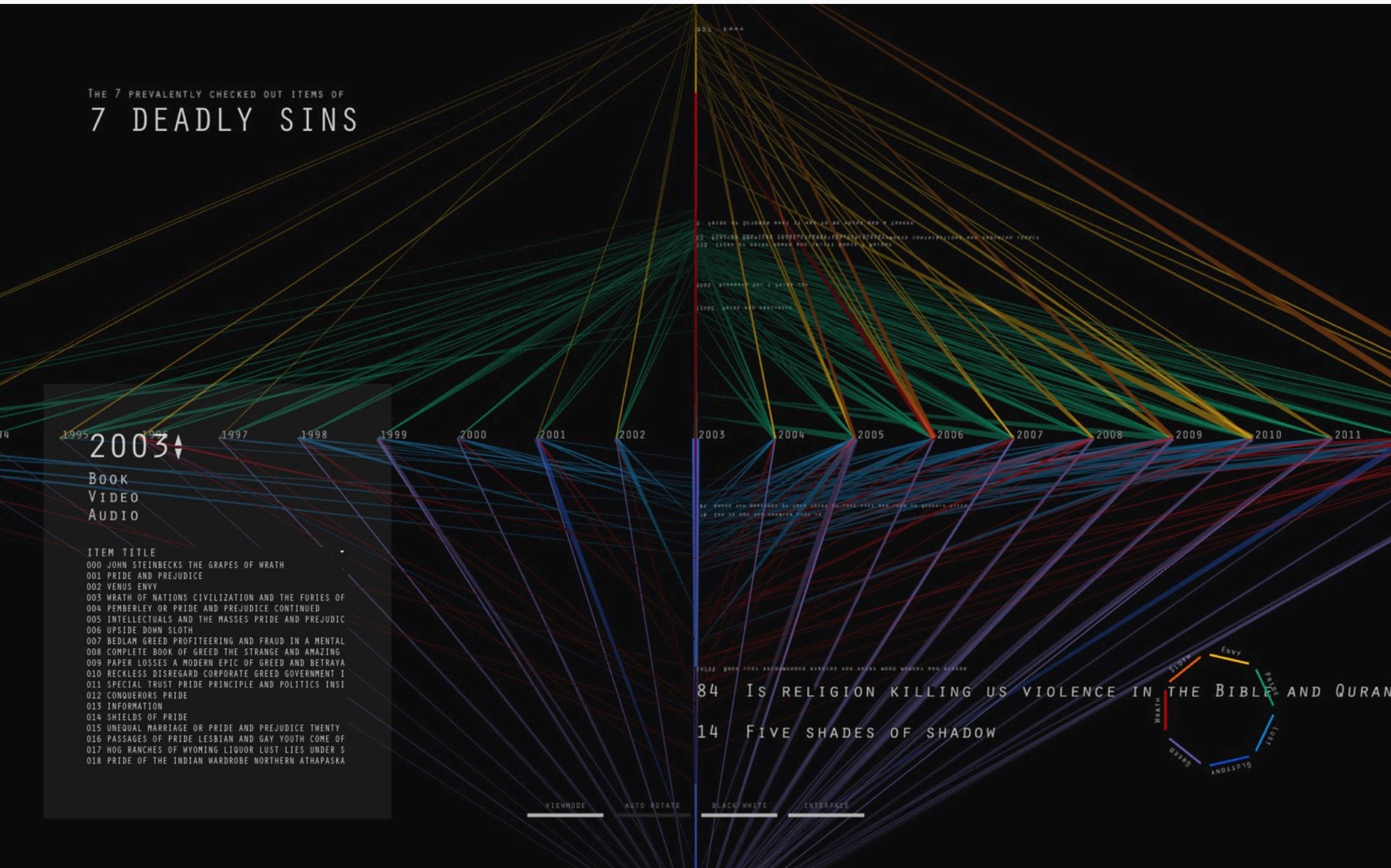
- STIJL
- BUDDHISM
- OLD MANS CAVE
- PATTERNS
- SUPER SIZE ME
- ME MY BROTHER
- LOOK CLOSER AN INTRODUCTION TO BUG WATCHING
- ARTISTS WAY A SPIRITUAL PATH TO HIGHER CREATIVITY
- LEARNED OPTIMISM
- NEW WAY TO COOK

TIME SPIRAL

This project shows a single book's 'life span'. Based on the data from Seattle Public Library between 2006 and 2010, it catches every single time when the book is checked out and returned. Everytime when this book is returned, a line is drawn between the check out point and the check in point. The brighter side of the line represents check in point and the darker side of the line represents check out point.



Visualization Design Study



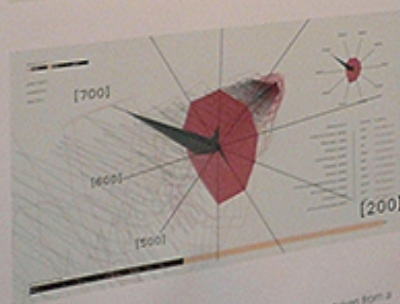
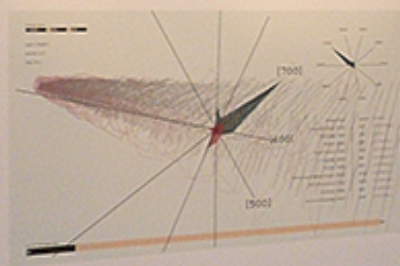
Data Processing Functions

- Validation: Ensuring that data is "clean, correct and useful"
- Sorting: Arranging items in some sequence and/or in different sets
- Summarization: Reducing detail data to its main points
- Aggregation: Combining multiple pieces of data (possibly from various sources)
- Analysis: Collection, organization, analysis, interpretation and presentation of data
- Reporting: List detail or summary data or computed information

Major Contributors

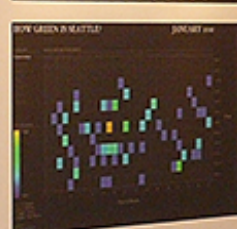
- Angus Forbes (2006)
- Charlie Roberts (2008)
- Reza Ali (2010)
- Karl Yerkes (2011)
- Geneva HEAD design workshop (2011)
- Javier Villegas (2011)
- RJ Duran (2012)
- Qian Liu (2012)
- Joshua Dickinson (2012)
- Yoon Chung Han (2013)
- Jay Byunkyu Kang (2013)
- Mohit Hingorani (2015)
- Jialiang “Rodger” Luo (2016)

Anis Haron



MAT 259 Visualizing Information
 Visualization of transactions from the Seattle Public Library, taken from a
 dataset of over 66 million entries collected since 2005
<http://www.mat.ubc.ca/~g.graduate/courses/mat259/>

RJ Duran



MAT 259 Visualizing Information
 Visualization of transactions from the Seattle Public Library, taken from a
 dataset of over 66 million entries collected since 2005
<http://www.mat.ubc.ca/~g.graduate/courses/mat259/>

Yoon Chung Han



MAT 259 Visualizing Information
 Visualization of transactions from the Seattle Public Library, taken from a
 dataset of over 66 million entries collected since 2005
<http://www.mat.ubc.ca/~g.graduate/courses/mat259/>

Qian Lu



MAT 259 Visualizing Information
 Visualization of transactions from the Seattle Public Library, taken from a
 dataset of over 66 million entries collected since 2005
<http://www.mat.ubc.ca/~g.graduate/courses/mat259/>

Art Shattuck



MAT 259 Visualizing Information
 Visualization of transactions from the Seattle Public Library, taken from a
 dataset of over 66 million entries collected since 2005
<http://www.mat.ubc.ca/~g.graduate/courses/mat259/>



VISWEEK 2012, Seattle

Future Work

- Continue further studies to reveal cultural trends through checkouts
- Create visualizations that provide both overview and detail-on-demand (requires more development time)
- Publish results of the 10+ years studies
- *Data will continue until 2019 when SPL Installation will be reviewed for possible continuation*

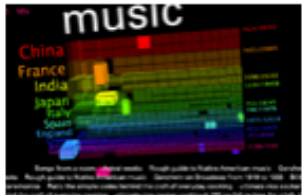
<http://vislab.mat.ucsb.edu/>



The Experimental Visualization Lab

Courses

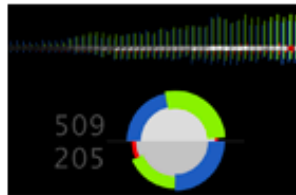
M259 Data Visualization - A studio course dealing with data mining, data aggregation and the visualization of abstract data in various modes that include frequency, spatialization, and 3D interaction.



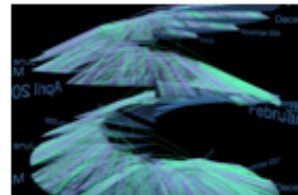
2011



2012



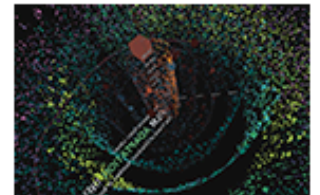
2013



2014



2015



2016

M594CP Optical-Computational Studio - An experimental studio course where students individually define a research topic that explores new directions in computational photography.

M594CM Fundamentals of Spatial Computing - (Forbes) A foundation course for computing in multidimensional spaces, investigating the synthetic and generative potentials of elementary geometric constructs.

Arts130 Digital Visual Culture - A theory based course that examines the impact of digital technologies on the study and analysis of the image.

Arts102 The Conceptual Art of Photoshop - A studio production courset that explores alternative methods of understanding what a signal processing instrument like Photoshop may be to extend its use in art exploration.