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Data Visualization: Tips & Tricks

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Data visualization: Tips and Tricks

Outline of presentation

- ▶ Overview & Questions to Ask (15 min)
- ▶ Data visualizations - uses in law (10 min)
- ▶ Tableau (5 min)
- ▶ Power BI (10 min)



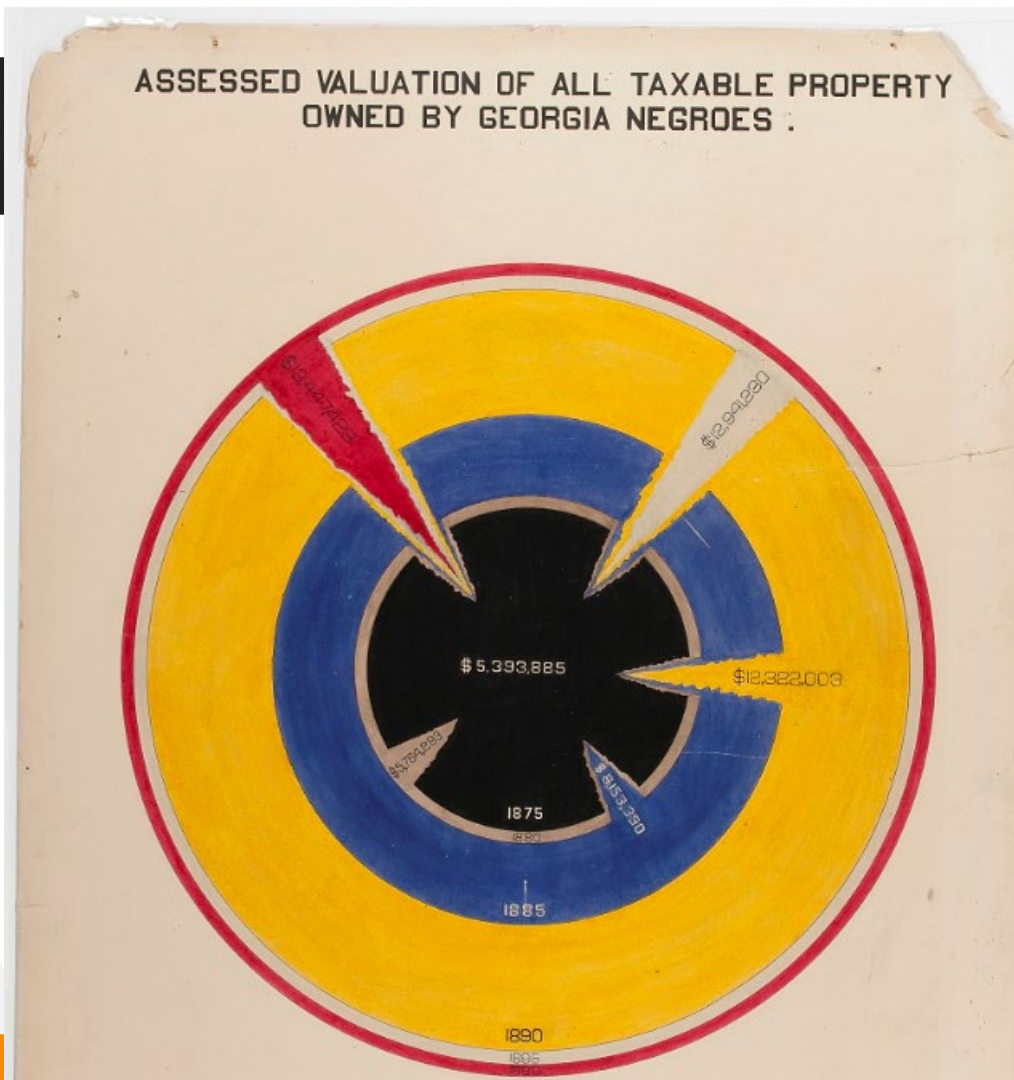
WHAT IS DATA VISUALIZATION?

By visualizing information, we turn it into a landscape that you can explore with your eyes. A sort of information map. And when you're lost in information, an information map is kind of useful.- David McCandless



Handdrawn

W.E.B. Dubois



Data goes in ...

The screenshot shows the Microsoft Excel interface with a data table. A red arrow points to cell H5, which is currently empty. The table has columns for Date, Month, Num, Item, Rep, and Amount. The data is as follows:

	A	B	C	D	E	F	G	H	I	J	K
1	Date	Month	Num	Item	Rep	Amount					
2	10/03/2011		2006-1568	CDRW Drive	DL	174.00					
3	10/03/2011		2006-1568	150 GB Hard Drive	DL	95.00					
4	10/03/2011		2006-1568	Repair Service	DL	195.00					
5	10/03/2011		2006-1567	Accessories	DL	1,089.00					
6	10/03/2011		2006-1567	150 GB Hard Drive	DL	95.00					
7	10/03/2011		2006-1567	Repair Service	DL	195.00					
8	10/04/2011		2006-1569	Laptop on Consignment	DL	500.00					
9	10/05/2011		2006-1570	Repair Service	DL	65.00					
10	10/06/2011		2006-1571	Computer-Poweruser	DL	2,895.00					
11	10/06/2011		2006-1572	Computer-Midrange	DL	1,195.00					
12	10/06/2011		2006-1572	Accessories	DL	56.00					
13	10/06/2011		2006-1572	Software	DL	364.00					
14	10/20/2011		2006-1573	Computer-Midrange	DL	1,195.00					
15	10/20/2011		2006-1573	Accessories	DL	56.00					
16	10/20/2011		2006-1573	Software	DL	364.00					
17	10/30/2011		2006-1574	Computer-Midrange	DL	1,195.00					
18	10/30/2011		2006-1574	Accessories	DL	56.00					
19	10/30/2011		2006-1574	Software	DL	364.00					
20	10/31/2011		2006-1575	Computer-Poweruser	DL	2,895.00					
21	10/31/2011		2006-1575	Accessories	DL	56.00					

Is it magic? ...

- ▶ Abracadabra!



Visualization comes out ...

20 year history of national team appearances in the FIFA World Cup

How to read

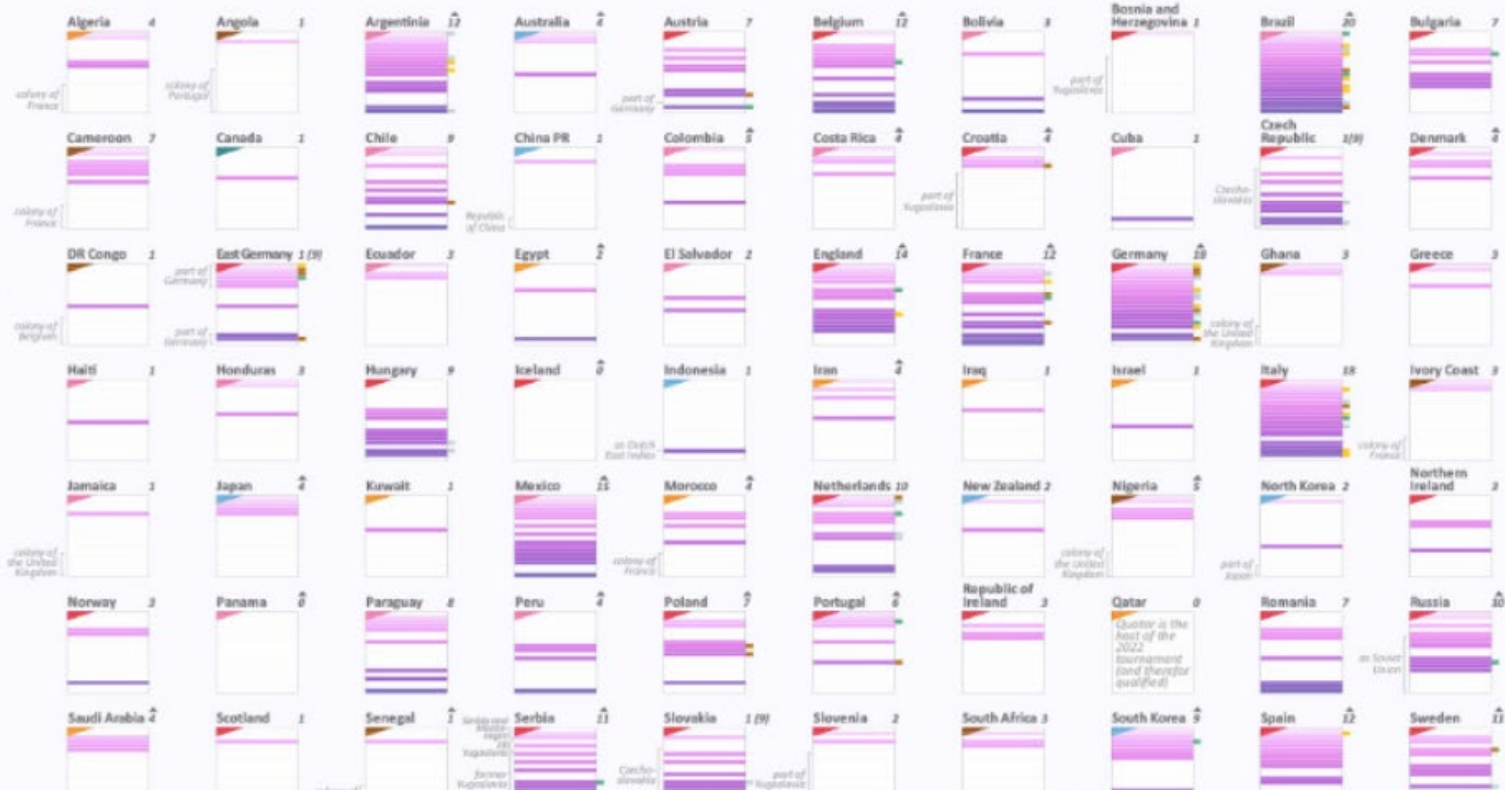
Comparing the 80 national teams which have been present during one or more World Cup tournaments. The appearances of a country's national soccer team is shown in a square which is divided in slices each representing one tournament year ordered from bottom (1930) to top (2014).



In case the concerning country was part of another country it first states the number of tournaments the concerning country participated in followed by the number (between parentheses) of participations while part of the other country

Top 10 teams

Rank	Team	Points	Places
1	Brazil	227	5
2	Germany	218	4
3	Italy	156	3
4	Argentina	140	3
5	Spain	99	2
6	England	98	2
7	France	96	2
8	Netherlands	93	2
9	Uruguay	72	2



Steps to creating a visualization & questions to ask

- ▶ **Gathering data**
 - ▶ Where from?
 - ▶ What format?
 - ▶ Cost?
 - ▶ Is it ready for use?
 - ▶ Is it authentic and reliable?

Big picture questions to ask

- ▶ Who is this for?
- ▶ What do they need?
- ▶ What could I show?
- ▶ What should I show?
- ▶ What will I show?

Granular view questions

What do you have?

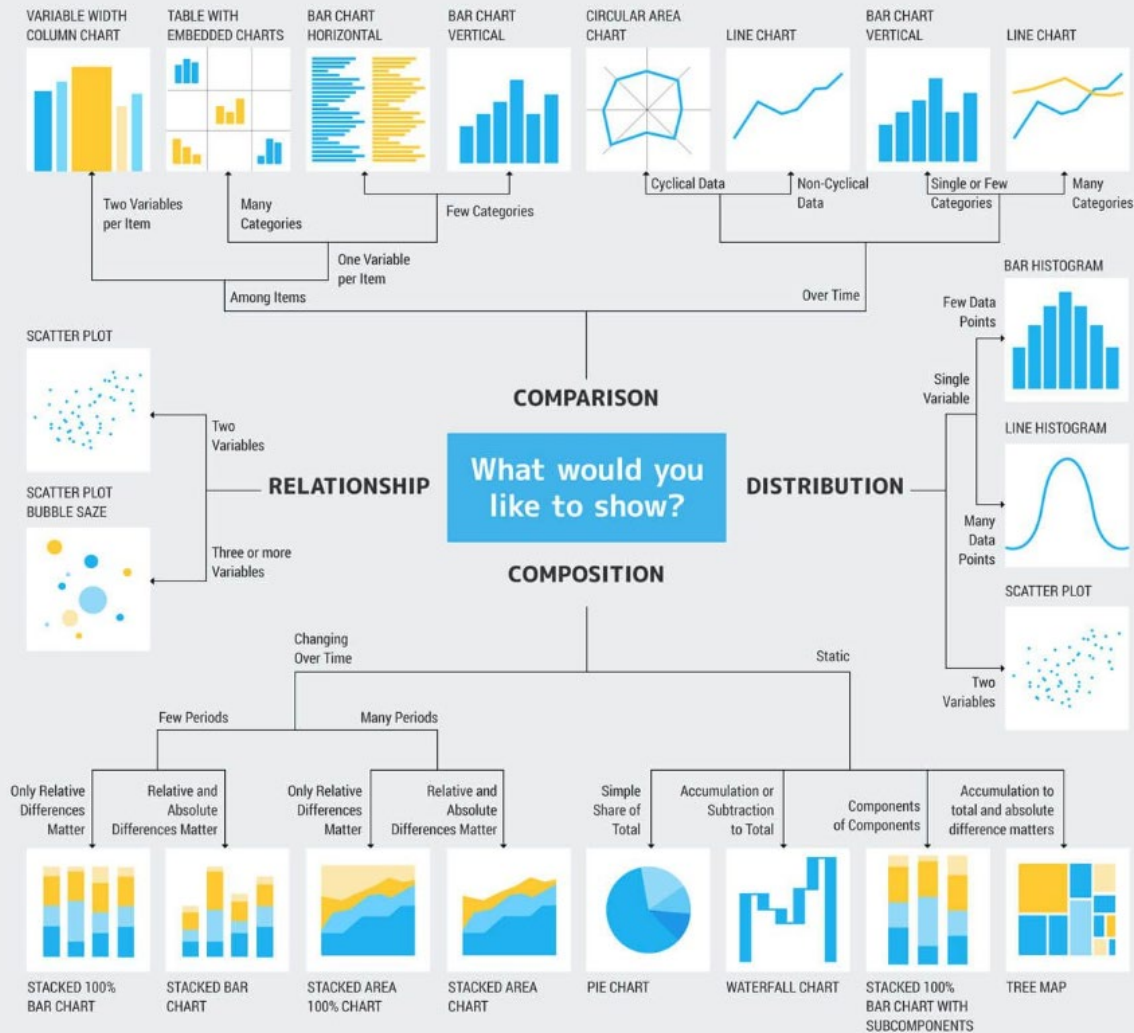
- ▶ Quantitative – data
- ▶ Qualitative – concept

What are you doing? (more complicated q)

- ▶ Making a statement
- ▶ Confirming a hypothesis
- ▶ Exploring

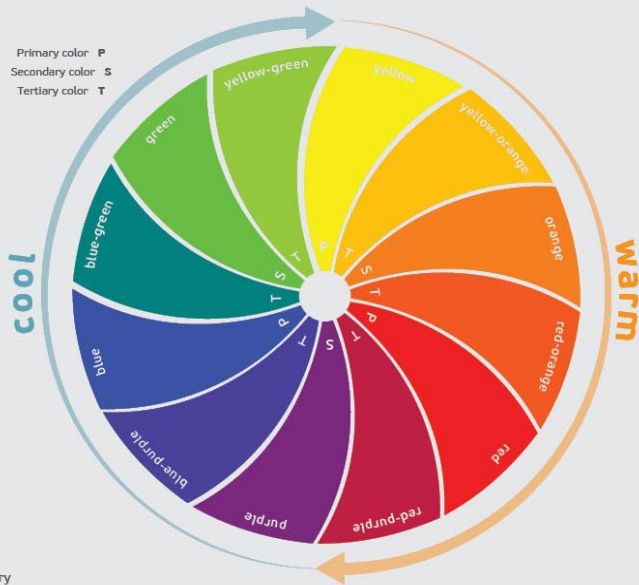
Credit: Good Charts (HBR Guide)

Abela's hierarchy



COLOR THEORY

Primary color P
Secondary color S
Tertiary color T

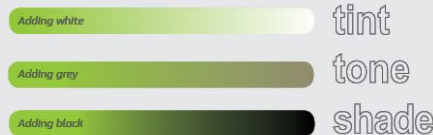


Hue (pure color)
Tint
Tone
Shade



moods

- Joyful
Optimist
Active
- Natural
Healing
Growth
- Power
Elegance
Mystery
- Loyalty
Peace
Wisdom
- Ambition
Nobility
Wealth
- Truth
Purity
Equality
- Dynamic
Passion
Danger
- Energy
Charisma
Innovation
- Neutral
Stability
Contemporary



related

contrasting

discordant



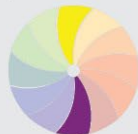
Achromatic



Monochromatic



Analogous



Complementary



Split Complementary



Triadic



Double Complement



Alternate Complement



Tetrad



Polychromatic



color schemes



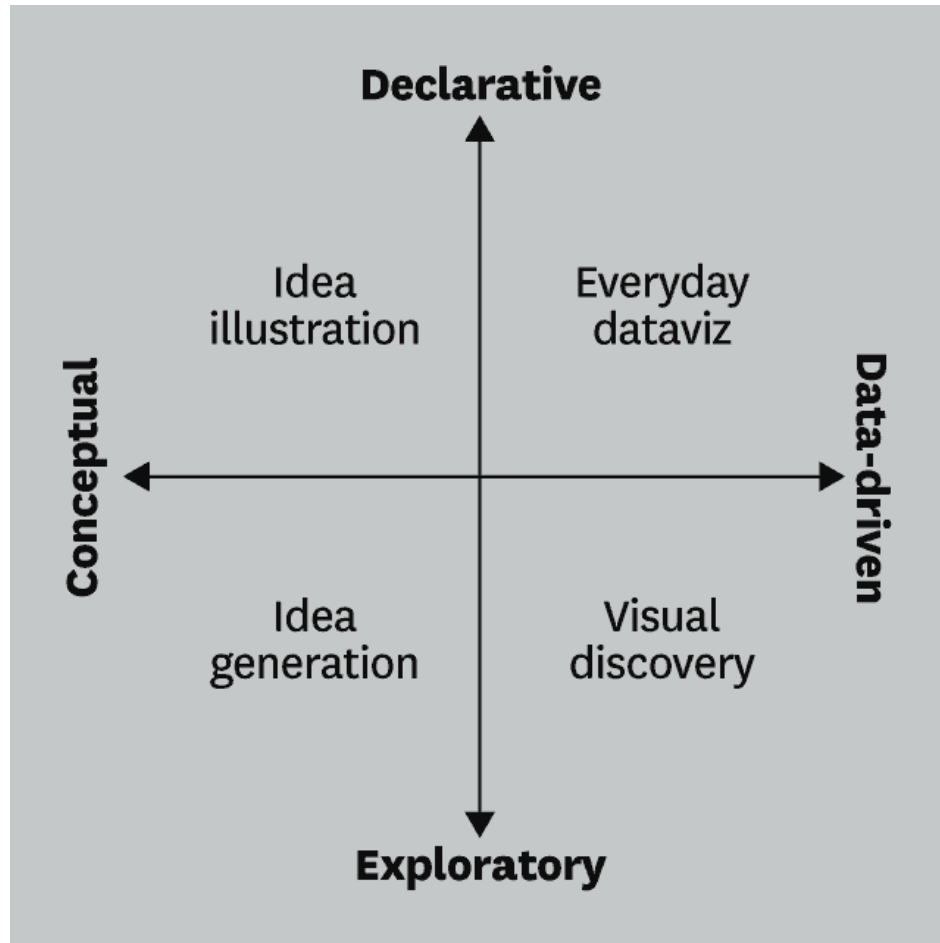
color schemes



color schemes



Uses of Data Visualization in Law

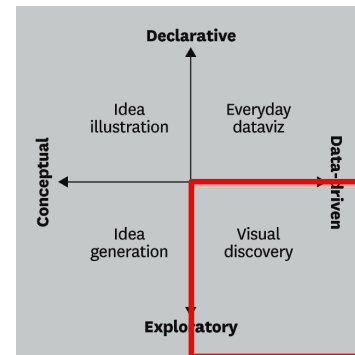
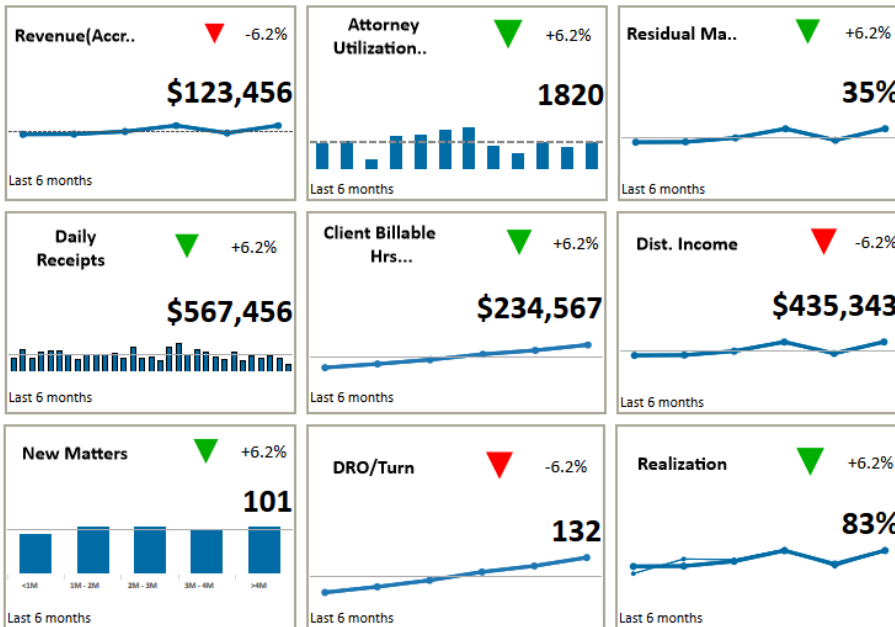


Data Driven and Exploratory

Business Intelligence Dashboard

- Summary
- Firm
- Practices
- Locations
- Clients
- Matters
- Fee Earn..
- Reports
- ?

Click on the metric to drill down and view detailed information



Data Driven and Exploratory

The screenshot displays the University of Baltimore website. At the top left is the university logo with the text "UNIVERSITY OF BALTIMORE". A navigation bar below the logo contains links for "home: school of law", "about the school of law", "admissions", "academics", "clinics and centers", "library", "faculty", "career development", "alumni", and "ABA required disclosures". The main content area features a large blue header with a white dot pattern and the title "The Supreme Court Mapping Project". Below this, a breadcrumb trail reads "School of Law > Faculty > Mapping the Supreme Court". On the left, a "FACULTY" sidebar lists: Home, SCOTUS Mapper Library, Online Mapping Tool, 4th Amendment Atlas, 2015 Term Cases, 2014 Term Cases, and Classic Networks. The main text area contains the heading "The Supreme Court Mapping Project is an ongoing and collaborative research venture that uses original software technology to enhance teaching, learning, and scholarship about Supreme Court doctrine." followed by the text "The SCOTUS Mapping Project has two components:". To the right, a grey box contains the text: "New to SCOTUS mapping? Browse the Mapping Resources page of the library. There you can find detailed explanations of maps with links the videos, blog posts and scholarly articles." and "Want to make your own SCOTUS map? Check out the free online map".

UNIVERSITY OF
BALTIMORE

home: school of law | about the school of law | admissions | academics | clinics and centers | library | faculty | career development | alumni | ABA required disclosures

The Supreme Court Mapping Project

< FACULTY

School of Law > Faculty > Mapping the Supreme Court

Home

SCOTUS Mapper Library

Online Mapping Tool

4th Amendment Atlas

2015 Term Cases

2014 Term Cases

Classic Networks

The Supreme Court Mapping Project is an ongoing and collaborative research venture that uses original software technology to enhance teaching, learning, and scholarship about Supreme Court doctrine.

The SCOTUS Mapping Project has two components:


New to SCOTUS mapping? Browse the [Mapping Resources](#) page of the library. There you can find detailed explanations of maps with links the videos, blog posts and scholarly articles.

Want to make your own SCOTUS map? Check out the free [online map](#).

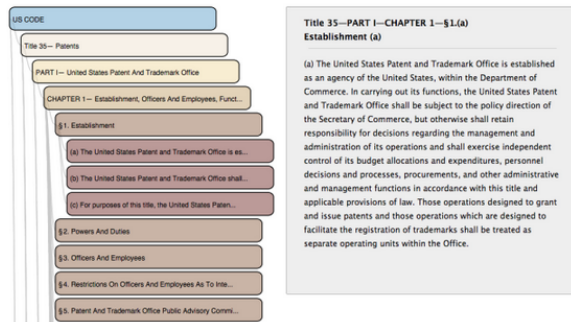
Data Driven and Exploratory

HARRY SURDEN

Professor of Law, University of Colorado Law School

HOME BLOG ABOUT RESEARCH PROJECTS COURSES CV VIDEOS FACULTY CONTACT 

VISUALIZING THE US CODE -PART 1: LAW EXPLORER



US Code Explorer: Title 35 (Click to Use)

Title 35—PART 1—CHAPTER 1—§ 1.(a) Establishment (a)

(a) The United States Patent and Trademark Office is established as an agency of the United States, within the Department of Commerce. In carrying out its functions, the United States Patent and Trademark Office shall be subject to the policy direction of the Secretary of Commerce, but otherwise shall retain responsibility for decisions regarding the management and administration of its operations and shall exercise independent control of its budget allocations and expenditures, personnel decisions and processes, procurements, and other administrative and management functions in accordance with this title and applicable provisions of law. Those operations designed to grant and issue patents and those operations which are designed to facilitate the registration of trademarks shall be treated as separate operating units within the Office.

PROJECTS



[US Code Explorer](#)



[Code Explorer 2](#)



[US Constitution Explorer](#)



[Probability Tree Diagram](#)

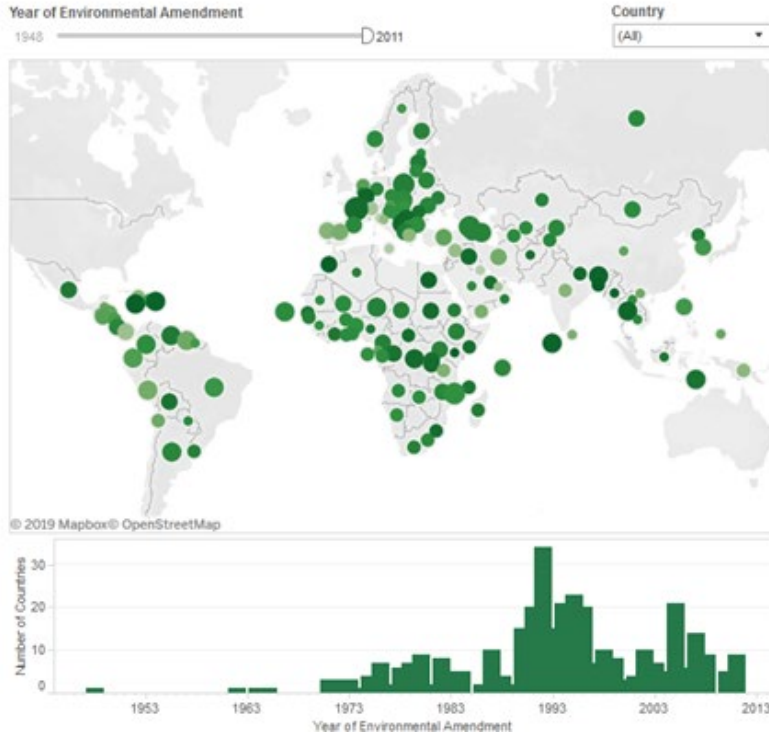
CONTACT

Twitter: @HarrySurden

Email: [hsurden \(at\) colorado.edu](mailto:hsurden@colorado.edu)

Data Driven and Exploratory

Right to Environment in National Constitutions



Amendment Categories

- (All)
- 1) State duties and obligations
- 2) State objectives
- 3) Right to information about the environm...
- 4) Right to a healthy environment
- 5) Concern for future generations
- 6) Individual duty to respect and conserve

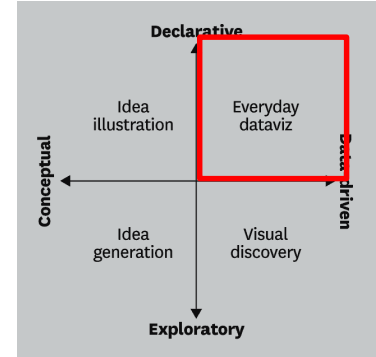
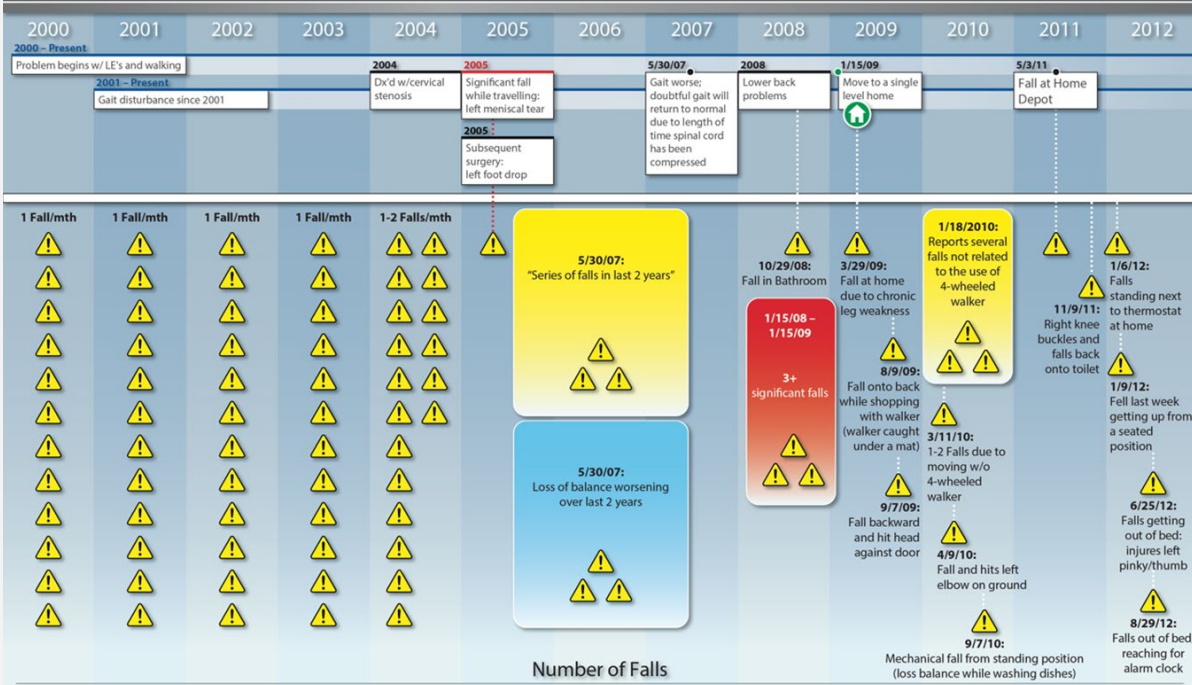
This visualization depicts 147 countries whose constitutions include environmental protection provisions. Of the constitutions of these 147 countries, 92 specifically cite a human right to a healthy environment (category 4). Other provisions indicate state duties and obligations (category 1), state objectives or goals (category 2), citizens' right to information about the status and health of the environment (category 3), concern for future generations or sustainable development (category 5), and individual duty of citizens to respect and conserve the environment (category 6).

Use the slider in upper left corner to navigate across time. Specific countries or categories can be viewed on the map by making selections in the appropriate boxes.

The **shade of the circle** corresponds to the age of the amendment (i.e. the darker the shade, the more recent the amendment). The **size of the circle** indicates the relative strength of a country's constitutional environmental provisions, as calculated by summing across the six categories. Thus, the larger the circle, the greater the number of categories covered by constitutional provisions.

DataDrive and Declarative

Jones v. Home Depo



DataDrive and Declarative

6. Guarantees

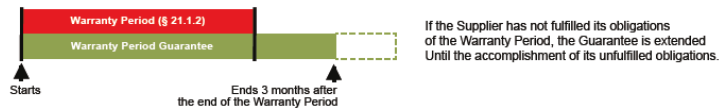
In order to guarantee the performance of Supplier's obligations hereunder the Supplier shall deliver at his sole expense to the Purchaser the following unconditional and irrevocable guarantees that are payable upon demand from a banking institution acceptable to the Purchaser:

6.1 Advance Payment Guarantee



The Supplier shall provide a guarantee in accordance with [Appendix 5](#), as a security for the amount of the advance payments made by the Purchaser (i.e. payments number 1-2 specified in [clause 5 "Payment Terms"](#) above.), equal to 30 % of the Purchase Price. The guarantee shall remain valid until three (3) months after the date of Provisional Acceptance. The delivery of this advance payment guarantee is a precondition for all the advance payments (as described above).

6.2 Warranty Period Guarantee



The Supplier shall provide, in accordance with [Appendix 5](#), a guarantee on the performance of the Supplier's remaining work and warranty obligations, equal to 10 % of the Total Purchase Price. The guarantee shall remain valid until three (3) months after the end of the Warranty Period of the Equipment. The delivery of this warranty period guarantee is a precondition for the payment of the third installment specified in [clause 5 "Payment Terms"](#) above. If the Supplier has not fulfilled its obligations of the Warranty Period at the expiry of the validity of the said guarantee bond, the Supplier shall extend its validity for the duration of the performance of its unfulfilled obligations.

5. Payment term

The Purchaser shall pay the Purchase Price specified above in accordance with the following payment schedule (hereinafter "Payment Schedule") and against the Supplier's invoice. The right to invoice arises on the fulfilment of the terms of payment stated below:

- 1) **10 % of the Purchase Price, fifty thousand (50 000) euro** as an advance payment when this Agreement has been signed, provided that the advance payment guarantee (as described in [clause 6 "Guarantees"](#)) have been delivered to the Purchaser;
- 2) **20 % of the Purchase Price, hundred thousand (100 000) euro** when complete detail engineering documentation by the Supplier have been delivered and approved by the Purchaser,
- 3) **60 % of the Purchase Price, three hundred thousand (300 000) euro** when the commissioning of the Equipment and final documentation concerning the Equipment has been completed and accepted by the Purchaser;
- 4) **10 % of the Purchase Price, fifty thousand (50 000) euro** when the warranty period guarantee and performance guarantee have been delivered to the Purchaser, and the Provisional Acceptance Certificate has been signed according to [clause 13 "Provisional Acceptance"](#).



Data Driven and Declarative



VENDOR POWER!

ভেতরের কমতা! 街販力量! قُوَّة البّياعين! ¡Si Se Puede!

A GUIDE TO STREET VENDING IN NEW YORK CITY



WAYS TO A BETTER VENDOR WORLD

In New York, street vending has always attracted ambitious, hard-working men and women with limited economic options. Successive waves of immigrants — Jewish and Italian in a previous era, now Chinese, Bangladeshi, Afghan, and Senegalese — have used vending to gain a foothold in their new country. Its low start-up costs, independence, and flexibility make vending a traditional first stop for small business entrepreneurs.

But vending isn't an easy way to get ahead. Throughout New York City's history, merchants resentful of "unfair" competition have joined forces with city officials concerned with congestion, modernization, and "quality of life" to bar vendors from streets and regulate them excessively. These complex and shifting laws force vendors back and forth across the border between the formal and informal economies, making it difficult for vendors to serve the public and make a decent and honest living.

Here are four basic ways the City can make vending laws work better for vendors, their customers, and everyone else.

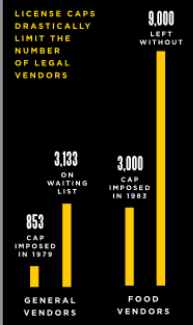
START-UP COSTS TO VEND

LICENSE	\$25 - 200 PER YEAR
FOOD PERMIT	\$15 - 200
TABLE	\$20 - 200
CART	\$3,000 - 80,000
GARAGE PERMIT FOR CART	\$300 - 500 PER MONTH
INVENTORY	\$500 - 3,000 TO START

FORMER NYC VENDORS




JERRY SEINFELD
JAY-Z
JEAN-MICHEL BASQUIAT
AMADOU DIALLO
LEVI STRAUSS



1. LIFT THE CAPS

It's virtually impossible to get a vending license in New York City because of strict caps, or limits, placed on the number of vendors in the 1970s and '80s. The estimated wait for a general vending license is several decades. By setting the caps far below vendor supply and public demand, the City unintentionally creates a thriving and exploitative black market for permits and licenses. Legal vendors have to buy licenses from illegal middlemen at exorbitant prices. Other vendors are driven underground, where they're unlicensed and unregulated. To bring vendors into the legal mainstream, the City should raise the caps to realistic levels and crack down on the black market in licenses and permits.

MIXED ACTION TOWARDS A "NOBLE PROFESSION"



Mayor Edward Koch (1978-1989) said "peddling is a noble profession." He proposed a bill to open more streets to vending while restricting the number of vendors per block through a site lottery, but it didn't pass. While he didn't enforce increased street restrictions, he signed Local Law 50 in 1978, capping general vendor licenses at 853, the number of licenses at the time. It was the first hard cap in the city's history.

BUSINESSES THAT STARTED AS PUSHCARTS

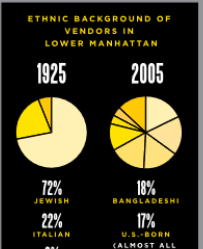


BLOOMINGDALE'S D'AGOSTINO
MACYS
ROC-A-FELLA RECORDS
COHEN'S FASHION OPTICAL
GOLDMAN SACHS

1880s



Four Jewish peddlers set up pushcarts along Hester Street on the Lower East Side, leading to the first pushcart market in New York City. The main Italian market evolved on Grand Street in lower Manhattan, and Paddy's Market in Hell's Kitchen served Irish immigrants.



1939



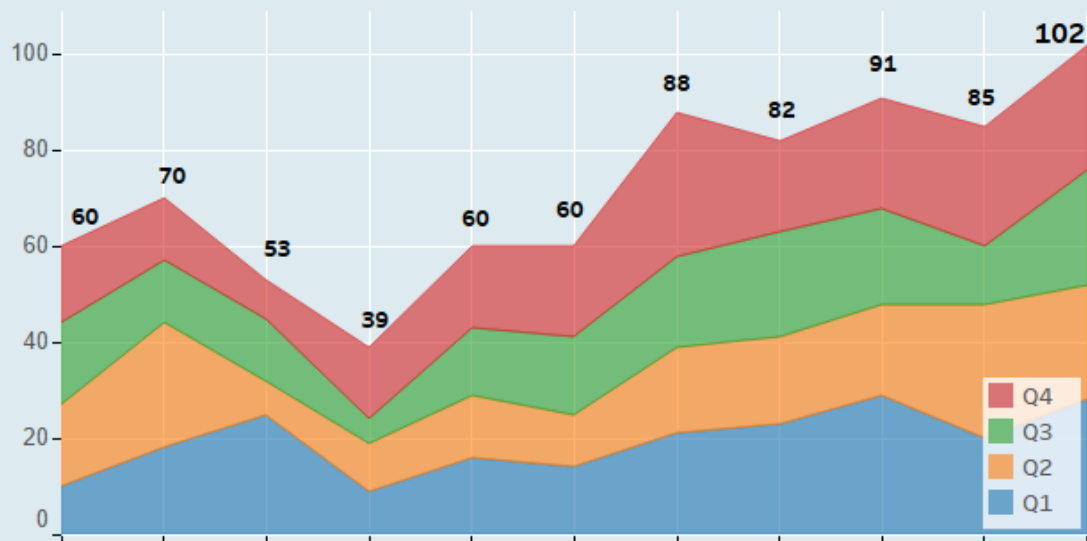
New York City featured an exhibit in the World's Fair called "The Life and Death of a Pushcart."



DataDrive and Declarative - Trend Analysis

Record-Breaking Year For U.S. Law Firm Mergers

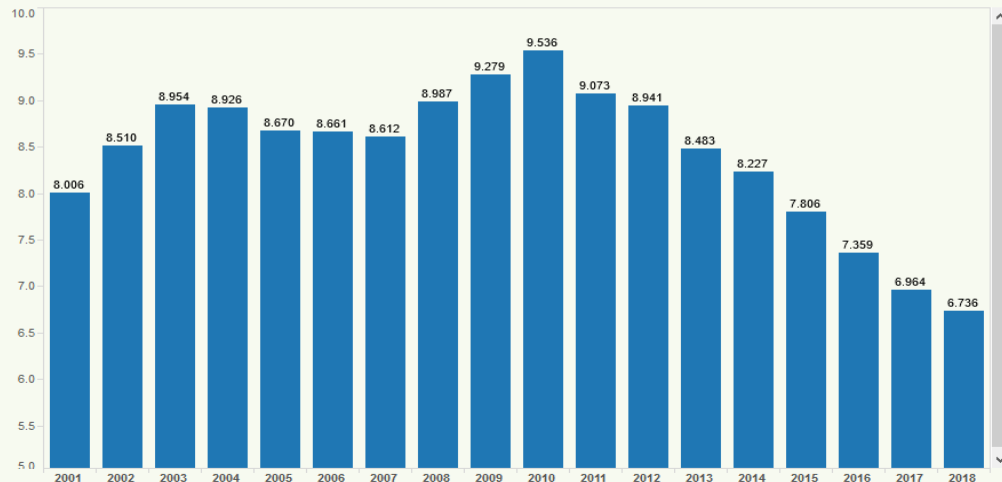
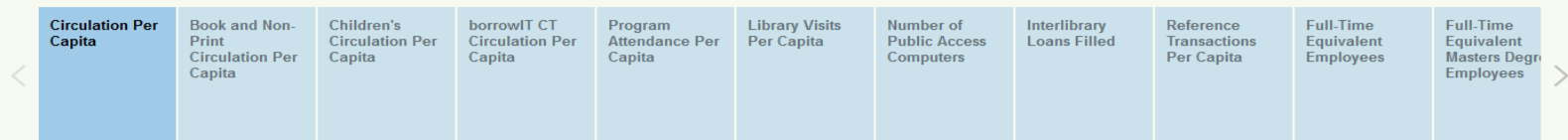
There were 102 law firm combinations involving U.S. firms in 2017 — the highest annual total recorded in the 11 years Altman Weil MergerLine has been compiling data. The largest merger combined 500-lawyer Womble Carlyle with 580-lawyer UK firm Bond Dickinson, creating a new transatlantic law firm, Womble Bond Dickinson.



DataDrive and Declarative - Trend Analysis

Statistical Trends for Connecticut Public Libraries, 2001 - 2018

Click thru the different panels below to see a variety of library statistical measures



Circulation Per Capita

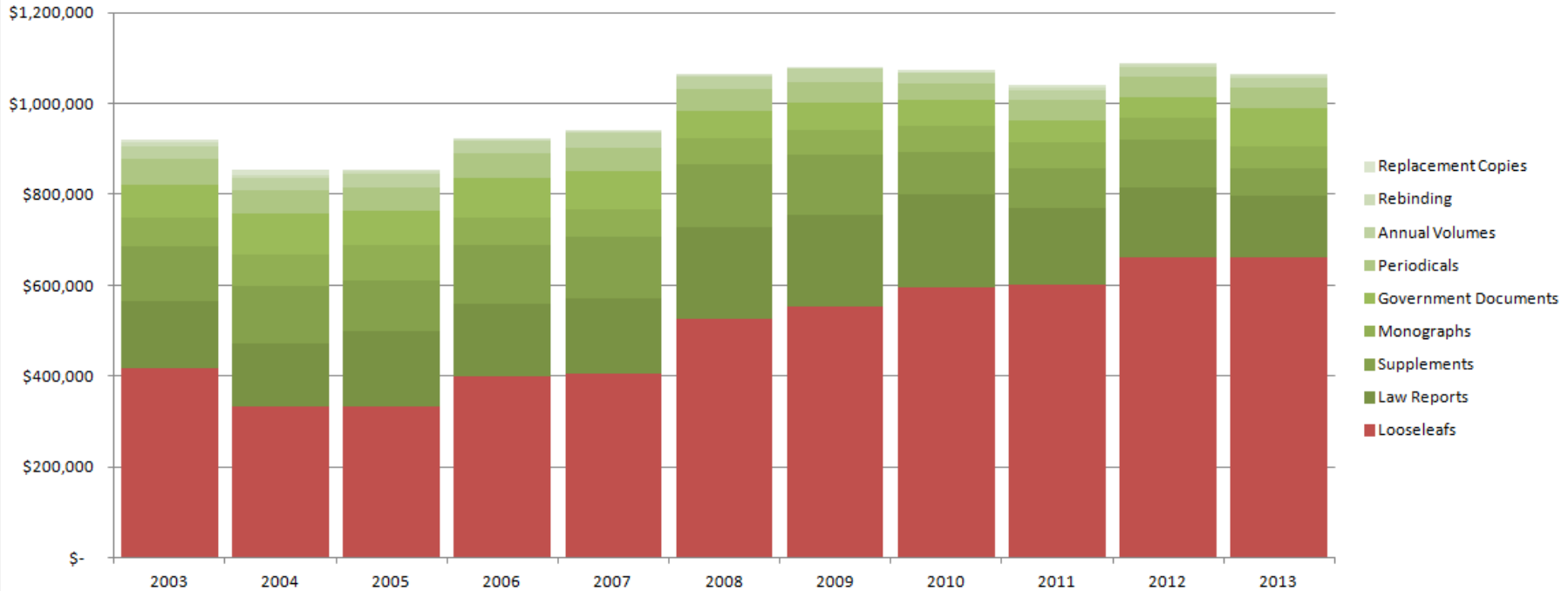
A reliable measure of library use, libraries are used as much now as they have ever been, though not all this use is reflected in the traditional borrowing of library materials. Circulation has declined in the last six years after spiking upward during the recent recession. A decline in circulation is typical after recessions, not so much because libraries are less popular but because recessions usually reduce library material budgets so much that the choices for borrowing new library materials become more limited.

Connecticut currently ranks 20th in the U.S. in circulation per capita.

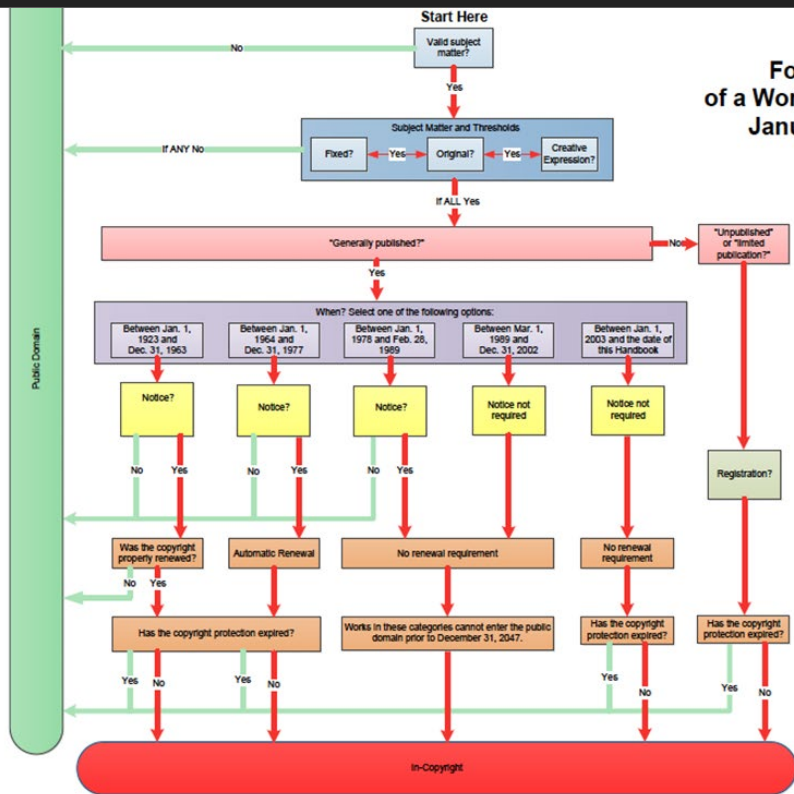
Based on the annual "Connecticut Public Libraries: a Statistical Profile" which compiles statistics from the Annual Report and Application for State Aid that public libraries complete each fall. Connecticut State Library, Division of Library Development

DataDrive and Declarative - Trend Analysis

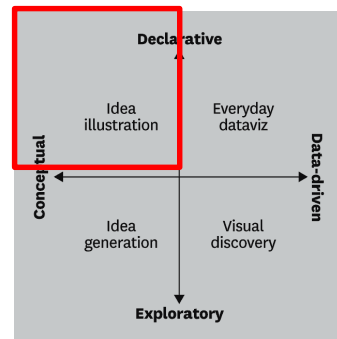
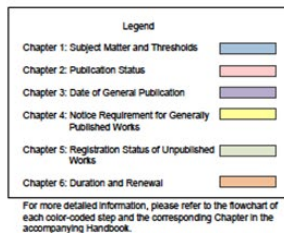
Great Library Print Collection Costs



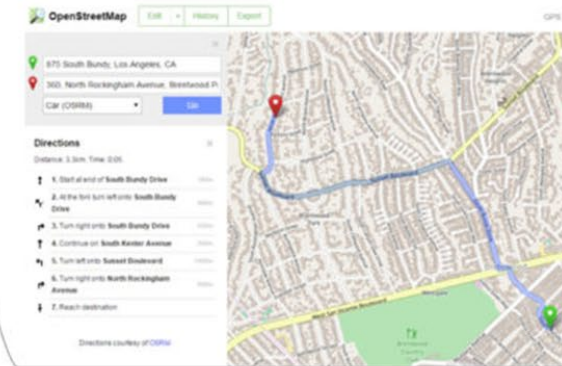
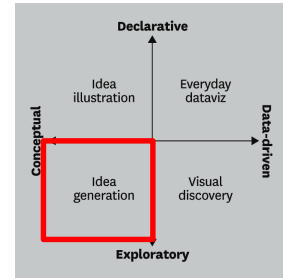
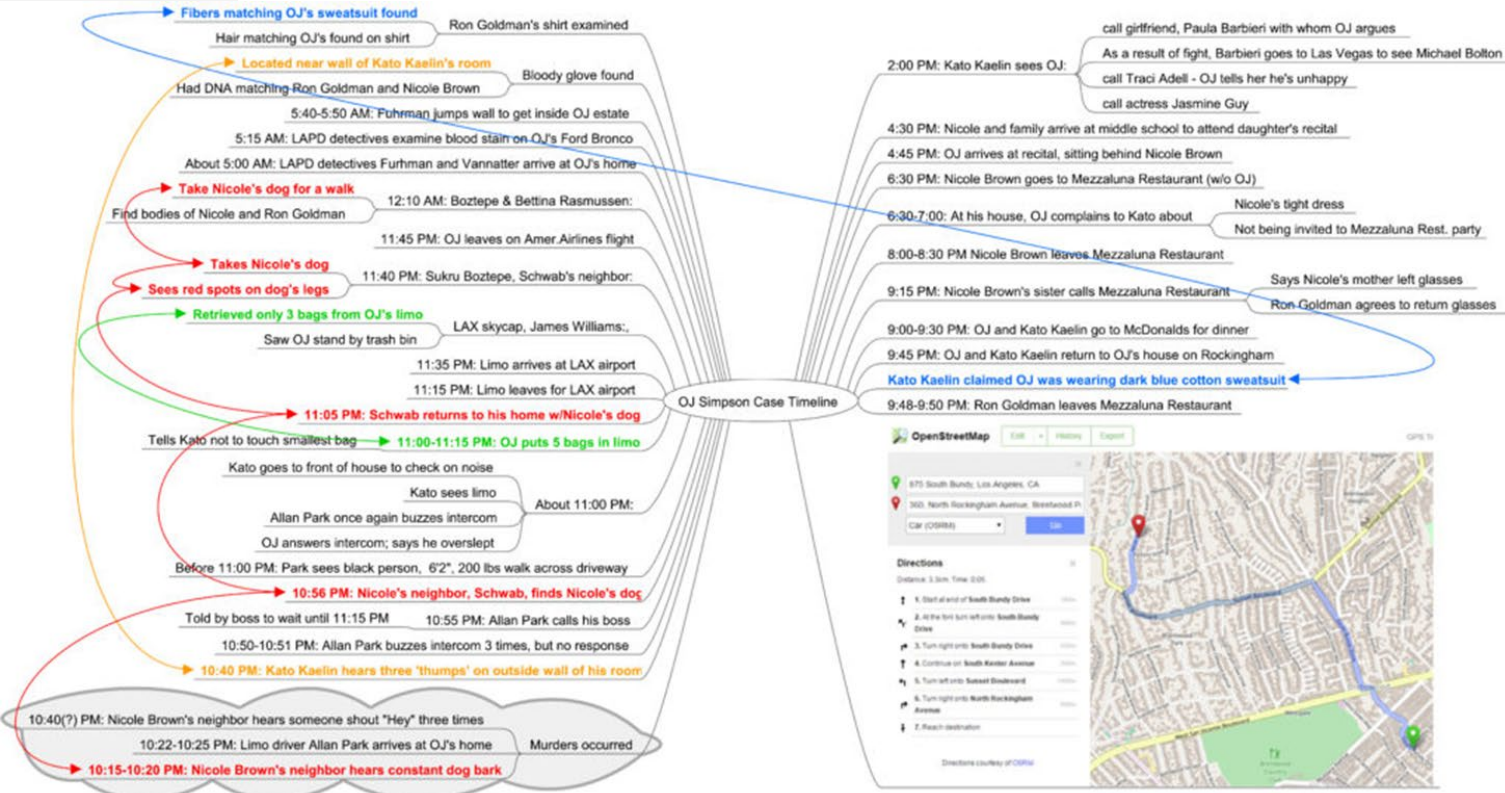
Conceptual and Declarative



MASTER FLOWCHART For Evaluating the Copyright Status of a Work Created in the United States Between January 1, 1923 and December 31, 1977



Conceptual and Exploratory



Data Visualization Tools



COMPLETENESS OF VISION

As of January 2019

© Gartner, Inc



TABLEAU

...an intuitive, interactive, visual-based exploration experience that enables users to analyze and present findings in their data without technical skills or coding.



Tableau

- ▶ **Tableau Desktop:** Individual use
- ▶ **Tableau Server:** Organization use
- ▶ **Tableau Online:** Cloud solution
- ▶ **Tableau Reader:** Read Tableau files
- ▶ **Tableau Public:** For journalists or anyone to publish interactive data online

The screenshot displays the Tableau Online web interface. At the top, the navigation bar includes the Tableau logo and menu items: Content, Users, Groups, Schedules, Tasks, Status, and Settings. Below this, a secondary navigation bar shows counts for Projects (14), Workbooks (171), Views (647), and Data Sources (32). The main content area features a search bar and a sidebar with 'General Filters' for Project, Owner, Tag, and modification dates. The central workspace is a grid of six data visualizations:

- Funding Flow:** A line chart showing two data series over time.
- Traffic Incidents:** A bar chart with a map overlay showing incident locations and times.
- Census 2013 Median Age Views:** A map of the United States with a color-coded overlay representing median age.
- UK Crime Statistics:** A map of the United Kingdom with a color-coded overlay representing crime statistics.
- Unemployment:** A horizontal bar chart showing data across various categories.
- Customer Analytics:** A scatter plot showing a positive correlation between two variables.

Each visualization includes its title, view count, and a star icon for favorites.

Sales
£2,695,080

Profit
£347,665

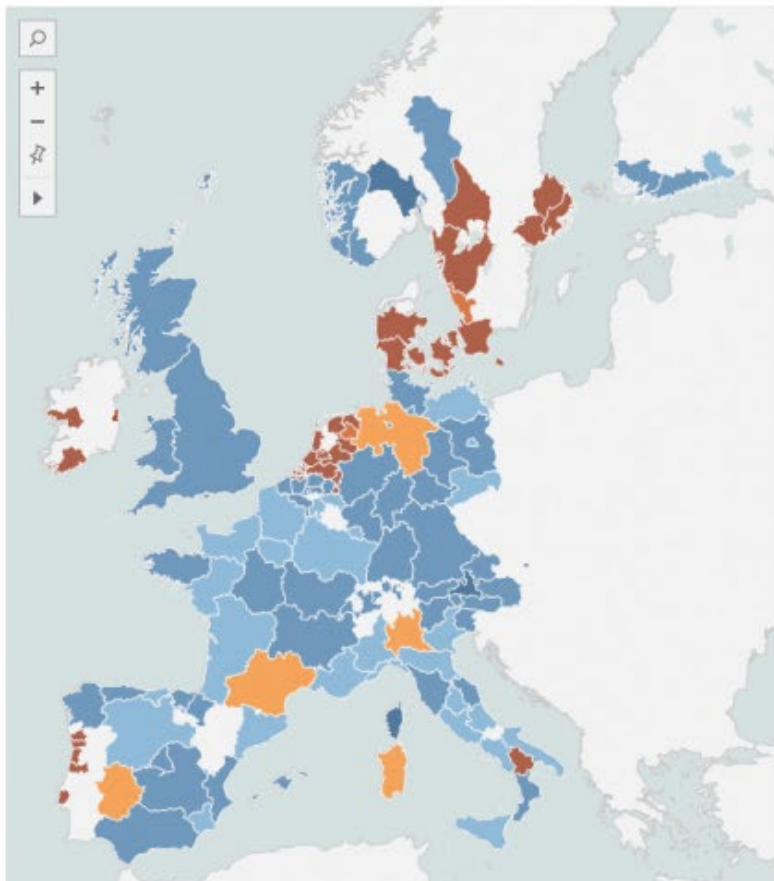
Profit Ratio
13%

Profit per Order
£81.31

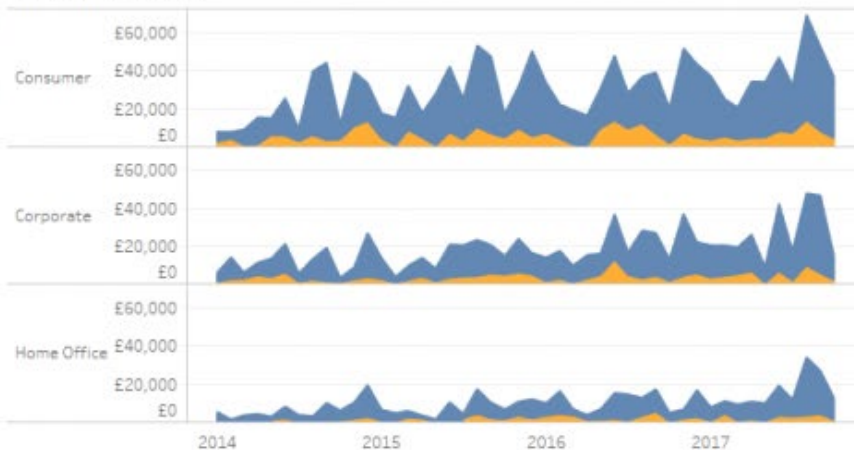
Sales per Customer
£3,390.04

Discount
10%

Quantity
34,426



Monthly Sales



Region

(All)

Order Date

01/01/2014 31/10/2017

Profit Ratio

-101% 47%

Profit Ratio

-50% 50%

Select Field

Segment

Select Sheet

Monthly Sales

Monthly Sales
Sales and Profit by Product Name

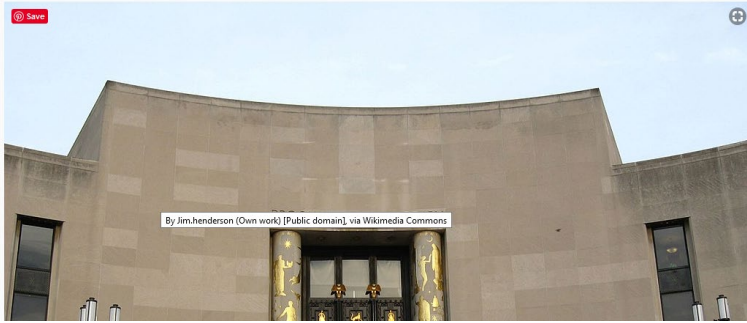
Sales by Product Category

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Furniture	2014	£6,752	£13,810	£4,436	£7,489	£8,879	£17,240	£2,197	£13,810
	2015	£6,302	£6,461	£10,541	£4,538	£10,041	£25,169	£11,836	£25,169
	2016	£16,180	£14,625	£13,118	£7,355	£10,009	£21,993	£15,167	£24,625
	2017	£11,380	£13,904	£15,632	£20,851	£11,978	£31,886	£15,361	£32,904
Office Supplies	2014	£8,068	£4,079	£9,574	£13,442	£13,537	£18,069	£6,223	£18,069
	2015	£16,675	£5,459	£15,387	£12,950	£12,699	£17,401	£18,633	£33,459
	2016	£27,729	£22,383	£14,361	£12,503	£17,172	£29,830	£19,045	£31,383
	2017	£21,254	£20,963	£17,607	£23,112	£24,488	£33,335	£21,018	£51,963
Technology	2014	£3,784	£4,747	£3,916	£9,202	£8,086	£19,047	£9,899	£23,916
	2015	£13,971	£11,062	£21,008	£16,981	£14,053	£30,904	£18,771	£34,062

Brooklyn Public Library saves time, money, and headcount with Tableau

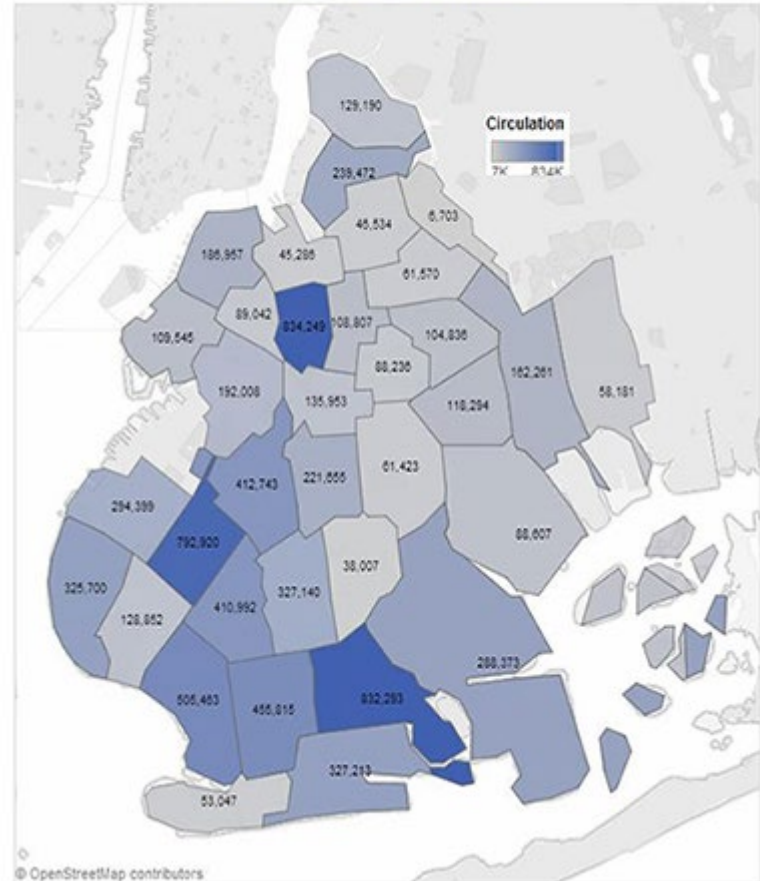
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Brooklyn Public Library: YTD Circulation (by Terminal) by Branch Zip Code

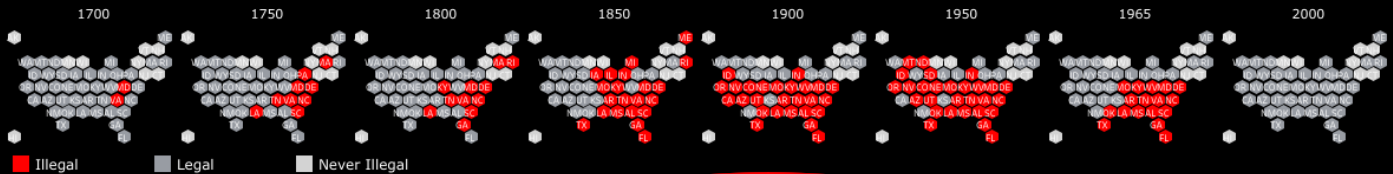
Note does not include online renewals.
(hover over each area for details)



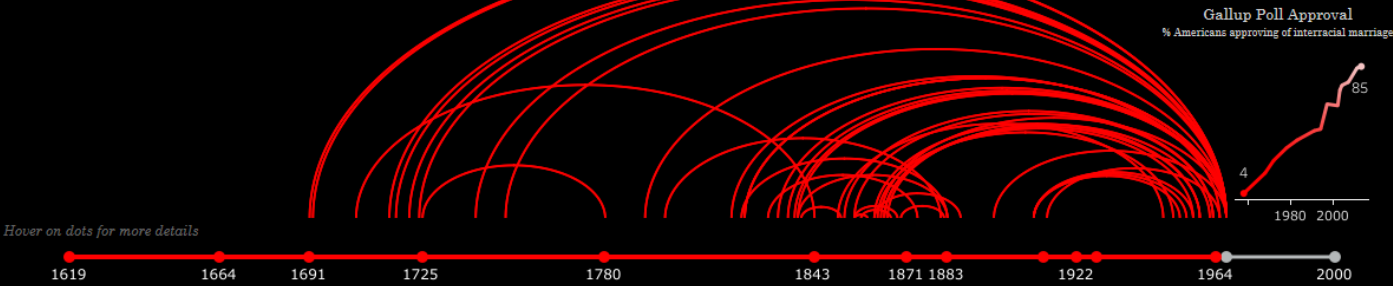
All persons born or naturalized in the United States, and subject to the jurisdiction thereof, are citizens of the United States and of the state wherein they reside. No state shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States; nor shall any state deprive any person of life, liberty, or property, without due process of law; nor deny to any person within its jurisdiction the equal protection of the laws. Representatives shall be apportioned among the several states according to their respective numbers, counting the whole number of persons in each state, including Indians bound to any person, but excluding three fifths of all other persons. But when the right to vote at the election for President and Vice President of the United States, Representatives in Congress, the executive and judicial officers, and the electors in any state, shall be denied to any person, because he is a native-born citizen of the United States, and twenty-one years of age, and citizen of the United States, or in any way abridged, except for participation in rebellion, or other crime, the basis of representation shall be ascertained as if the number of such persons should be added to the whole number of male citizens twenty-one years of age in such state. No person shall be a Senator or Representative in Congress, or elector in any state, or hold any office, civil or military, under the United States, or under any state, who, having previously taken an oath, as a member of Congress, or as an officer of the United States, or as an officer of the United States, shall have engaged in insurrection or rebellion against the same, or given aid or comfort to the enemies thereof. But Congress may by a vote of two-thirds of each House, remove such disability. The validity of the public debt of the United States, authorized by law, including debts incurred for payment of pensions and bounties for services in suppressing insurrection or rebellion, shall not be questioned. But neither the United States nor any state shall assume or pay any debt or obligation incurred in aid of insurrection or rebellion against the United States, or any debt or obligation incurred by any state in aid of such insurrection or rebellion, or any debt or obligation incurred by any state in aid of such insurrection or rebellion.

White & Black

A history of interracial marriage laws in the United States



Click on state above to highlight timeline



Hover on dots for more details

In 1619, the first enslaved African people were brought to what is now the United States. 72 years later, the Commonwealth of Virginia outlawed interracial marriage, the first territory to do so.

By the time that the Founding Fathers declared that "all men are created equal, that they are endowed by their Creator with certain unalienable Rights," 10 territories had passed laws banning interracial marriage.

At the onset of the Civil War, of the 34 states that existed at the time, 25 of them had laws banning interracial marriage. When the Greatest Generation came back from World War II, 30 of the 48 states had bans on interracial marriage.

In 1967, the Supreme Court ruled in *Loving v Virginia* that interracial marriage bans were unconstitutional. The legal hurdle had been cleared, but as Dr. King noted, legality did not mean acceptance.

"Marriage is one of the 'basic civil rights of man', fundamental to our very existence and survival. ...Under our Constitution, the freedom to marry, or not marry, a person of another race resides with the individual and cannot be infringed by the State..."



These convictions must be reversed."

-Chief Justice Earl Warren



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Microsoft Power BI

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Power BI Pro: Organization use

BI Reader: not available



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Data should empower, not overwhelm. With Power BI, you can easily interact with your data, using simple drag-and-drop gestures to discover trends and natural language queries to get lightning-fast answers.



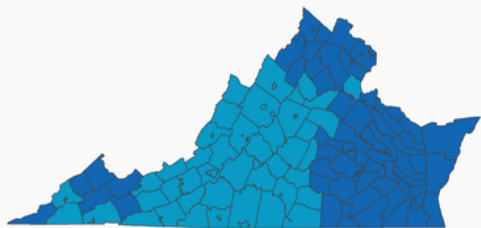
Virginia Democratic Gubernatorial Primary

Tuesday, June 13, 2017

Showing results for all of Virginia

Select a county

All



100.0% precincts reporting
Last updated June 14, 2017 11:27:22 am EDT

AP

AP

The Associated Press and Microsoft deliver up-to-the-minute election results

The world relies on The Associated Press (AP) to deliver up-to-the-minute election results. For the 2017 Virginia gubernatorial primary, AP and Microsoft used Power BI to create visualizations of election data. AP offered member news outlets these visualizations, which included an interactive map showing results by county and party, to provide audiences with near-real-time results.

[READ THE STORY >](#)

United States electricity production

Electricity Production by source (% of total)



THANKS!

Any questions?