

Creative Coding

Professor Danne Woo

creativecode.dannewoo.com

ARTS 249

Spring 2020

Thursday 2:00 PM – 5:50 PM

I-Building 213

Static Visual Design

Week 01: Intro to programming, Processing and creative coding

Week 02: Forms, Shapes and Variables

Week 03: Computational Color and Export

Week 04: Repetition, Decisions and Randomization

Week 05: Function, Classes and Typography

Week 06: Data Visualization

Week 07: Midterm Presentation

Data Visualization

12s0407.xls

Table with row headers in column A and column headers in rows 4 and 5. Leading dots indicate

Z Table 407. Vote Cast for U.S. Senators, 2010, Incumbent Senators, 2011 -- States
3 [1,353 represents 1,353,000. D = Democrat, R = Republican, I = Independent. ANSI = American National Standards Institute]

State	2-DIGIT ANSI	2010			Incumbent senators and year term expires \1		
		Votes cast, total \2	Democratic	Republican	Percent for leading party	Name, party and year	Name, party and year
Alabama	01	1,485,499	515,619	968,181	R-65.2	Jeff Sessions (R) 2015	Richard C. Shelby (R) 2017
Alaska	02	255,503	60,045	90,839	R-35.6	Lisa Murkowski (R) 2017	Mark Begich (D) 2015
Arizona	04	1,708,484	592,011	1,005,615	R-58.9	Jon Kyl (R) 2013	John McCain (R) 2017
Arkansas	05	779,957	280,156	451,618	R-57.9	John Boozman (R) 2017	Mark L. Pryor (D) 2015
California	06	10,000,163	5,218,441	4,217,366	D-52.2	Barbara Boxer (D) 2017	Dianne Feinstein (D) 2013
Colorado	08	1,772,282	851,590	822,731	D-48.1	Mark Udall (D) 2015	Michael F. Bennett (D) 2017
Connecticut	09	1,153,115	605,204	498,341	D-52.5	Richard Blumenthal (D) 2017	Joseph I. Lieberman (I) 2013
Delaware	10	307,402	174,012	123,053	D-56.6	Christopher Coons (D) 2015	Thomas R. Carper (D) 2013
Florida	12	5,411,106	1,092,936	2,645,743	R-48.9	Marco Rubio (R) 2017	Bill Nelson (D) 2013
Georgia	13	2,555,256	996,516	1,489,904	R-58.3	Saxby Chambliss (R) 2015	Johnny Isakson (R) 2017
Hawaii	15	370,583	277,228	79,939	D-74.8	Daniel K. Akaka (D) 2013	Daniel K. Inouye (D) 2017
Idaho	16	449,530	112,057	319,953	R-71.2	James E. Risch (R) 2015	Mike Crapo (R) 2017
Illinois	17	3,704,473	1,719,478	1,778,698	R-48.0	Richard J. Durbin (D) 2015	Mark Kirk (R) 2017
Indiana	18	1,744,481	697,775	952,116	R-54.6	Daniel Coats (R) 2017	Richard G. Lugar (R) 2013
Iowa	19	1,116,063	371,686	718,215	R-64.4	Chuck Grassley (R) 2017	Tom Harkin (D) 2015
Kansas	20	337,692	220,971	587,175	R-70.1	Jerry Moran (R) 2017	Pat Roberts (R) 2015
Kentucky	21	1,356,096	600,052	755,706	R-55.7	Rand Paul (R) 2017	Mitch McConnell (R) 2015
Louisiana \3	22	1,264,994	476,572	715,415	R-56.6	Mary L. Landrieu (D) 2015	David Vitter (R) 2017
Maine	23	(X)	(X)	(X)	(X)	Susan M. Collins (R) 2015	Olympia J. Snowe (R) 2013
Maryland	24	1,833,858	1,140,531	655,666	D-62.2	Barbara A. Mikulski (D) 2017	Benjamin L. Cardin (D) 2013
Massachusetts	25	(X)	(X)	(X)	(X)	Scott P. Brown \4 (R) 2013	John F. Kerry (D) 2015
Michigan	26	(X)	(X)	(X)	(X)	Carl Levin (D) 2015	Debbie Stabenow (D) 2013
Minnesota	27	(X)	(X)	(X)	(X)	Al Franken (D) 2015	Amy Klobuchar (D) 2013
Mississippi	28	(X)	(X)	(X)	(X)	Thad Cochran (R) 2015	Roger F. Wicker (R) 2013
Missouri	29	1,943,899	789,736	1,054,160	R-54.2	Roy Blunt (R) 2017	Claire McCaskill (D) 2013
Montana	30	(X)	(X)	(X)	(X)	Max Baucus (D) 2015	John Tester (D) 2013
Nebraska	31	(X)	(X)	(X)	(X)	Mike Johanns (R) 2015	Ben Nelson (D) 2013
Nevada	32	721,404	362,785	321,361	D-50.3	Dean Heller \5 (R) 2013	Harry Reid (D) 2017
New Hampshire	33	454,710	167,545	273,218	R-60.1	Kelly Ayotte (R) 2017	Jeanne Shaheen (D) 2015
New Jersey	34	(X)	(X)	(X)	(X)	Robert Menendez (D) 2013	Frank R. Lautenberg (D) 2015
New Mexico	35	(X)	(X)	(X)	(X)	Jeff Bingaman (D) 2013	Tom Udall (D) 2015
New York	36	4,763,899	3,047,880	1,239,605	D-64.0	Kirsten E. Gillibrand \6 (D) 2013	Charles E. Schumer (D) 2017
North Carolina	37	2,660,079	1,145,074	1,458,046	R-54.8	Richard Burr (R) 2017	Kay R. Hagan (D) 2015
North Dakota	38	238,534	0	181,689	R-76.2	Kent Conrad (D) 2013	John Hoeven (R) 2017
Ohio	39	3,015,094	1,503,297	2,168,742	R-56.8	Sherrod Brown (D) 2013	Rob Portman (R) 2017
Oklahoma	40	1,017,151	265,814	718,482	R-70.6	Tom Coburn (R) 2017	James M. Inhofe (R) 2015
Oregon	41	1,142,588	825,507	566,199	D-57.2	Jeff Merkley (D) 2015	Ron Wyden (D) 2017
Pennsylvania	42	3,977,661	1,948,716	2,028,945	R-51.0	Robert P. Casey Jr. (D) 2013	Patrick J. Toomey (R) 2017
Rhode Island	43	(X)	(X)	(X)	(X)	Sheldon Whitehouse (D) 2013	Jack Reed (D) 2015
South Carolina	44	1,318,794	364,598	810,771	R-61.5	Jim DeMint (R) 2017	Lindsey Graham (R) 2015
South Dakota	45	227,947	0	227,947	R-100.0	Tim Johnson (D) 2015	John Thune (R) 2017

Data Visualization

AN ACCOUNTING OF THE YEAR IN

Photos

ANALOG & DIGITAL

Flickr Views:

14,702

WWW.FLICKR.COM/PHOTOS/FELTRON

Percent of Photos Posted to Flickr:

3%

201 PHOTOS

DIGITAL PHOTOS: ANALOG PHOTOS:

6,115 648

PHOTOS BY LOCATION:

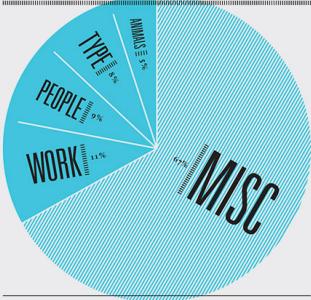


LAST PHOTO:

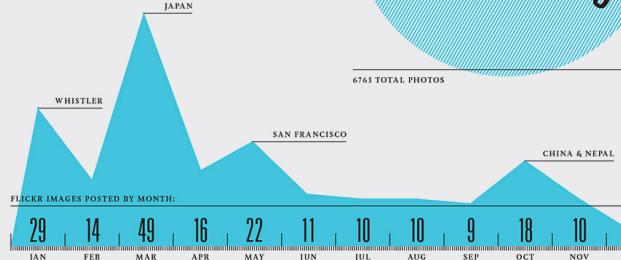
RYAN, BONNIE & SARA

PATRIOT SALOON, 11:18 PM, DECEMBER 31ST

PHOTOS BY SUBJECT:



6761 TOTAL PHOTOS



FLICKR IMAGES POSTED BY MONTH:

AN ACCOUNTING OF THE YEAR IN

Reading

BOOKS & MAGAZINES

BOOK PAGES READ:

4,736

26% INCREASE OVER 2006

MAGAZINE PAGES READ:

1,758

12 MAGAZINES

LBS OF MAGAZINES RECEIVED:

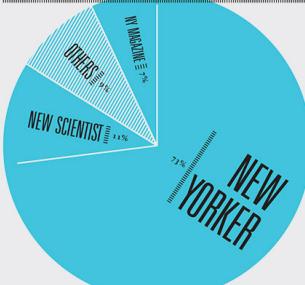
77

FROM 6 SUBSCRIPTIONS

FIVE

NGIZI ADICHIE, DON DELILLO,
JONATHAN LETHMEN,
PRIMO LEVI (2)

MAGAZINES READ:



91 TOTAL MAGAZINES

BOOKS READ BY FIRST PUBLICATION DATE:



BOOKS READ:

20

IGG, BEASTS OF NO NATION, BLACKWATER, BLINK, THE CATCHER IN THE RYE, DEAD FISH MUSEUM, THE DIAMOND AGE, GALAPAGOS, THE HEART OF THE WORLD, INFINITE JEST, THE LOOMING TOWER, THE MEZZANINE, THE MYSTERY GUEST, OFF THE BOOKS, PROUST WAS A NEUROSCIENTIST, SOON I WILL BE INVINCIBLE, A SPOT OF BOther, THE TIPPING POINT, UNIVERSAL PRINCIPLES OF DESIGN, THE WORLD IS FLAT

BEST FICTION:

A SPOT OF BOther

MARK HADDON, 2006

BEST NON-FICTION:

THE HEART OF THE WORLD

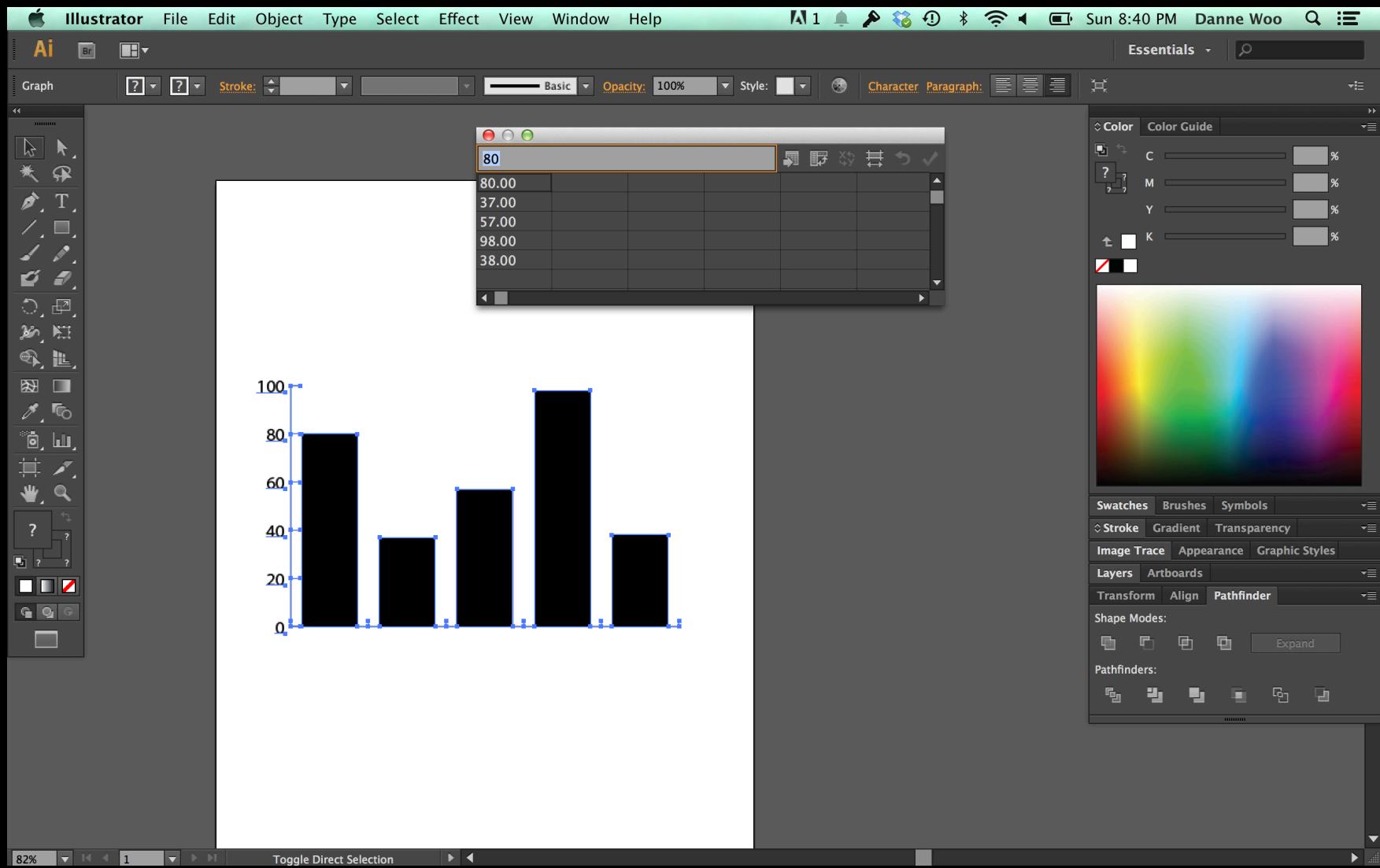
IAN BAKER, 2004

BEST ART BOOK:

SEVEN HUNDRED PENGUINS

PENGUIN, 2007

Illustrator



Problem



Problem

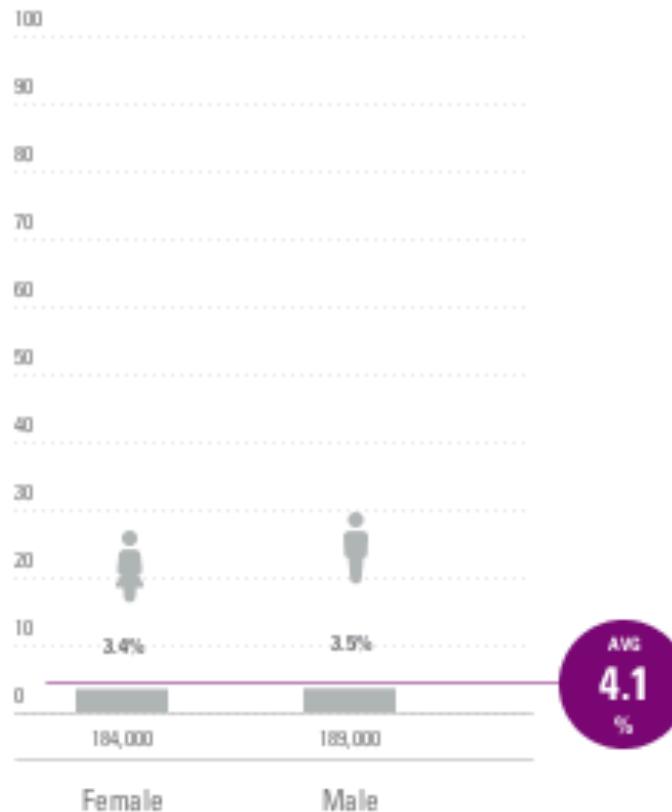
3.4c

National Event Dropout Rates of Public High School Students in Grades 9 -12 by

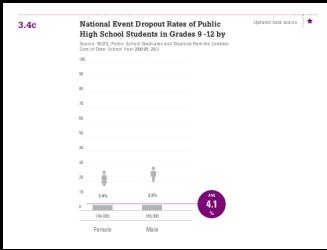
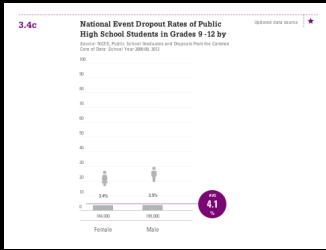
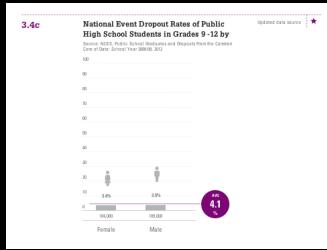
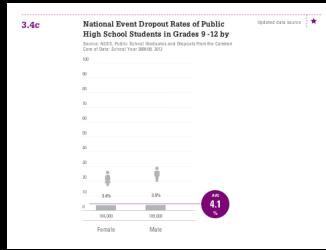
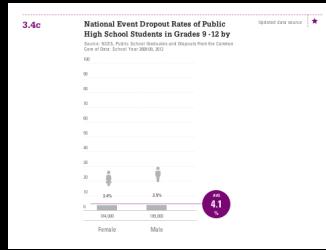
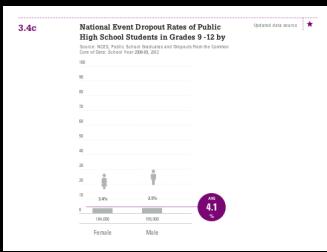
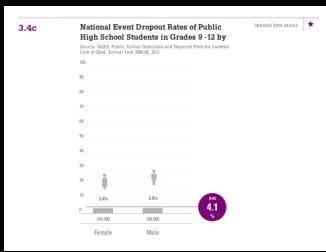
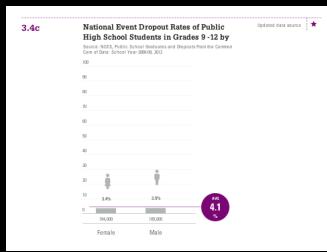
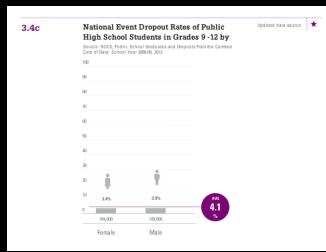
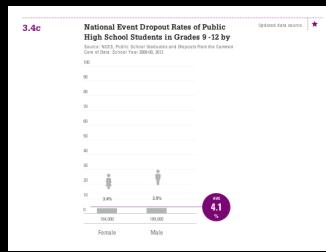
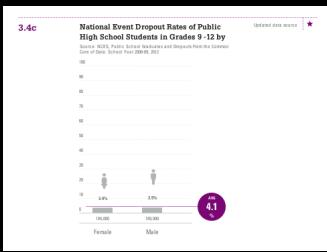
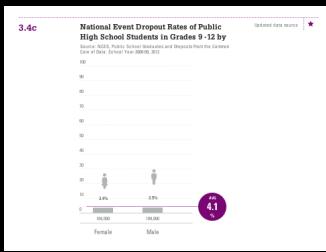
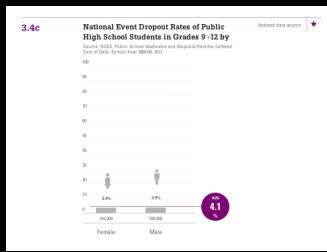
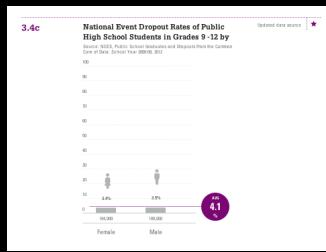
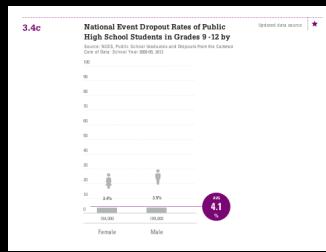
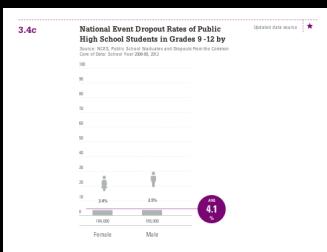
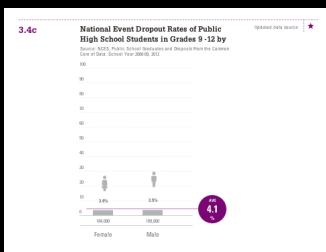
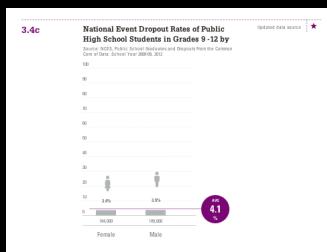
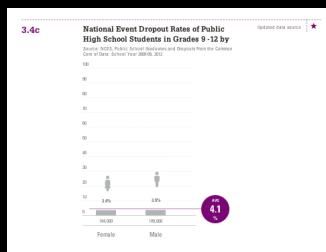
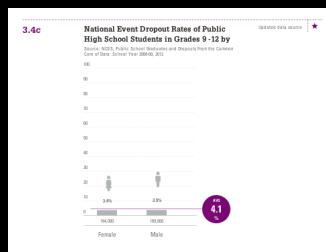
Updated data source



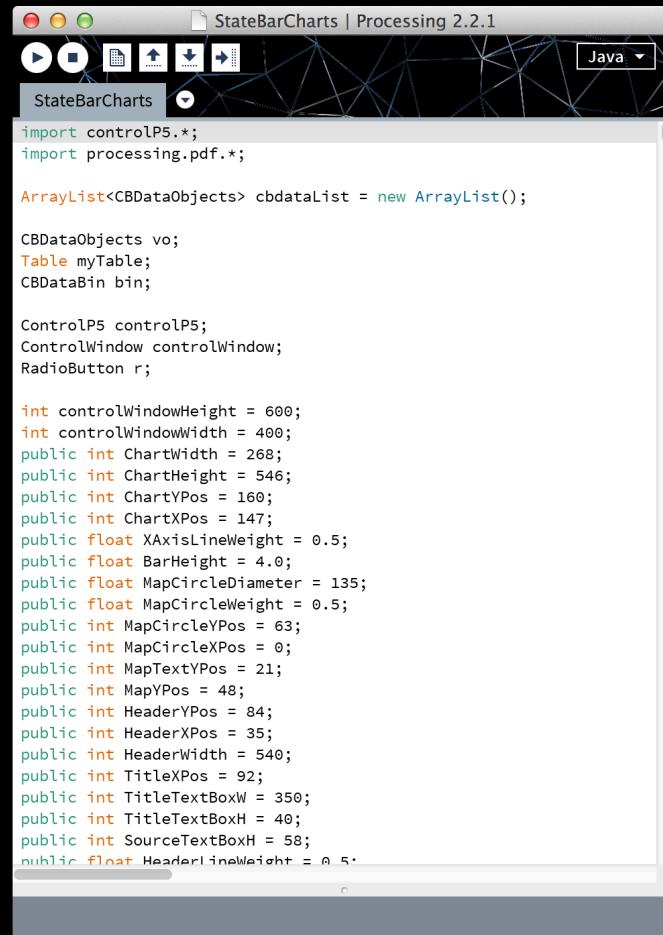
Source: NCES, Public School Graduates and Dropouts From the Common Core of Data: School Year 2008-09, 2012



Problem



Solution



The screenshot shows the Processing 2.2.1 IDE interface with the title bar "StateBarCharts | Processing 2.2.1". The code editor contains Java code for a sketch named "StateBarCharts". The code imports controlP5 and processing.pdf libraries, defines variables for a list of CBDataObjects, a Table, and a CBDataBin, and initializes ControlP5, ControlWindow, and RadioButton objects. It also defines several constants for chart dimensions and positions.

```
import controlP5.*;
import processing.pdf.*;

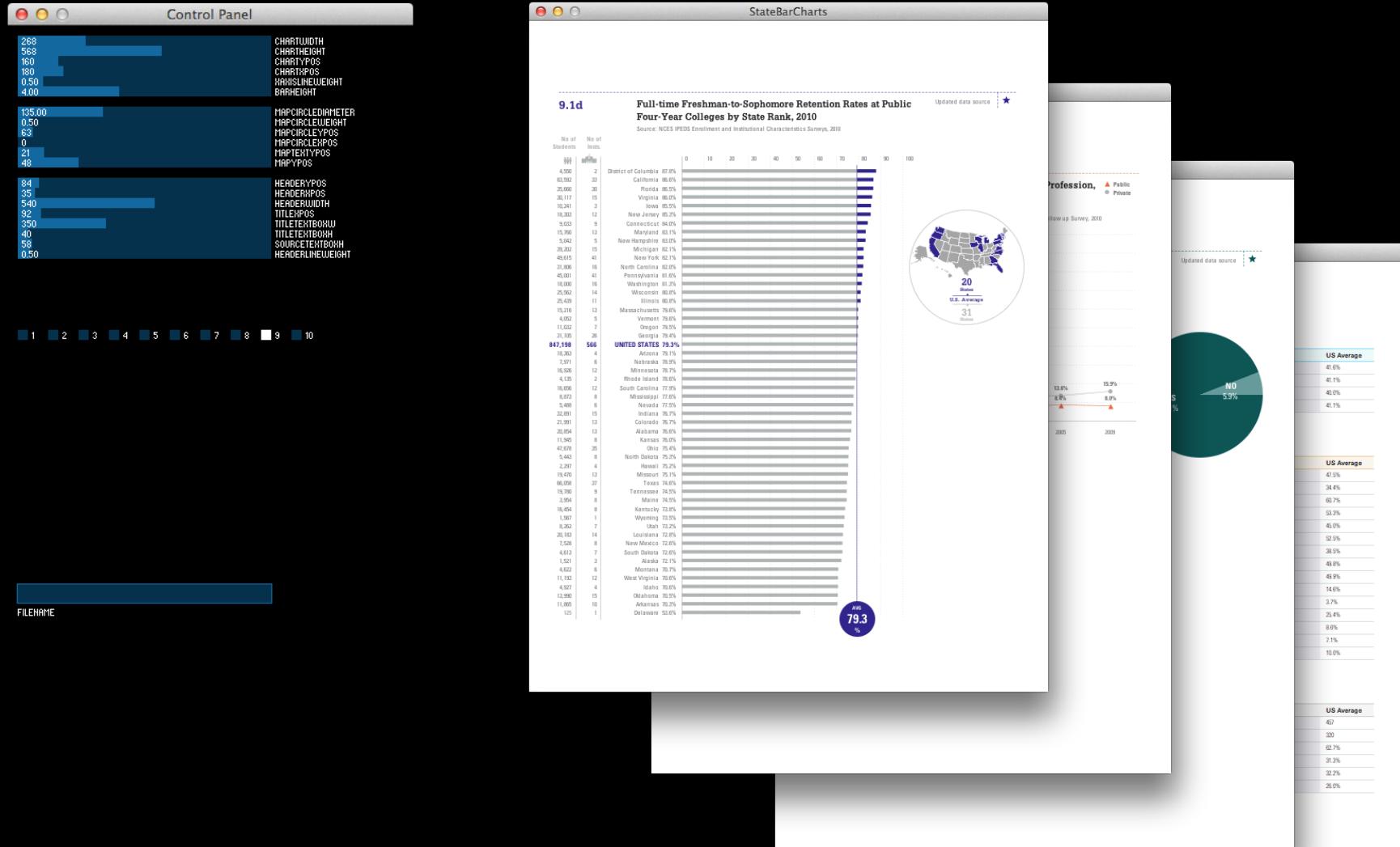
ArrayList<CBDataObjects> cbdataList = new ArrayList();

CBDataObjects vo;
Table myTable;
CBDataBin bin;

ControlP5 controlP5;
ControlWindow controlWindow;
RadioButton r;

int controlWindowHeight = 600;
int controlWindowWidth = 400;
public int ChartWidth = 268;
public int ChartHeight = 546;
public int ChartYPos = 160;
public int ChartXPos = 147;
public float XAxisLineWeight = 0.5;
public float BarHeight = 4.0;
public float MapCircleDiameter = 135;
public float MapCircleWeight = 0.5;
public int MapCircleYPos = 63;
public int MapCircleXPos = 0;
public int MapTextYPos = 21;
public int MapYPos = 48;
public int HeaderYPos = 84;
public int HeaderXPos = 35;
public int HeaderWidth = 540;
public int TitleXPos = 92;
public int TextBoxW = 350;
public int TextBoxH = 40;
public int SourceTextBoxH = 58;
public float HeaderLineWeight = 0.5;
```

Data and Code



Comparison



Time Spent
5 Weeks

Additional Costs
\$30,000

Human Errors
≈20



Time Spent
5 Hours

Additional Costs
\$0

Human Errors
0

Why Use Code



- Custom Software
- Saves Time/Money
- Reduce Human Error
- Easy Updates
- Handles Large Data Sets
- Live Data
- Interactivity
- Animation
- Math Calculations

Data Visualization

Find Data

The screenshot shows the NYC Open Data homepage. At the top, there's a banner with the text "NYC OpenData" and "1100+ Datasets Available". Below the banner, the main title is "New York City Restaurant Inspection Results". A subtext below it says: "Restaurant inspection results are now available in a tabular format on NYC OpenData. Check out the dataset to see how your favorite restaurant was graded." There's a search bar at the bottom with the placeholder "Search" and a "View More Stories" link.

<https://data.cityofnewyork.us/>

The screenshot shows the US Census Bureau website. The header includes links for "Topics", "Geography", "Library", "Data", and "About the Bureau". Below the header, there's a section titled "American Community Survey - State and Local Areas" with a brief description and a small graphic of a town. To the right, there are three main data visualization sections: "Population Clock", "QuickFacts", and "U.S. Census Bureau Economic Indicators". The "Population Clock" shows population counts for the U.S. and world. The "QuickFacts" section provides quick facts about people, business, and geography. The "Economic Indicators" section displays various economic statistics with graphs and tables. At the bottom, there's a "Stat of the Day" and a "Nondeposit Credit Intermediation" section.

<http://www.census.gov/>

The screenshot shows the Baseball-Reference.com website. The main page features a large search bar and navigation links like "play_index", "players", "team", "seasons", "managers", "leaders", "awards", "postseason", "boxes", "japan", "nib", "minors", "draft", "more", and "tips". Below the search bar, there's a "Today's Games" section and a "AU HLD & HLD games today" link. The central part of the page displays a table of "Daily Recap" (Top performers) and "Box Scores & Results". At the bottom, there's a "2014 Postseason Postseason History" section with a table of "Simple Rating System Top 10".

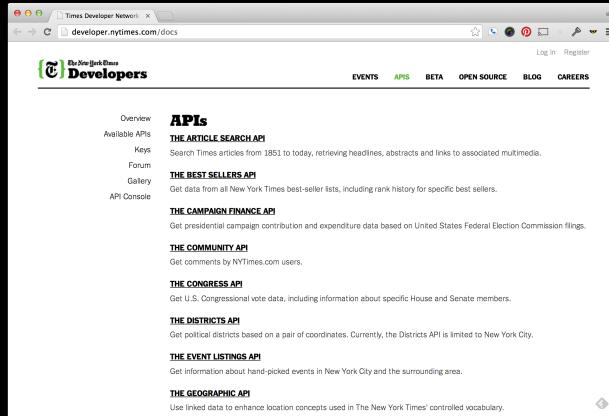
<http://www.baseball-reference.com/>

The screenshot shows the Guardian Data Store website. The header includes links for "Edition: UK | US | AU | Sign in | Beta". Below the header, there's a "Sign into the Guardian using your Facebook account" button. The main content area features a "COMPARED SIDE BY SIDE, I HAVE TO GO WITH GLIDDEN" section with a small image of a can of tuna. To the right, there's a "DATA STORE" section with the tagline "Facts are sacred". Below that, there are sections for "Latest from the Datablog" and "Editor's picks". The "Latest from the Datablog" section has a link to "What Arsenal lack in silverware, they make up for in creditworthiness". The "Editor's picks" section has a link to "Most Europeans can speak multiple languages, UK and Ireland not so much".

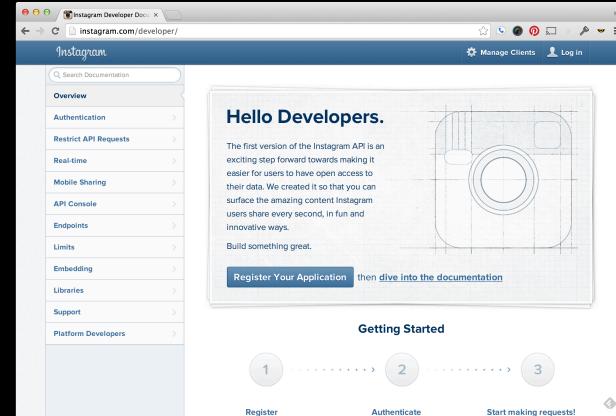
<http://www.theguardian.com/data>

Data Visualization

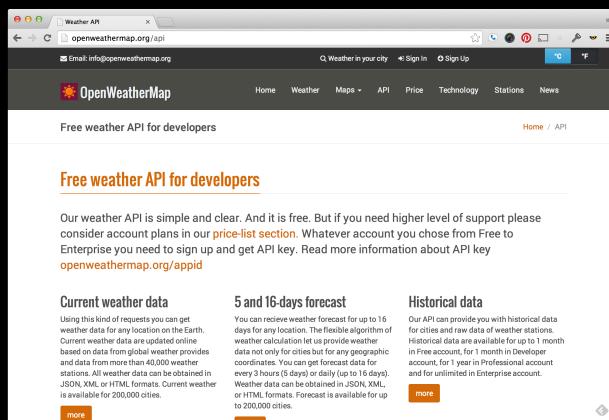
Find Data (APIs)



<http://developer.nytimes.com/>



<http://instagram.com/developer/>



<http://openweathermap.org/api>



<https://dev.twitter.com/>

Data Visualization

Data Collection



Wearables

This is your personal data.

OpenPaths API

Access key: QOPENBjKMKCYURWFKAJUNK
Secret key: SHOW

You can access this dataset programmatically through the OpenPaths API, which uses two-legged OAuth authentication. These are your security credentials – anyone with these tokens will be able to access your data.

You can [reset](#) your secret key at any time. For more information, visit the [API documentation](#).

View my map

Download my data

CSV
JSON
KML

Requests

Connect and Import

<https://openpaths.cc> and App



Feltron Reporter App



Apple iPhone Health Sensors

Data Visualization

Data Formats

Tabular

CSV (Comma Separated Values)

TSV (Tab Separated Values)

Node-Based

JSON (JavaScript Object Notation)

XML (Extensible Markup Language)

Data Visualization

CSVs

1	LABEL	value1	value2	value3	value4	value5
2	1990	80	26	39	12	26
3	1991	25	28	92	73	14
4	1992	95	26	32	25	85
5	1993	13	66	-42	85	36
6	1994	48	12	11	35	74
7	1995	73	35	52	86	25
8	1996	95	64	32	24	69
9	1997	13	23	67	75	64
10	1998	48	41	34	35	25
11	1999	73	51	26	14	58
12	2000	73	23	48	85	52
13	2001	95	34	52	7	13
14	2002	13	65	74	14	63

Data Visualization

CSVs



Microsoft Excel



Google Spreadsheet

Data Visualization

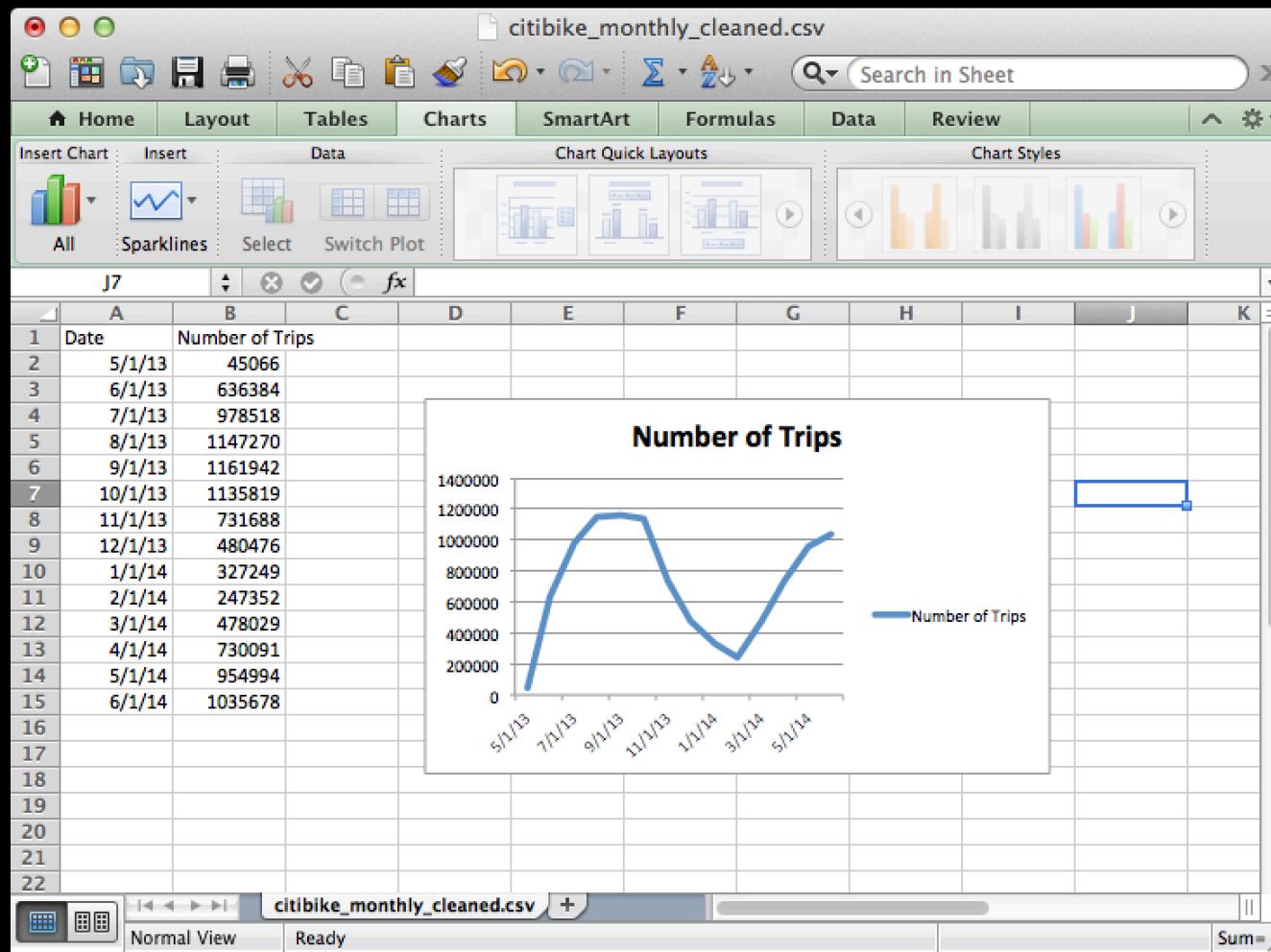
Analysis and Clean Up



tripduration																		
1	tripduration	starttime	stoptime	start station	start station	start station	start station	end station	end station	end station	end station	bikeid	usertype	birth year	gender			
2	1142	8/1/14 0:00	8/1/14 0:19	470	W 20 St & 8	40.7434534	-74.00004	312	Allen St & E 1	40.722055	-73.989111	19117	Subscriber	1969	1			
3	117	8/1/14 0:00	8/1/14 0:02	236	St Marks Pl &	40.7284186	-73.98714	432	E 7 St & Aver	40.7262179	-73.983799	20549	Subscriber	1991	1			
4	546	8/1/14 0:00	8/1/14 0:09	224	Spruce St & I	40.7114636	-74.005524	340	Madison St & 8	40.7126904	-73.987763	15997	Subscriber	1984	1			
5	2126	8/1/14 0:00	8/1/14 0:35	150	E 2 St & Aver	40.7208736	-73.980858	522	E 51 St & Lex	40.7571476	-73.972078	21437	Subscriber	1988	1			
6	329	8/1/14 0:00	8/1/14 0:05	519	E 42 St & Var	40.752416	-73.97837	477	W 41 St & 8	40.7564055	-73.990026	16693	Subscriber	1981	1			
7	308	8/1/14 0:00	8/1/14 0:05	477	W 41 St & 8	40.7564055	-73.990026	478	11 Ave & W	40.760301	-73.998842	19797	Subscriber	1958	1			
8	648	8/1/14 0:00	8/1/14 0:11	2012	E 27 St & 1 A	40.739445	-73.976806	2012	E 27 St & 1 A	40.739445	-73.976806	21209	Customer	1980	0			
9	438	8/1/14 0:00	8/1/14 0:08	228	E 48 St & 3 A	40.7546011	-73.971879	153	E 40 St & 5 A	40.7520623	-73.981632	21501	Subscriber	1980	1			
10	515	8/1/14 0:00	8/1/14 0:09	127	Barrow St & 4	40.7317243	-74.006744	483	E 12 St & 3 A	40.7322327	-73.9889	18836	Subscriber	1986	1			
11	673	8/1/14 0:00	8/1/14 0:11	514	12 Ave & W	40.760875	-74.002777	530	11 Ave & W	40.771522	-73.990541	20333	Subscriber	1985	1			
12	214	8/1/14 0:00	8/1/14 0:04	334	W 20 St & 7	40.7423879	-73.997262	482	W 15 St & 7	40.7393554	-73.999318	19758	Subscriber	1957	1			
13	641	8/1/14 0:00	8/1/14 0:11	345	W 13 St & 6	40.736494	-73.997044	174	E 25 St & 1 A	40.7381765	-73.977387	14679	Subscriber	1974	1			
14	512	8/1/14 0:01	8/1/14 0:09	407	Henry St & P	40.700469	-73.991454	243	Fulton St & R	40.688226	-73.979382	14745	Subscriber	1978	1			
15	662	8/1/14 0:01	8/1/14 0:12	445	E 10 St & Ave	40.7274079	-73.98142	476	E 31 St & 3 A	40.7439431	-73.979661	17858	Subscriber	1983	1			
16	237	8/1/14 0:01	8/1/14 0:05	257	Lispenard St	40.7193923	-74.002472	361	Allen St & He	40.7160587	-73.991908	20699	Subscriber	1991	1			
17	1440	8/1/14 0:01	8/1/14 0:25	515	W 43 St & 1C	40.7600944	-73.994618	355	Bayard St & I	40.7160212	-73.99744	14722	Subscriber	1989	1			
18	243	8/1/14 0:01	8/1/14 0:05	293	Lafayette St	40.7302867	-73.990765	432	E 7 St & Aver	40.7262179	-73.983799	15702	Subscriber	1978	2			
19	416	8/1/14 0:01	8/1/14 0:08	522	E 51 St & Lex	40.7571476	-73.972078	476	E 31 St & 3 A	40.7439431	-73.979661	20150	Subscriber	1972	1			
20	634	8/1/14 0:01	8/1/14 0:12	462	W 22 St & 1C	40.7469196	-74.004519	368	Carmine St &	40.730386	-74.00215	18534	Subscriber	1977	1			
21	414	8/1/14 0:01	8/1/14 0:08	3002	South End Av	40.711512	-74.015756	337	Old Slip & Fri	40.7037992	-74.008387	14703	Subscriber	1981	1			
22	556	8/1/14 0:01	8/1/14 0:10	284	Greenwich A	40.7390169	-74.002638	79	Franklin St &	40.7191155	-74.006667	15378	Subscriber	1964	1			
23	863	8/1/14 0:01	8/1/14 0:16	368	Carmine St &	40.730386	-74.00215	401	Allen St & Riv	40.7201958	-73.989978	15737	Subscriber	1982	1			
24	621	8/1/14 0:01	8/1/14 0:12	160	E 37 St & Lex	40.748238	-73.978311	297	E 15 St & 3 A	40.734232	-73.986923	20601	Subscriber	1980	1			
25	634	8/1/14 0:01	8/1/14 0:12	511	E 14 St & Ave	40.7293869	-73.977724	345	W 13 St & 6	40.736494	-73.997044	15024	Subscriber	1987	1			
26	686	8/1/14 0:02	8/1/14 0:13	276	Duane St & C	40.7174875	-74.010455	346	Bank St & Hu	40.7365289	-74.00618	14787	Subscriber	1967	1			
27	375	8/1/14 0:02	8/1/14 0:08	479	9 Ave & W 4	40.7601925	-73.991255	478	11 Ave & W	40.760301	-73.998842	19994	Subscriber	1971	1			
28	898	8/1/14 0:02	8/1/14 0:17	311	Norfolk St &	40.7172274	-73.988021	460	S 4 St & Wytl	40.7128589	-73.965903	16526	Subscriber	1983	1			
29	935	8/1/14 0:02	8/1/14 0:18	476	E 31 St & 3 A	40.7439431	-73.979661	473	Rivington St	40.7211006	-73.991925	16383	Subscriber	1974	1			
30	644	8/1/14 0:02	8/1/14 0:18	401	All St & 8th	40.7201958	-73.980070	137	Rivington St & B	40.7212343	-74.006744	10623	Subscriber	1974	1			

Data Visualization

Analysis and Clean Up



Data Visualization

Ethics

- 1. Truthful** Be honest
- 2. Functional** Be clear
- 3. Beautiful** Design highlights
- 4. Insightful** Interesting points
- 5. Enlightening** Aha moment

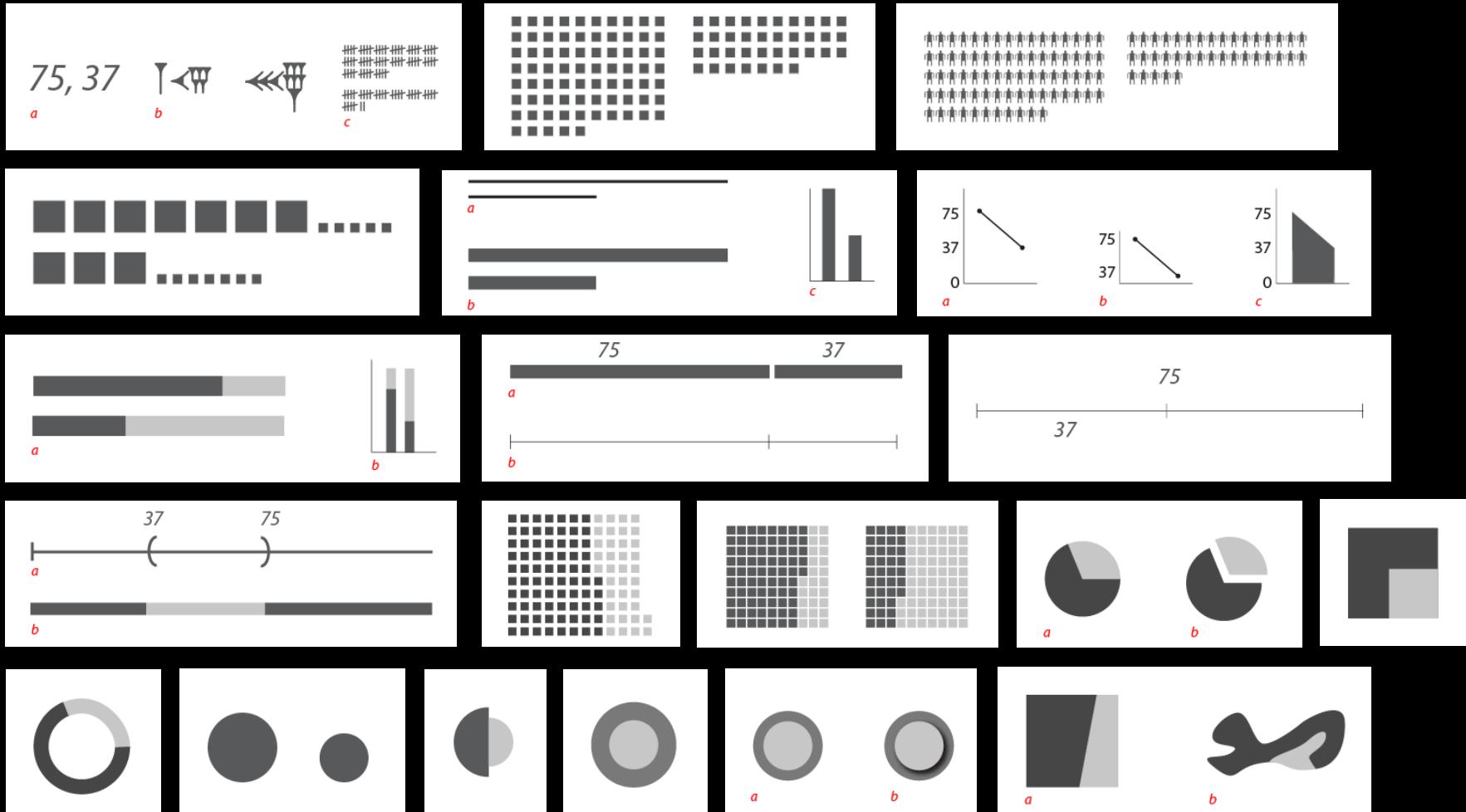
Data Visualization

Visualizing the Data



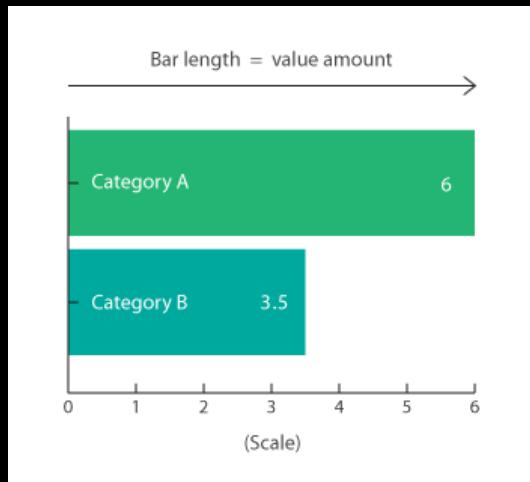
Data Visualization

45 Ways to Visualize 75 and 37



Data Visualization

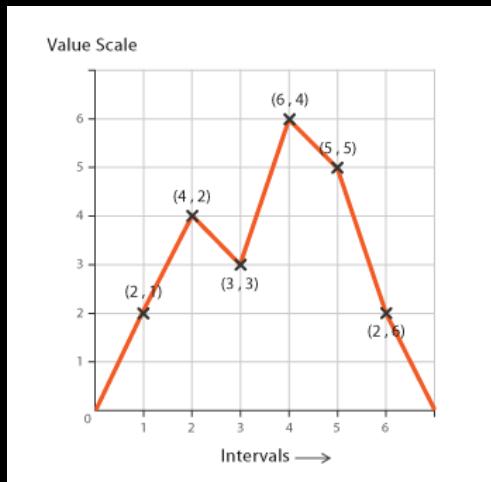
Chart Types



Bar Chart

Categorical Data

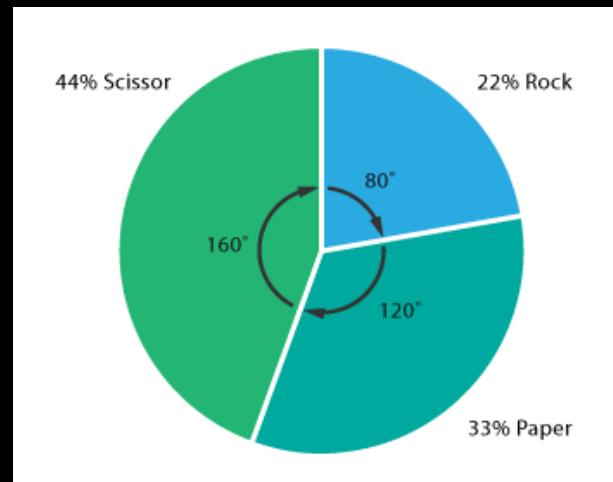
Apples, Oranges and Bananas



Line/Area Chart

Time Based Data

1991, 1992, 1993, 1994



Pie/Donut Chart

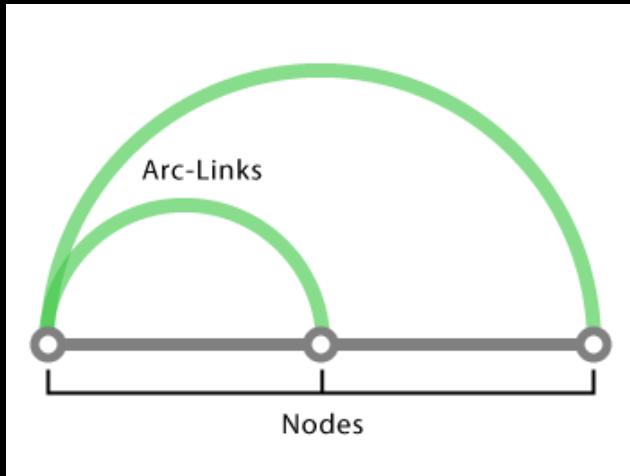
Parts of a Whole

44%, 22%, 33%

Must add up to 100%

Data Visualization

Chart Types



Node-Based Chart

Network Data

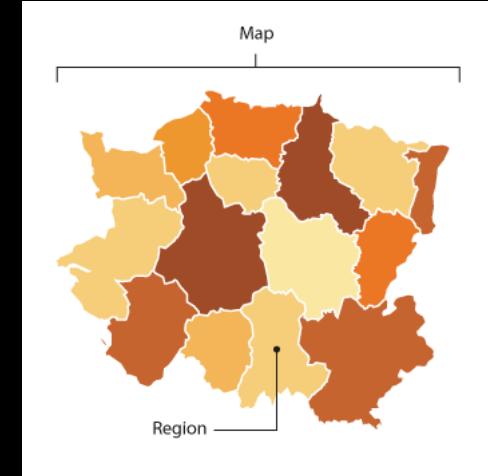
John is connected to Sally, Sarah and Chris



Dot Matrix

Categorical Data

Apples, Oranges and Bananas



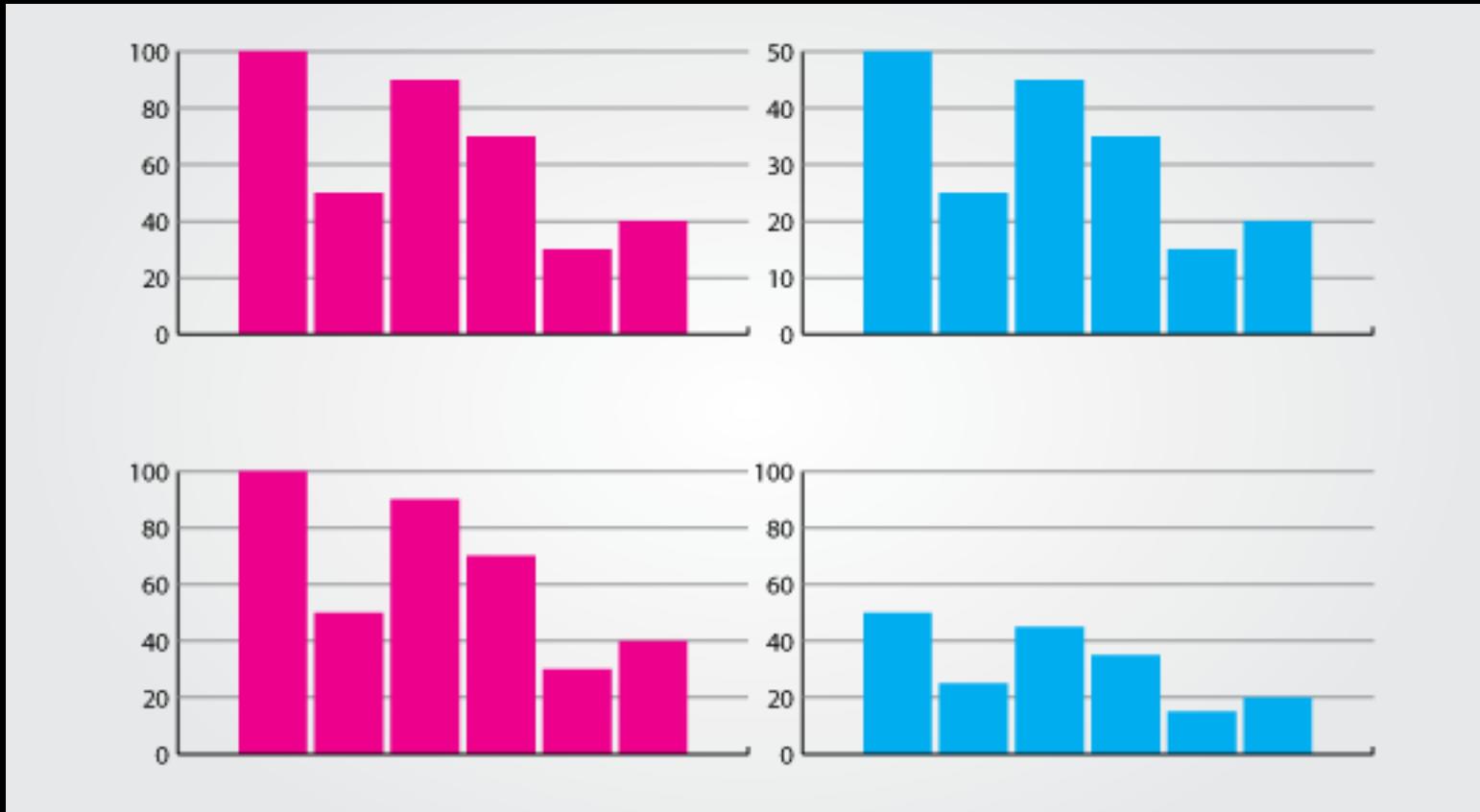
Choropleth Map

Geographical Data

New York, Hawaii, Alaska

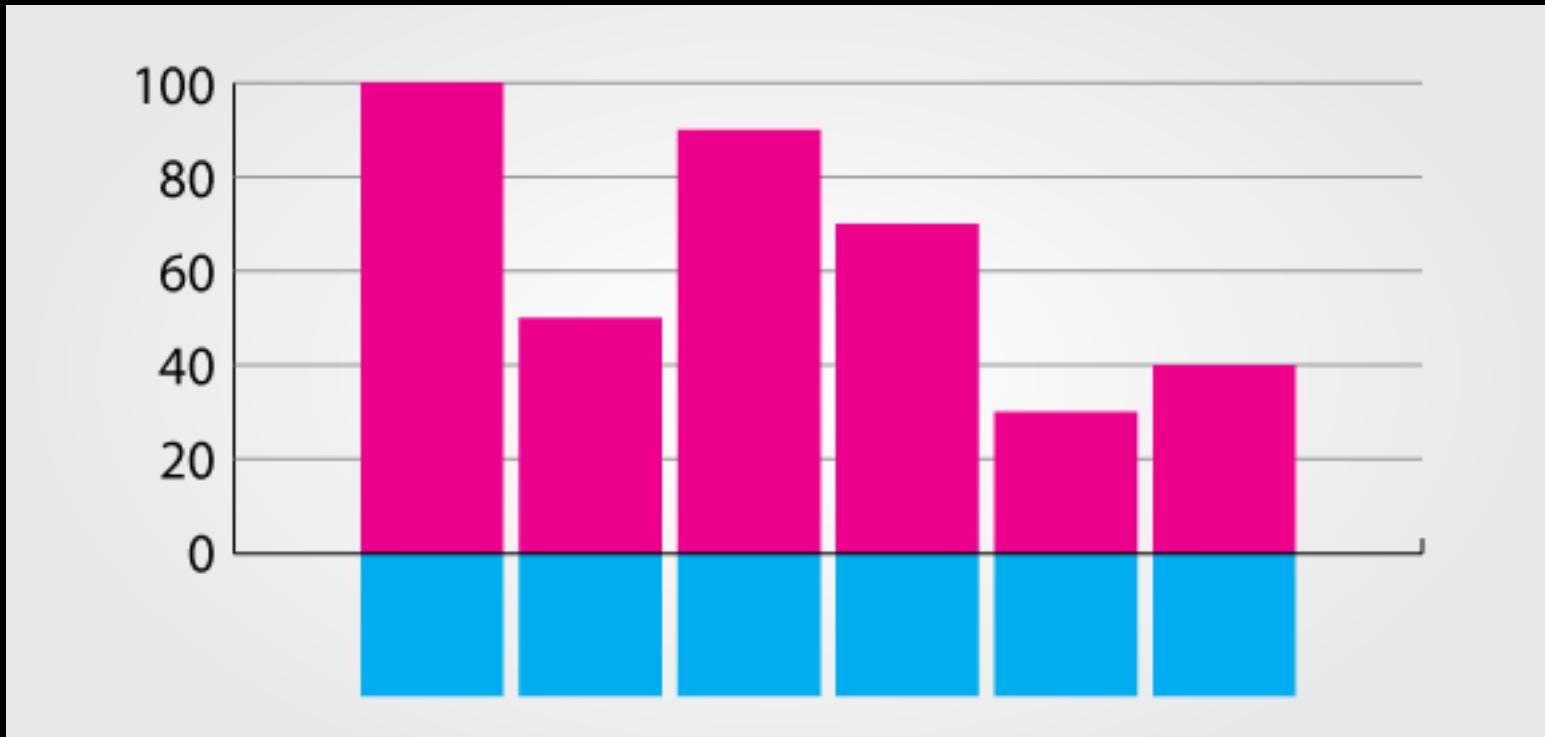
Data Visualization

Bad Habits



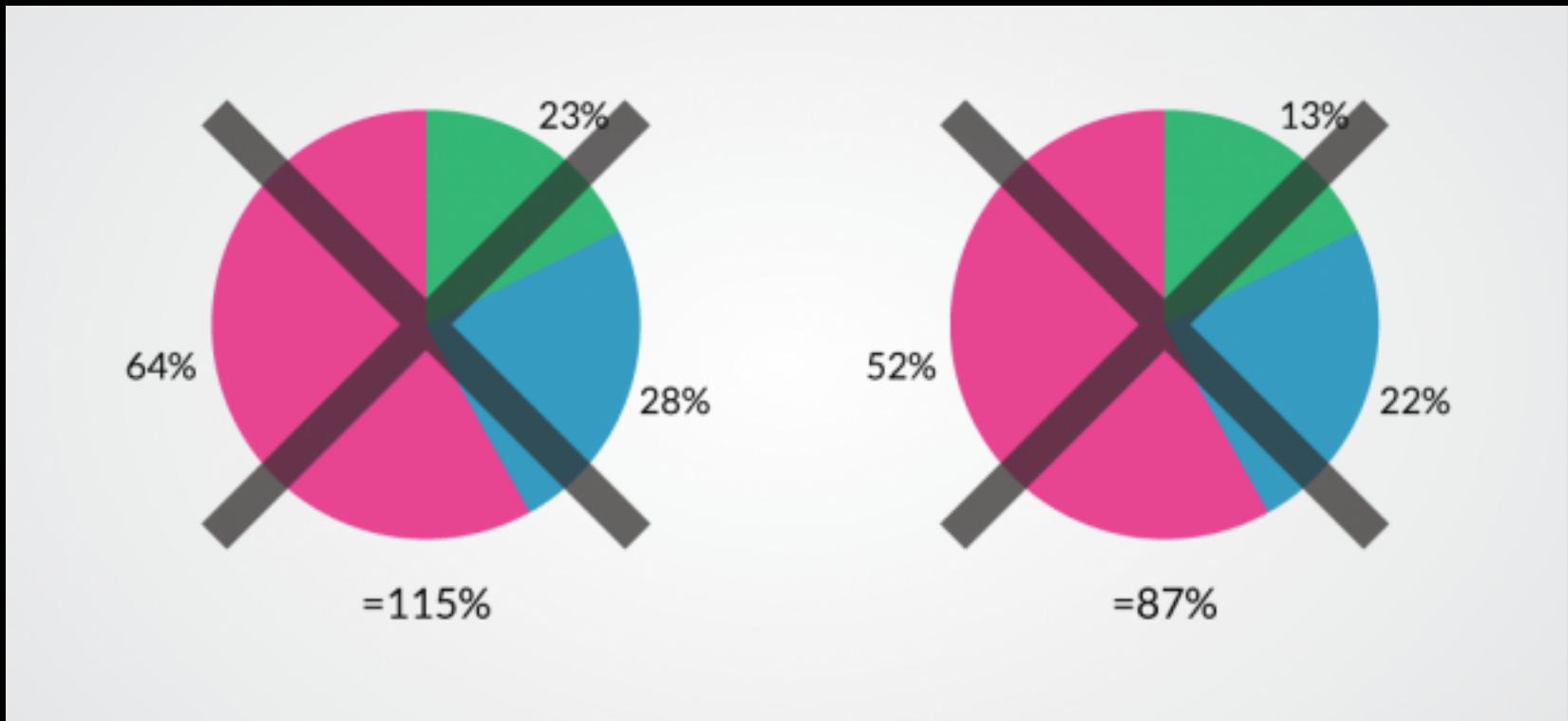
Data Visualization

Bad Habits



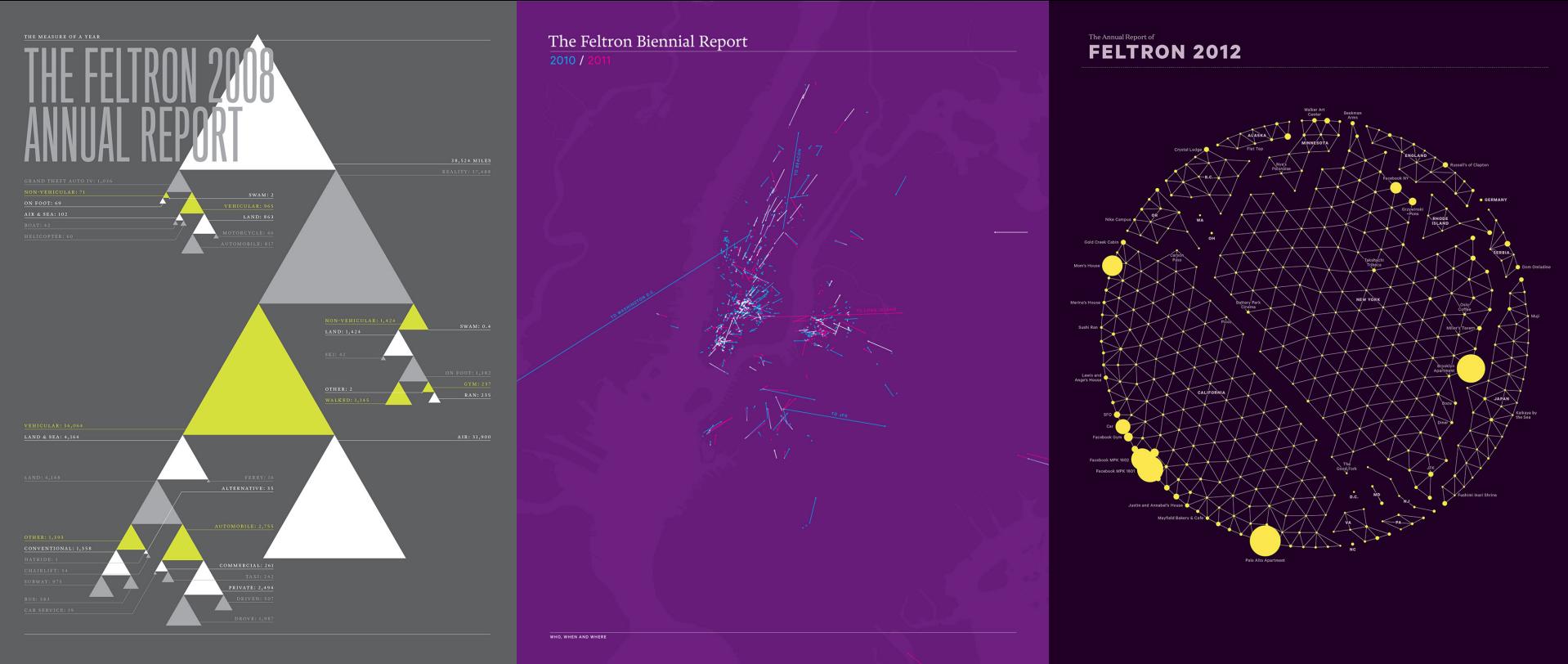
Data Visualization

Bad Habits



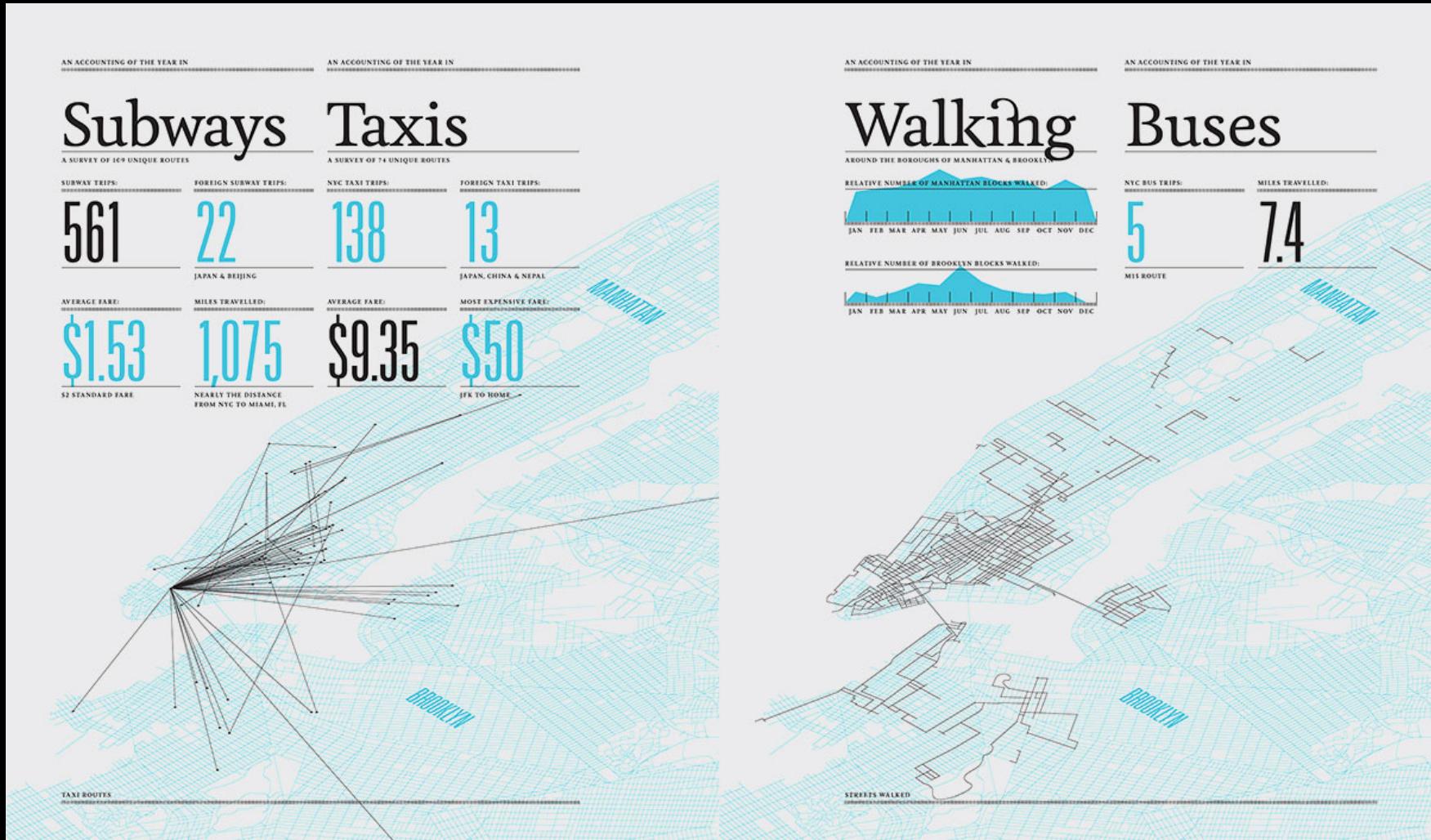
Data Visualization

Nicholas Felton – Annual Reports



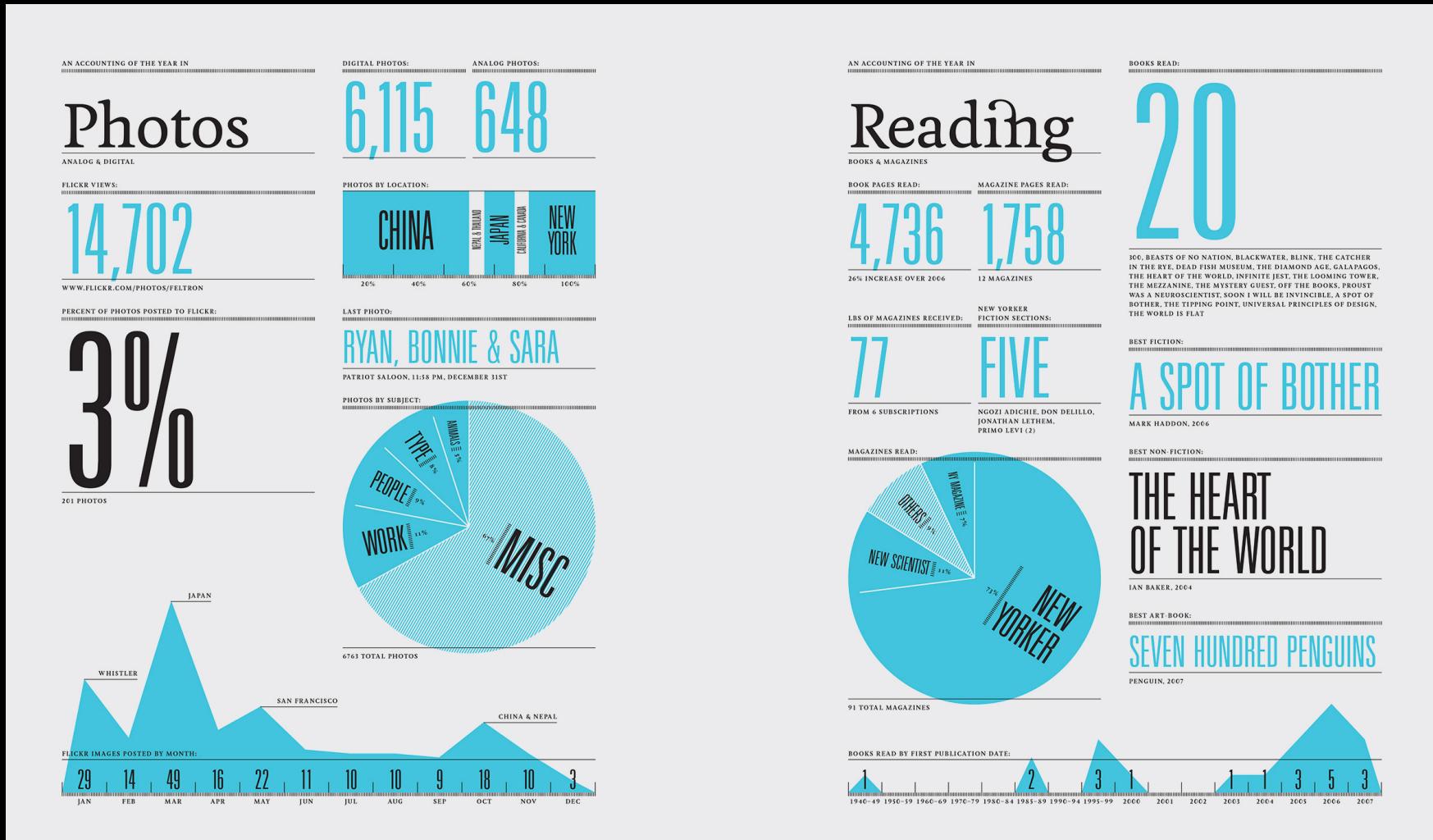
Data Visualization

Nicholas Felton – Annual Reports



Data Visualization

Nicholas Felton – Annual Reports



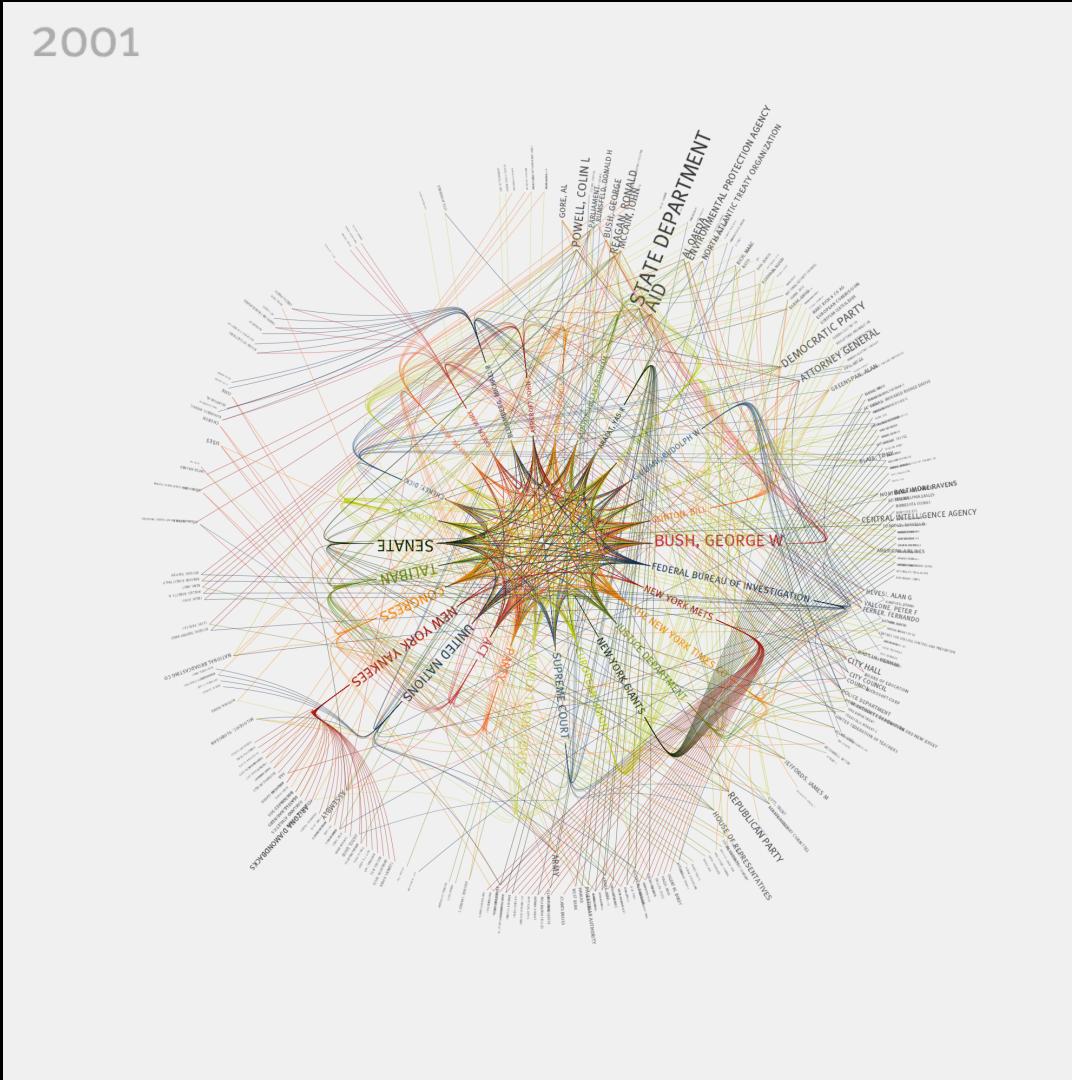
Data Visualization

Nicholas Felton – Annual Reports



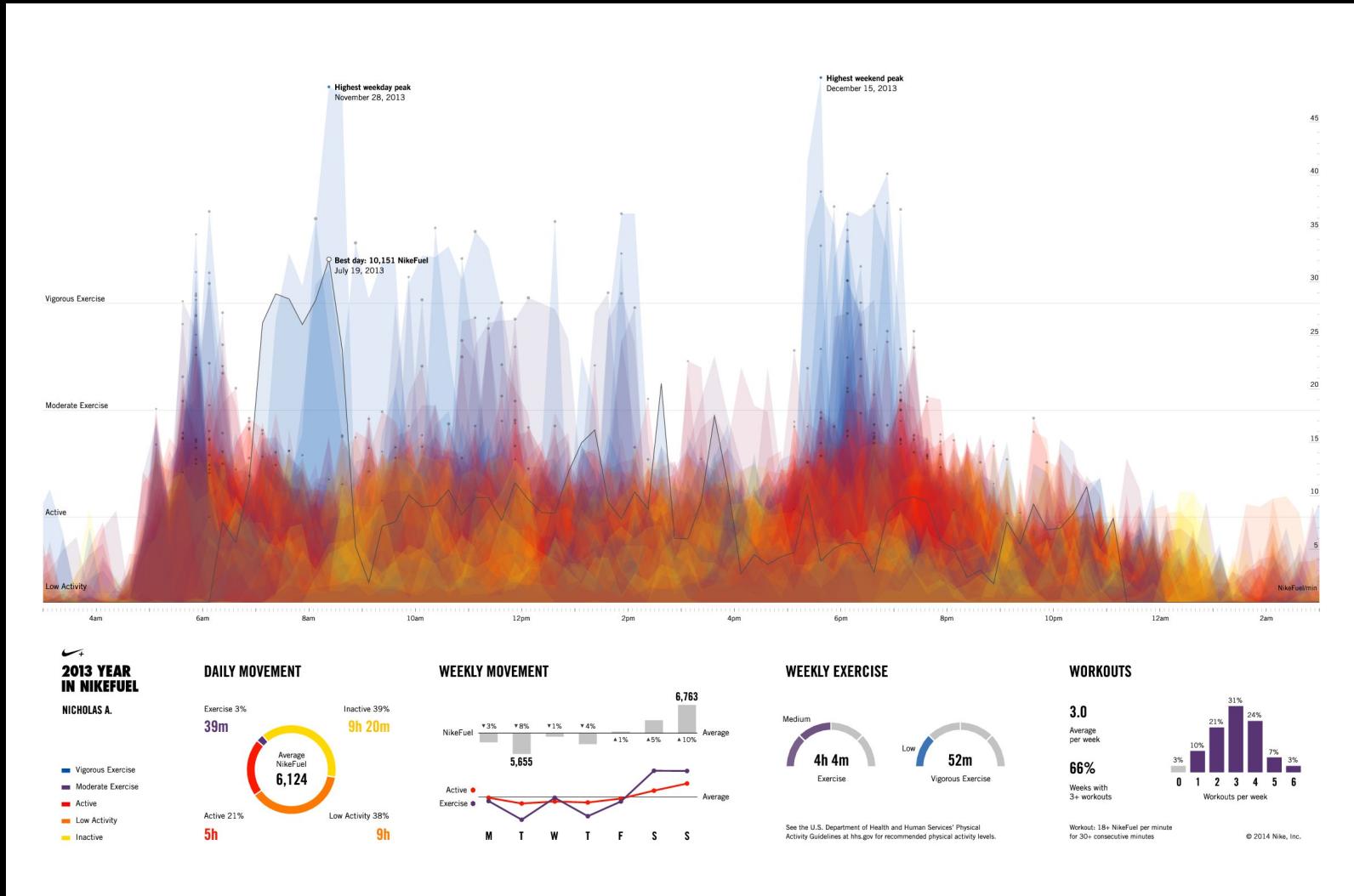
Data Visualization

Jer Thorp – NY Times Posters



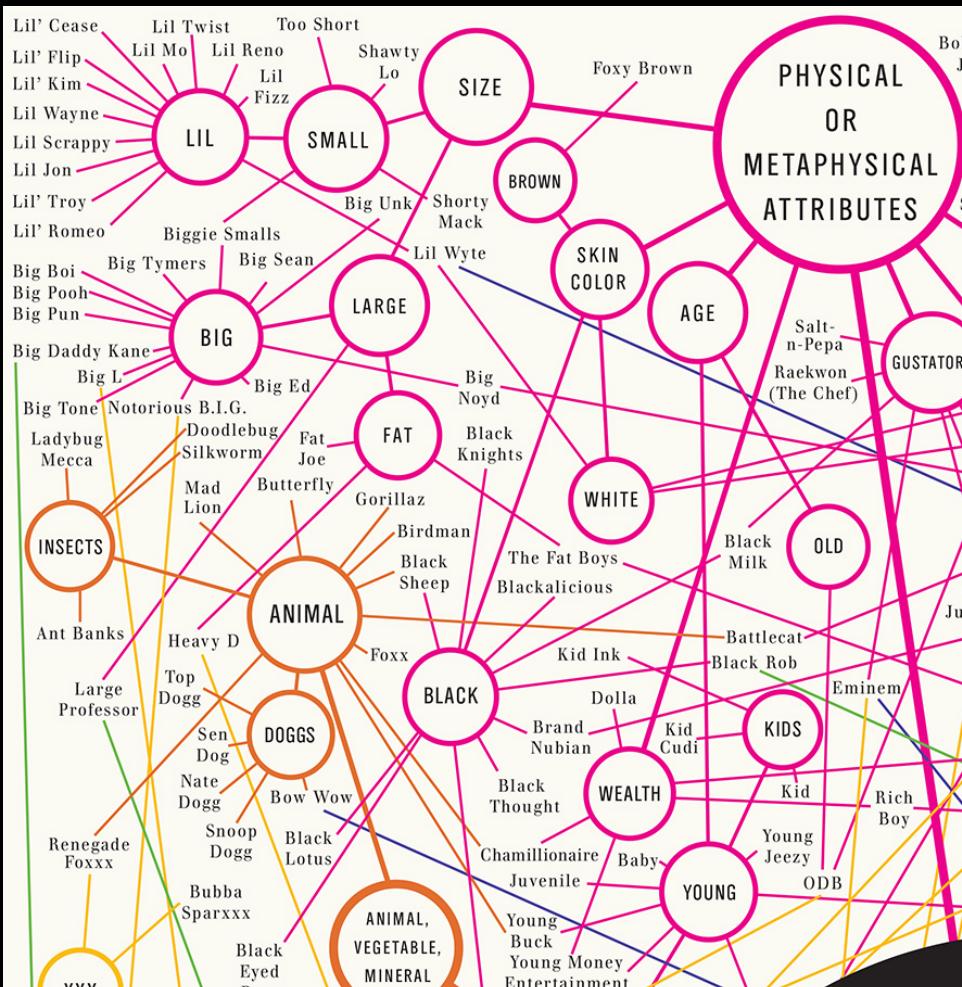
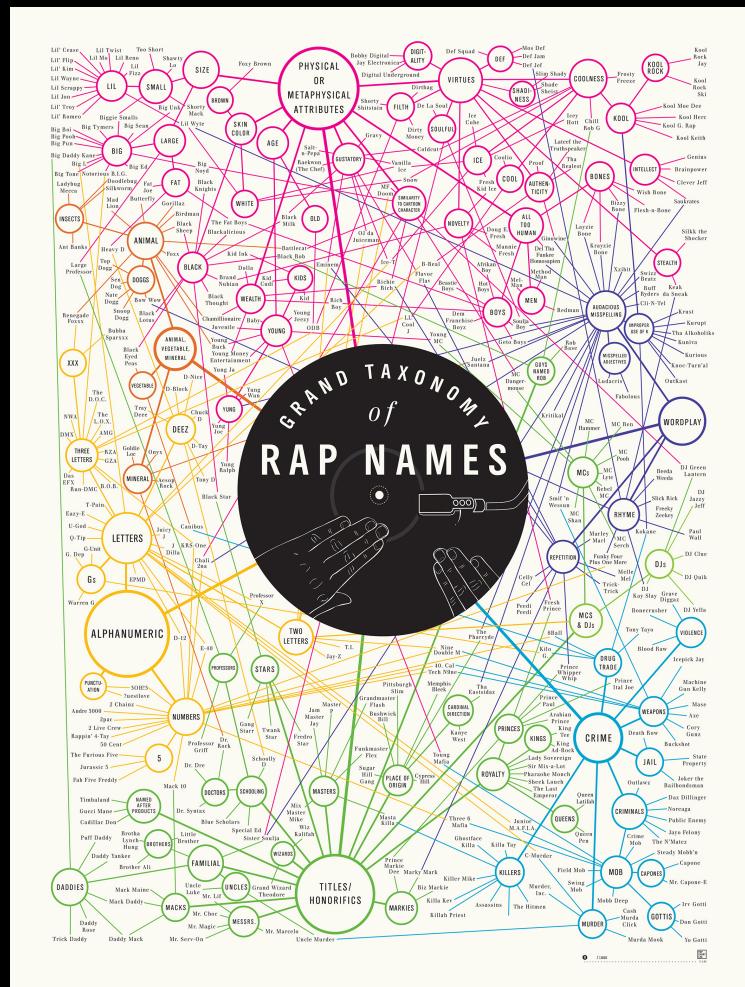
Data Visualization

Fathom Design – Nike Fuel Band



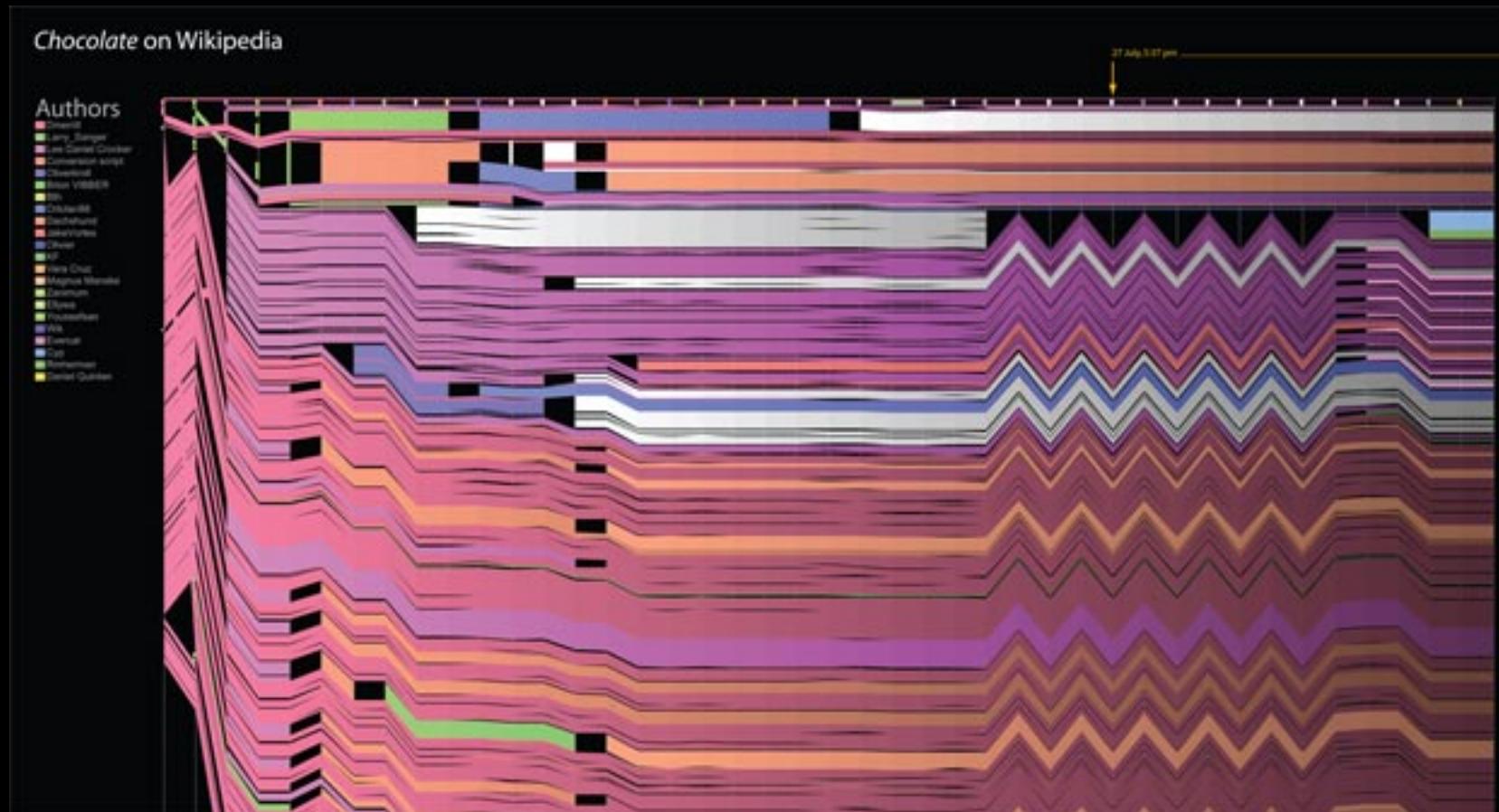
Data Visualization

Pop Chart Labs – Rap Names



Data Visualization

Hint.fm – Visualizing Wikipedia



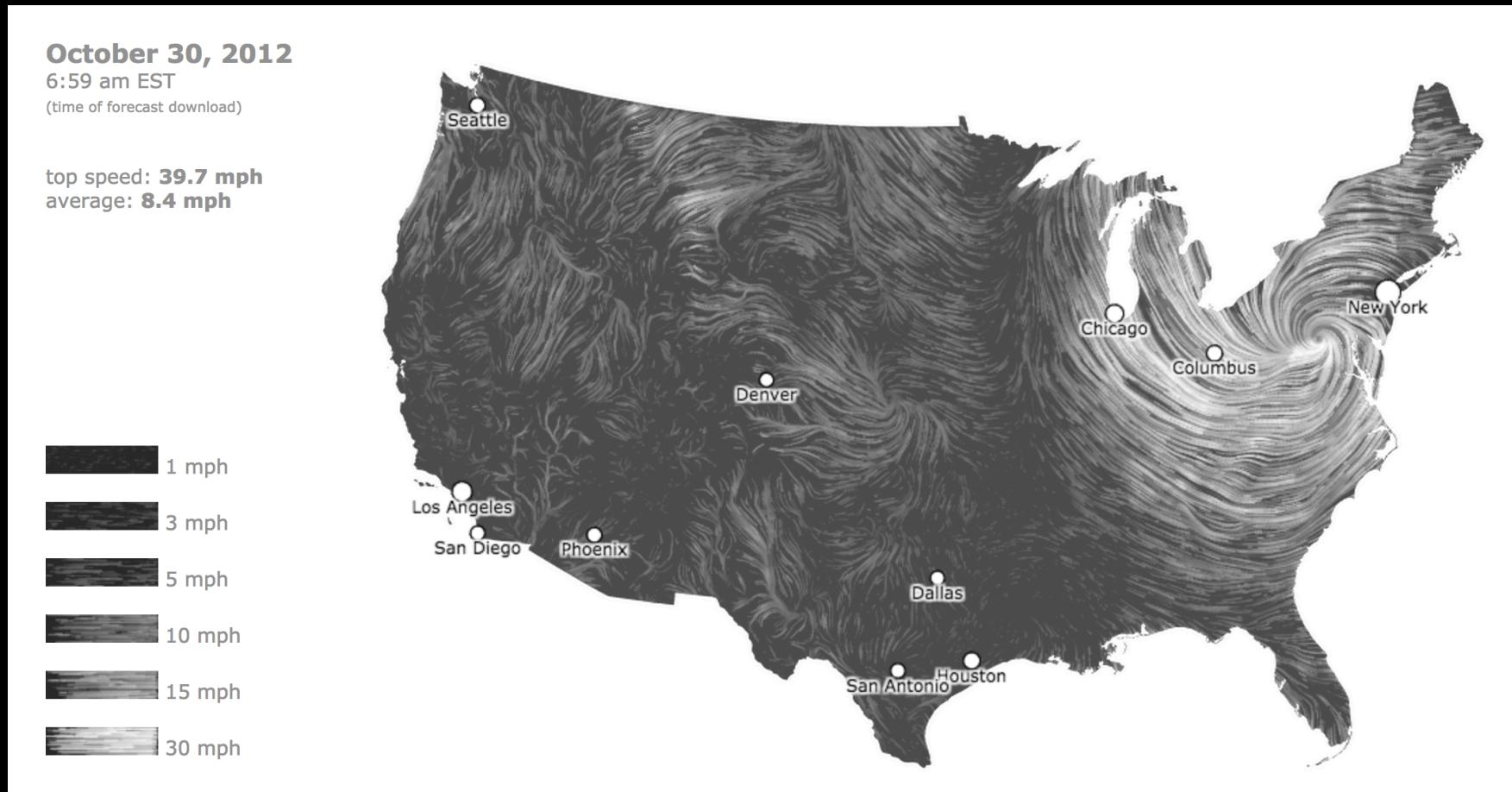
Data Visualization

Massimo Vignelli – MTA Subway Map



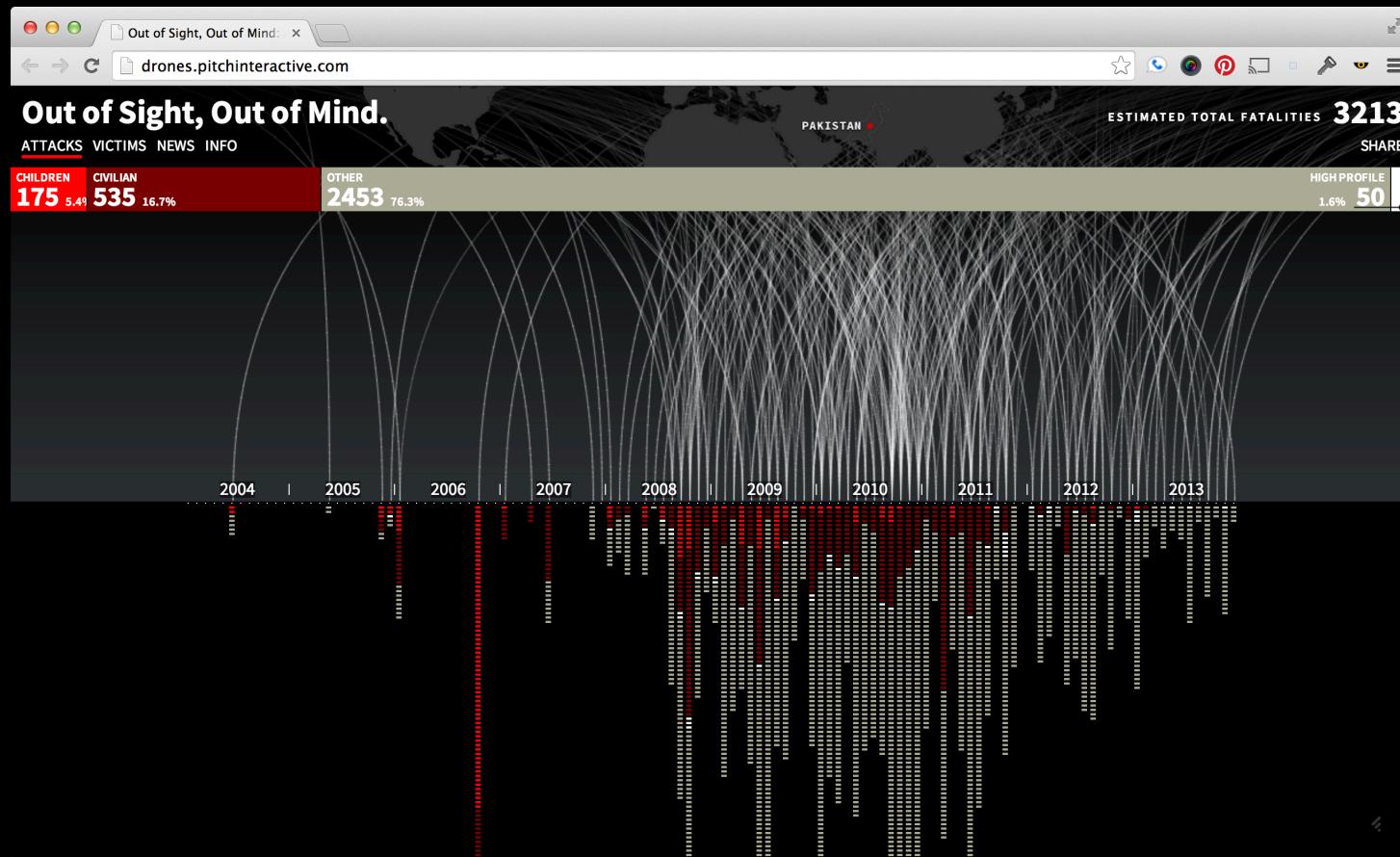
Animation and Interaction

Hint.fm – Wind Data



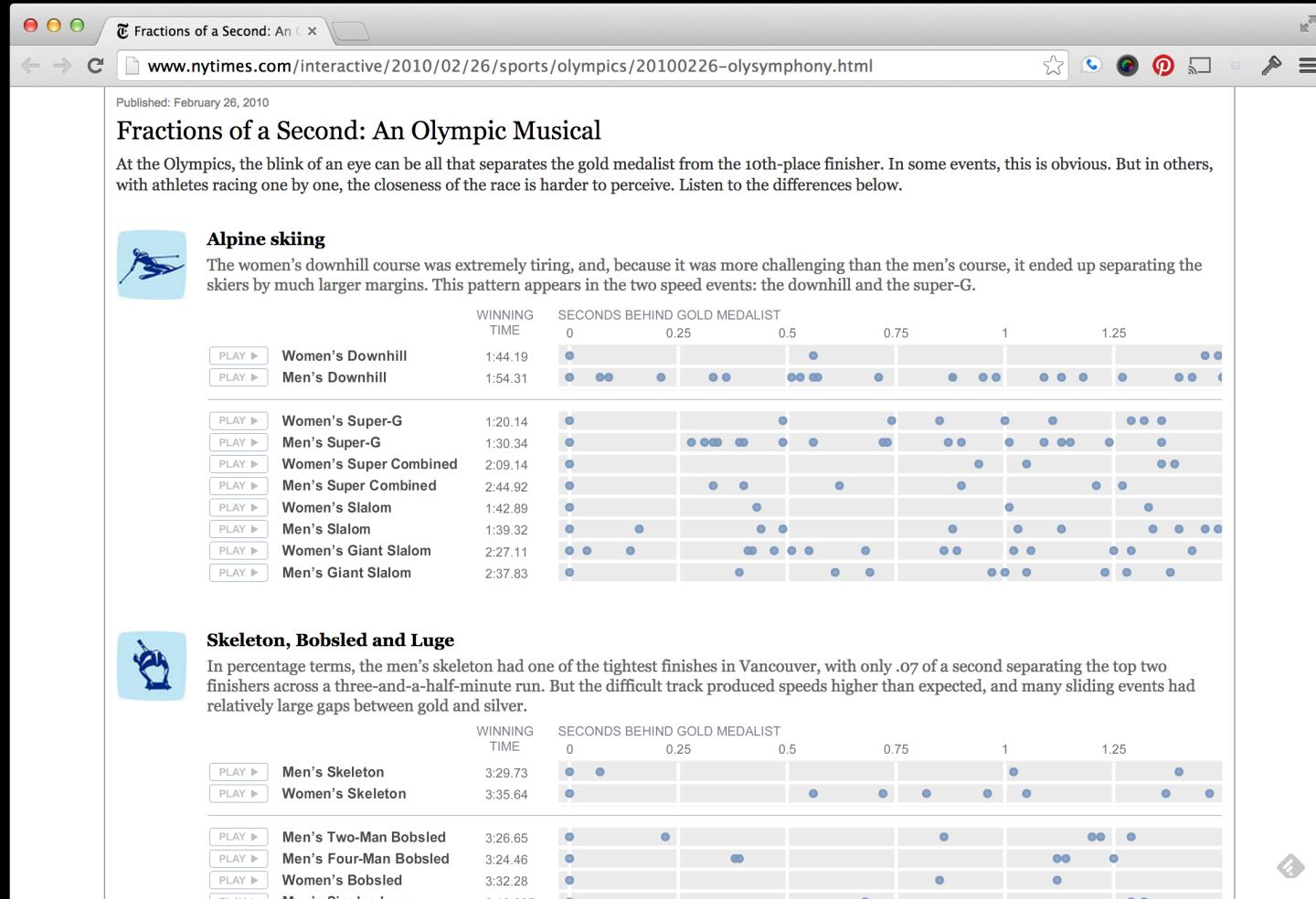
Animation and Interaction

Pitch Interactive – Out of Sight, Out of Mind



Data Sonification

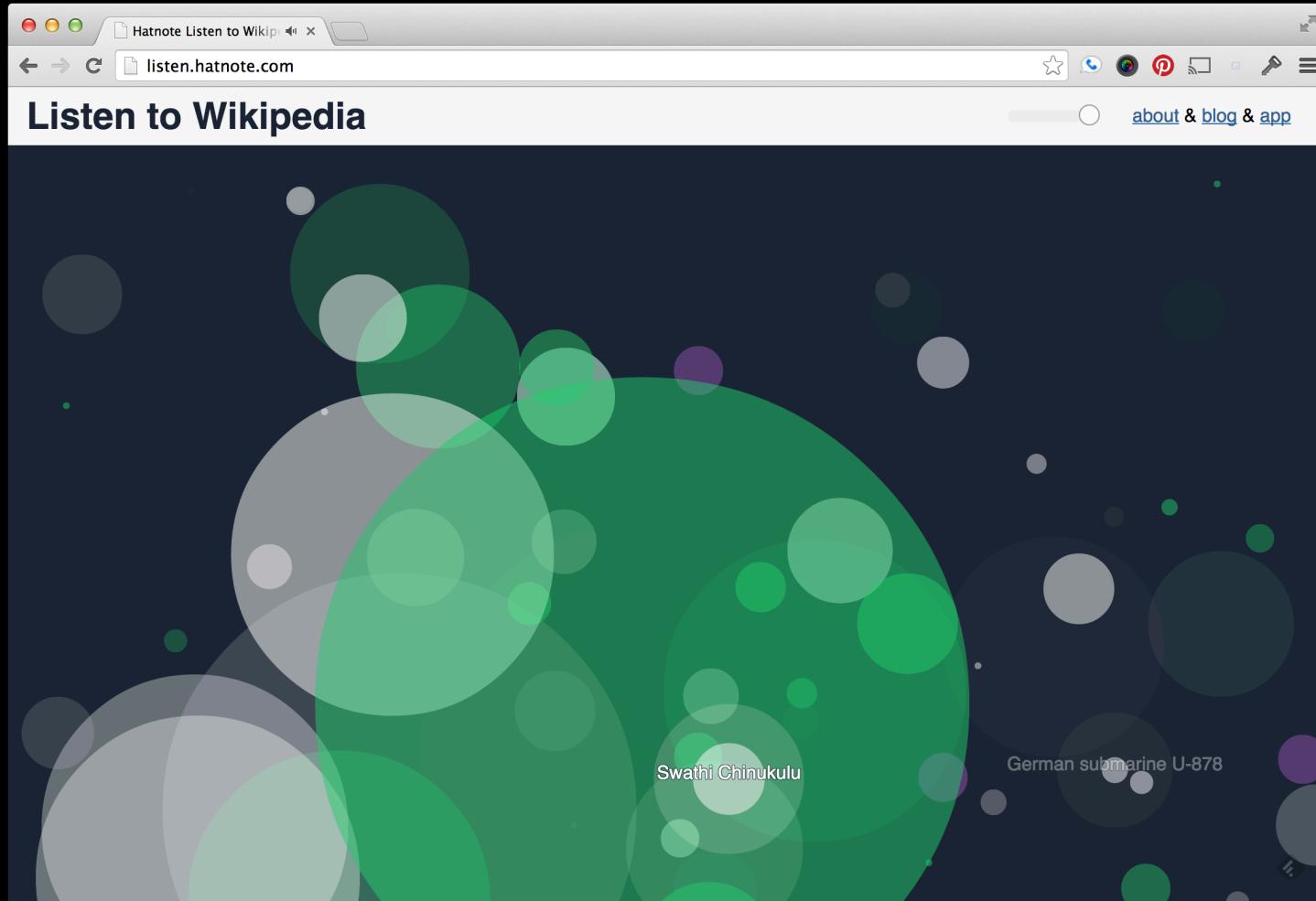
NY Times – Fractions of a Second: An Olympic Musical



<http://www.nytimes.com/interactive/2010/02/26/sports/olympics/20100226-olysymphony.html>

Data Sonification

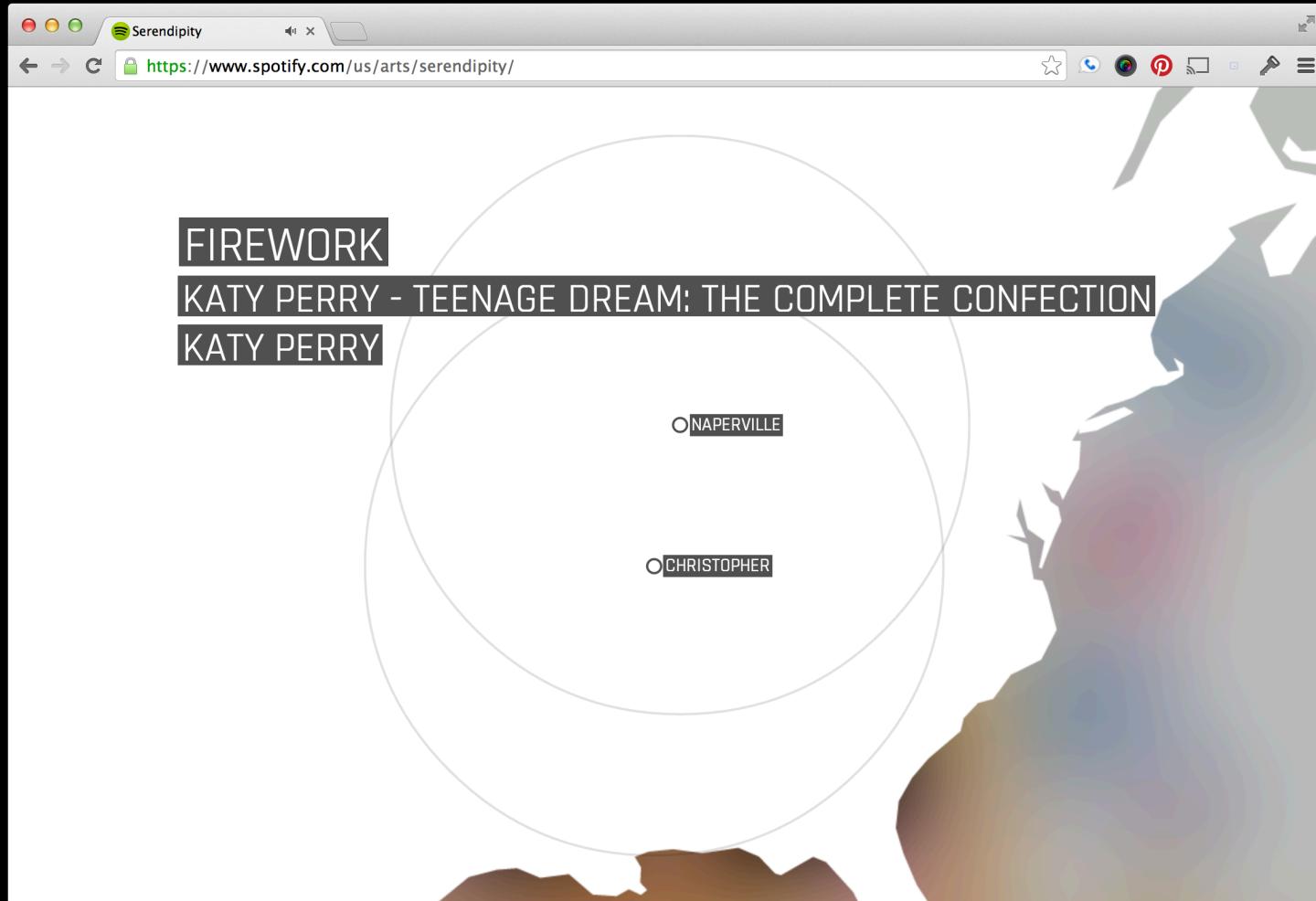
Listen to Wikipedia



<http://listen.hatnote.com/>

Data Sonification

Kyle McDonald – Spotify Serendipity



<https://www.spotify.com/us/arts/serendipity/>

Data Art

Rafael Lozano Hemmer – Pulse Park



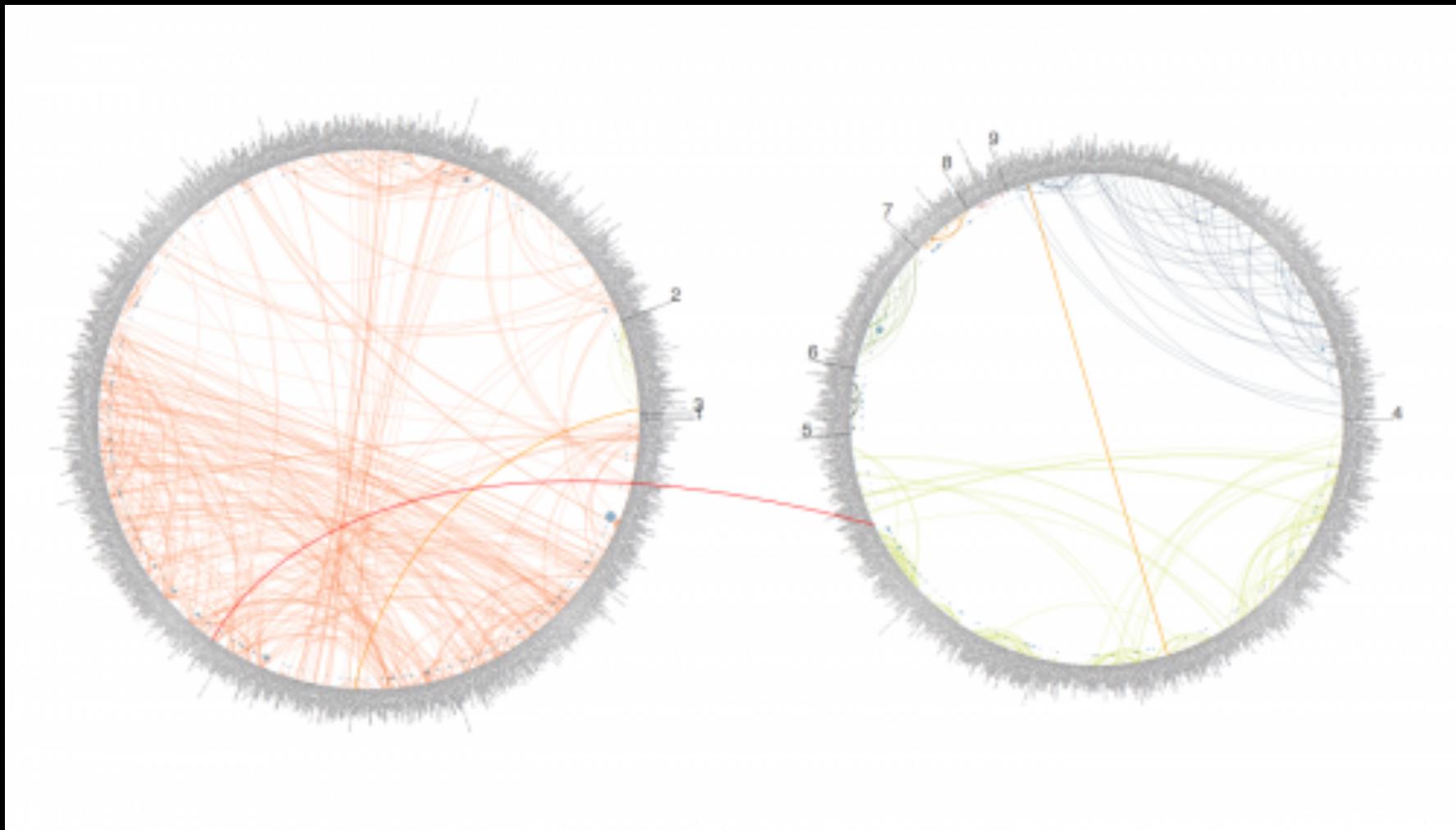
Data Art

Jer Thorp – 9/11 Memorial



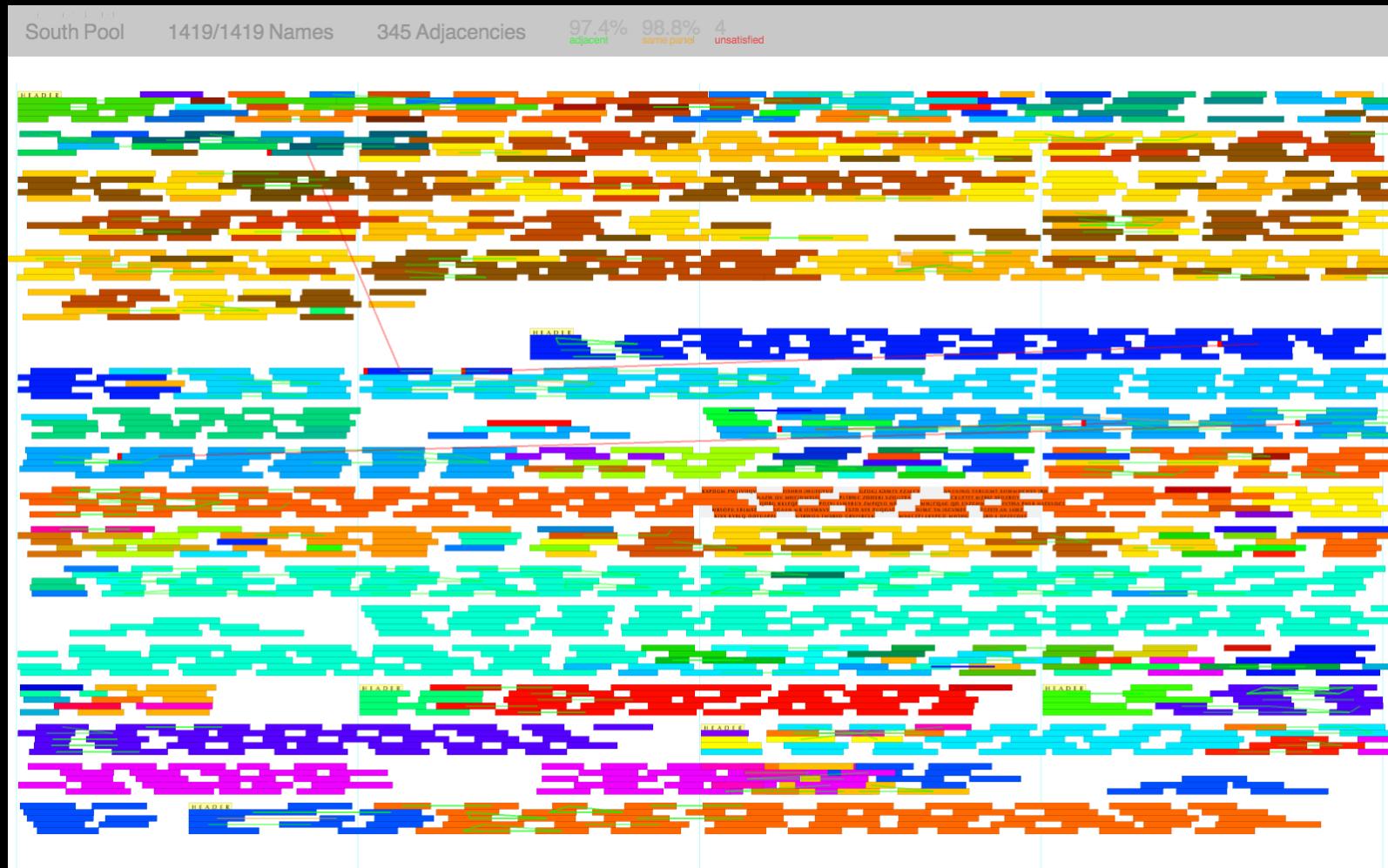
Data Art

Jer Thorp – 9/11 Memorial



Data Art

Jer Thorp – 9/11 Memorial



Data Visualization

Arrays

```
var variableName = [19, 32, 87];  
variableName[0] = 19, variableName[1] = 32, variableName[2] = 87  
variableName.length = 3
```

Data Functions – map(), max(), min(), arc(), sort(), reverse(), preload(), loadJSON()

Table Class – Table, loadTable(), getCount(), getRow(), getNum(), getString()

Array Data

Not Using the Map Function

```
var numbers = [ 19, 30, 62, 89, 52 ];
```

```
for (var i = 0; i < numbers.length; i++) {  
    var n = numbers[i];  
    fill(n, 100, 100);  
    rect(i * 20, height - n, 20, n);  
}
```



Array Data

Map Function

Re-maps a number from one range to another.

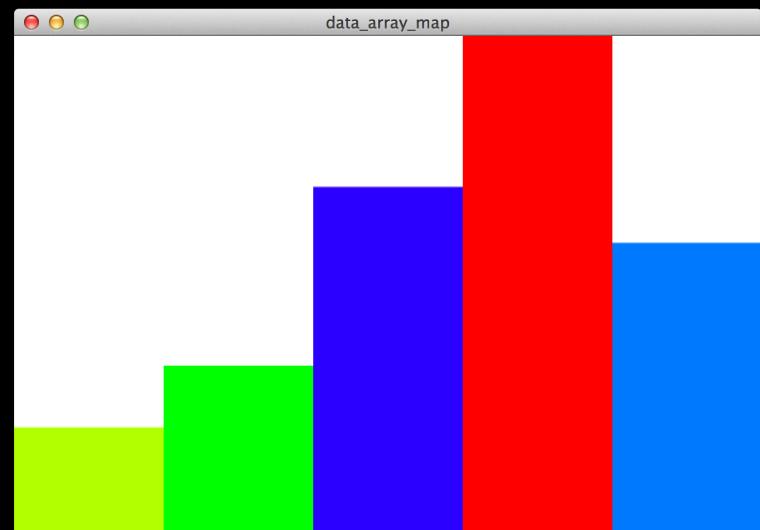
```
map(value, start1, stop1, start2, stop2);
```

Array Data

Using Map Function

```
var numbers = [ 19, 30, 62, 89, 52 ];

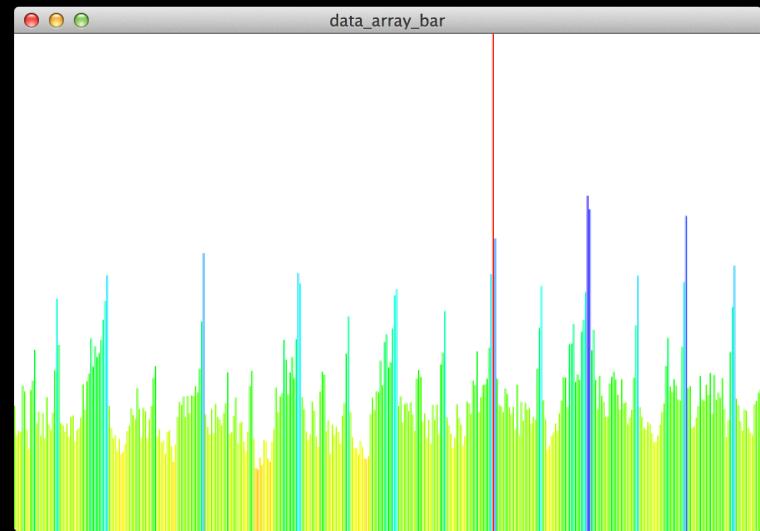
for (vari = 0; i < numbers.length; i++) {
  var n = numbers[i];
  var x = map(i, 0, numbers.length, 0, width);
  var w = width/numbers.length;
  var h = map(n, 0, max(numbers), 0, height);
  var y = height - h;
  var c = map(n, 0, max(numbers), 0, 360);
  fill(c, 100, 100);
  rect(x, y, w, h);
}
```



Array Data

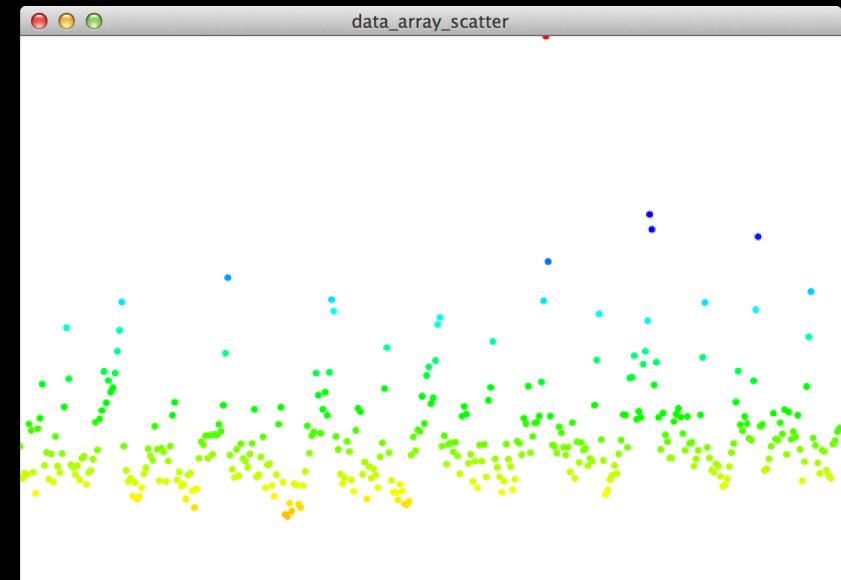
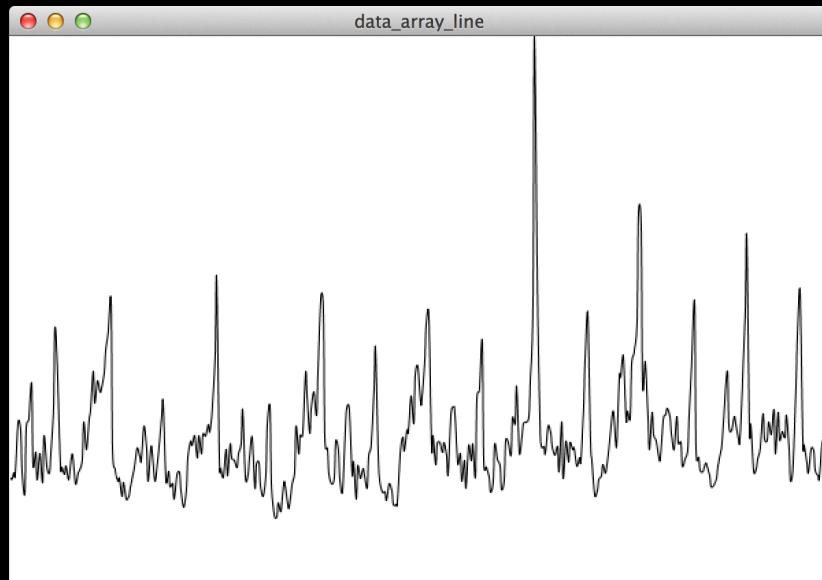
Simple Bar

```
var numbers = [ 341,262,274,271,396,380, ... ];  
function setup() {  
  createCanvas(600, 400);  
  background(255);  
  colorMode(HSB, 360, 100, 100);  
  smooth();  
  noStroke();  
  for (var i = 0; i < numbers.length; i++) {  
    var n = numbers[i];  
    var x = map(i, 0, numbers.length, 0, width);  
    var h = map(n, 0, max(numbers), 0, height);  
    var c = map(n, 0, max(numbers), 0, 360);  
    var y = height - h;  
    fill(c, 100, 100);  
    rect(x, y, 1, h);  
  }  
}
```



Array Data

Simple Bar

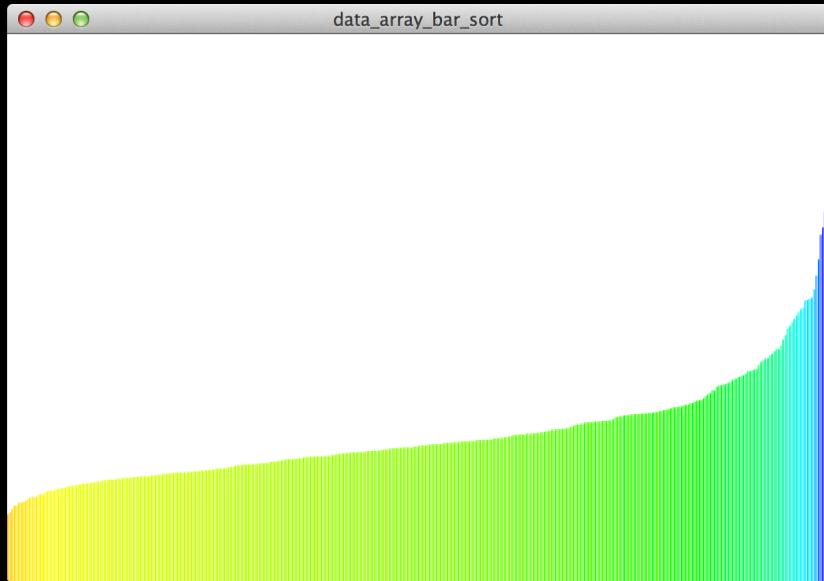


```
beginShape();
curveVertex(x, y);
endShape();
```

```
ellipse(x, y, 5, 5);
```

Array Data

Sort and Reverse



```
numbers = sort(numbers);
for(var i = 0; i < numbers.length; i++) {
    ...
}
```

```
numbers = reverse(numbers);
for(var i = 0; i < numbers.length; i++) {
    ...
}
```

Array Data

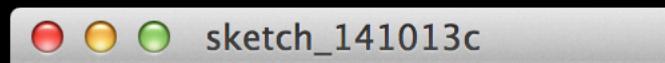
Pie Chart

```
arc(x, y, diameter, diameter, start angle, end angle);
```

Array Data

Pie Chart

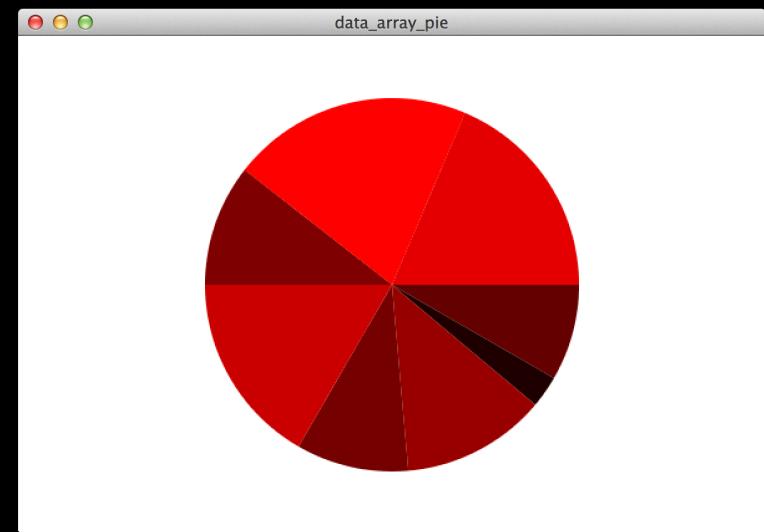
```
arc(width/2, height/2, 200, 200, radians(30), radians(330));
```



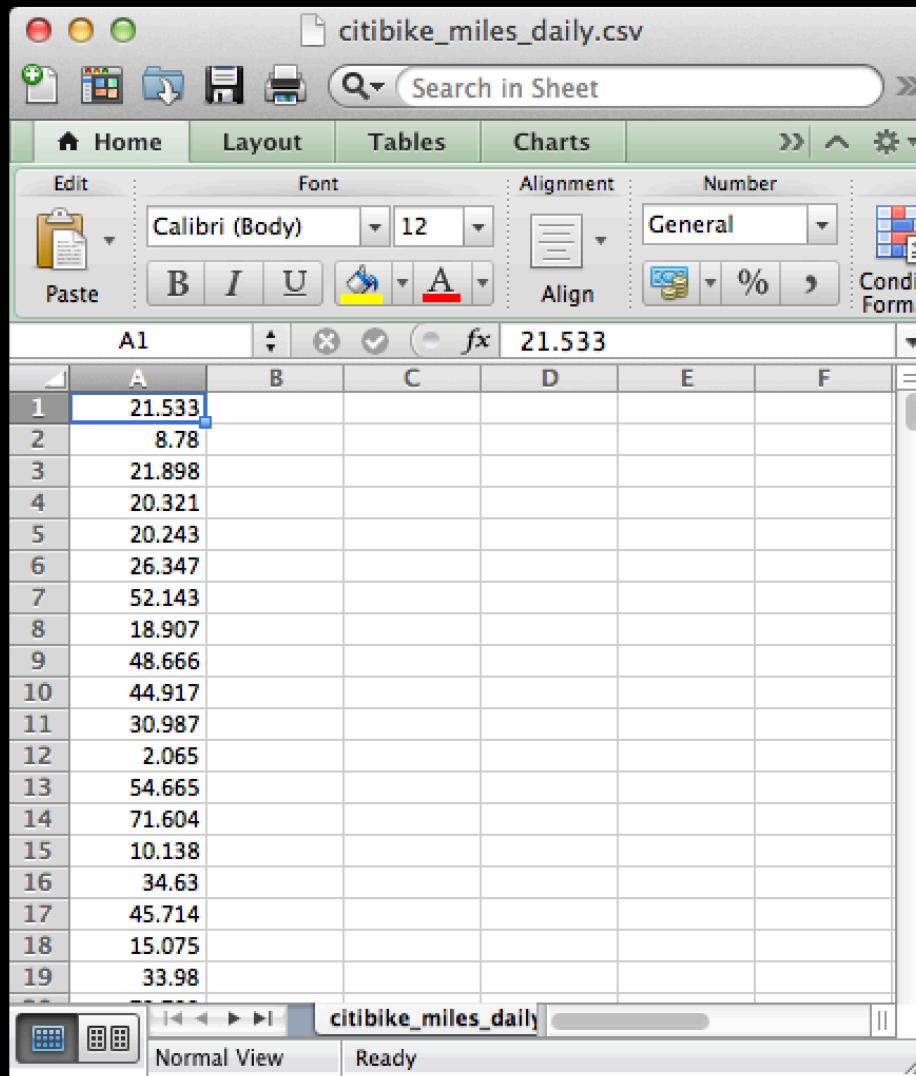
Array Data

Pie Chart

```
var numbers = [ 30, 10, 45, 35, 60, 38, 75, 67 ];  
function setup() {  
  createCanvas(600, 400);  
  background(255);  
  colorMode(HSB, 360, 100, 100);  
  noStroke();  
  var diameter = 300;  
  var lastAngle = 0;  
  for (var i = 0; i < numbers.length; i++) {  
    var n = numbers[i];  
    var c = map(n, 0, max(numbers), 0, 100);  
    fill(0, 100, c);  
    arc(width/2, height/2, diameter, diameter, lastAngle, lastAngle+radians(n));  
    lastAngle += radians(n);  
  }  
}
```



Loading CSVs



A screenshot of the Numbers application on OS X, displaying a spreadsheet titled "citibike_miles_daily.csv". The spreadsheet contains 19 rows of data, each with a single numerical value in column A. The data starts at row 1 with 21.533 and continues down to row 19 with 33.98. The application interface includes a toolbar at the top with icons for file operations, a search bar, and tabs for Home, Layout, Tables, and Charts. The formula bar shows "A1" and the value "21.533". The bottom of the window shows the status bar with "Normal View" and "Ready".

A	B	C	D	E	F
1	21.533				
2	8.78				
3	21.898				
4	20.321				
5	20.243				
6	26.347				
7	52.143				
8	18.907				
9	48.666				
10	44.917				
11	30.987				
12	2.065				
13	54.665				
14	71.604				
15	10.138				
16	34.63				
17	45.714				
18	15.075				
19	33.98				

Loading CSVs

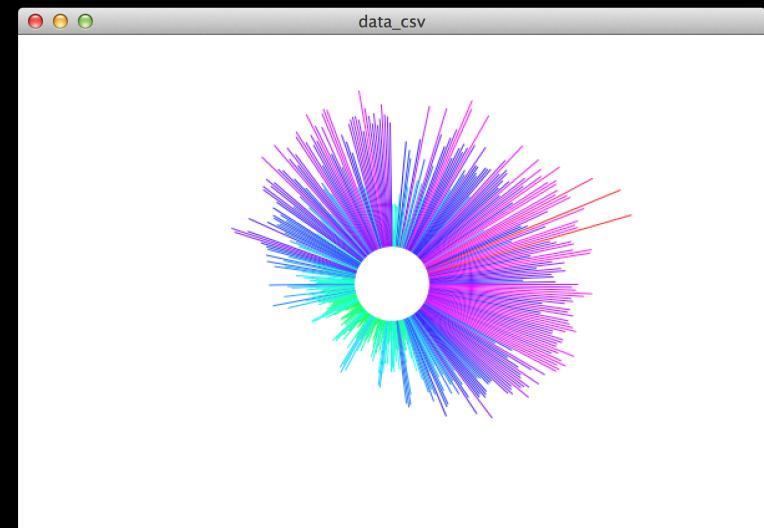
Table Class

```
var innerCircle = 30;  
var values = [];  
var data;  
function preload() {  
  data = loadTable("data/citibike_miles_daily.csv", "csv", "header");  
}  
function setup() {  
  createCanvas(600, 400);  
  noStroke();  
  background(255);  
  colorMode(HSB, 360, 100, 100);  
  for(var i = 0; i < data.getRowCount(); i++) {  
    for (var j = 0; j < data.getColumnCount(); j++) {  
      values.push(data.getNum(i, j));  
    }  
  }  
}
```

Loading CSVs

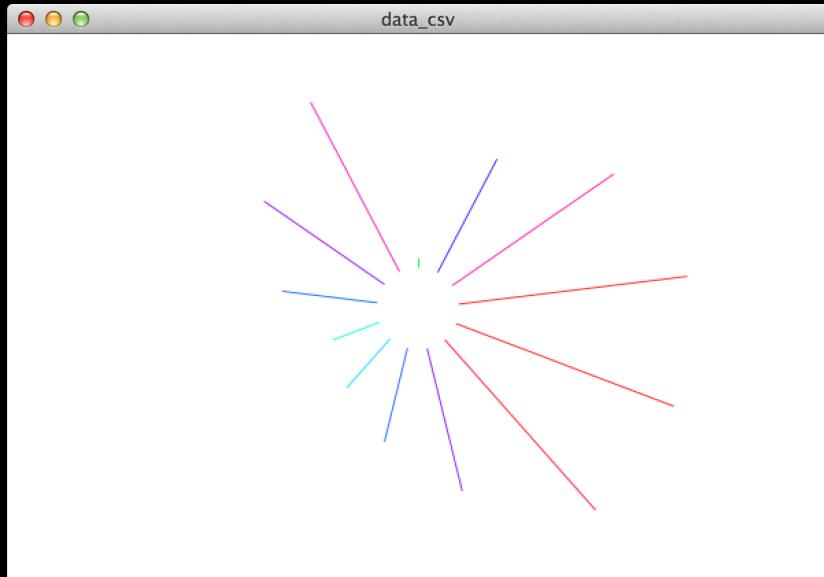
Table Class

```
for(var i = 0; i < values.length; i++) {  
    var n = values[i];  
    var x = width/2;  
    var y = height/2;  
    var w = 1;  
    var h = -map(n, 0, max(values), 0, height/2 - innerCircle);  
    var r = map(i, 0, values.length, 0, TWO_PI);  
    var c = map(n, 0, max(values), 120, 360);  
    fill(c, 80, 100);  
    push();  
    translate(x, y);  
    rotate(r);  
    rect(0, -innerCircle, w, h);  
    pop();  
}
```

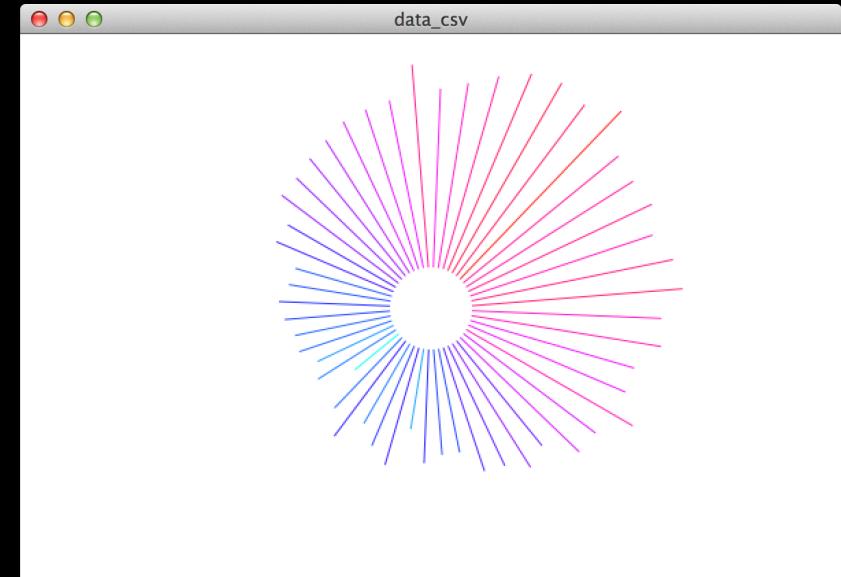


Loading CSVs

Table Class



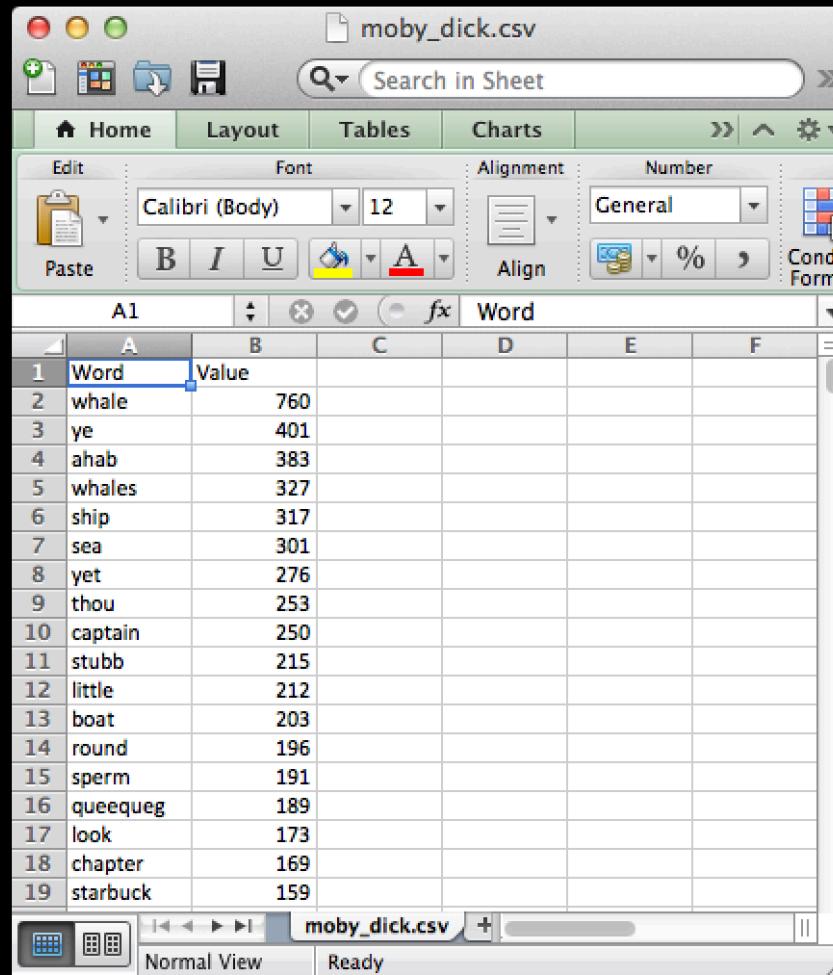
Monthly CitiBike Usage



Weekly NYC Temperature

Loading CSVs

Multiple Columns



	A	B	C	D	E	F
1	Word	Value				
2	whale	760				
3	ye	401				
4	ahab	383				
5	whales	327				
6	ship	317				
7	sea	301				
8	yet	276				
9	thou	253				
10	captain	250				
11	stubb	215				
12	little	212				
13	boat	203				
14	round	196				
15	sperm	191				
16	queequeg	189				
17	look	173				
18	chapter	169				
19	starbuck	159				

Loading CSVs

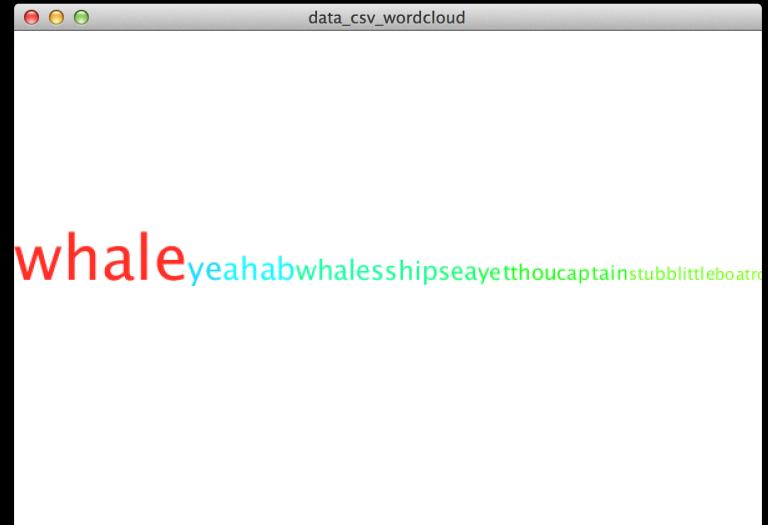
Multiple Columns

```
var data, innerCircle = 30;  
var words = [], values = [];  
function preload() {  
    data = loadTable("data/moby_dick.csv", "csv", "header");  
}  
function setup() {  
    createCanvas(600, 400);  
    noStroke();  
    background(255);  
    colorMode(HSB, 360, 100, 100);  
    for(var i = 0; i < data.getRowCount(); i++) {  
        for (var j = 0; j < data.getColumnCount(); j++) {  
            if(j == 0) words.push(data.getString(i, j));  
            if(j == 1) values.push(data.getNum(i, j));  
        }  
    }  
}
```

Loading CSVs

Multiple Columns

```
for(var i = 0; i < 20; i++) {  
  var w = words[i];  
  var n = values[i];  
  var y = height/2;  
  var s = map(n, 0, max(values), 0, 50);  
  var c = map(n, 0, max(values), 0, 360);  
  fill(c, 80, 100);  
  textSize(s);  
  text(w, 0, y);  
  translate(textWidth(w), 0);  
}
```



APIs and p5js

The screenshot shows a web browser window for the OpenWeatherMap website (<https://openweathermap.org>). The page features a large banner with the text "We Deliver 2 Billion Forecasts Per Day" and "1,500 new subscribers a day | 1,200,000 customers | 20+ weather APIs". Below the banner, there is a search bar with fields for "Your city name", a "Search" button, and a "Current location" link. The main content area displays the "Current weather and forecasts in your city" for London, GB. It shows a temperature of 12 °C with a broken clouds icon, a forecast for 20°C and 0.12mm precipitation, and a second forecast for 15°C and 0.08mm precipitation. Navigation tabs include Main, Daily, Hourly, Chart, and Map. A "Support Center" link is visible in the top left, and a "Sign In" or "Sign Up" link in the top right. The temperature unit is currently set to Celsius (°C).

Current weather and forecast - ×

https://openweathermap.org

Support Center

Weather in your city Sign In Sign Up

°C °F

OpenWeatherMap

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We Deliver 2 Billion Forecasts Per Day
1,500 new subscribers a day | 1,200,000 customers | 20+ weather APIs

Your city name Current location

Current weather and forecasts in your city

Weather in London, GB

12 °C

Broken clouds

20°C 0.12mm

Precipitation Temperature

Export

12

15°C 0.08mm

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APIs and p5js

The screenshot shows the p5.js Web Editor interface. The title bar reads "p5.js Web Editor | Two potato". The address bar shows the URL "https://editor.p5js.org". The menu bar includes "File", "Edit", "Sketch", "Help & Feedback", and user account information "Hello, dannewool! | My Account". The toolbar has icons for play, stop, auto-refresh, and a preview button.

The code editor window contains a file named "sketch.js". The code uses the p5.js library to fetch weather data for three cities (San Diego, New York, Honolulu) from the OpenWeatherMap API. It stores the cities in an array and sends a GET request for each city's weather. The results are then displayed in a "Preview" window.

```
var cities = ["San Diego", "New York", "Honolulu"];
var weather = [];

function preload() {
  var url = 'https://api.openweathermap.org/data/2.5/weather?q=';
  // Please login into http://openweathermap.org/api and get your own appid
  var settings = '&units=imperial';
  var appid = '&appid=2dd2ba333f1580953e2e4bd38c7b227a';
  for (var i = 0; i < cities.length; i++) {
    var city = cities[i];
    weather.push(loadJSON(url + city + settings + appid));
  }
}

function setup() {
  createCanvas(600, 400);
  noStroke();
  background(255);
  textSize(24);
  textAlign(CENTER);
  translate(width/2, 50);
  for (var i = 0; i < weather.length; i++) {
    text(cities[i] + " - " + weather[i].main.temp, 0, 40*i);
  }
}
```

The "Preview" window displays the results for each city:

- San Diego - 71.87
- New York - 49.08
- Honolulu - 82.85

The bottom of the editor shows a "Console" tab and a "Clear" button.

Homework

- 1. Create a poster for your mid term presentation next week. Make sure to use classes, functions and the programming methods we learned so far this semester. You must print out your poster as well as display and talk about your code. The print out must be at least 11 x 17 inches and full color. I would suggest working smaller, outputting a SVG and scaling up the SVG for print. You may design whatever you want, movie poster, book cover, wall paper, wrapping paper, artistic, abstract, etc.**
- 2. Put your p5js sketch in the Dropbox folder before our next class and be prepared to talk about it.**

Creative Code Shows

Artechouse

Chelsea, NYC

artechouse.com/nyc



Zerospace, NYC

33rd St., NYC

zerospace.co



BAM Technopolis

321 Ashland Pl, Brooklyn

bam.org/kids/2020/teknopolis-2020



Creative Coding

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