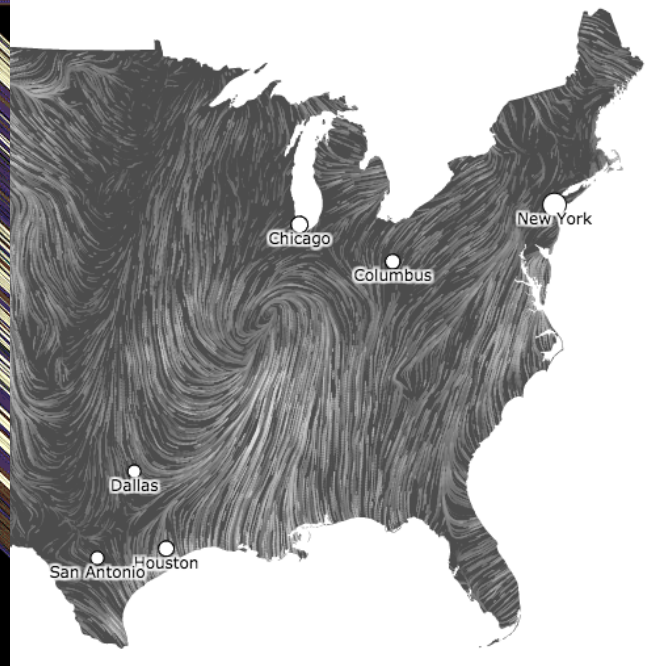
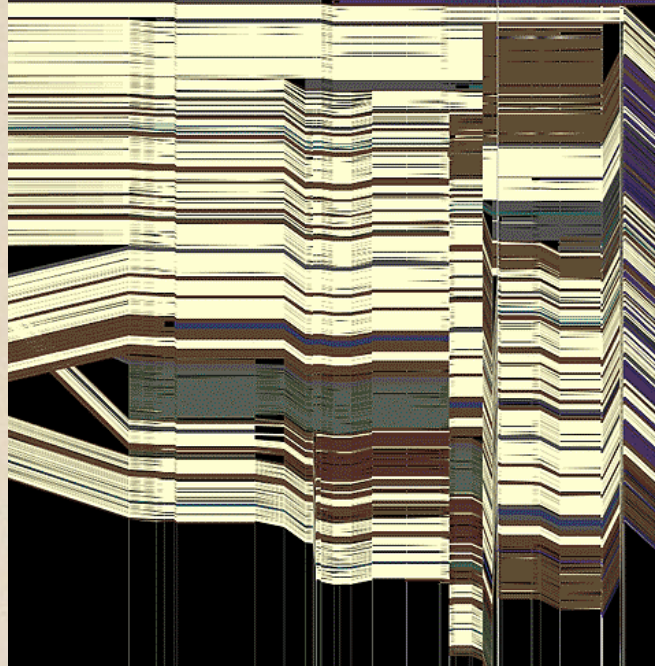
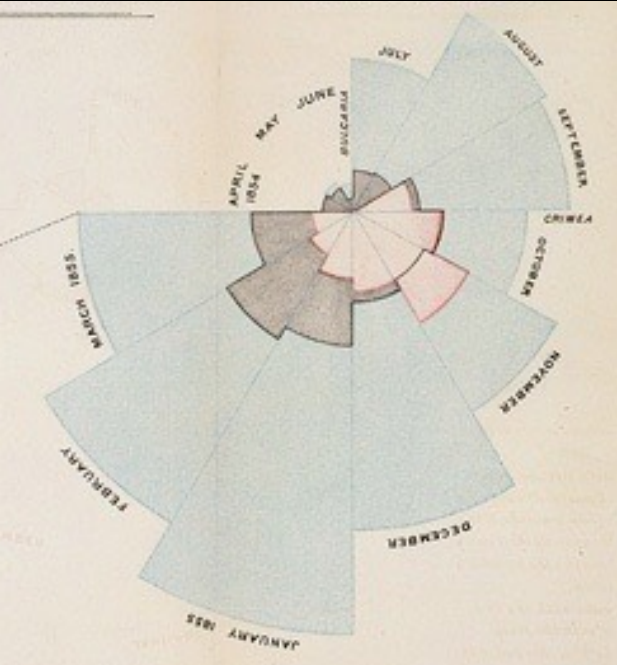


CSE 512 - Data Visualization

The Value of Visualization

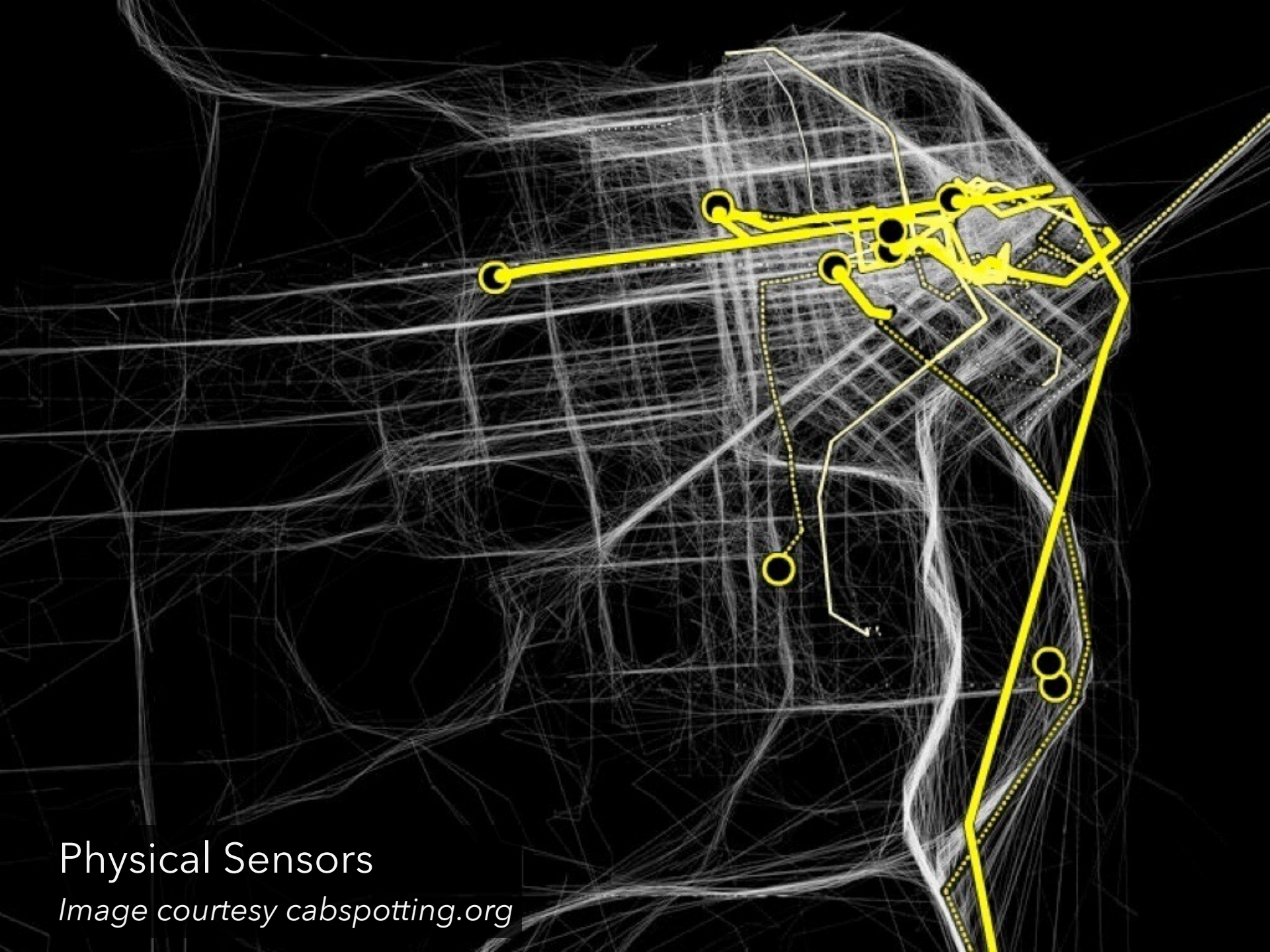


Jeffrey Heer University of Washington

**How much data (bytes)
did we produce in 2010?**

2010: 1,200 exabytes
10x increase over 5 years

Gantz et al, 2008, 2010

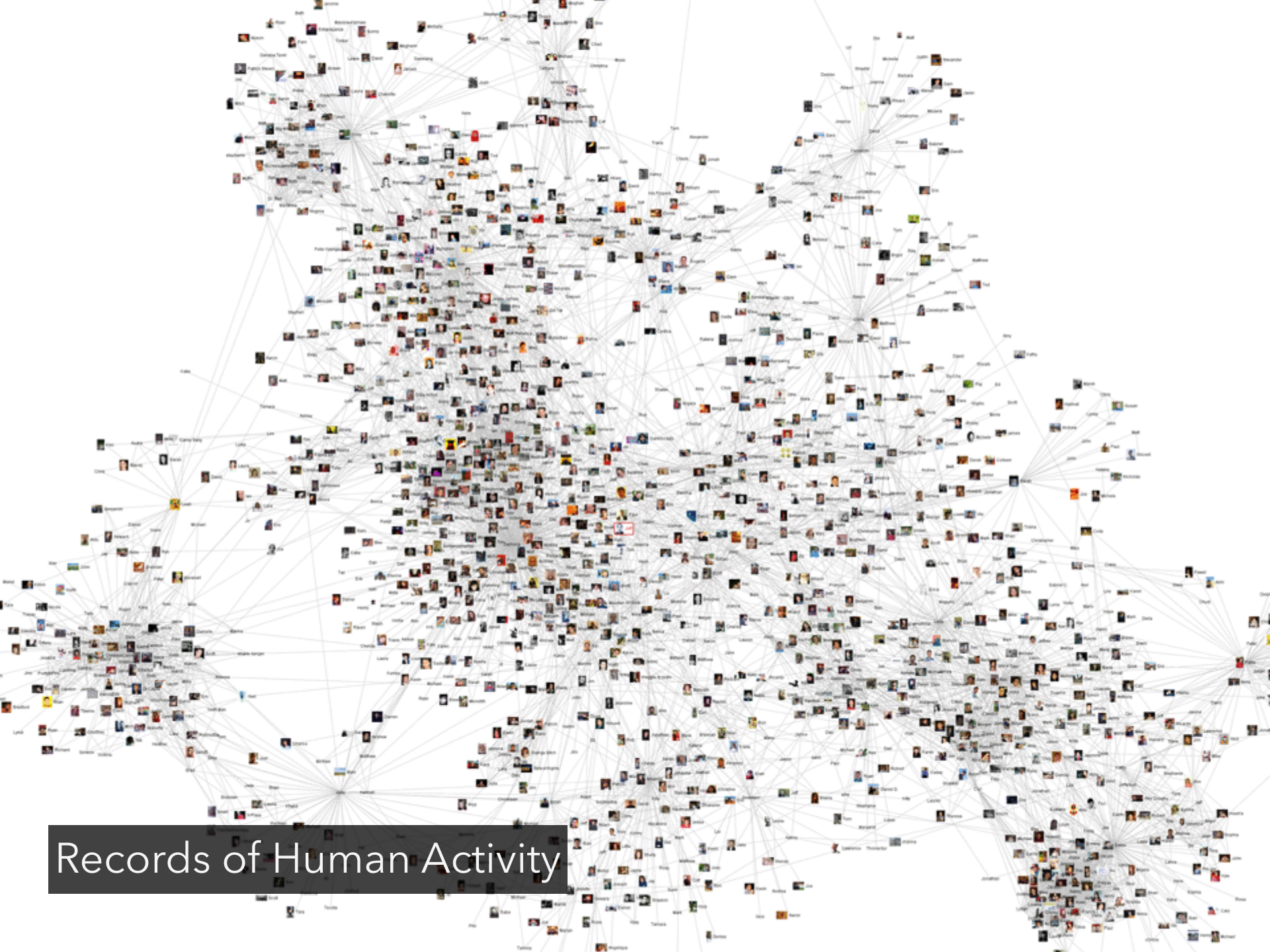


Physical Sensors

Image courtesy cabspotting.org



Health & Medicine



Records of Human Activity



1	Zundark
1	The Cunctator
1	The Epost
1	Conversion script
1	RK
1	Fredb
1	B4hand
1	KamikazeArcher
1	Stephen Gilbert
8	Skrubenstein
5	Mimccorn
1	Isis
1	Derek Ross
2	Dante Alighieri
3	Maveric149
2	Jazbug
8	Jdirl
1	Theanthrope
2	Wesley
1	Dreamword
4	Stevetigo
1	Camembert
2	Hephaestus
1	Zoe
1	MyRedDice
2	G-Man
1	Kingturtle
1	Montrealais
1	...

Abortion

(Revision as of 22:56 4 Jun 2003)

"**Abortion**," in its most commonly used sense, refers to the deliberate early termination of a **pregnancy**, resulting in the death of the **embryo** or **fetus**. [1] Medically, the term also refers to the early termination of a pregnancy by natural ("spontaneous abortion" or **miscarriage**), usually within the first 12 to 14 weeks of pregnancy, or to the cessation of normal growth of the embryo or fetus, usually within the first 12 weeks) or to the cessation of normal growth of the body part or organ. What follows is a discussion of the issues related to deliberate or "induced" abortion.

Methods

Depending on the stage of pregnancy an abortion is performed by a number of different methods. The earliest terminations (before nine weeks) are usually performed by a chemical abortion, which is the usual method, though **mifepristone** is usually the only legal method. Although research has uncovered similar effects from **methotrexate** and **misoprostol**. Concern with chemical abortion and extending up to around the fifteenth week suction-aspiration vacuum abortion is the most common approach, replacing the more risky dilation and curettage (D & C). From the fifteenth week up until around the eighteenth week a surgical dilation and curettage (D & E) is used.

As the fetus size increases other techniques may be used to secure abortion in the third trimester. premature expulsion of the fetus can be induced with prostaglandin, this can be coupled with injecting the amniotic fluid with saline or urea solution. Very late abortions can be brought about by the controversial intact dilation and extraction (D & X) or a hysterotomy abortion, similar to a caesarian section.

The controversy

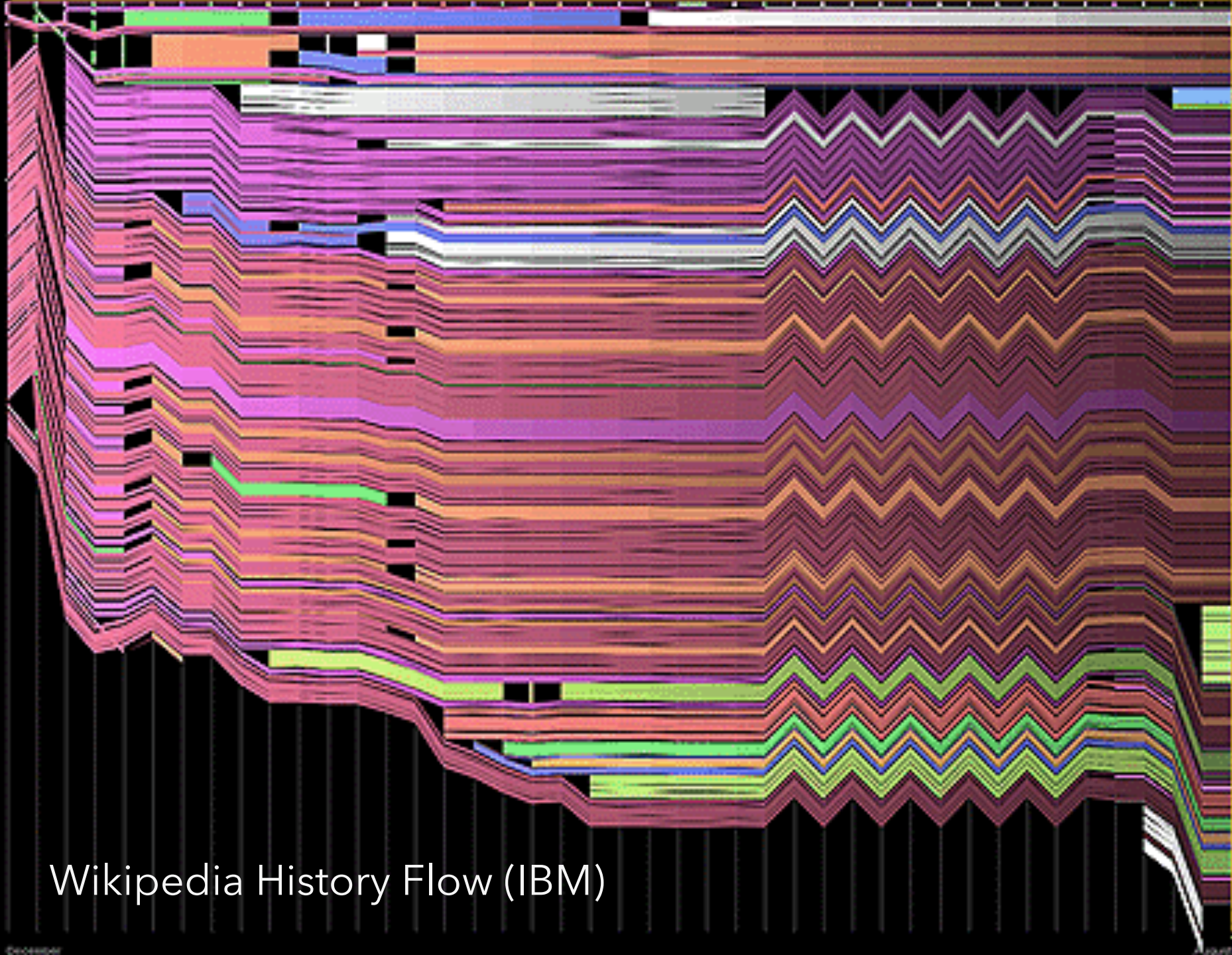
The morality and legality of abortion is a long important topic in **applied ethics** and is also discussed by **legal scholars** and **religious philosophers**. Important facts about abortion are also recorded by **sociologists** and **historians**.

Abortion has been common in most societies, although it has often been opposed by some institutionalized religions and governments. In the 19th century, politics in the United States and Europe became commonly accepted by the late 20th century. Additionally, abortion is accepted in **China**, **India** and other populous countries. The **Catholic Church** remains opposed to the procedure, however, and in other countries notably the **United States** and the (predominantly Catholic) **Republic of Ireland**, the controversy is extremely active, to the extent that even the respective positions are subject to heated debate. While those on both sides of the debate are generally peaceful, if heated, in their defense of their positions, the debate is sometimes characterized by violence. Though true of both sides, this is more marked on the side of those opposed to abortion, because of what they see as the gravity and urgency of their views.

The central question

The central question in the abortion debate is a clash of presumed or perceived rights. On the one hand, is a fetus (sometimes called the "unborn" or "pre-life"/anti-abortion advocates) a human with a right to life, and if so, at what point in pregnancy does the fetus become human? On the other hand, is a fetus part of a woman's body?

Wikipedia History Flow (IBM)



Wikipedia History Flow (IBM)

The ability to take data—to be able to **understand** it, to **process** it, to **extract value** from it, to **visualize** it, to **communicate** it—that's going to be a hugely important skill in the next decades, ... because now we really do have **essentially free and ubiquitous data**. So the complimentary scarce factor is the ability to understand that data and extract value from it.

Hal Varian, Google's Chief Economist
The McKinsey Quarterly, Jan 2009

A Poverty of Attention

“What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it.”



Herb Simon
as quoted by Hal Varian
Scientific American
September 1995

What is Visualization?

"Transformation of the symbolic into the geometric"
[McCormick et al. 1987]

"... finding the artificial memory that best supports our natural means of perception." [Bertin 1967]

"The use of computer-generated, interactive, visual representations of data to amplify cognition."
[Card, Mackinlay, & Shneiderman 1999]

Set A

X	Y
10	8.04
8	6.95
13	7.58
9	8.81
11	8.33
14	9.96
6	7.24
4	4.26
12	10.84
7	4.82
5	5.68

Set B

X	Y
10	9.14
8	8.14
13	8.74
9	8.77
11	9.26
14	8.1
6	6.13
4	3.1
12	9.11
7	7.26
5	4.74

Set C

X	Y
10	7.46
8	6.77
13	12.74
9	7.11
11	7.81
14	8.84
6	6.08
4	5.39
12	8.15
7	6.42
5	5.73

Set D

X	Y
8	6.58
8	5.76
8	7.71
8	8.84
8	8.47
8	7.04
8	5.25
19	12.5
8	5.56
8	7.91
8	6.89

Summary Statistics

$$u_X = 9.0 \quad \sigma_X = 3.317$$

$$u_Y = 7.5 \quad \sigma_Y = 2.03$$

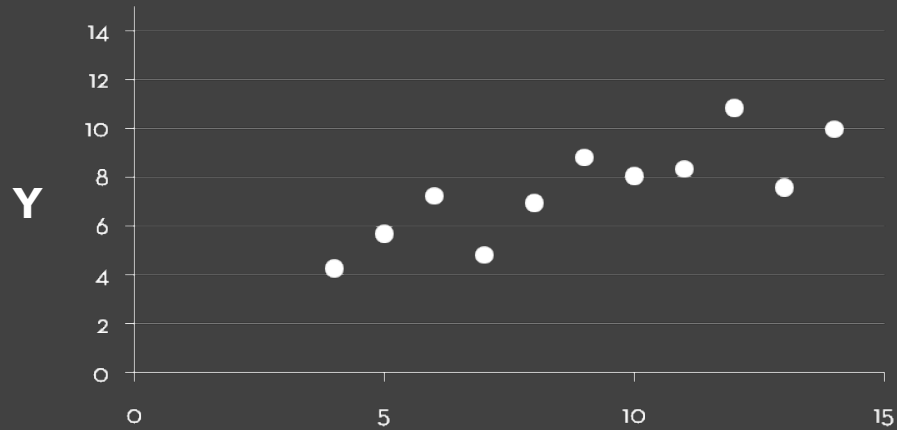
Linear Regression

$$Y = 3 + 0.5 X$$

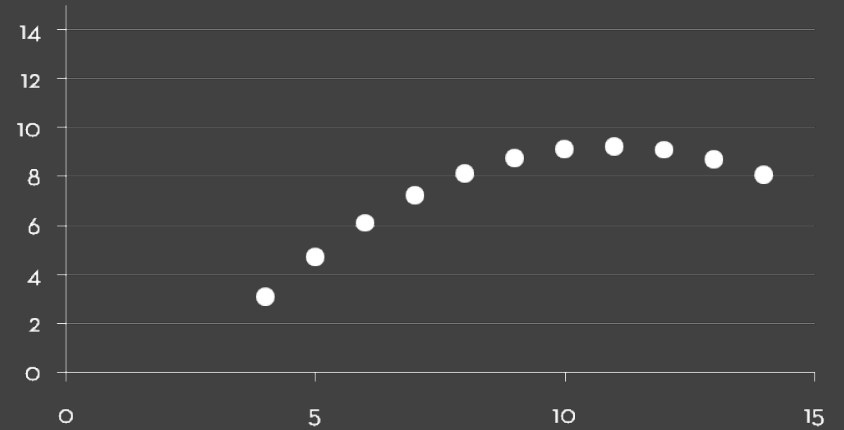
$$R^2 = 0.67$$

[Anscombe 1973]

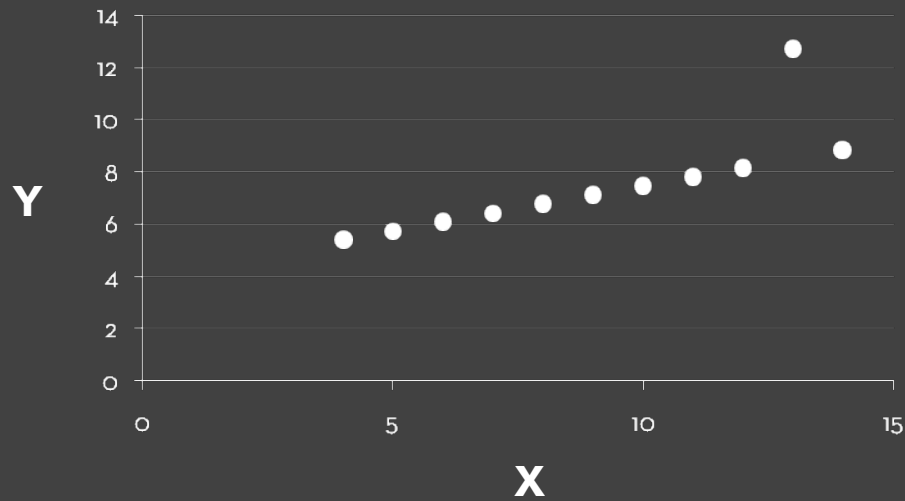
Set A



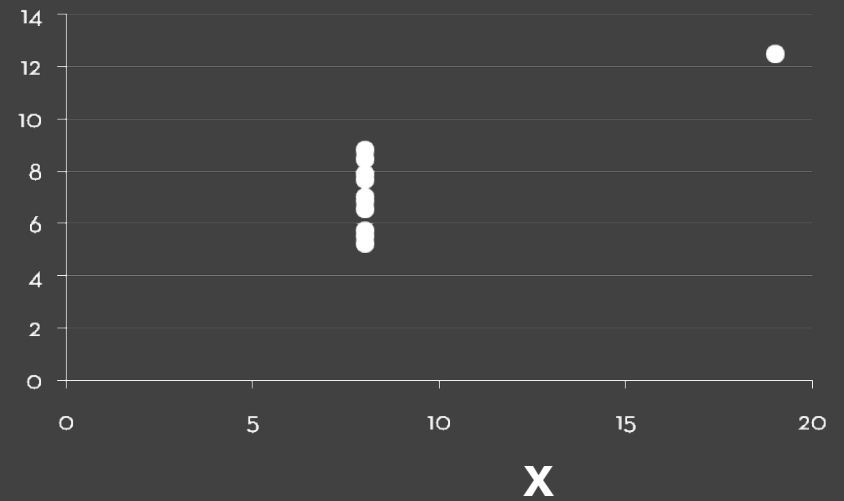
Set B



Set C



Set D



Why Create Visualizations?

Why Create Visualizations?

Answer questions (or discover them)

Make decisions

See data in context

Expand memory

Support graphical calculation

Find patterns

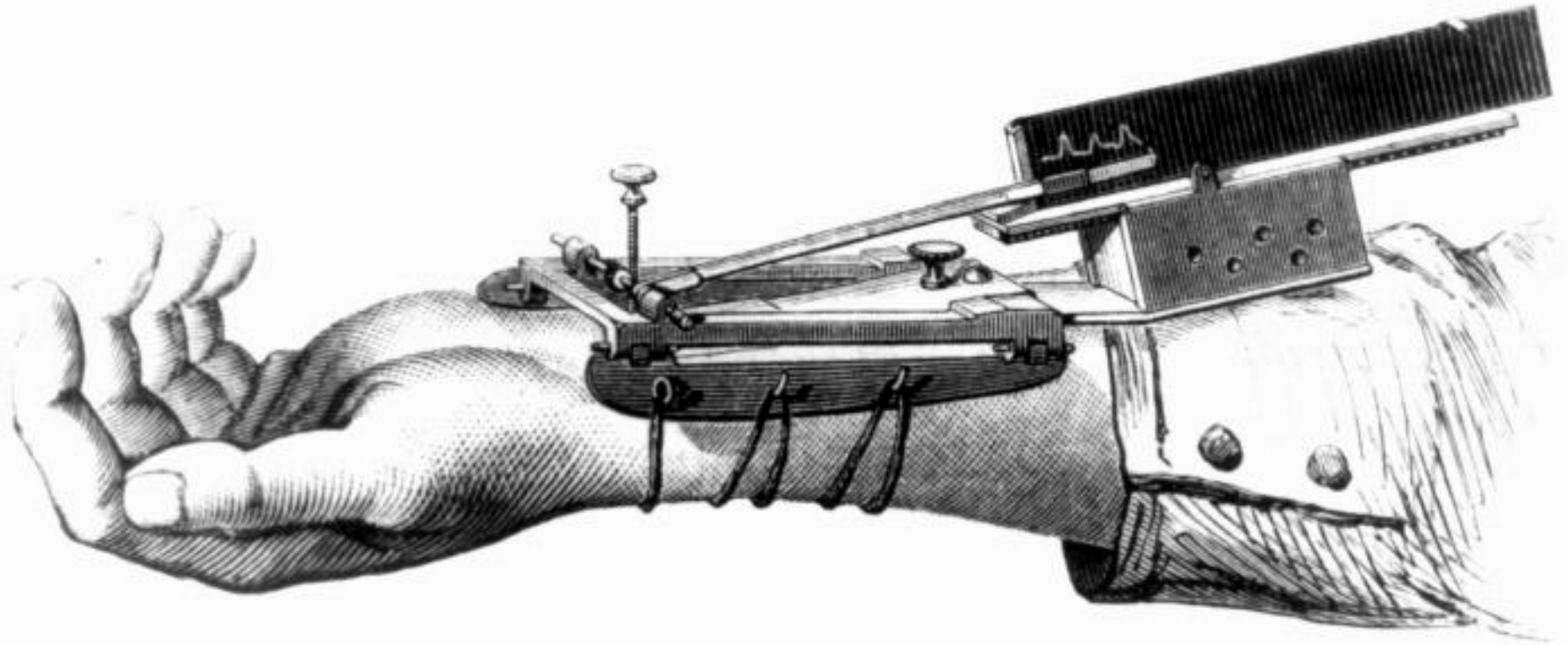
Present argument or tell a story

Inspire

Record Information



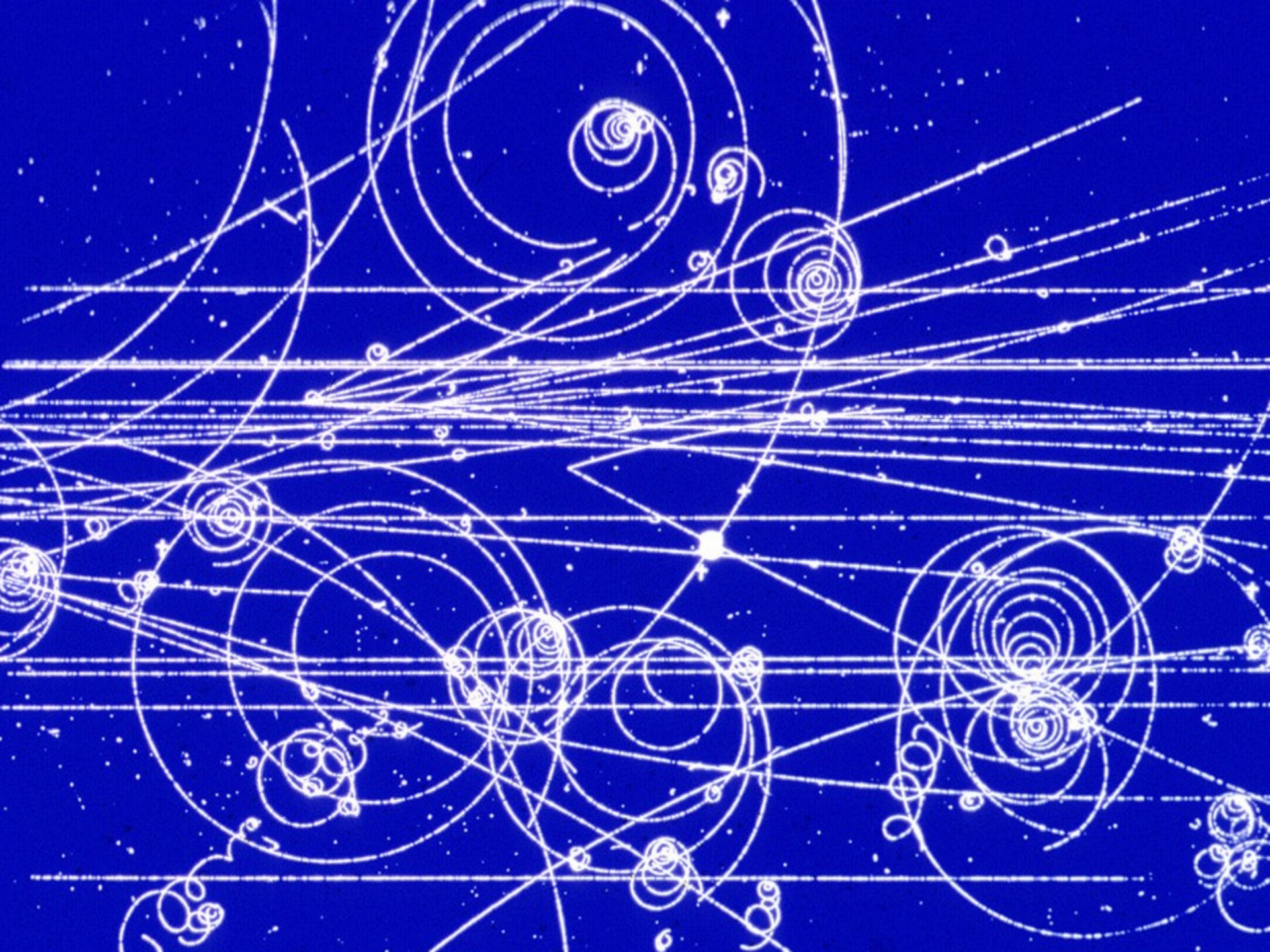
Gallop, Bay Horse "Daisy" [Muybridge 1884-86]



1.

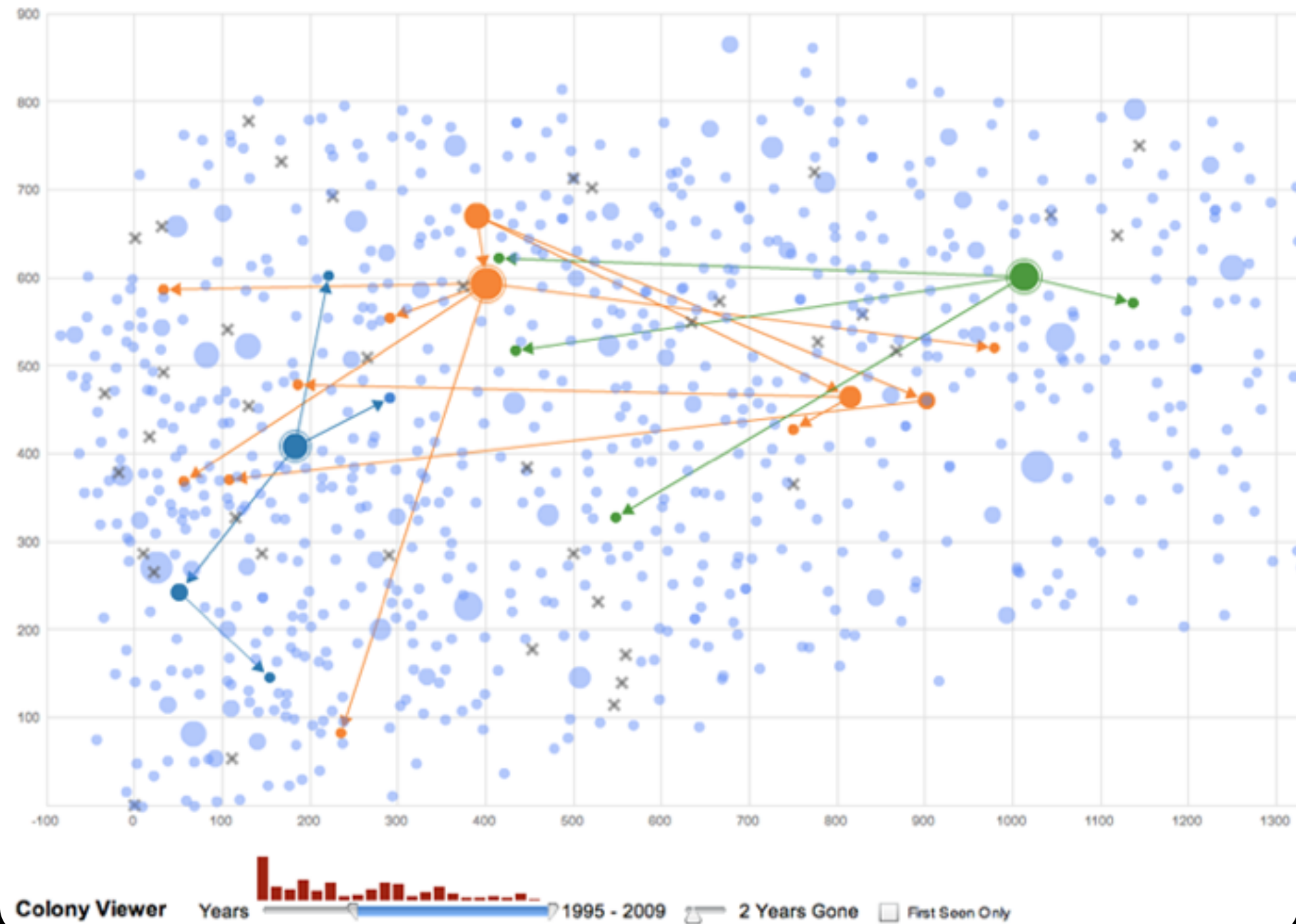
Marey's **sphygmograph** in use,
1860. *La méthode graphique dans
les sciences expérimentales et
principalement en physiologie et en
médecine.*

E.J. Marey's sphygmograph [from Braun 83]





This image shows a close-up of a 1000-yard grid map. The grid lines are spaced at 100-yard intervals. Numerous numerical values are printed at the intersections of the grid lines, representing data points. Some of these values are circled in blue ink, including 351, 310, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000. Some values are circled in blue ink, including 351, 310, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 42



Support Reasoning

HISTORY OF O-RING DAMAGE ON SRM FIELD JOINTS

	SRM No.	Cross Sectional View			Top View		Clocking Location (deg)
		Erosion Depth (in.)	Perimeter Affected (deg)	Nominal Dia. (in.)	Length Of Max Erosion (in.)	Total Heat Affected Length (in.)	
Oct 30, 1985	61A LH Center Field**	22A	None	0.280	None	None	36° -- 66°
	61A LH CENTER FIELD**	22A	NONE	0.280	NONE	NONE	338° -- 18°
8-	51C LH Forward Field**	15A	0.010	154.0	4.25	5.25	163
	51C RH Center Field (prim)***	15B	0.038	130.0	12.50	58.75	354
	51C RH Center Field (sec)***	15B	None	45.0	None	29.50	354
	41D RH Forward Field	13B	0.028	110.0	3.00	None	275
	41C LH Aft Field*	11A	None	0.280	None	None	--
	41B LH Forward Field	10A	0.040	217.0	3.00	14.50	351
July	STS-2 RH Aft Field	2B	0.053	116.0	--	--	90

*Hot gas path detected in putty. Indication of heat on O-ring, but no damage.

**Soot behind primary O-ring.

***Soot behind primary O-ring, heat affected secondary O-ring.

Clocking location of leak check port - 0 deg.

OTHER SRM-15 FIELD JOINTS HAD NO BLOWHOLES IN PUTTY AND NO SOOT NEAR OR BEYOND THE PRIMARY O-RING.

SRM-22 FORWARD FIELD JOINT HAD PUTTY PATH TO PRIMARY O-RING, BUT NO O-RING EROSION AND NO SOOT BLOWBY. OTHER SRM-22 FIELD JOINTS HAD NO BLOWHOLES IN PUTTY.

BLOW BY HISTORY

SRM-15 WORST BLOW-BY

- o 2 CASE JOINTS (80°), (110°) ARC
- o MUCH WORSE VISUALLY THAN SRM-22

SRM 22 BLOW-BY

- o 2 CASE JOINTS (30-40°)

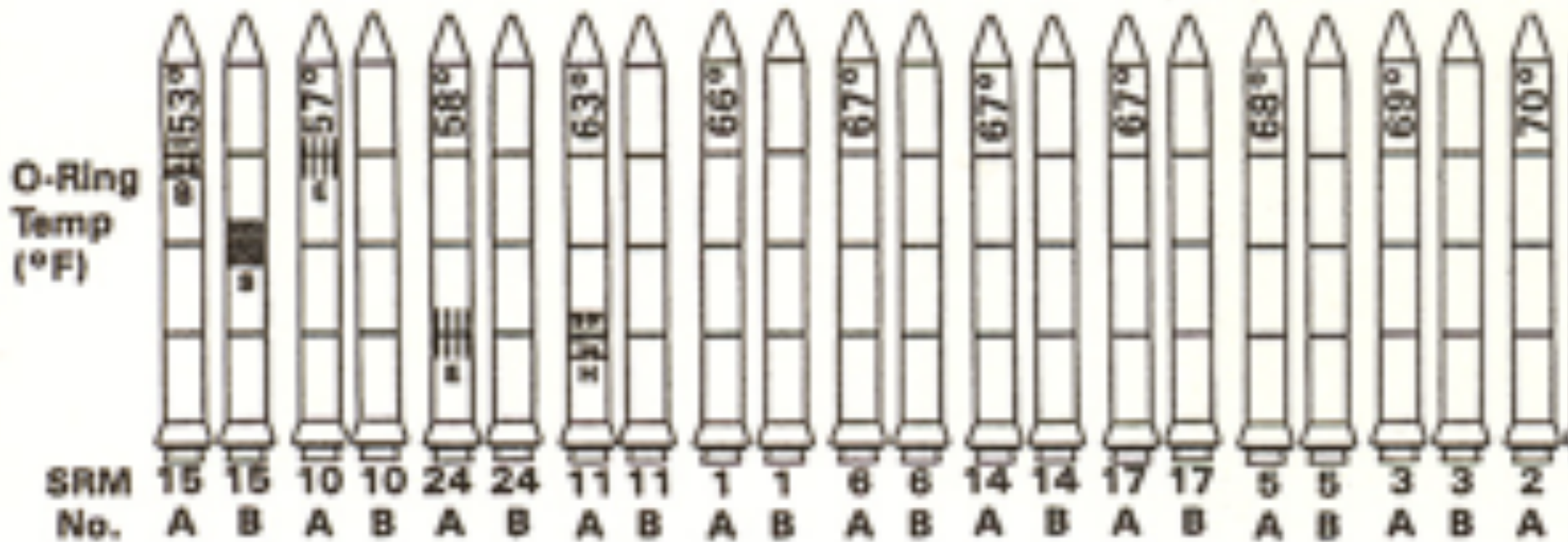
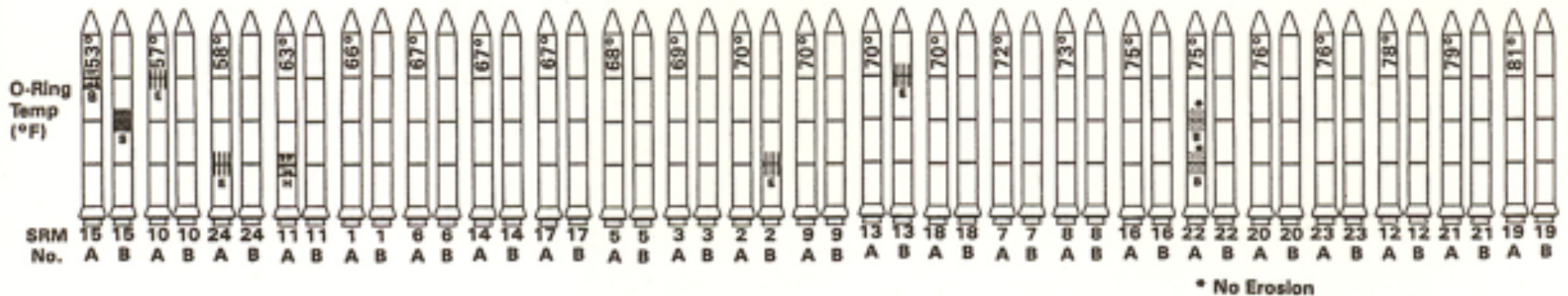
SRM-13A, 15, 16A, 18, 23A 24A

- o NOZZLE BLOW-BY

HISTORY OF O-RING TEMPERATURES (DEGREES - F)

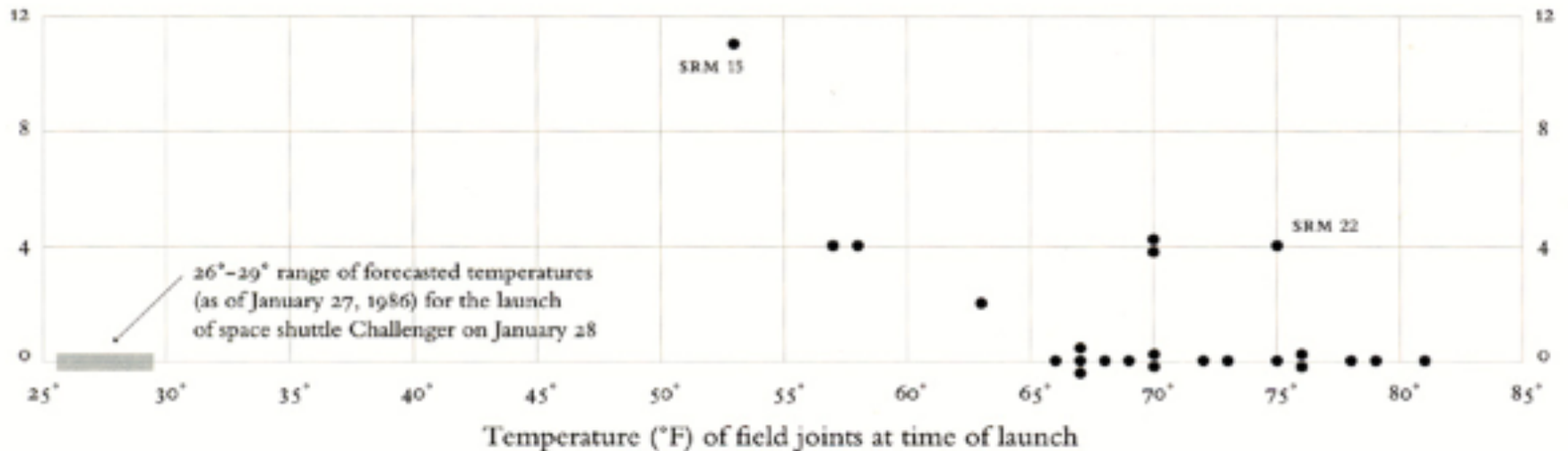
MOTOR	MBT	AMB	O-RING	WIND
DM-4	68	36	47	10 MPH
DM-2	76	45	52	10 MPH
QM-3	72.5	40	48	10 MPH
QM-4	76	48	51	10 MPH
SRM-15	52	64	53	10 MPH
SRM-22	77	78	75	10 MPH
SRM-25	55	26	29	10 MPH
			27	25 MPH

Make a Decision: Challenger



Make a Decision: Challenger

O-ring damage
index, each launch



Visualizations drawn by Tufte show how low temperatures damage O-rings [Tufte 97]

Data in Context: Cholera Outbreak



In 1854 John Snow plotted the position of each cholera case on a map. [from Tufte 83]

Data in Context: Cholera Outbreak



Used map to hypothesize that pump on Broad St. was the cause. [from Tufte 83]

Expand Memory: Multiplication

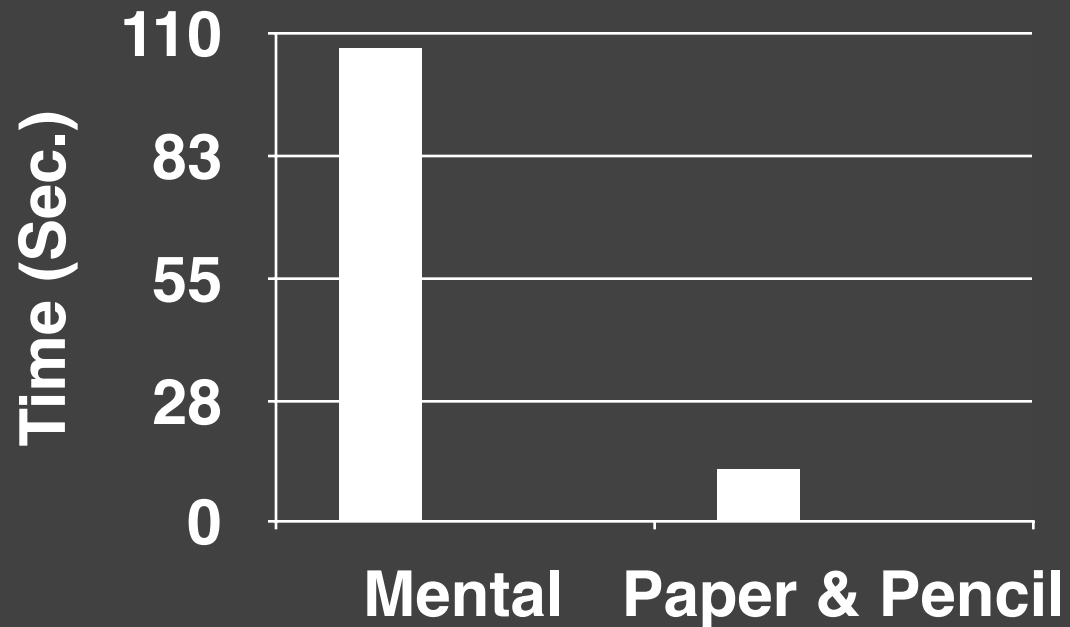
Class Exercise!

Expand Memory: Multiplication

$$\begin{array}{r} 34 \\ \times 72 \\ \hline \end{array}$$

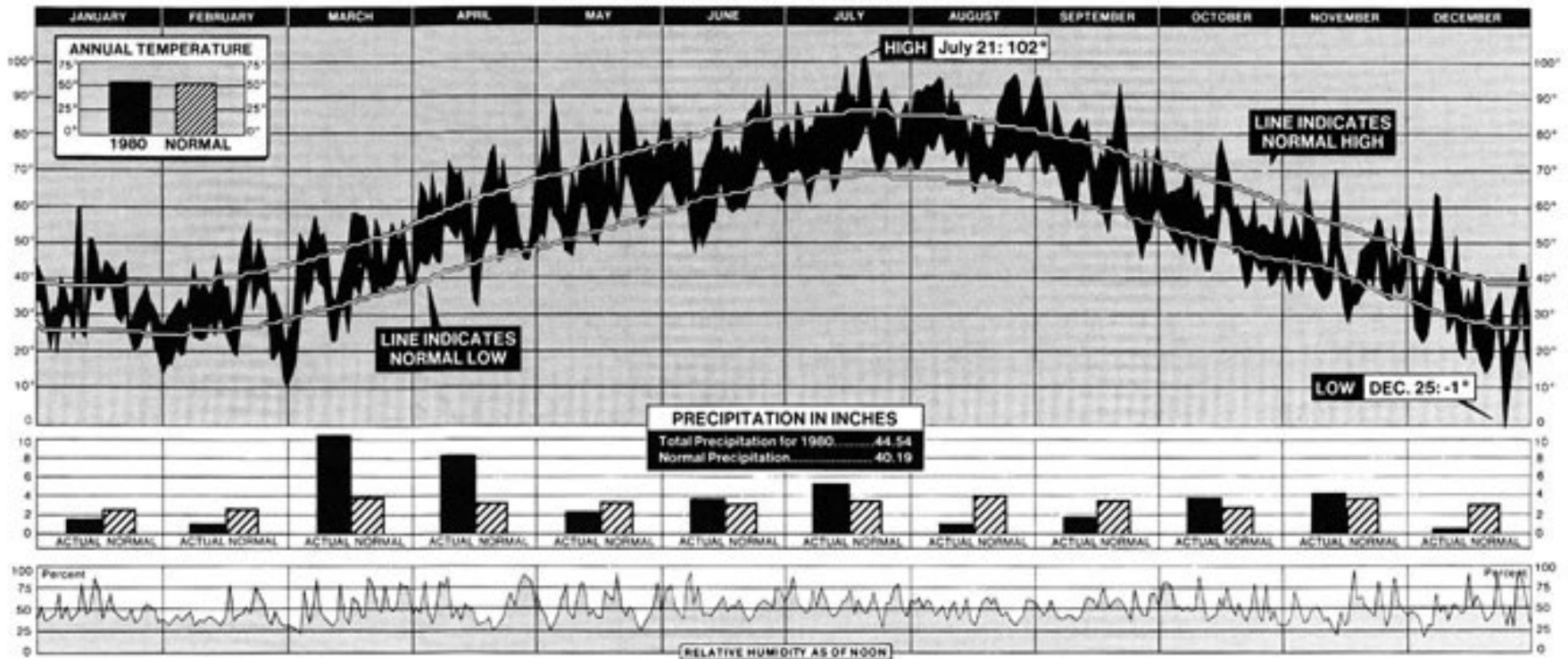
Expand Memory: Multiplication

$$\begin{array}{r} 34 \\ \times 72 \\ \hline 68 \\ 2380 \\ \hline 2448 \end{array}$$



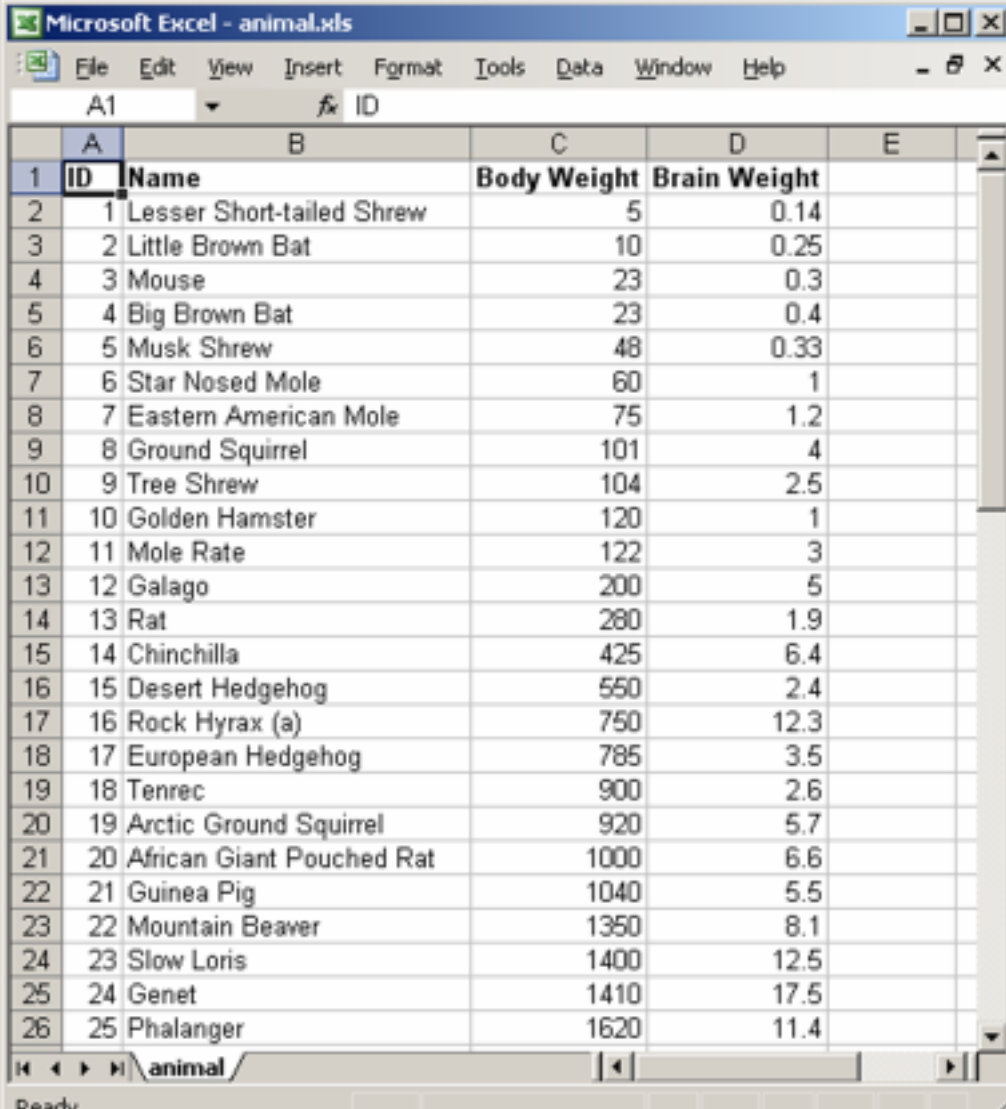
Find Patterns: NYC Weather

NEW YORK CITY'S WEATHER FOR 1980



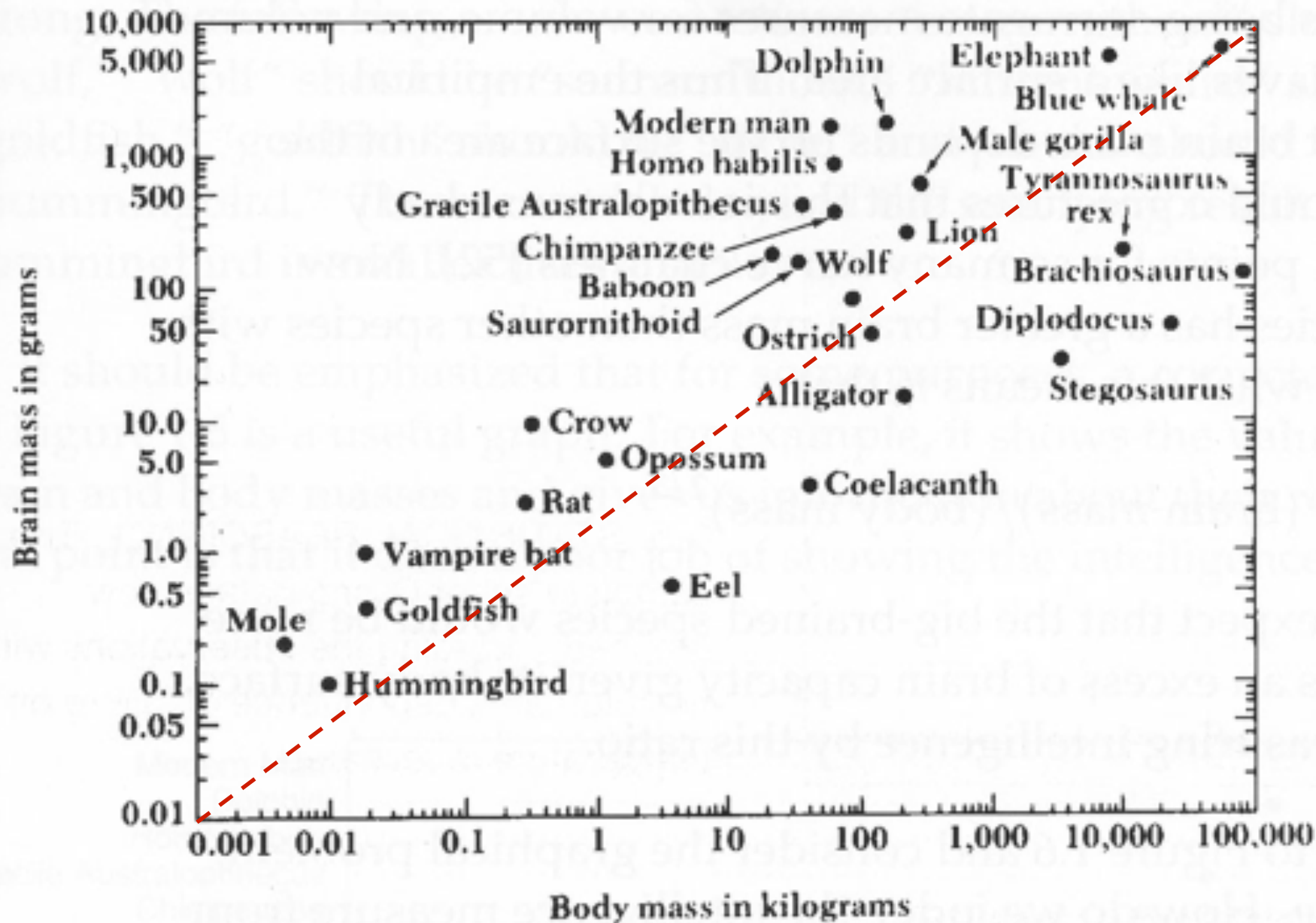
[New York Times 1981]

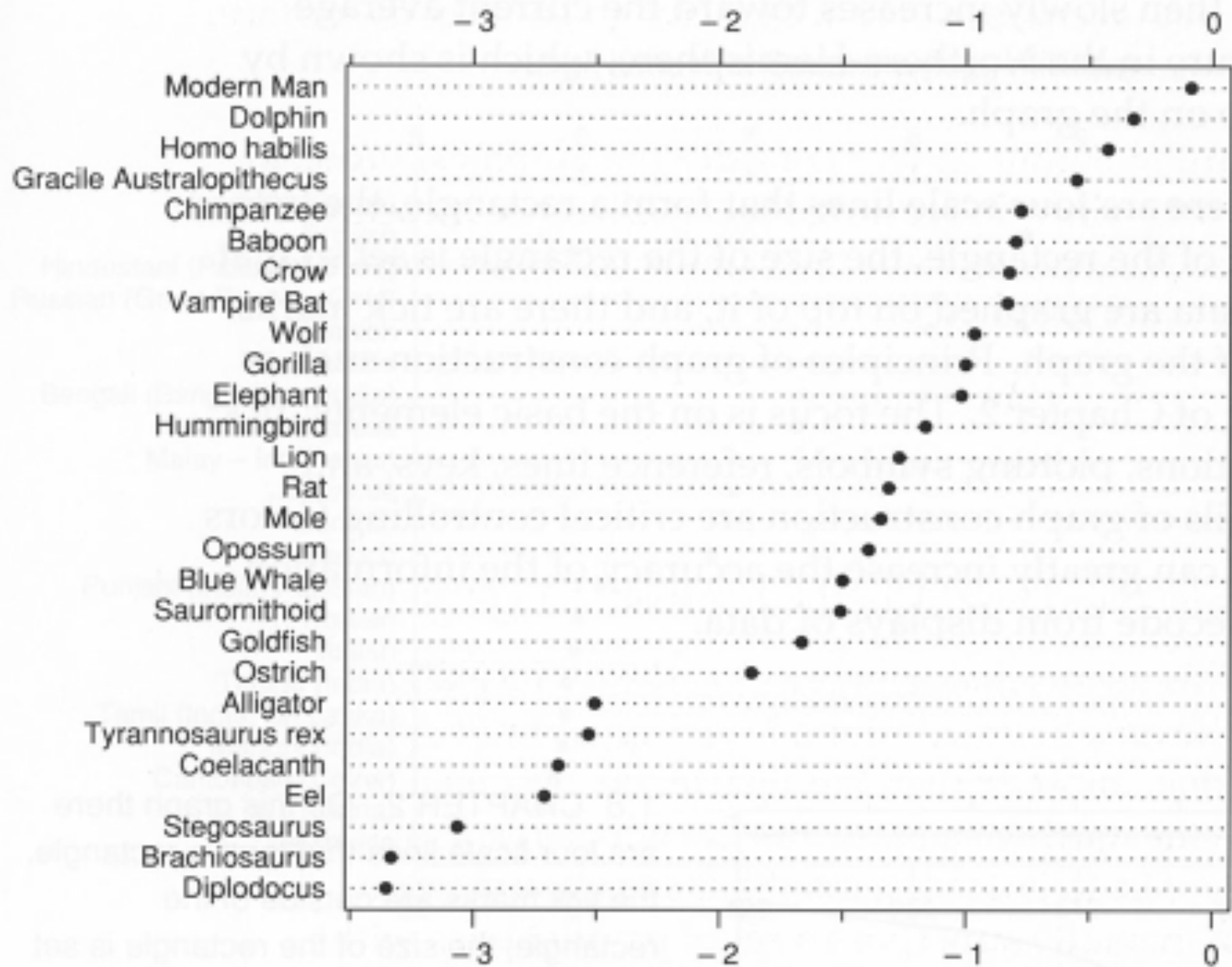
The Most Powerful Brain?



A screenshot of a Microsoft Excel spreadsheet titled "animal.xls". The spreadsheet contains a table with 5 columns: ID, Name, Body Weight, and Brain Weight. The data is organized into 26 rows, with the first row serving as a header. The table lists various animals and their corresponding body and brain weights. The status bar at the bottom indicates the file is "Ready".

ID	Name	Body Weight	Brain Weight
1	Lesser Short-tailed Shrew	5	0.14
2	Little Brown Bat	10	0.25
3	Mouse	23	0.3
4	Big Brown Bat	23	0.4
5	Musk Shrew	48	0.33
6	Star Nosed Mole	60	1
7	Eastern American Mole	75	1.2
8	Ground Squirrel	101	4
9	Tree Shrew	104	2.5
10	Golden Hamster	120	1
11	Mole Rate	122	3
12	Galago	200	5
13	Rat	280	1.9
14	Chinchilla	425	6.4
15	Desert Hedgehog	550	2.4
16	Rock Hyrax (a)	750	12.3
17	European Hedgehog	785	3.5
18	Tenrec	900	2.6
19	Arctic Ground Squirrel	920	5.7
20	African Giant Pouched Rat	1000	6.6
21	Guinea Pig	1040	5.5
22	Mountain Beaver	1350	8.1
23	Slow Loris	1400	12.5
24	Genet	1410	17.5
25	Phalanger	1620	11.4





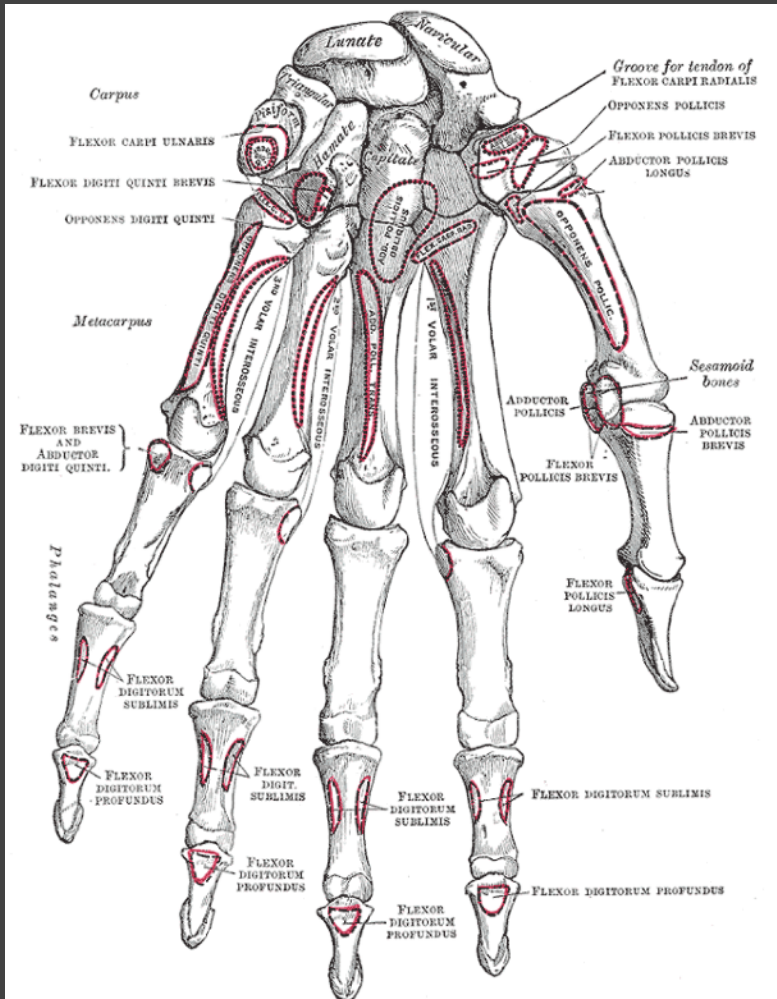
The Elements of Graphing Data

[Cleveland]

$\text{Log}_{10} \text{ Brain Weight} - \frac{2}{3} \text{Log}_{10} \text{ Body Weight}$

**Convey Information
to Others**

Inspire

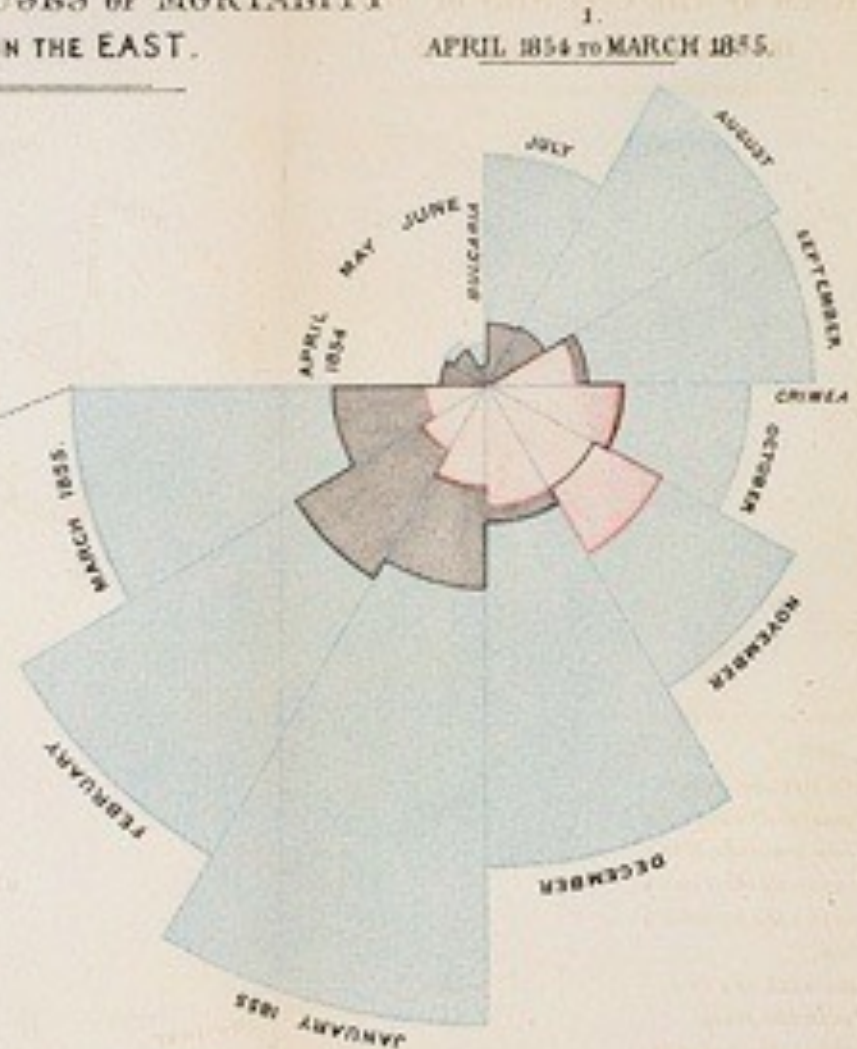
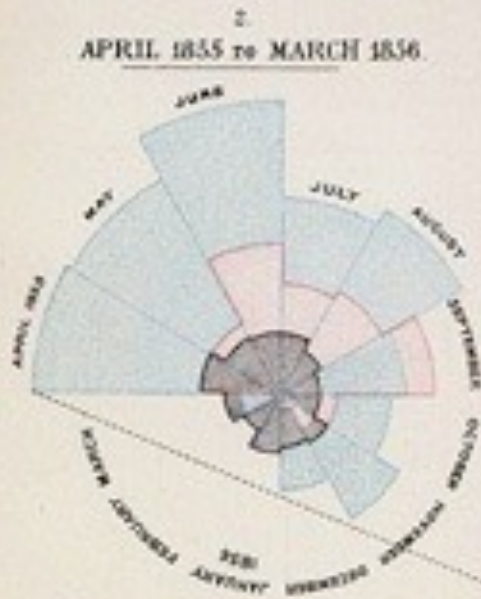


Bones in hand [from 1918 edition]



Double helix model [Watson and Crick 53]

DIAGRAM OF THE CAUSES OF MORTALITY IN THE ARMY IN THE EAST.



"to affect thro' the Eyes
what we fail to convey to
the public through their
word-proof ears"

1856 "Coxcomb" of Crimean War Deaths, Florence Nightingale

The Value of Visualization

Record information

Blueprints, photographs, seismographs, ...

Analyze data to support reasoning

Develop and assess hypotheses

Find patterns / Discover errors in data

Expand memory

Communicate information to others

Share and persuade

Collaborate and revise

Goals of Visualization Research

1 Understand how visualizations convey information

What do people perceive/comprehend?

How do visualizations inform mental models?

2 Develop principles and techniques for creating effective visualizations and supporting analysis

Leverage perception & augment cognition

Improve ties between visualization & mental model

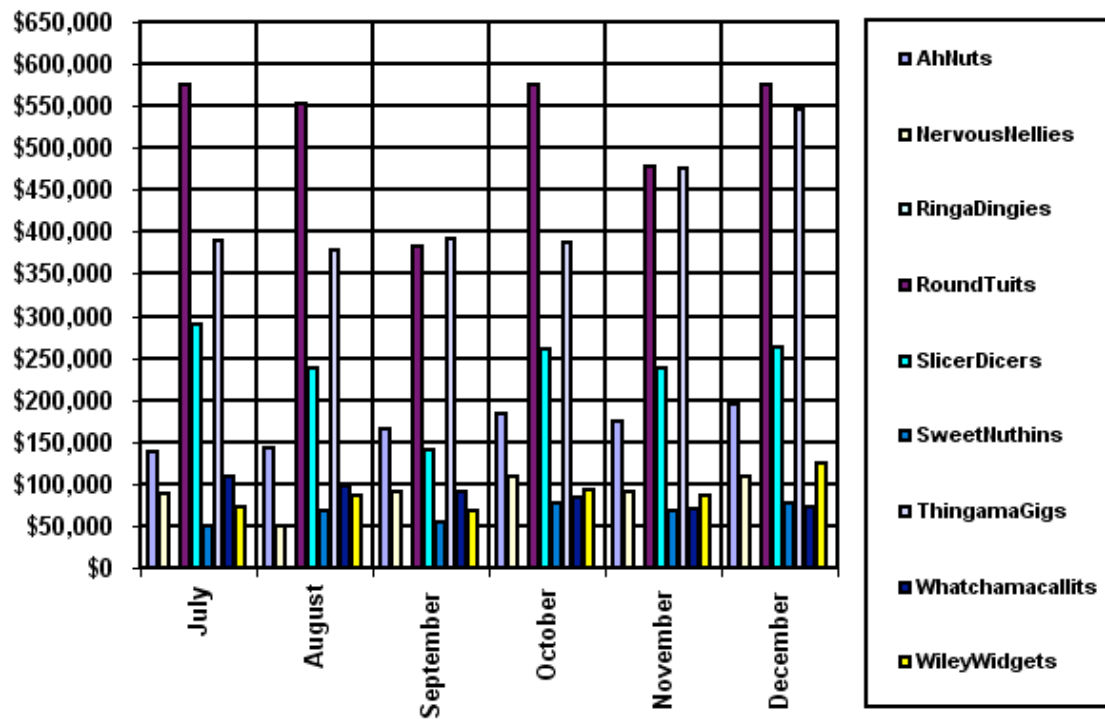
Course Topics

Data and Image Models

LES VARIABLES DE L'IMAGE											
POINTS			LIGNES			ZONES		12 14			
XY 2 DIMENSIONS DU PLAN											
Z TAILLE											
VALEUR											
LES VARIABLES DE SÉPARATION DES IMAGES											
GRAIN											
COULEUR											
ORIENTATION											

Visualization (Re-)Design

SlicerDicers' Sales Compared to Other Products

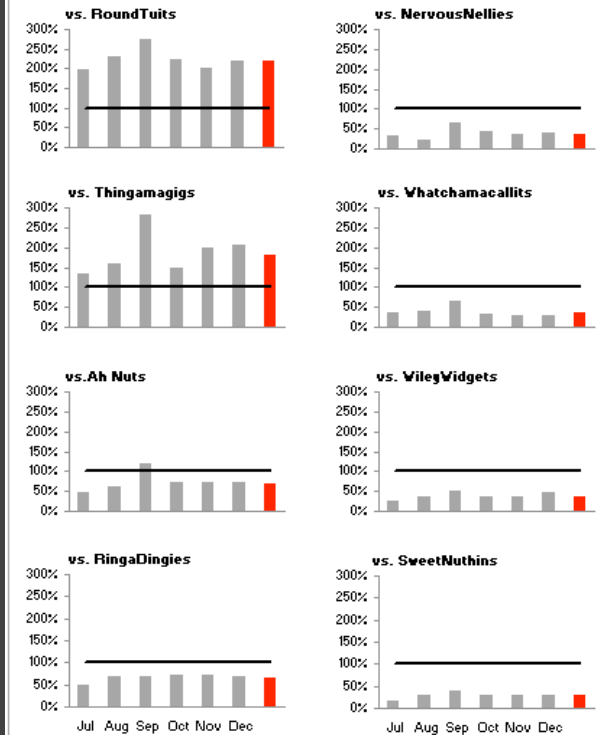


Problematic design

Sales of SlicersDicers Compared to Other Products

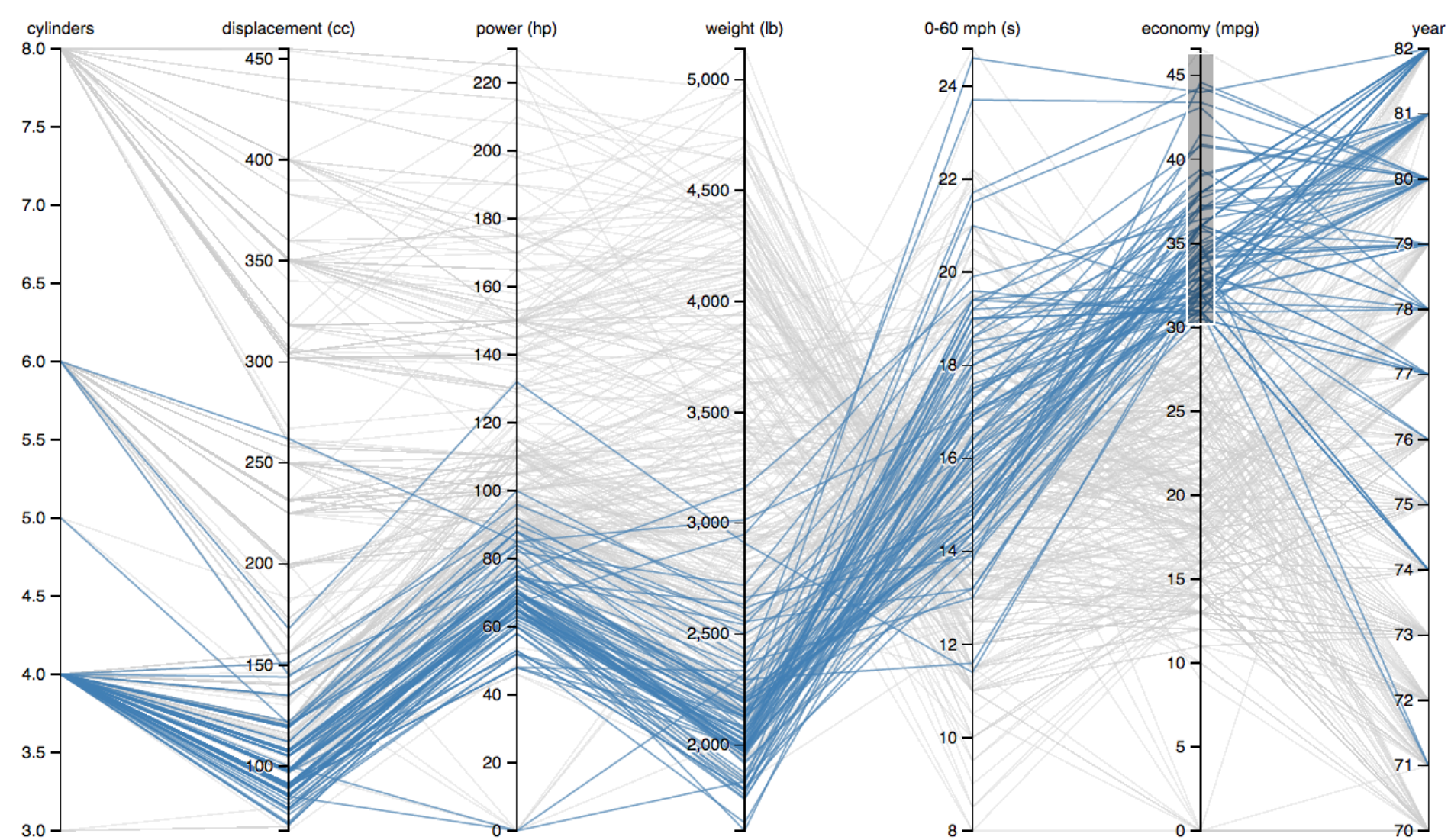
July - December, 2003

(SlicersDicers' sales are displayed as black reference lines of 100%; the red bars represent the average monthly sales percentage for July through December.)

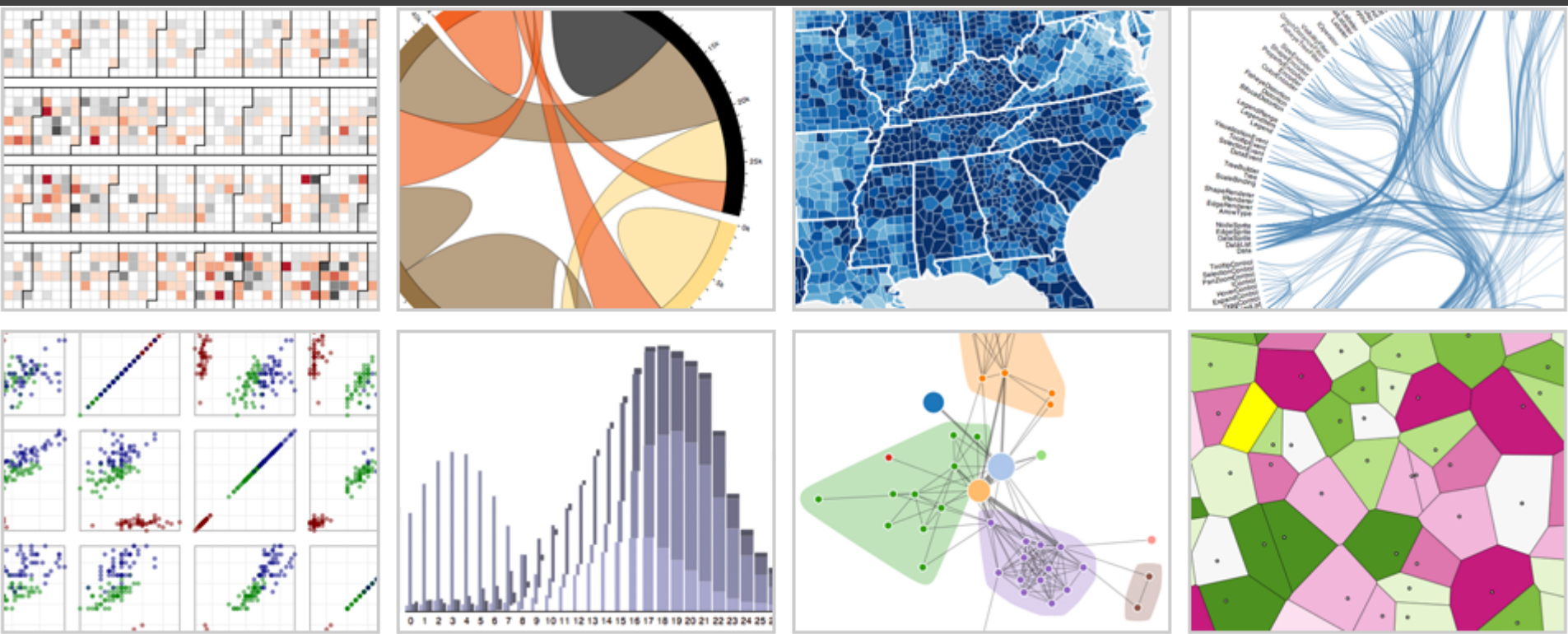


Redesign

Exploratory Data Analysis



Visualization Software



D3: Data-Driven Documents

Interaction

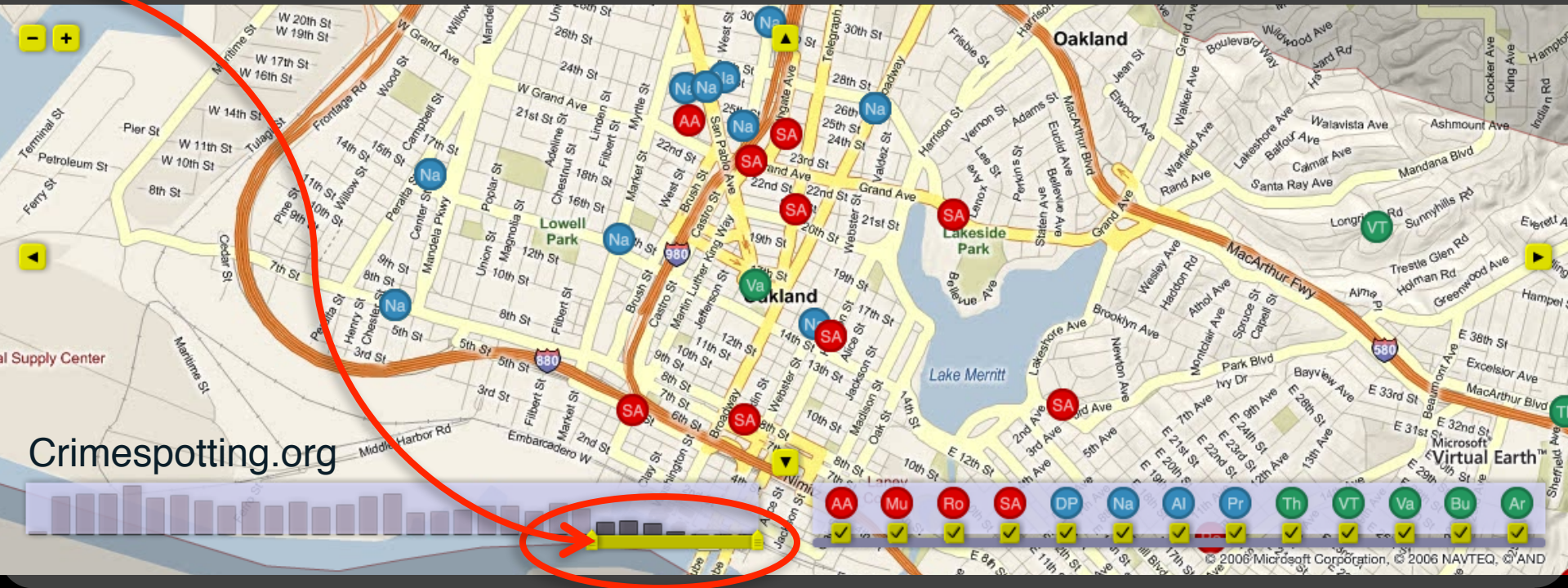
Friday, December 12, 2008
154 reports

2008 Microsoft Corporation. © 2006 NAVTEQ, © AND

154 reports



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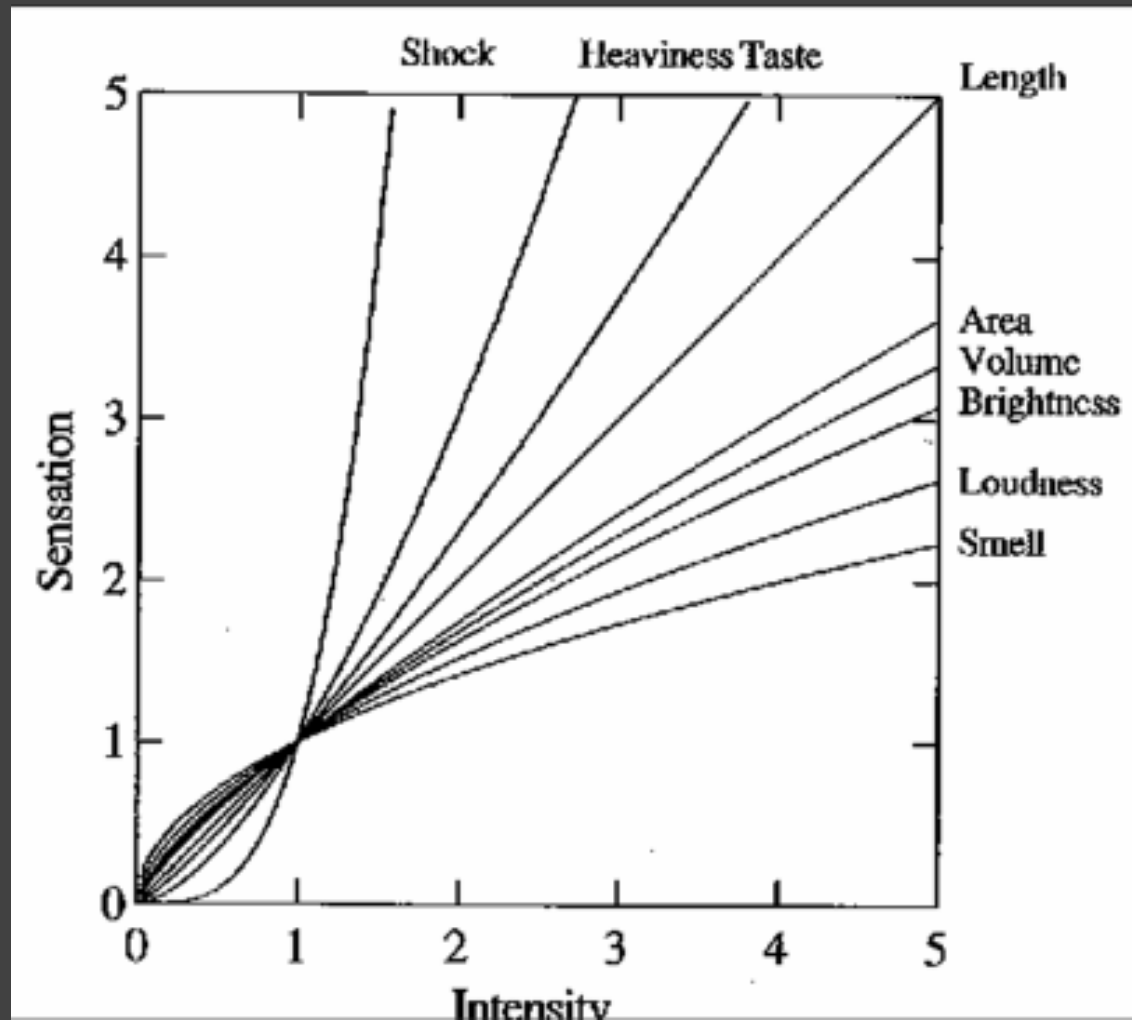


Crimespotting.org



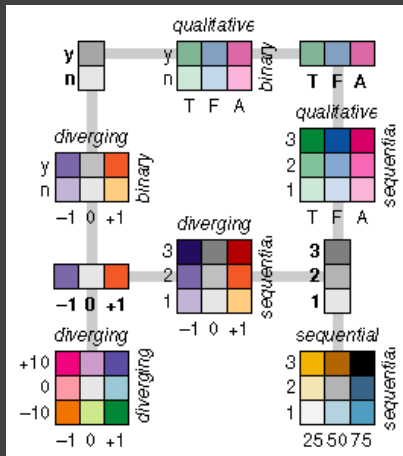
© 2006 Microsoft Corporation, © 2006 NAVTEQ, © AND

Graphical Perception

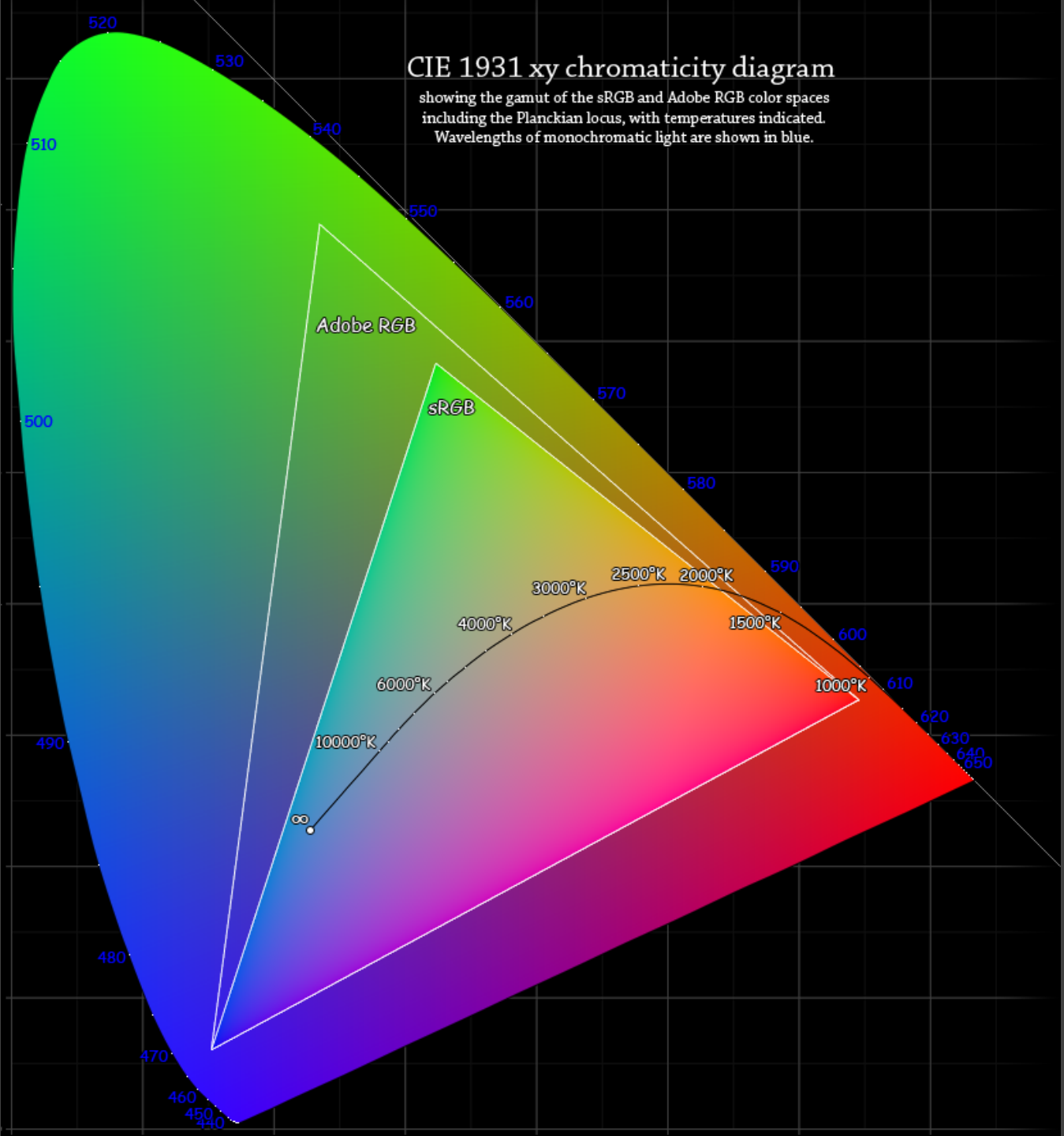


The psychophysics of sensory function [Stevens 61]

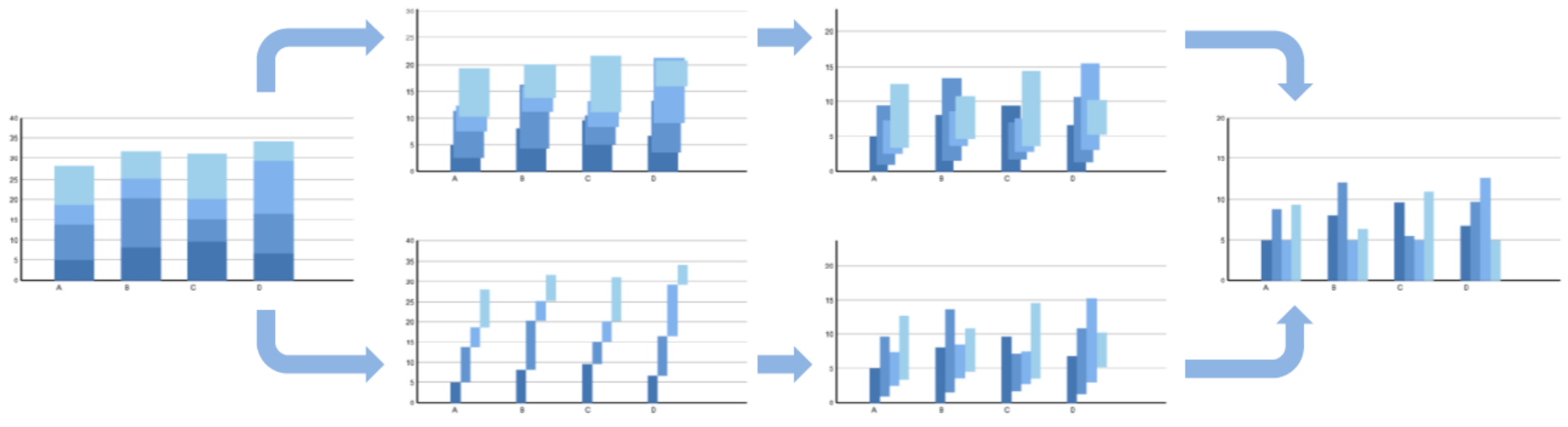
Color



Color Brewer

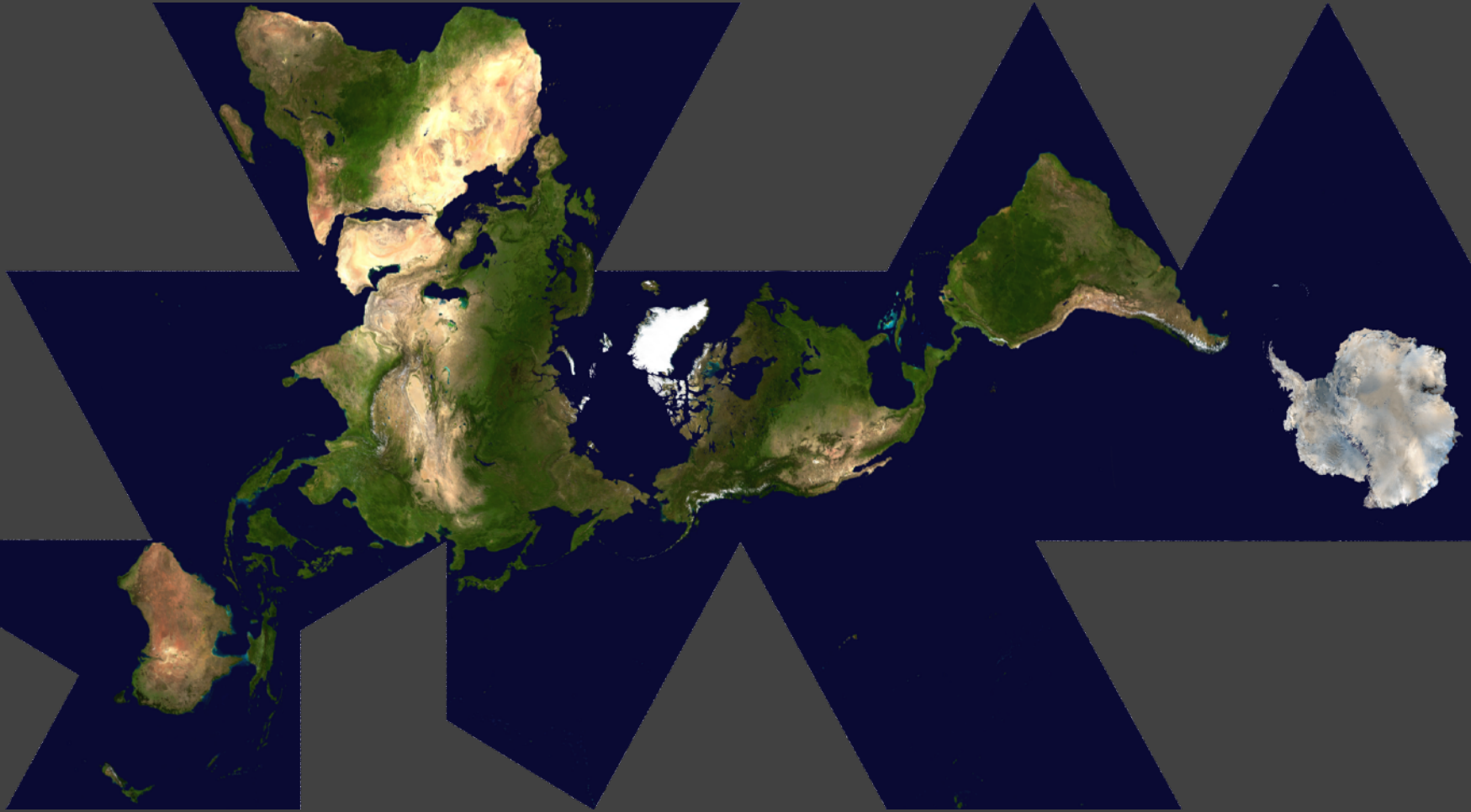


Animation



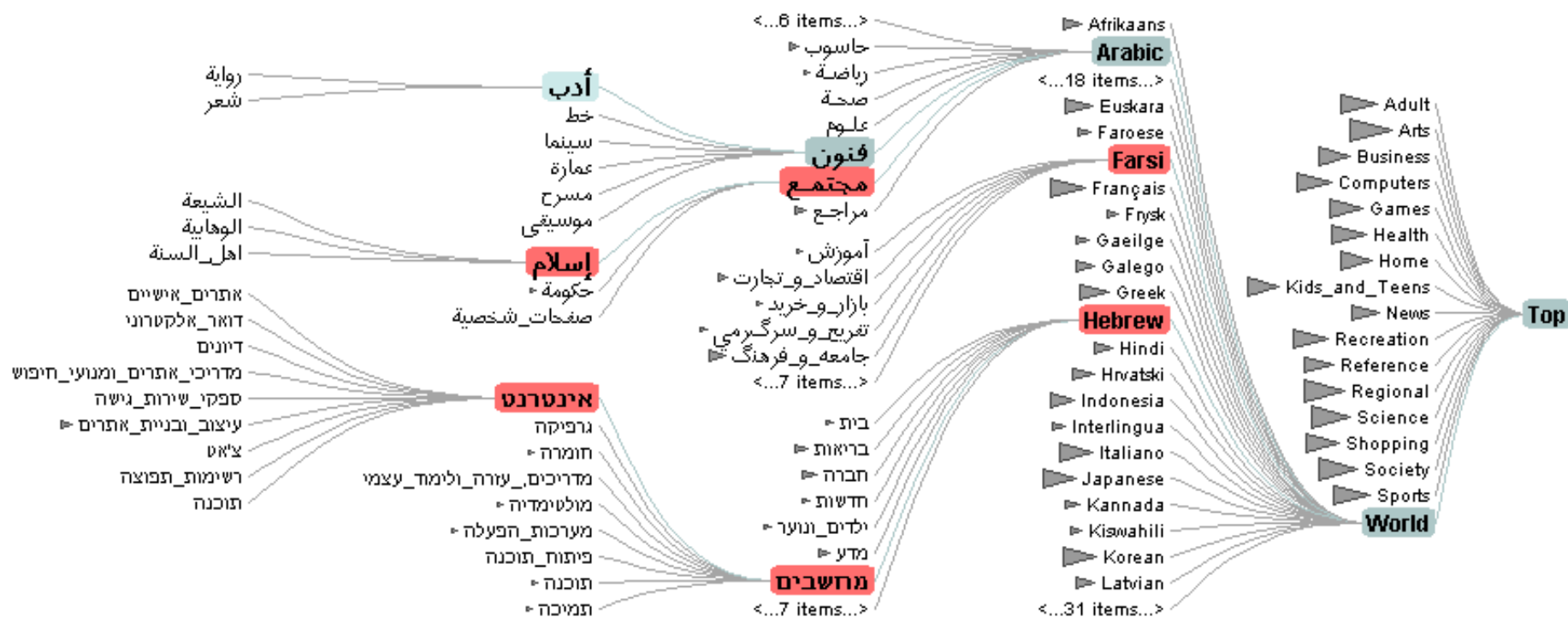
Animated transitions in statistical data graphics [Heer & Robertson 07]

Maps



Dymaxion Maps [Fuller 46]

Hierarchies



Degree-Of-Interest Trees [Heer & Card 04]

Networks



community >>

Enable

search >>

Zephoria

User ID 21721

Friends 266

Age ??

Gender Female

Status Single

Location San Francisco, CA

Hometown Lancaster, PA

Occupation researcher: social networks, identity, context

Interests apophenia, observing people, culture, questioning power, reading, buddhism, ipseity, computer-mediated communication, social networks, technology, anthropology, stomp

Music psytrance/goa/trance [Infected Mushroom, Son Kite... Iboga/Digital Structures], Ani Difranco, downtempo, Thievery Corporation, Beth Orton, Morcheeba, Ween, White Stripes

Books Authors: Erving Goffman, Stanley Milgram, Jeanette Winterson, Eric Schlosser, Leslie Feinberg, Dorothy Allison, Italo Calvino, Hermann Hesse

TV Shows ??

Movies Koyaanisqatsi, Amelie, Waking Life, Tank Girl, The Matrix, Clockwork Orange, American Beauty, Fight Club, Boys Don't Cry

Member Since ??

Last Login 2003-10-21

Last Updated 2003-10-21

About [Some know me as danah...]

I'm a geek, an activist and an academic, fascinated by people and society. I see life as a very large playground and enjoy exploring its intricacies. I revel in life's chaos, while simultaneously providing my own insane element.

My musings:
<http://www.zephoria.org/thoughts/>

Want to Meet Someone who makes life's complexities seem simply elegant.

Visualizations : Word tree / Alberto Gonzales

Creator: Martin Wattenberg
Tags:

explore

- visualizations
- data sets
- comments
- topic hubs

participate

- create visualization
- upload data set
- create topic hub
- register

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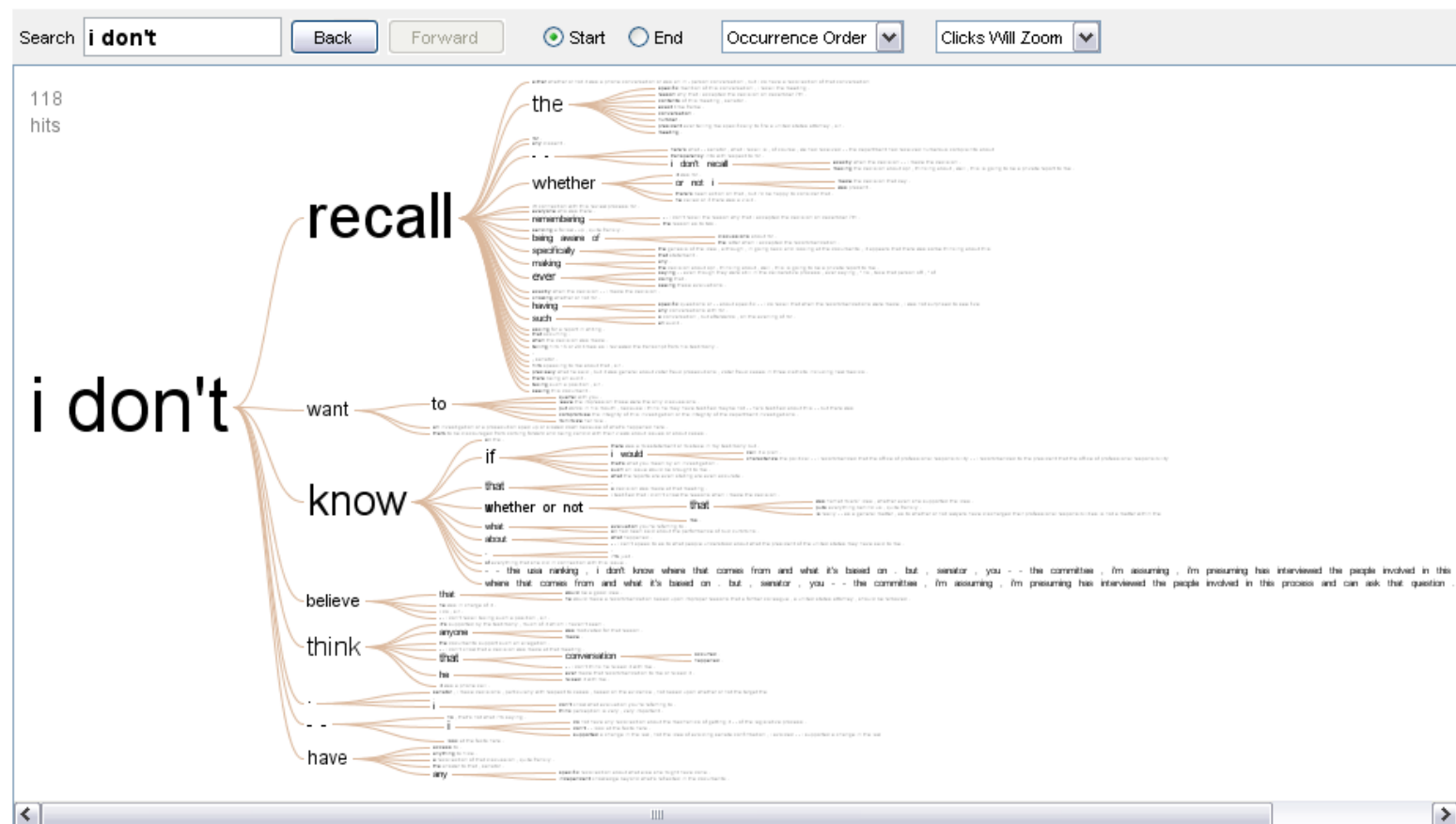
network obama

people politics

population

population
president

president prices religion
the 1990s racial



Data file: Word in testimony from Gonzales, 4/19/2007

Data source: CQ Transcript Wire via the Washington Post

 This data set has not yet been rated

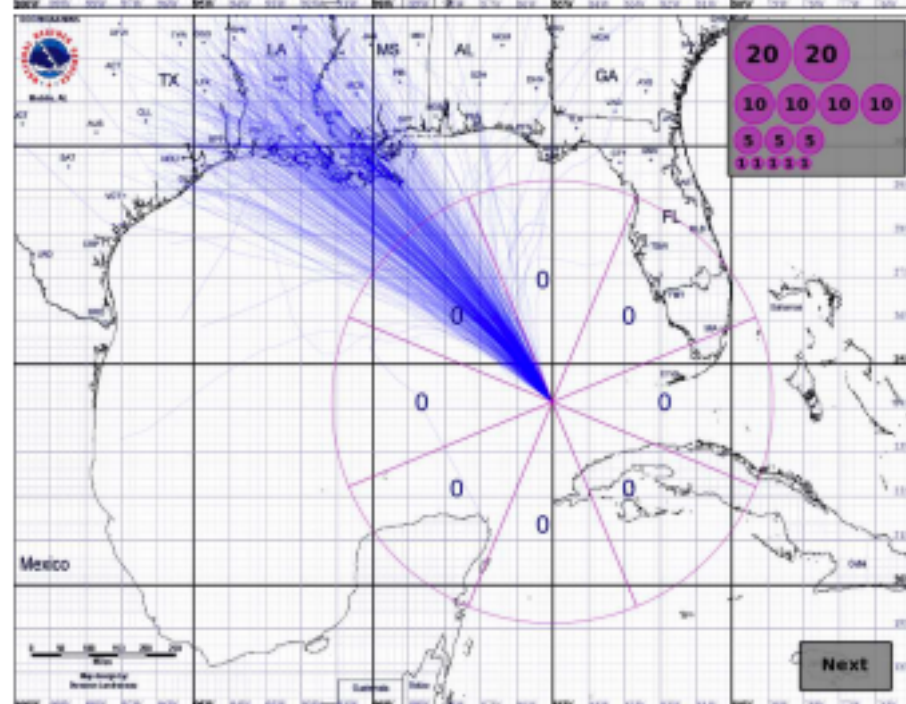
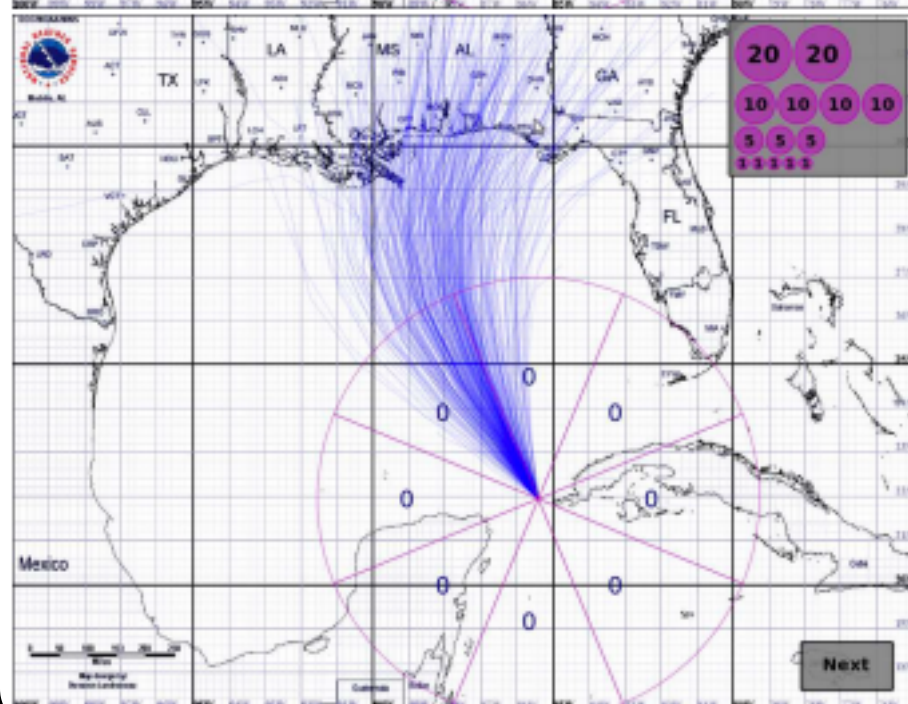
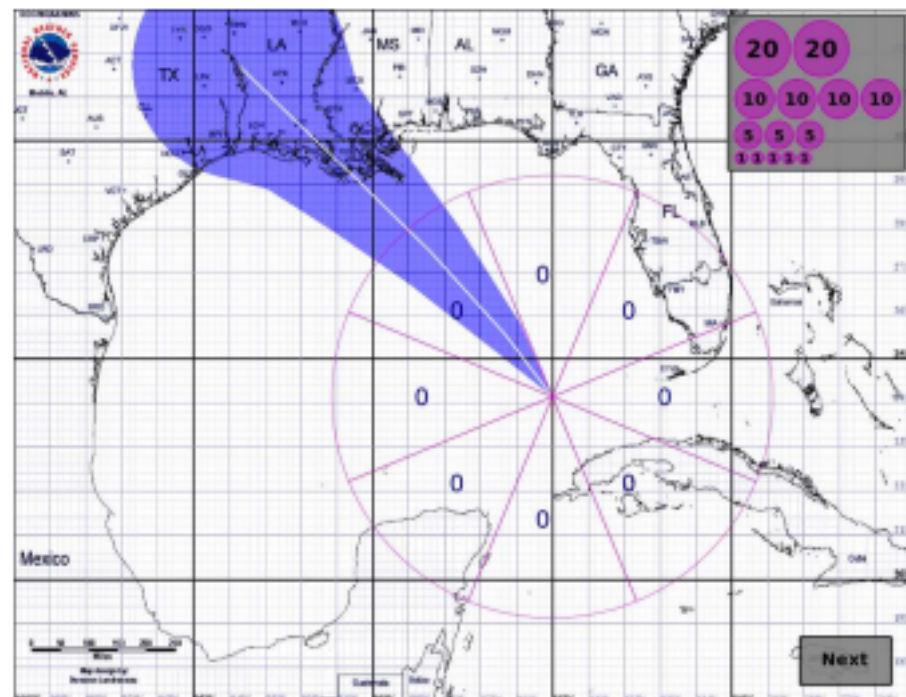
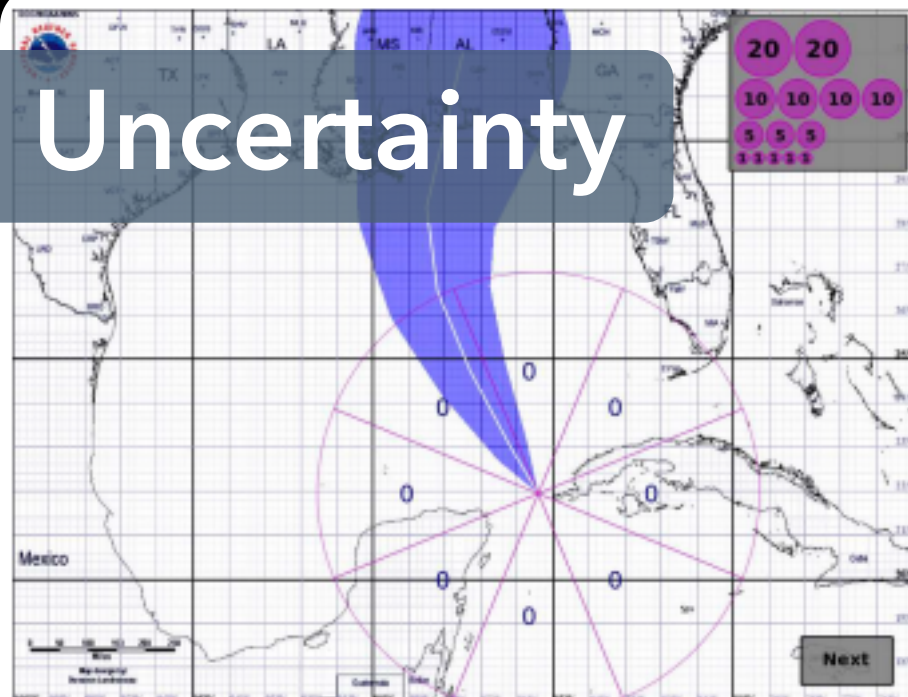


Comments (4)

currently showing

▲ This visualization has 4 positive and 0 negative

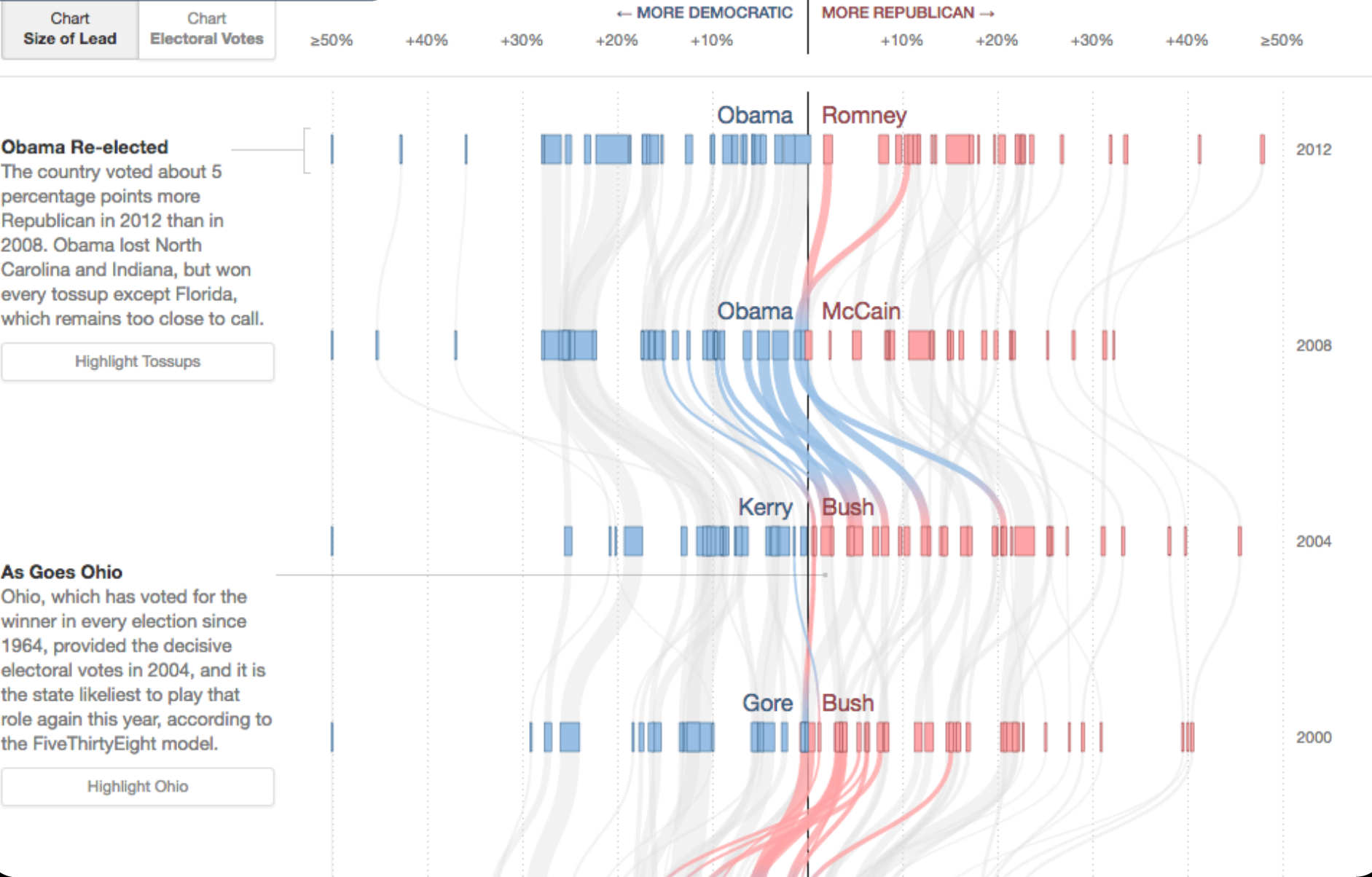
Uncertainty



Narrative

Recent elections have placed a heavy emphasis on “swing states” — Ohio, Florida and the other competitive states. Yet in the past, many more states shifted between the Democratic and Republican parties. A look at how the states stuck or shifted between elections and how they have shifted over past elections.

- Each box represents a state sized by number of electoral votes.
- Each curve shows how much it shifted left or right between elections



Course Mechanics

You should expect to:

- 1 *Evaluate and critique* visualization designs
- 2 *Learn* visualization techniques & theory
- 3 *Implement* interactive data visualizations
- 4 *Develop* a substantial visualization project

Instructors

cse512@cs

Instructor

Jeffrey Heer

Assoc Prof, CSE

OH: *Tu 10:15-11:15a, 642 CSE*

<http://jheer.org>

Assistants

Leilani Battle

OH: *Fri 3:30-4:30p, CSE 2nd Floor*

Shobhit Hathi

OH: *Mon 1-2p, CSE 5th Floor*

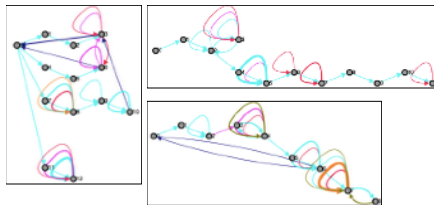
Halden Lin

OH: *Mon 1-2p, CSE 5th Floor*

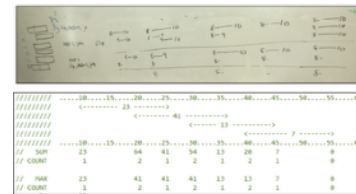
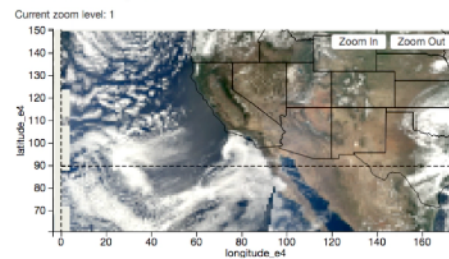
Leilani Battle

Office Hours 3:30-4:30pm Fridays
CSE 2nd Floor Breakout
(Out of town 4/20)

I'm a postdoc working on making big data analysis systems fast and easy to use. I often build user behavior models for visualization prediction and recommendation.



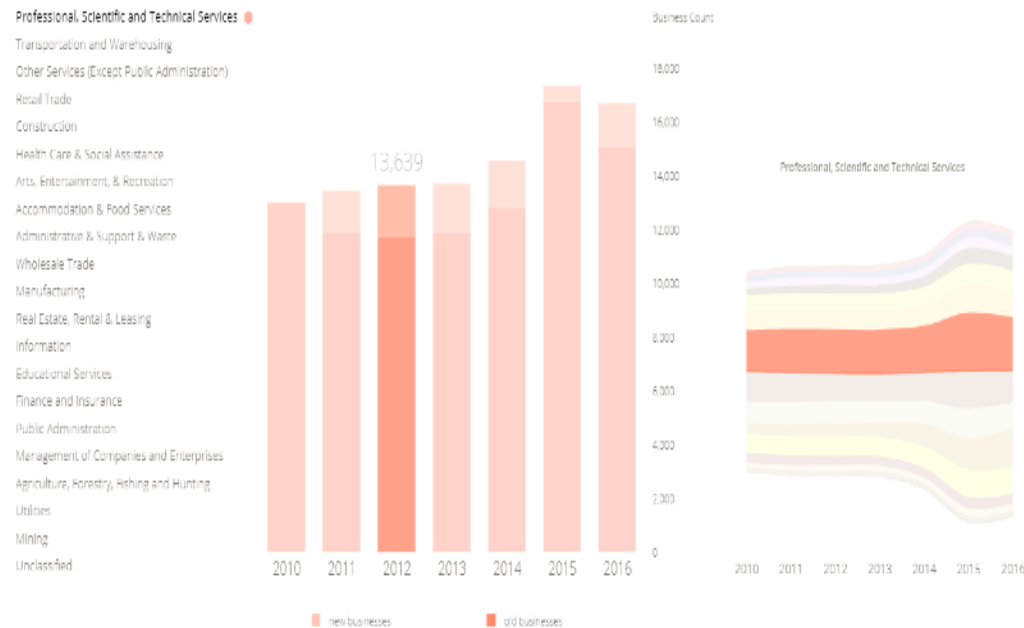
Latitude-Longitude view



Shobhit Hathi

Hi! I'm a combined BS/MS student in my first quarter as a graduate student. I took data visualization last Spring, and I'm really excited to be a part of 512 this quarter!

My office hours will be 1-2 Mondays in the 5th floor breakout.



Halden Lin

OH: Monday 1-2pm, CSE 5th Floor

Hello!

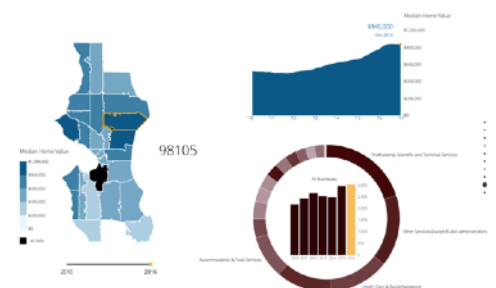
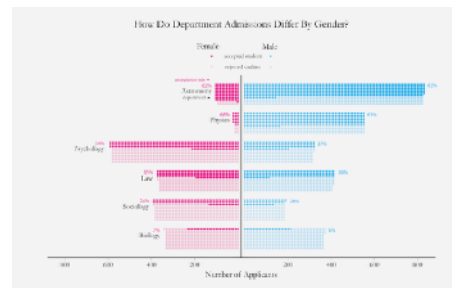
I'm a combined B.S./M.S.

Computer Science student with research interests in automated visualization design, currently working with Kanit 'Ham' Wongsuphasawat and Dominik Moritz in Jeff's lab (IDL).

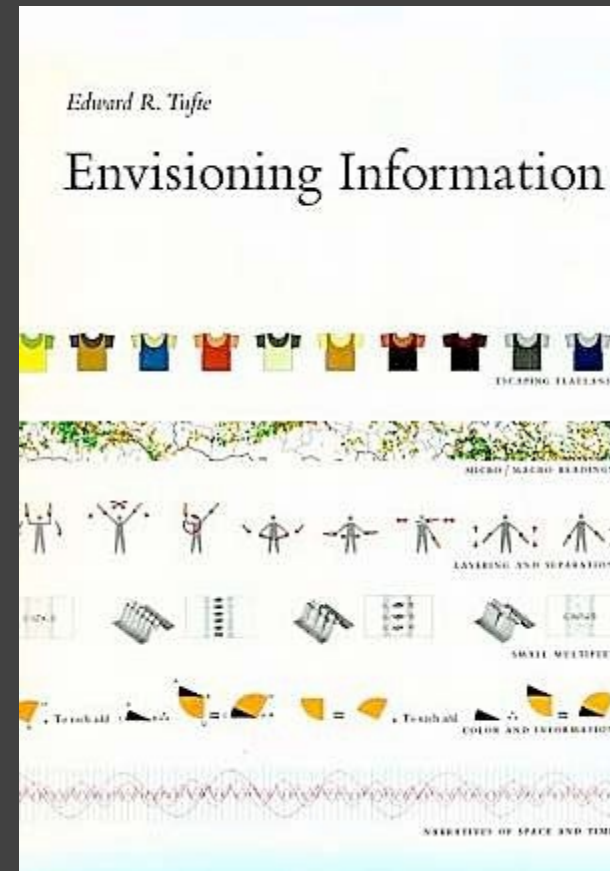
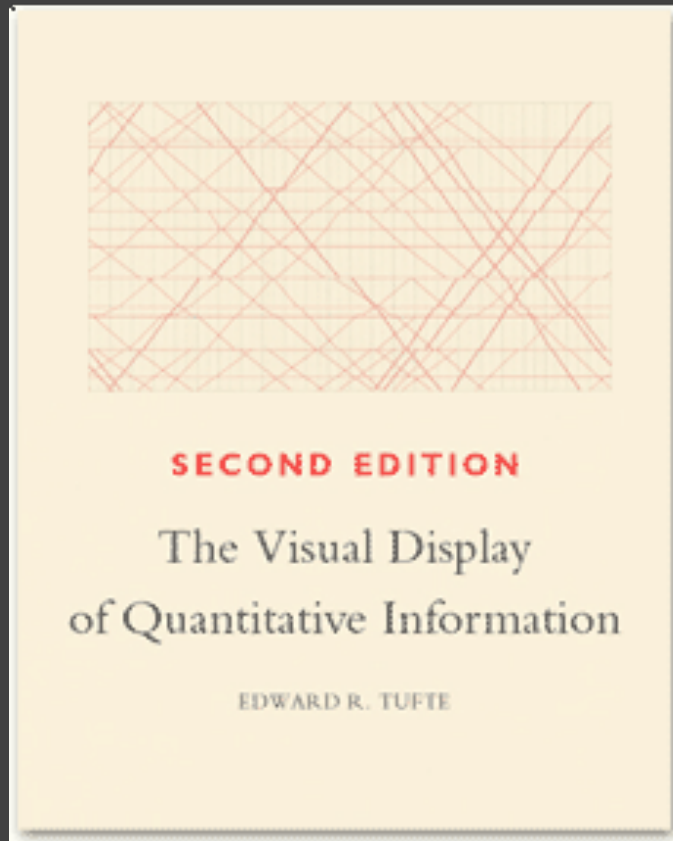
Wongsuphasawat and Dominik Moritz in Jeff's lab (IDL).

I'm also a huge fan of visual and user experience design.

Always happy to chat.



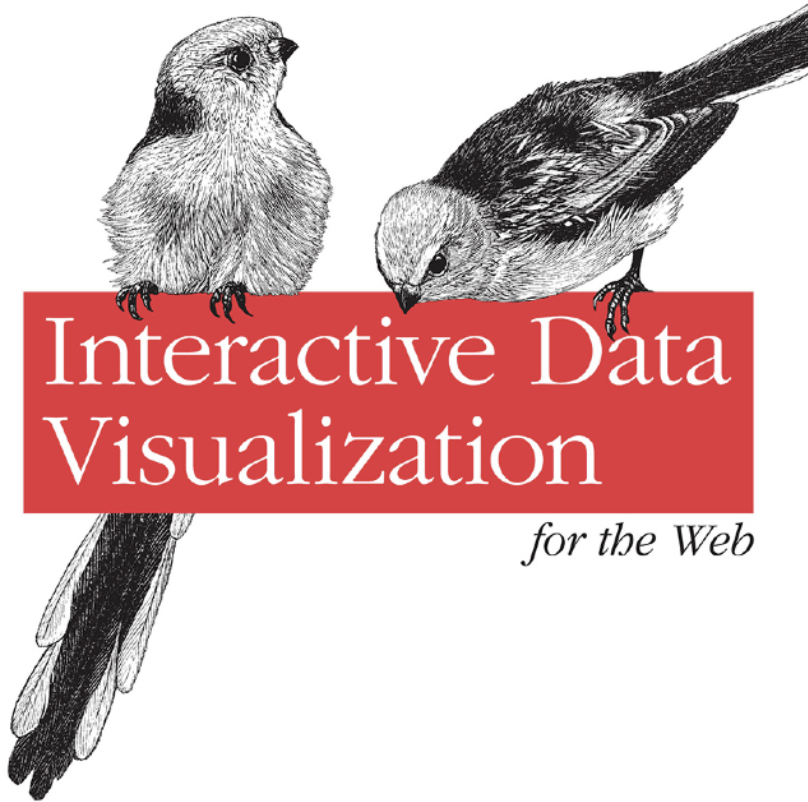
Textbooks



See also: www.edwardtufte.com

Optional Textbook

An Introduction to Designing With D3



O'REILLY®

Scott Murray

Interactive Data Visualization for the Web, 2nd Edition

For learning D3!

Book available online.

Code / examples on GitHub.

We will be using **D3 v5**.

<https://d3js.org>

Readings

Some from textbooks, also many articles.

Material in class will loosely follow readings.

Readings should be read by start of class.

Post discussion comments on class Canvas forum.

One comment per week (up through week 8).

Comments must be posted by Friday 11:59pm.

You have 1 "pass" for the quarter.

Assignments

Class Participation (10%)

A1: Visualization Design (10%) - *Due 4/2*

A2: Exploratory Data Analysis (15%) - *Due 4/13*

A3: Interactive Prototype (25%) - *Due 4/30*

Peer Evaluation - *Due 5/7*

FP: Final Project (40%)

Proposal - *Due 5/10*

Initial Prototype - *Due 5/21*

Project Deliverables - *Due 5/30 (tentative)*

Final Project

Visualization research project on topic of choice

Initial **prototype** and **peer evaluation**

Design reviews and **final presentation**

Submit and publish on GitHub

Projects from **previous classes** have been:

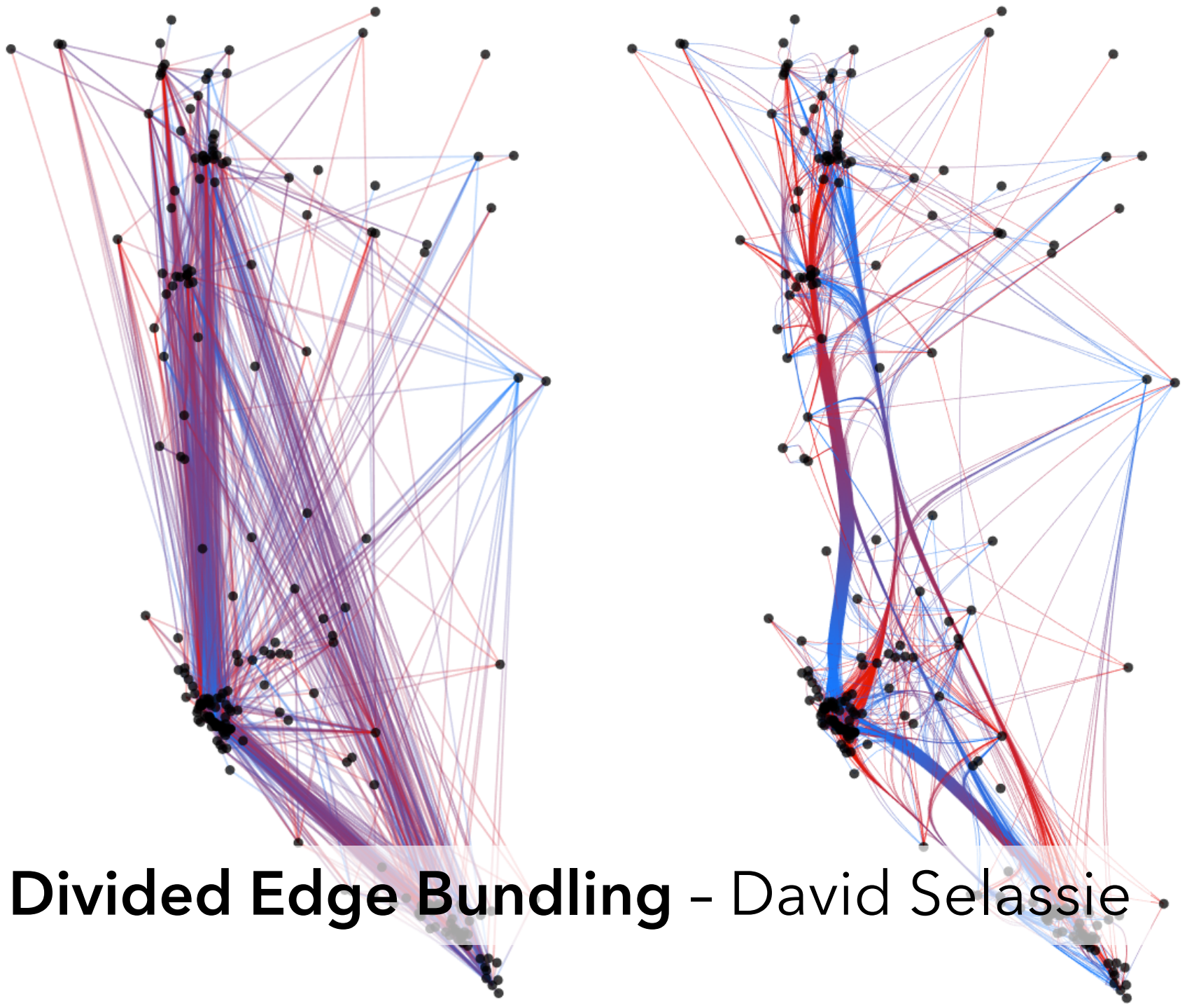
- Published as research papers
- Featured in the New York Times
- Released as successful open source projects



RunMonster

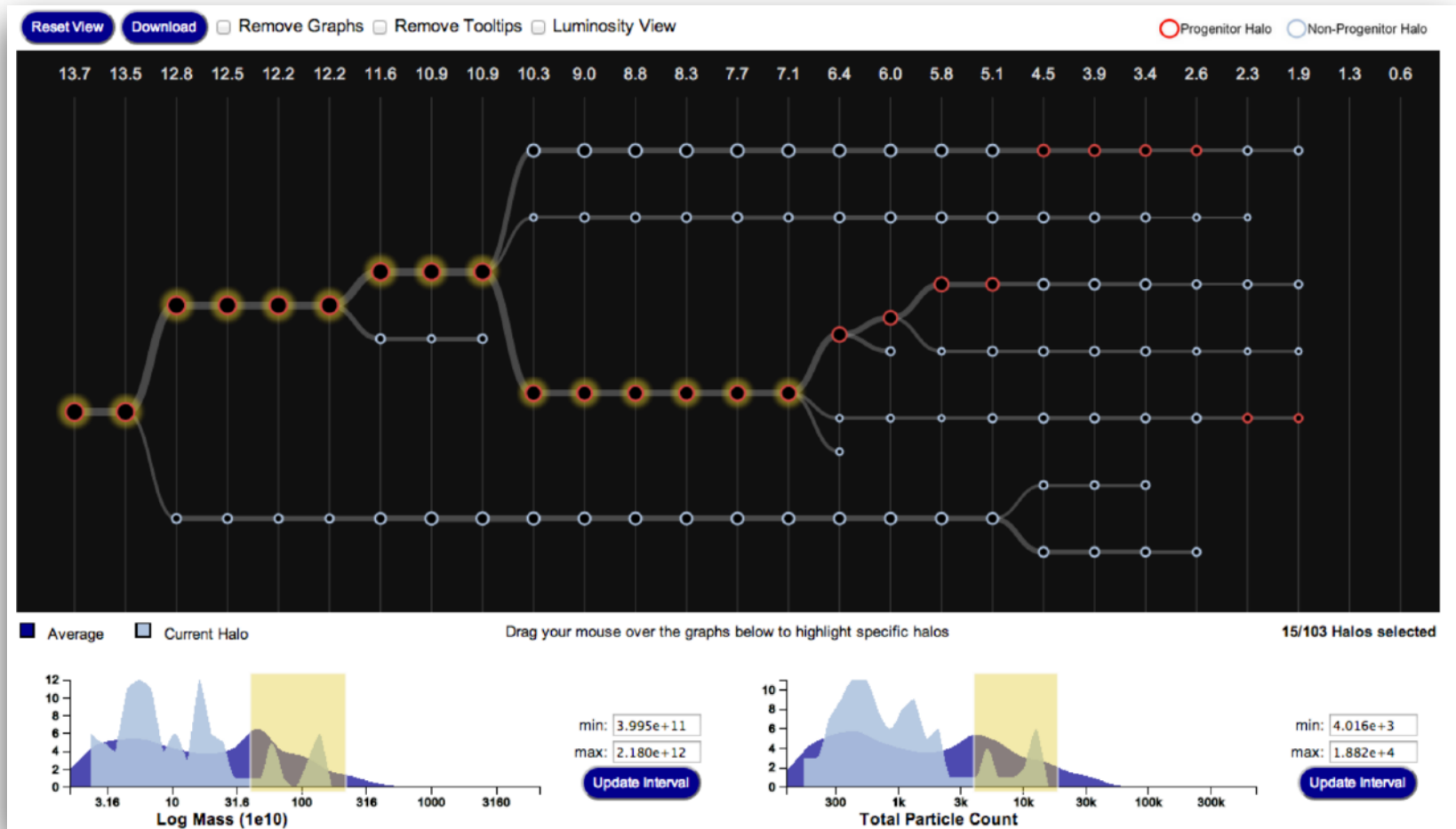
Troy Brant & Steve Marmon





Divided Edge Bundling – David Selassie

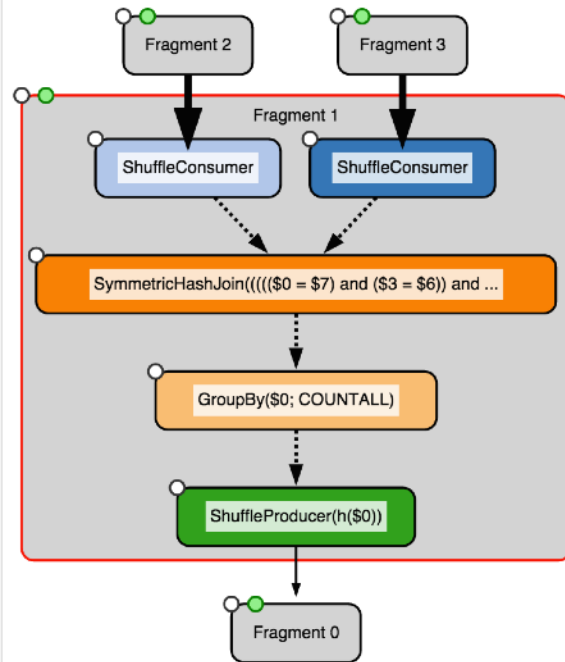
Visualizing Galaxy Merger Trees



S. Loebman, **J. Ortiz**, **L. Orr**, M. Balazinska, T. Quinn et al. [SIGMOD '14]

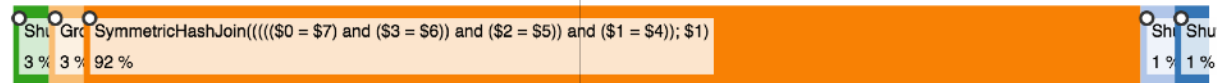
Perfopticon Distributed Query Performance

Physical Query Plan:

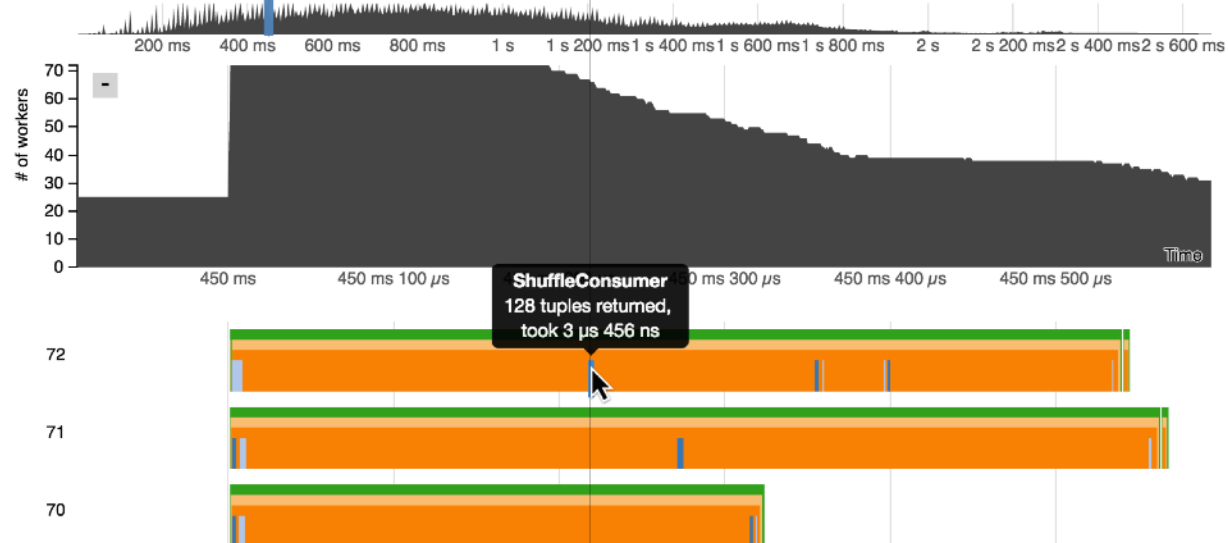


Overview / Operators inside fragment 1

Query time contribution collapse/expand

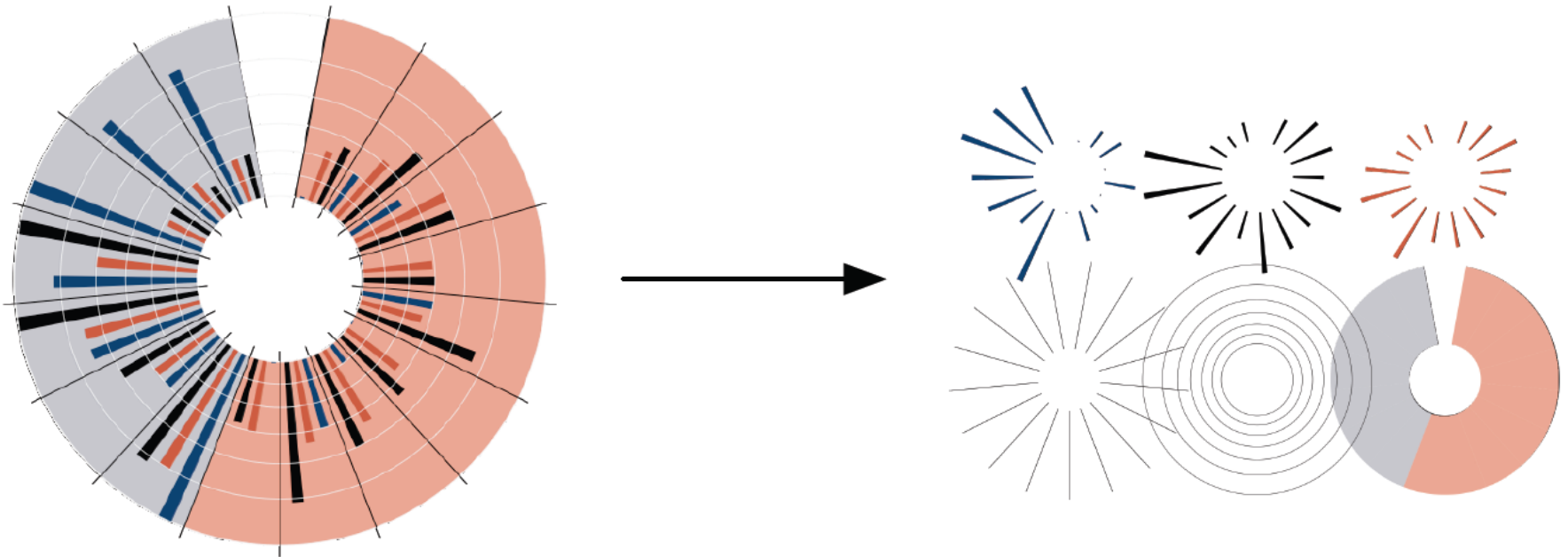


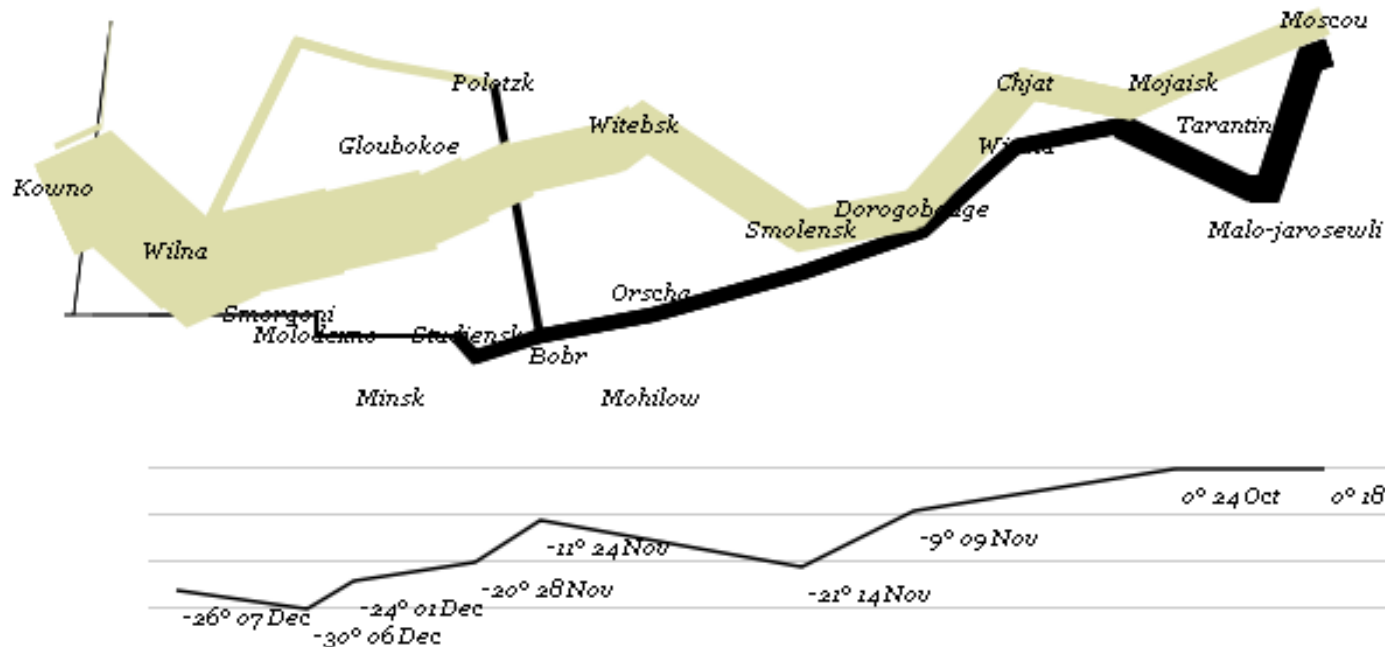
Detailed execution



Protovis: A Graphical Toolkit for Visualization

Mike Bostock





```
var army = pd.nest(napoleon.army, "dir", "group");
var vis = new pv.Panel();

var lines = vis.add(pv.Panel).data(army);
lines.add(pv.Line)
  .data(function() army[this.idx])
  .left(lon).top(lat).size(function(d) d.size/8000)
  .strokeStyle(function() color[army[panelIndex][0].dir]);
```

```
vis.add(pv.Label).data(napoleon.cities)
  .left(lon).top(lat)
  .text(function(d) d.city).font("italic 10px Georgia")
  .textAlign("center").textBaseline("middle");
```

```
vis.add(pv.Rule).data([0,-10,-20,-30])
  .top(function(d) 300 - 2*d - 0.5).left(200).right(150)
  .lineWidth(1).strokeStyle("#ccc")
  .anchor("right").add(pv.Label)
  .font("italic 10px Georgia")
  .text(function(d) d+"°").textBaseline("center");
```

```
vis.add(pv.Line).data(napoleon.temp)
  .left(lon).top(tmp) .strokeStyle("#0")
  .add(pv.Label)
  .top(function(d) 5 + tmp(d))
  .text(function(d) d.temp+"° "+d.date.substr(0,6))
```


Visualizing the Republic of Letters

Daniel Chang, Yuankai Ge, Shiwei Song

Republic of Letters

1700



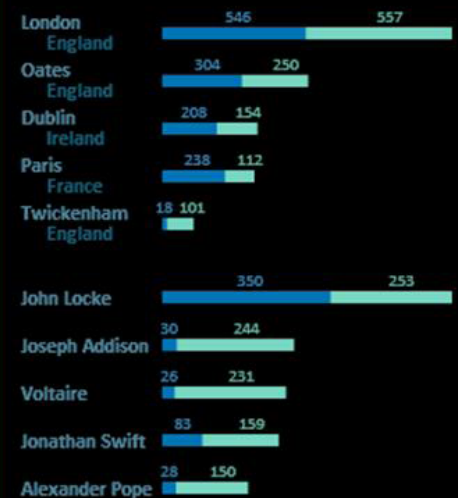
FILTER BY AUTHOR

Clear All

Damien Desormes
Daniel Cornabs
Daniel de Pury
Daniel Defoe
Daniel Malthus
Daniel Marc Antoine Chardon
Daniel Muller

TOP CITIES AND AUTHORS

Letters received Letters sent



Questions?

A1: Visualization Design

Design a static visualization for a data set.

Every 10 years, the census documents the demographic make-up of the U.S., influencing congressional districting and social services. This dataset contains a summary of census data for two years a century apart: 1900 and 2000.

You must choose the message you want to convey. What question(s) do you want to answer? What insight do you want to communicate?

A1: Visualization Design

Pick a **guiding question**, use it to title your vis.
Design a **static visualization** for that question.
You are free to **use any tools** (inc. pen & paper).

Deliverables (upload via Canvas; see A1 page)

Image of your visualization (PNG or JPG format)

Short description + design rationale (≤ 4 paragraphs)

Due by **8:00 pm, Monday April 2.**