



Matthew Brehmer | @mattbrehmer | mattbrehmer.ca

–
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New Experiences for Communicating with an Audience About Data

Matthew Brehmer, Tableau Research

–

@ MICA – Oct 3 2022

About Tableau

“Helping people see and understand data...”

tableau.com, a Salesforce company

est. 2003 by Christian Chabot, Pat Hanrahan, and Chris Stolte

The screenshot displays the Tableau interface for a dashboard titled "Weather Trends". The interface is divided into several panes:

- Data:** Shows "Weather Data" as the selected data source.
- Dimensions:** Lists fields such as Date, City, Country, Region, Time, and Measure Names.
- Measures:** Lists fields such as Hourly Temp, Rainfall, Windspeed, Latitude (generated), Longitude (generated), and Measure Values.
- Marks:** Shows the "Automatic" mark type and options for Color, Size, Text, Detail, and Tooltip.
- Columns and Rows:** Both are currently empty, with "Drop field here" prompts.
- Dashboard View:** The main area shows a large empty space with "Drop field here" prompts, indicating that no visualizations have been created yet.

About Tableau Research

research.tableau.com

established 2012 | director: Vidya Setlur

a team of 9 researchers / architects, working on:

visualization, human-computer interaction, natural language processing / generation, cartography, applied machine learning, ...

alumni include:

Jock Mackinlay, Leland Wilkinson, Chris Stolte, Maureen Stone, Pat Hanrahan, Robert Kosara

New Experiences for Communicating with an Audience About Data

**tools for bespoke communication-oriented
visualization design / construction**

**tools for preparing and delivering
presentations involving data visualization**

New Experiences for Communicating with an Audience About Data

- ▶ **tools for bespoke communication-oriented visualization design / construction**

tools for preparing and delivering presentations involving data visualization

Tools for Making Charts...

THE CHARTMAKER DIRECTORY

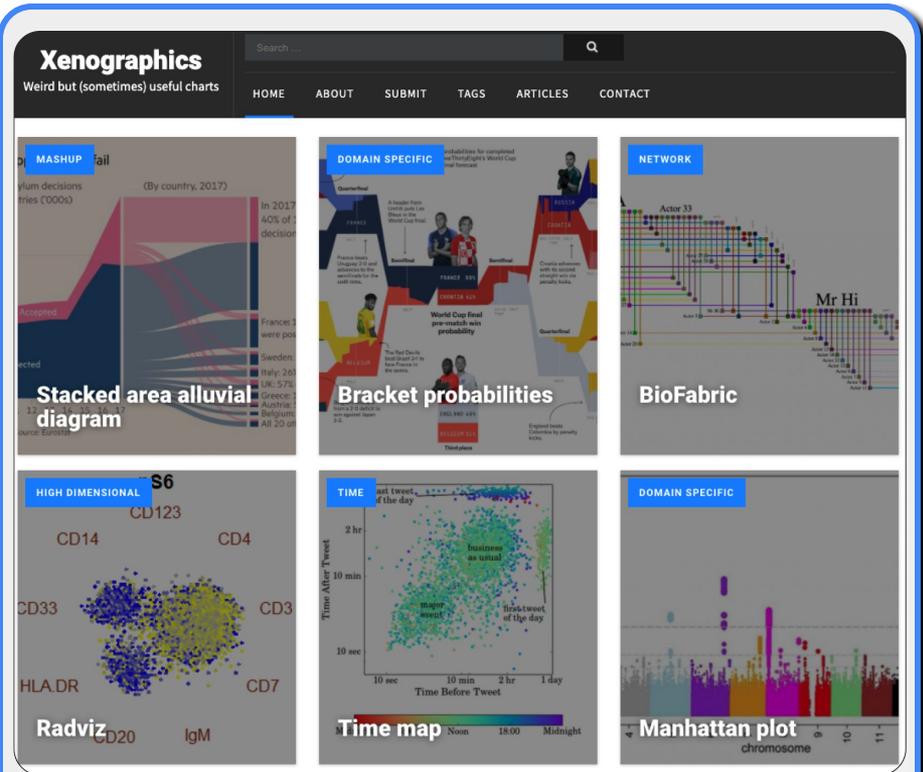
Filter by chart name or AKA

Reference type: Example Solution Chart families: Categorical Hierarchical Relational Temporal Spatial

	Amazon QuickSight	ArtGIS	ChartJS	Charticulator	D3.js	Data Illustrator	Datavizapp	Datylon	Flourish	FusionCharts	Gephi	Google Charts
Network diagram					●●○				○		○●○	
Sanku diagram	●●			●	○				○			●
Chord diagram				●●	●				●			
Line chart	●		●	●	●●●	○	○●○	●●●	○●○	○		●●
Bump chart				●●	○	○			○			
Slope graph				●	○	○			○			
Connected scatter plot				●	○●				○			
Area chart	●		●		●		●●	○●○	○●	○		●

Andy Kirk's Chartmaker Directory 

chartmaker.visualisingdata.com



Maarten Lambrechts' [xenographics](http://xenographics.com) 🖱️

...weird but sometimes useful charts – OpenVisConf 2018



Charticator

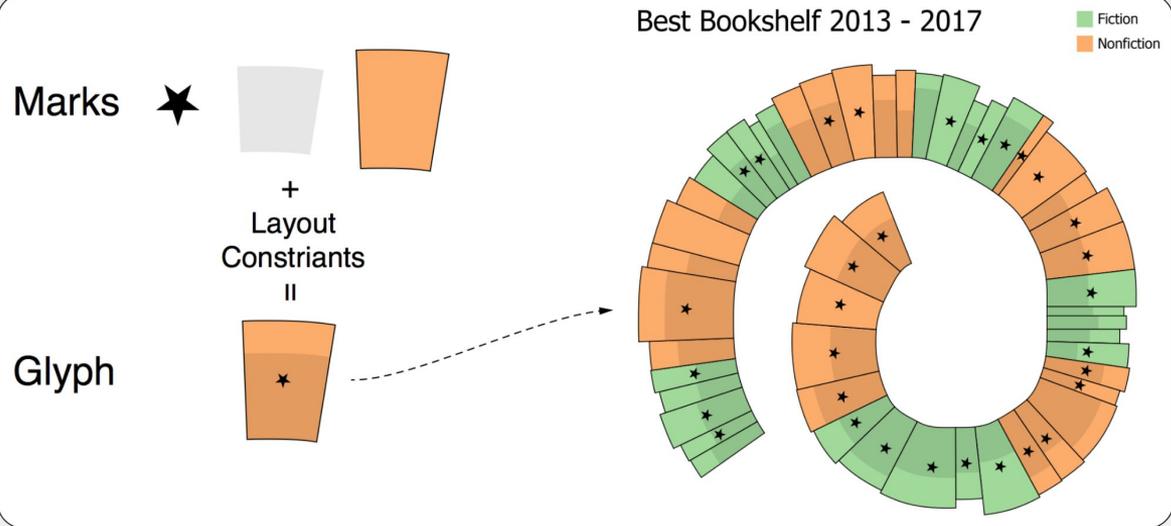
Interactive Construction of Bespoke Chart Layouts

Microsoft Research | charticator.com

Donghao Ren, Bongshin Lee, and Matthew Brehmer



shortlist, 2018 Information is Beautiful Awards



Charticulator: Interactive Construction of Bespoke Chart Layouts

Microsoft Research | charticulator.com

Donghao Ren, Bongshin Lee, and Matthew Brehmer



Zhicheng "Leo" Liu

Mar 25, 2020 · 8 min read · Member-only · Listen



Evaluating Visualization Authoring Systems through Critical Reflections

This article is a group effort, with contributions from the authors of our [InfoVis'19 paper](#).

TLDR: A new generation of visualization authoring systems has emerged in the past few years. Designed to support a common goal, these systems vary in terms of their visualization models, system architectures, and user interfaces. What are the strengths and weaknesses of these systems? How do we choose the right tools to build our visualization? We propose to use critical reflections as a method to compare these systems.

Lyra

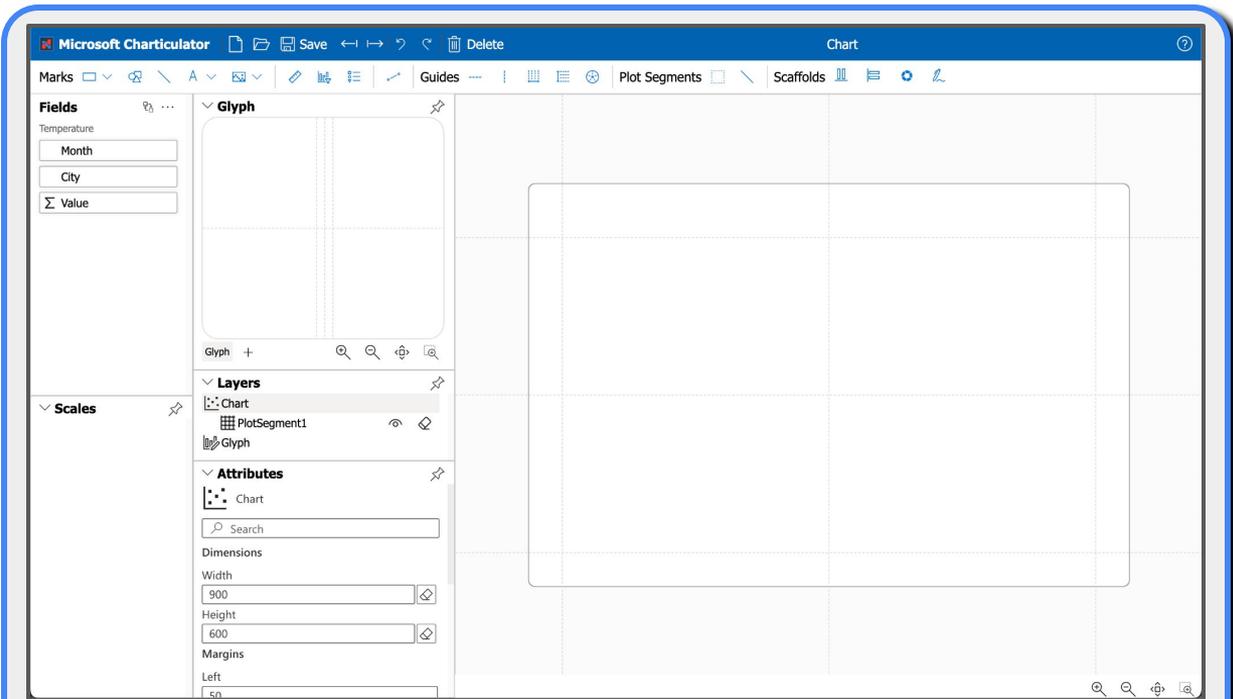


Data Illustrator



Charticulator





👉 the blank canvas in communication-oriented visualization
... missing design inspiration support in vis construction tools

- Year
- Title
- Genre
- Author
- AuthorGender
- AuthorAge
- Pages
- Rating
- RatingCount
- IsBestSeller

- Glyph

- Layers

Chart

- PlotSegment1
- Title
- Glyph

- Attributes

Chart

Dimensions

Width: 100

Height: 100

Margins

Left: 50

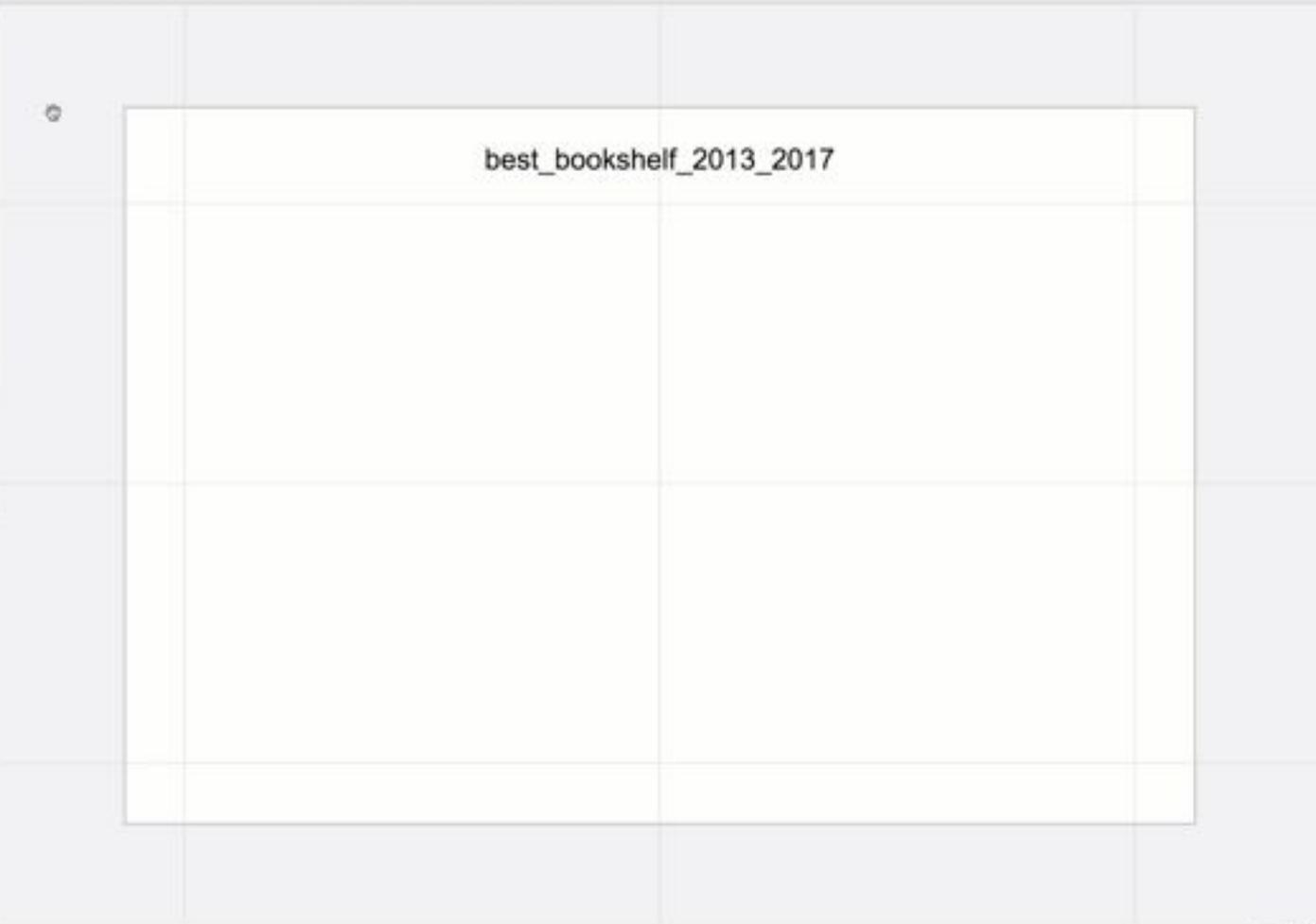
Right: 50

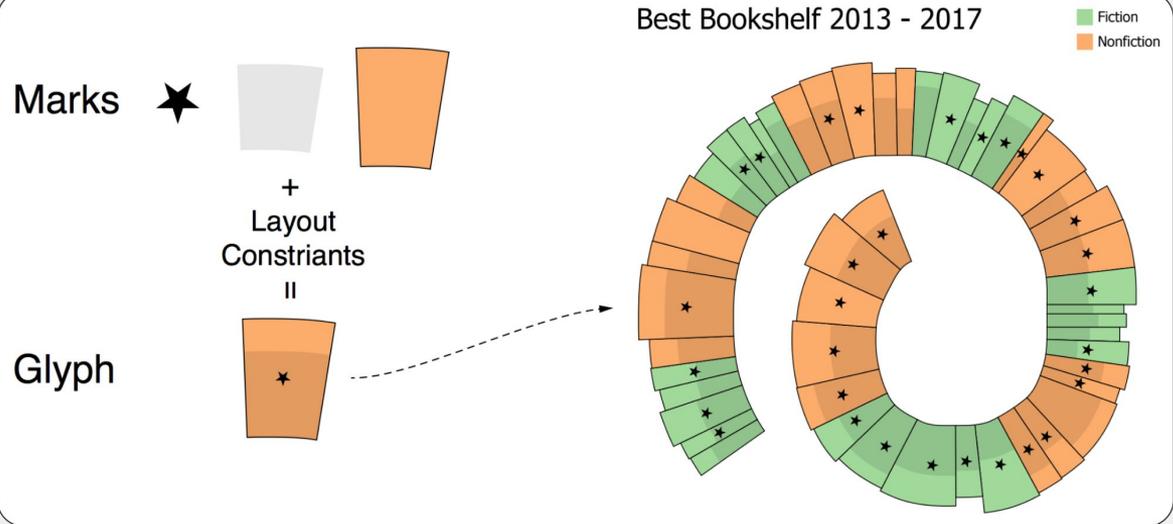
Top: 50

Bottom: 50

Background

Color: (none)





a **glyph** is “a small visual object that depicts attributes of a data record”

– Borgo et al (2013)

“...single data points are encoded individually by assigning their dimensions to one or more marks and their visual variables”

– Fuchs et al (2016)



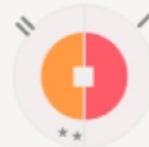
JUVENTUS
96



BORUSSIA DORTMUND
97



REAL MADRID
98



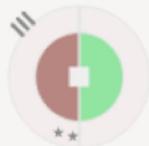
MANCHESTER UNITED
99



REAL MADRID
00



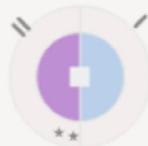
BAYERN
0



PORTO
04



LIVERPOOL
05



BARCELONA
06



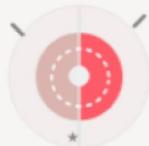
MILAN
07



MANCHESTER UNITED
08



BARCE
0



CHELSEA
12



BAYERN MUNICH
13



REAL MADRID
14



@_CJMayer on Tableau Public

140 YEARS OF MICHIGAN FOOTBALL

This graphic, inspired by Giorgia Lupi's data portraits, shows 140 years of Michigan Football, with each circle representing a season and graphical elements within that circle describing that season's results.

HOW TO READ

SHADING AT TOP LEFT INDICATES CONFERENCE
1880-1899 = INDEPENDENT,
 1900-1929 = WESTERN,
 1930-1939 = BIG TEN

A FILLED BLACK STAR UP HERE IS A NATIONAL CHAMPIONSHIP

AN OUTLINED BLUE STAR IS A CONFERENCE CHAMPIONSHIP



DOTS ON THE LEFT ARE WINS

DOTS ON THE RIGHT ARE LOSSES

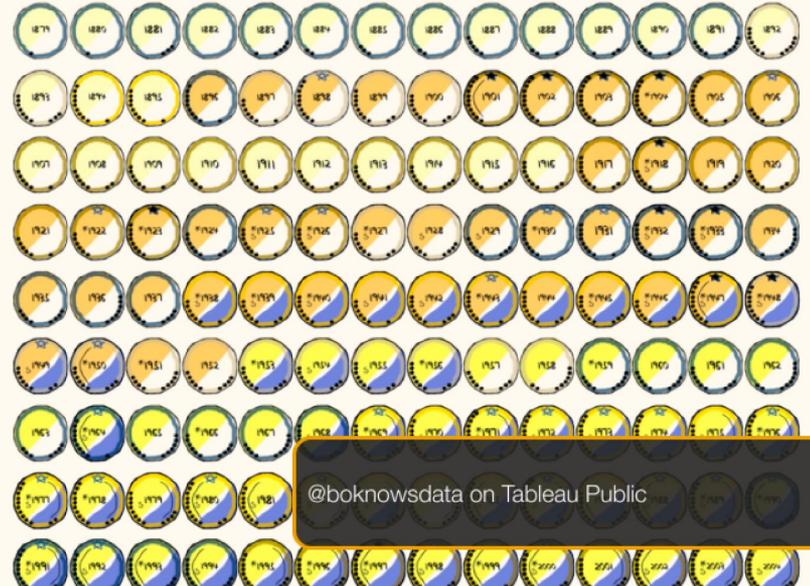
AN ARC ON THE LEFT IS A BOWL WIN

AN ARC ON THE RIGHT IS A BOWL LOSS

BLUE SHADING REPRESENTS A TOP 25 RANKING AT THE END OF THE YEAR

- * BEAT OHIO STATE
- S BEAT MICHIGAN STATE

Year
 1997



@boknowsdata on Tableau Public

Take my breath away

Cities around the world are **falling** to meet the World Health Organisation (WHO) guidelines for **air particulate** - tiny material in the air that can be harmful if breathed in.

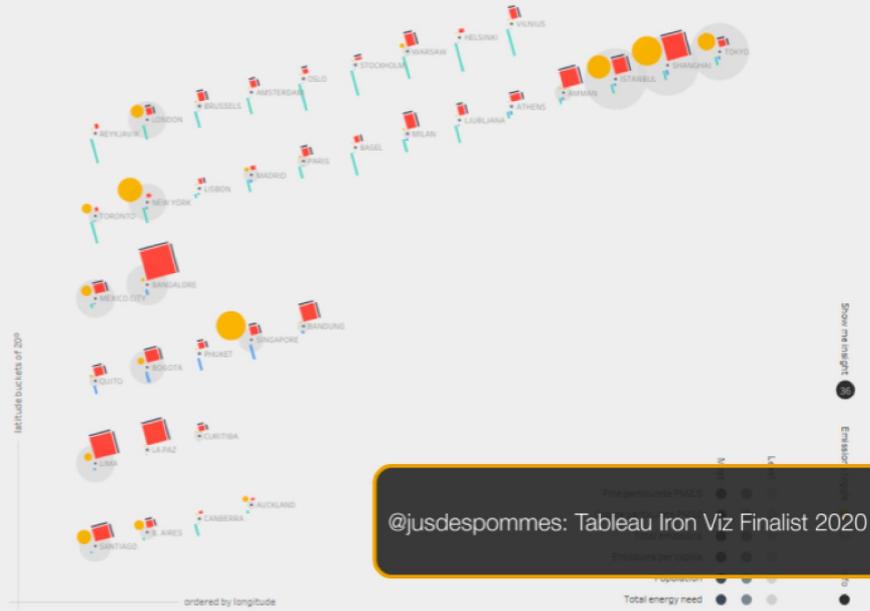
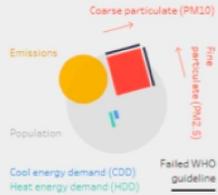
Context

In 1800 years, we amassed a World population of 1 bn people - fast forward 200 years and we are now at near 8 bn.

Common-sense dictates that more people means more consumption of energy and the raw materials needed to produce it - this consumption has byproducts.

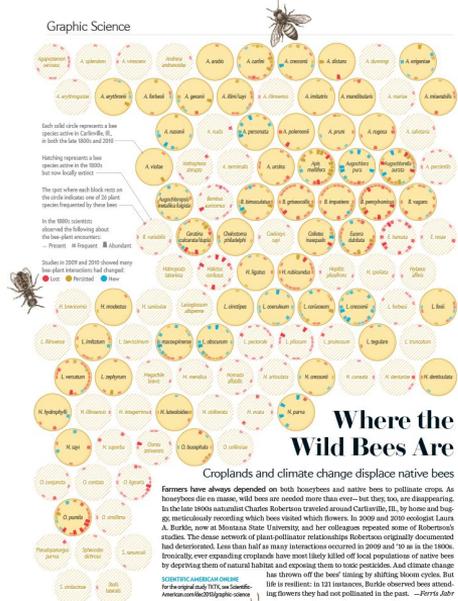
These byproducts are now causing unprecedented air pollution from emissions that affect our planet and air particulate that affects our health.

How to read chart



@jusdespommes: Tableau Iron Viz Finalist 2020

Graphic Science



Each solid circle represents a bee species active in Carlinville, Ill., in both the late 1800s and 2010.

Hatching represents a bee species active in the 1800s but now locally extinct.

The spot where each block rests on the circle indicates one of 26 plant species frequented by these bees.

In the 1880s scientists observed the following about the bee-plant encounters:

- Present
- Frequent
- Abundant

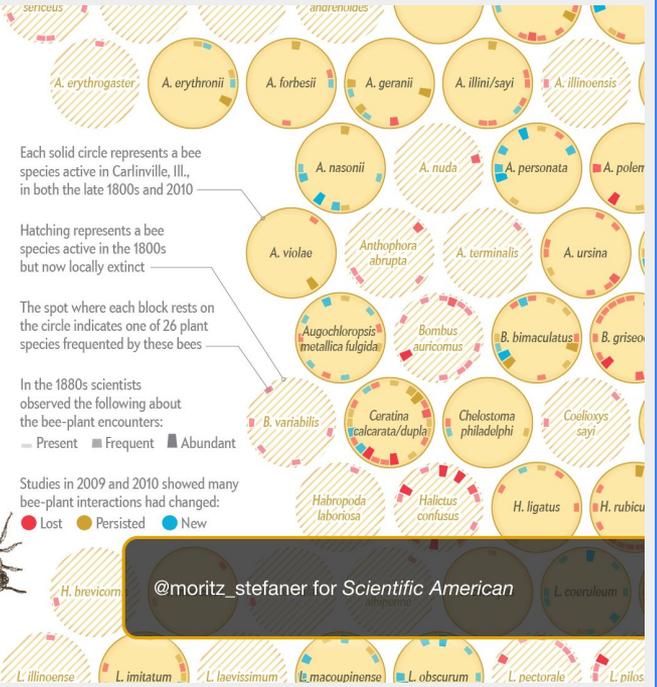
Studies in 2009 and 2010 showed every bee that interactions had changed:

- Lost
- Persisted
- New

Where the Wild Bees Are

Croplands and climate change displace native bees

Farmers have always depended on both honeybees and native bees to pollinate crops. As honeybees die en masse, wild bees are needed more than ever—but they, too, are disappearing. In the late 1800s naturalist Charles Robertson traveled around Carlinville, Ill., by horse and buggy, meticulously recording which bees visited which flowers. In 2009 and 2010 ecologist Laura A. Borde, now at Montana State University, and her colleagues repeated some of Robertson's studies. The dense network of plant-pollinator relationships Robertson originally documented had deteriorated. Less than half as many interactions occurred in 2009 and '10 as in the 1800s. Locally ever-expanding croplands have most likely killed off local populations of native bees by depriving them of natural habitat and exposing them to toxic pesticides. And climate change threatens the bees' timing by shifting bloom cycles. But life is resilient: In 121 instances, Borde observed bees straggling flowers they had not pollinated in the past. —Terri Jaber



Each solid circle represents a bee species active in Carlinville, Ill., in both the late 1800s and 2010.

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- Lost
- Persisted
- New

@moritz_stefaner for Scientific American

How to inspire novel glyph design?

**Capture semantic associations
between marks ...**

**Evoke (memorable) figurative
associations ...**



Inspiration at the Role of the Dice: An Exercise in Aleatoric Visualization Design

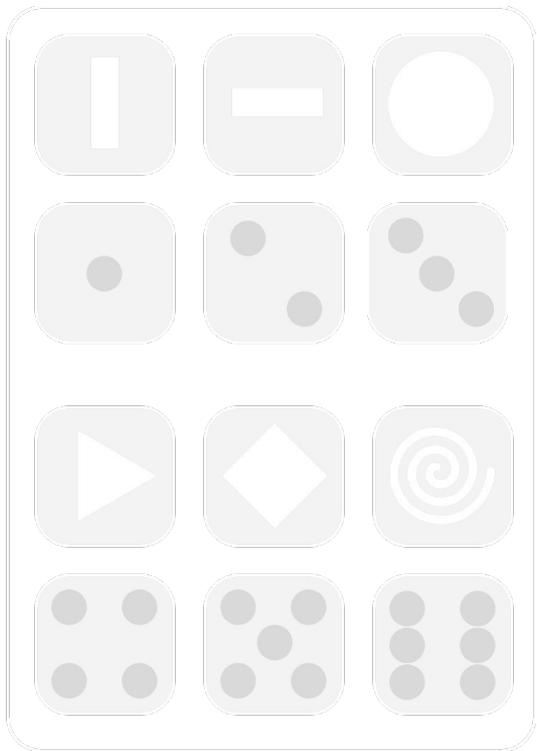
forthcoming article in *Nightingale*

adapted from “Generative Design Inspiration for Glyphs with **Diatoms**” IEEE VIS 2021

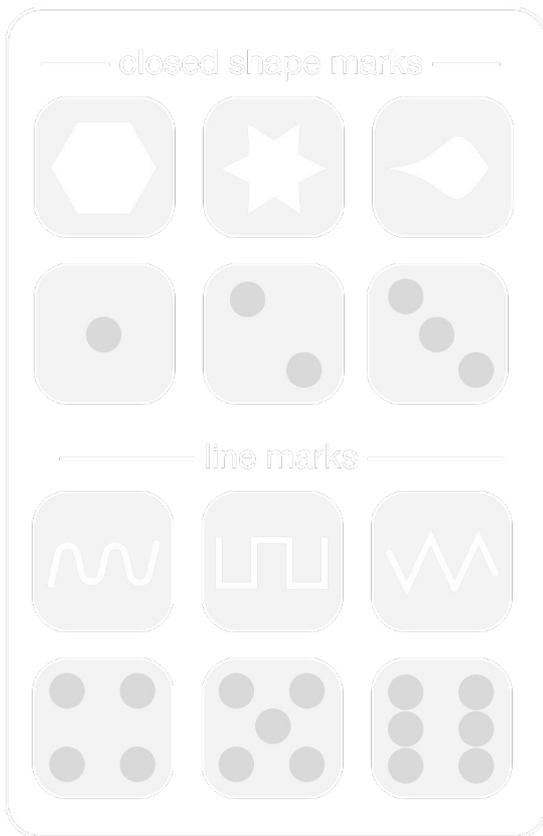
with Carmen Hull and Robert Kosara

image: unsplash (@niccreates)

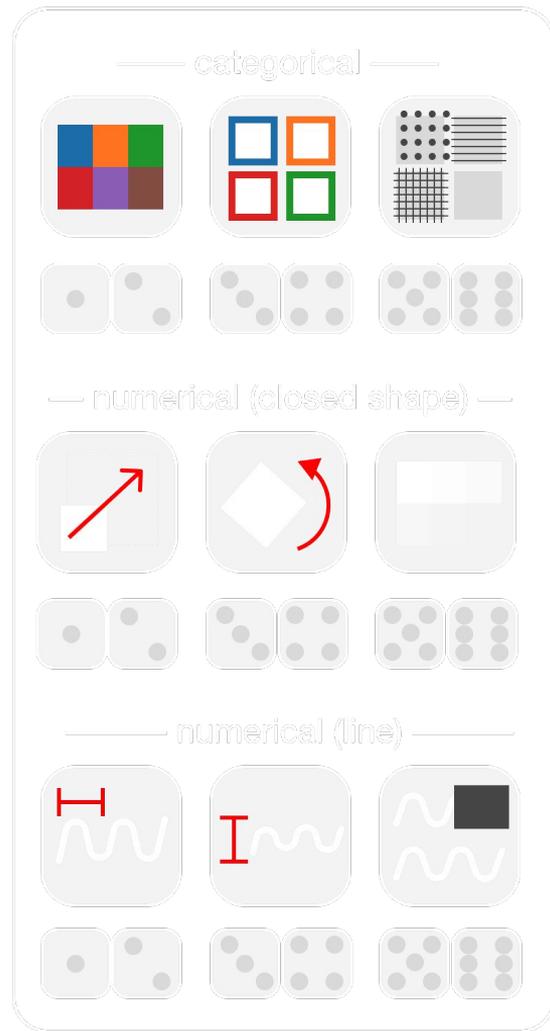
glyph scaffold palette

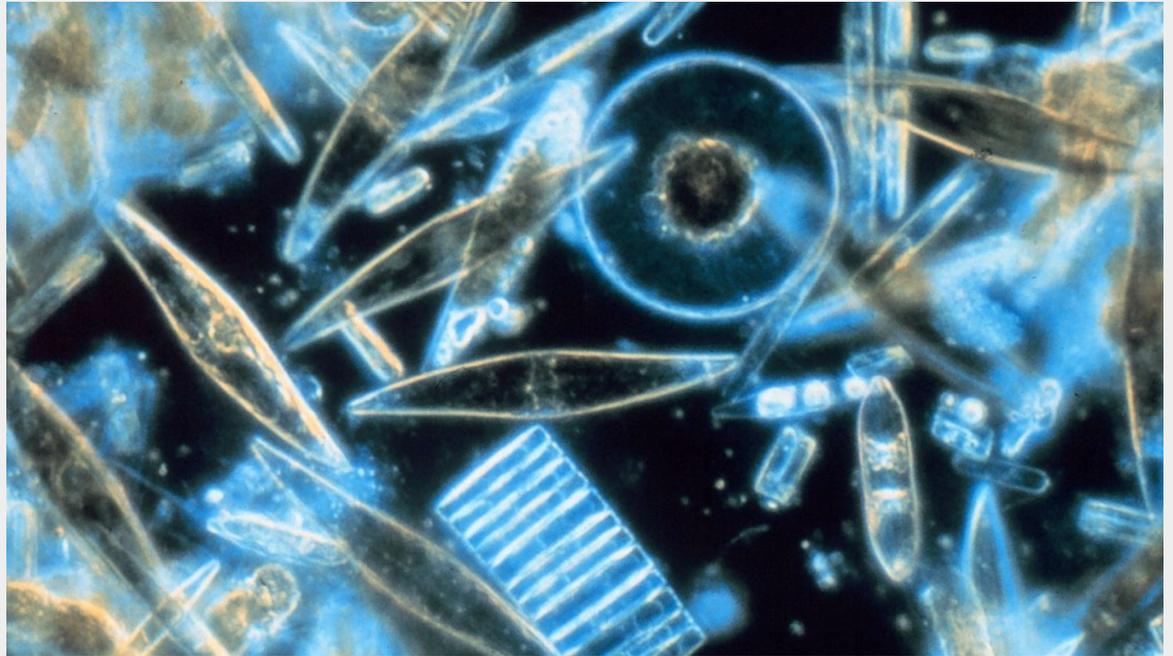


mark shape palette



visual properties palette



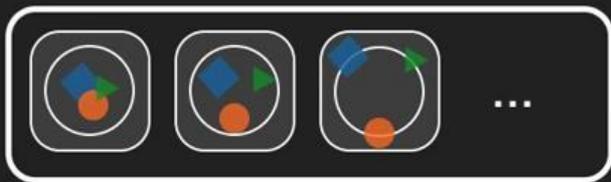


Generative Design Inspiration for Glyphs with Diatoms

In *IEEE Transactions on Visualization and Computer Graphics*, 2022 (VIS 2021, open access)

Matthew Brehmer, Carmen Hull, and Robert Kosara
image: wikimedia commons

Scaffold Gravity



Scaffold



Channel Assignment



Mark Assignment



Conjunction



Repeat

Column Set #1

Column Set #2

Place	Region	Area	Population	Bike Score	Transit Sc.	Walk Score
Boston	Northeast	232	672,840	70	73	81
Chicago	Midwest	607	2,704,965	70	65	78
...

Small Multiples Design B

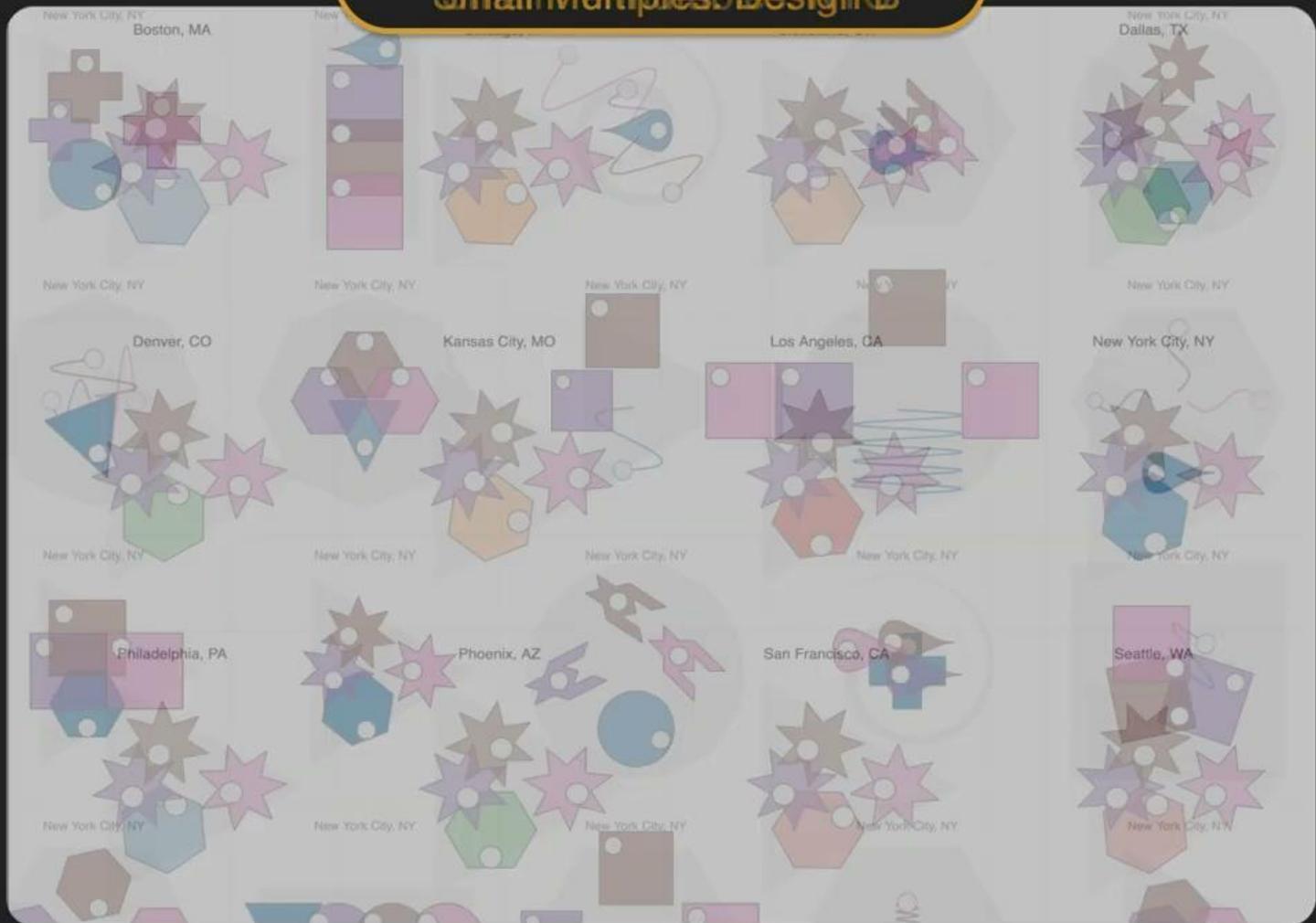
Mark Shapes

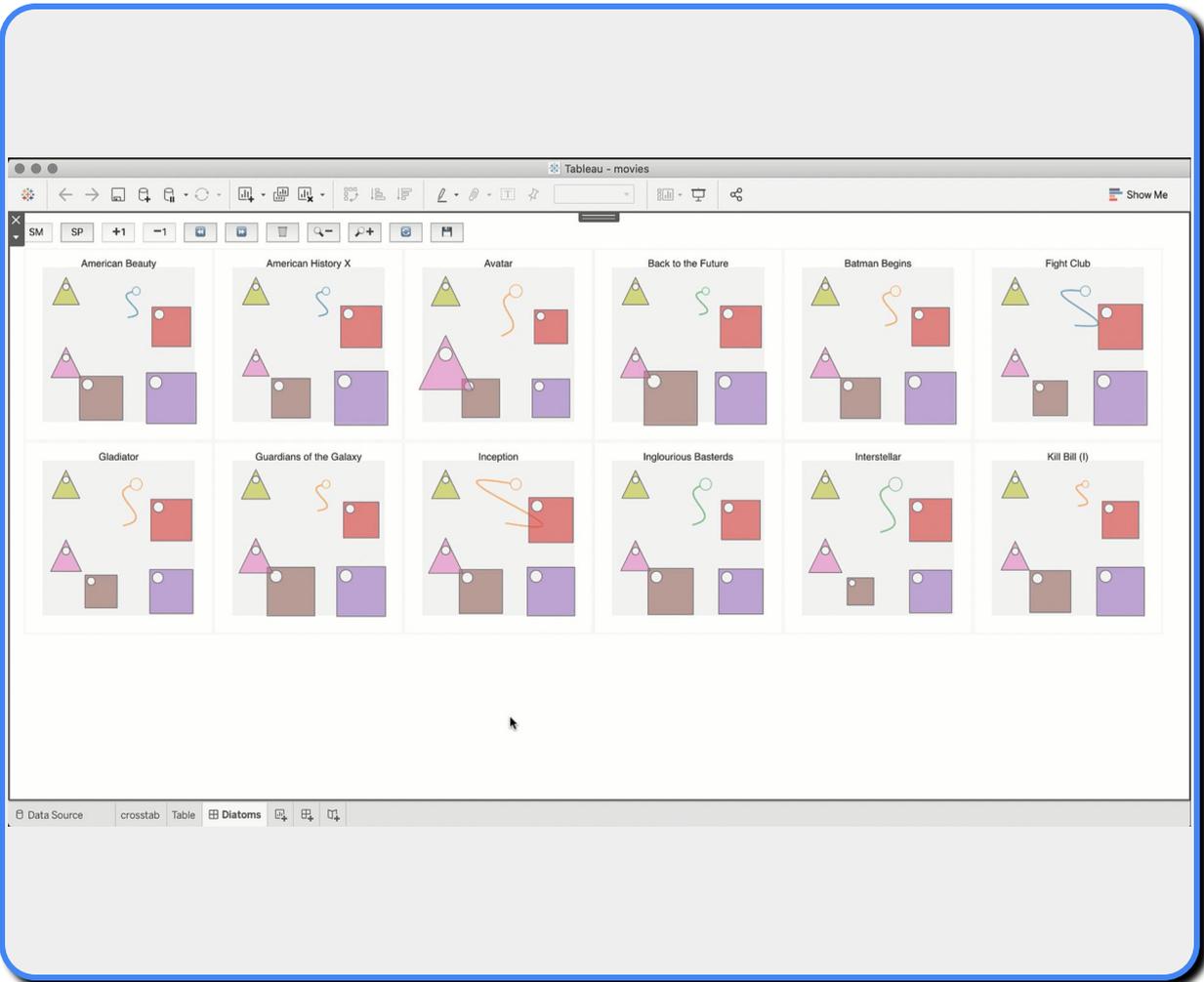


Encoding Channels



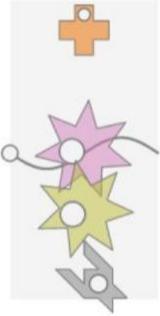
Glyph Scaffolds





P2's Glyph Designs

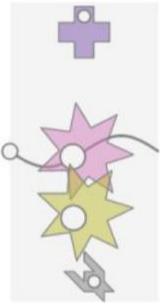
Australia



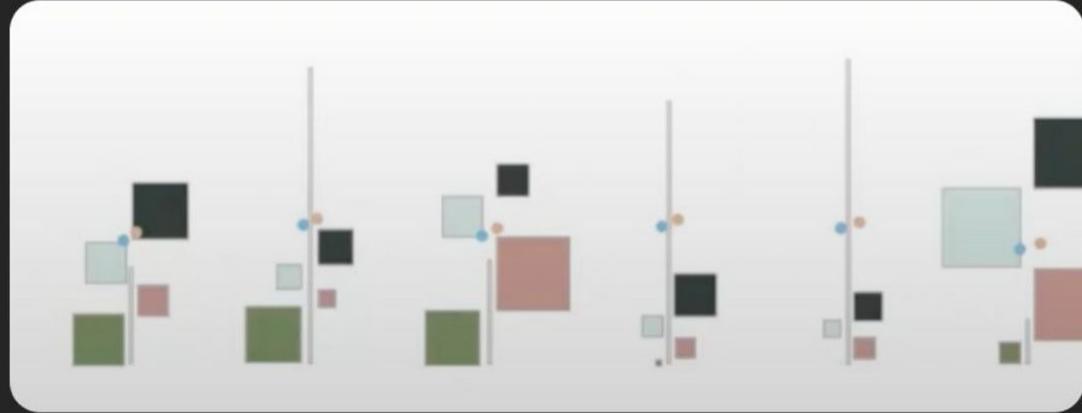
Brazil



United Kingdom

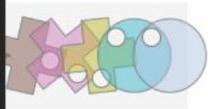


Indonesia



P3's Glyph Design

WALL-E



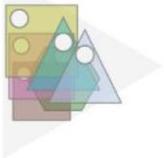
WALL-E



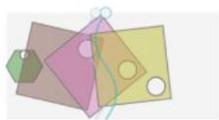
WALL-E



WALL-E



WALL-E



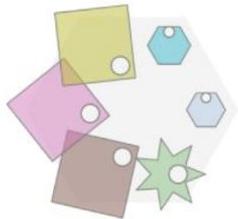
WALL-E



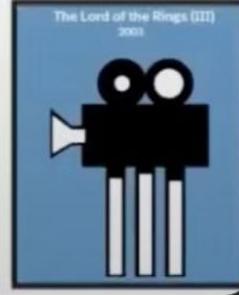
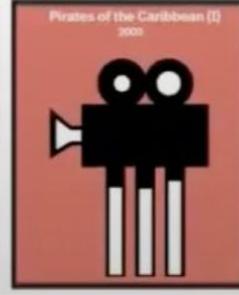
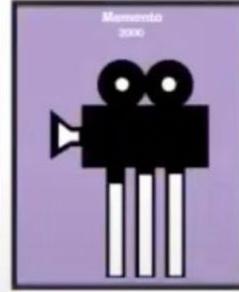
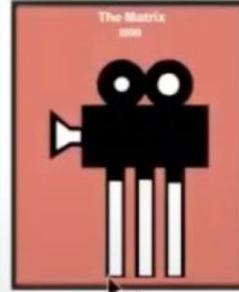
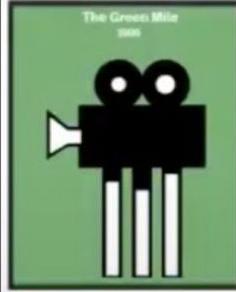
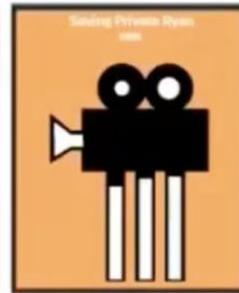
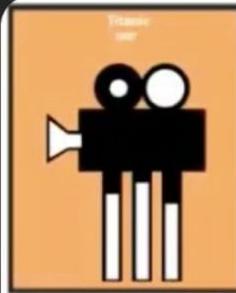
WALL-E



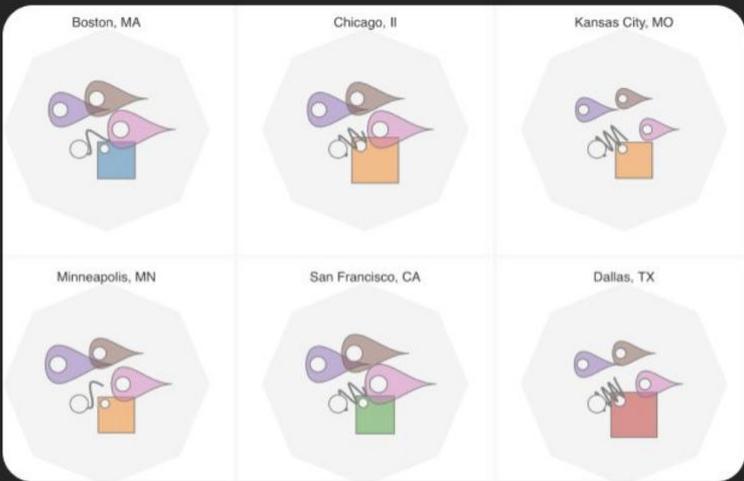
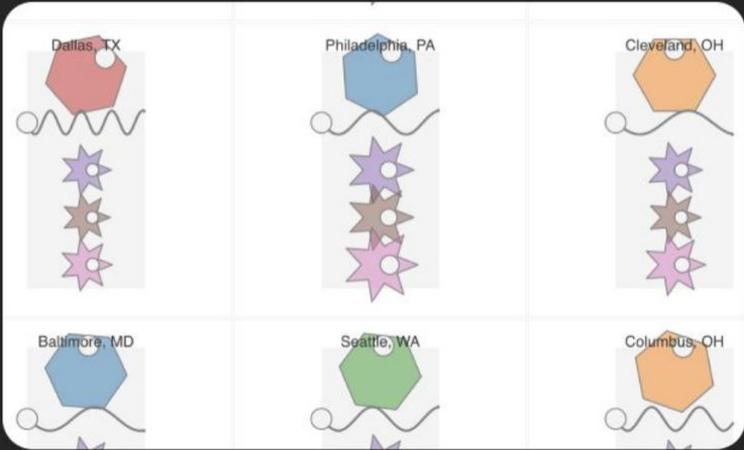
WALL-E



WALL-E



P5's Glyph Design





Aleatoric / Generative Design Inspiration for Data Visualization

bring-your-own palettes, genetic + subjunctive design, pedagogical implications ...

New Experiences for Communicating with an Audience About Data

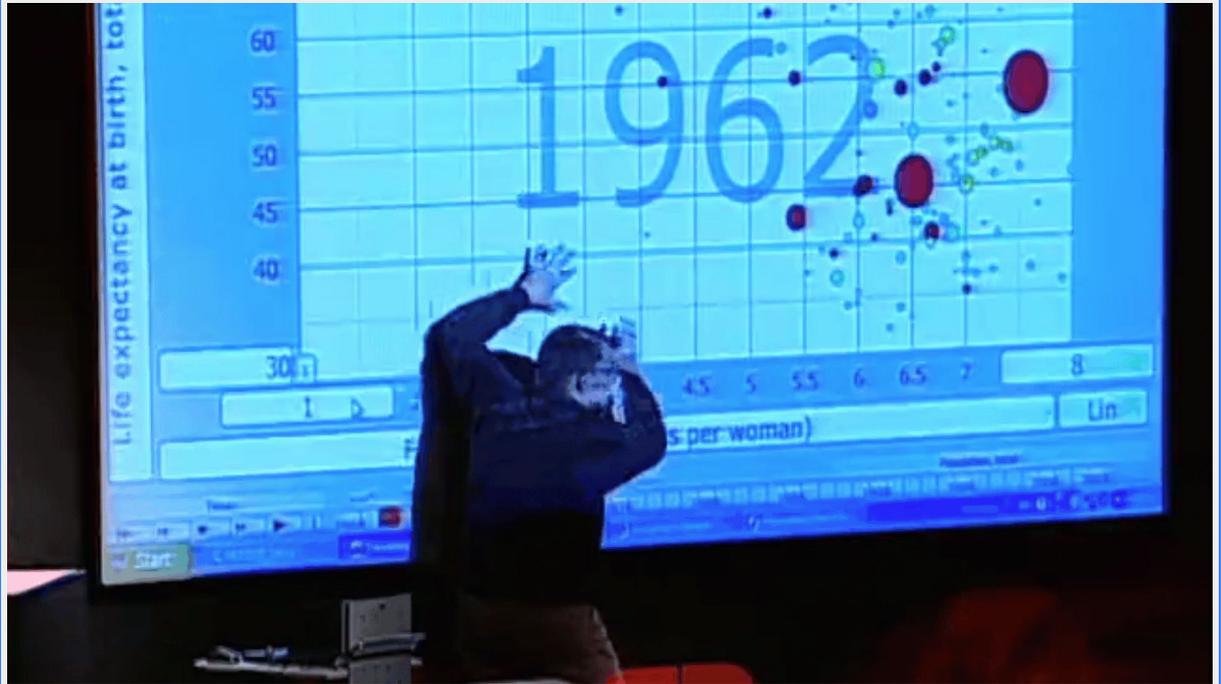
tools for bespoke communication-oriented
visualization design / construction

- ▶ **tools for preparing and delivering
presentations involving data visualization**

**Engaging an audience beyond
data analysts ...**

**... in contexts beyond data
analysis applications**

**... choice of visual representation
is only one part of the story**



👉 Hans Rosling's TED Conference Talks (2006, 2007)

gapminder.com/videos



image: campaign creators (unsplash)



image: chris montgomery (unsplash)



Published in Tableau Engineering Blog



Robert Kosara

Oct 26, 2021 · 4 min read



How Do People Communicate and Collaborate with Data in Organizations?

Data is everywhere in organizations, but how do people actually use it to communicate, present, and collaborate? Matt Brehmer and I investigated this question in a pair of studies that we report on in a paper to be published at the VIS 2021 conference this week, titled *From Jam Session to Recital: Synchronous Communication and Collaboration Around Data in Organizations*. In addition to asking about people's uses of data presentations in meetings, we showed them a series of mock-ups for ideas that we thought would make for better recorded and live presentations.

Adapted from:

From Jam Session to Recital
Synchronous Communication and Collaboration
Around Data in Organizations

Matthew Brehmer and Robert Kosara, IEEE VIS 2021

Explore / Makeover Mondays / Tableau Research / tourguide / Dashboard

Undo Redo Revert Refresh Pause Data Details View: Original Alerts Metrics Subscribe Edit Share Downloads Comments Full Screen

Crosstab | Playhead | Scatterplot | Timelines | Relative Age Timelines | Ratings | Dashboard

The SuperBookStore Bestsellers Dashboard

00:00 This video will introduce you to SuperBookStore's dashboard of top rated books over the past 25 years. I'll first direct your attention to the top right. Here's a scatter plot of our highest rated and bestselling fiction titles over the past 20 years, from 1996 to 2016, where larger circles correspond to more ratings.

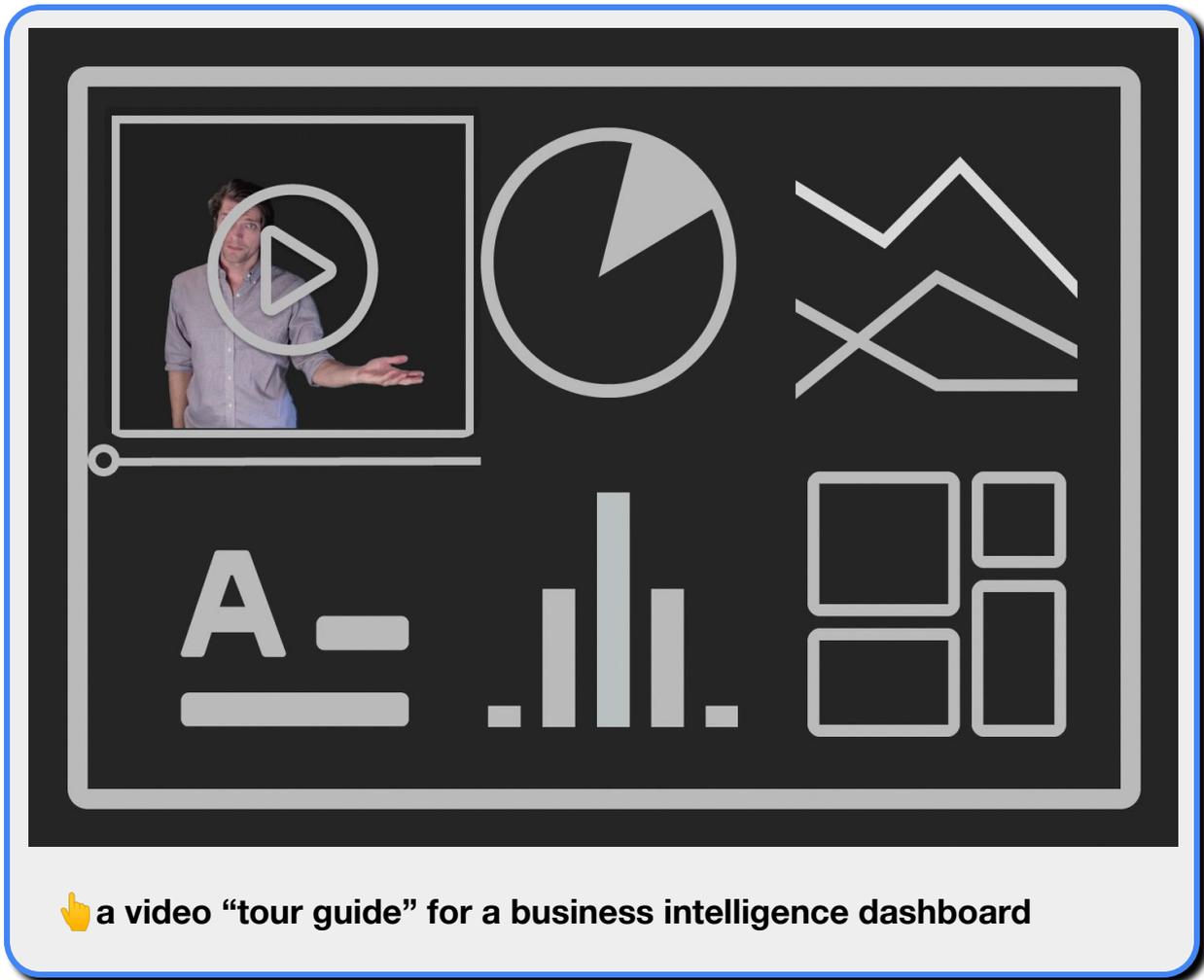
00:19 And here's our bestselling non-fiction titles shown below them, and as you can see our non-fiction titles tend to have higher scores but fewer ratings than our fiction titles. You'll also notice that we've seen more bestsellers in the early half of the last decade.

00:27 Now added in blue is the remainder of our highest-rated titles, those that were not bestsellers.

Book Ratings (sized by # Ratings) of Bestselling Fiction over Time

Author	Author Gen.	Title	Genre	Is Best Seller	Yr	Author...	Pages	Rating	Rating...
Alice Munro	female	Hateship, Friendship, Coa...	Fiction	True	2001	69	323	4.1	12,639
Selected Stories			Fiction	True	1996	62	688	4.3	5,357
Anthony Doerr	male	All the Light We Cannot S...	Fiction	True	2014	41	531	4.3	530,482
Barbara Kingsolver	female	The Poisonwood Bible	Fiction	True	1998	43	546	4.0	559,572
Chad Harbach	male	The Art of Fielding	Fiction	True	2011	37	512	4.0	89,521
Chimamanda Ngozi Adichie	female	Americanah	Fiction	True	2013	36	477	4.3	131,199
Chris Ware	male	Building Stories	Fiction	True	2012	45	260	4.3	5,374
Colson Whitehead	male	The Underground Railroad	Fiction	True	2016	47	306	4.0	82,601
Dave Eggers	male	A Hologram for the King	Fiction	True	2012	42	312	3.3	22,613
Dunne Iarfh	female	The Goodrich	Fiction	True	2013	50	771	3.9	456,286
Elena Ferrante	female	The Story of the Last Chil...	Fiction	True	2015	71	480	4.4	27,561
Emma Donoghue	female	Room	Fiction	True	2010	41	321	4.0	549,432
George Saunders	male	Tenth of December	Fiction	True	2013	54	272	4.0	42,910
Wiley Mays	female	Bring Us the Bodies (The...	Fiction	True	2012	60	407	4.3	51,146
Ian McEwan	male	Atonement	Fiction	True	2002	53	351	3.9	363,350
Ian McGuire	male	The North Water	Fiction	True	2016	52	272	4.0	12,645
Jeannette Walls	female	Half Broke Horses	Fiction	True	2009	48	272	4.0	118,529
Jennifer Egan	female	A Visit from the Goon S...	Fiction	True	2010	48	288	3.6	126,608
Jesmyn Ward	female	Sing, Unburied, Sing	Fiction	True	2017	41	285	4.1	7,031
Jonathan Franzen	male	Freedom	Fiction	True	2010	51	562	3.7	129,779
Karen Russell	female	Swamplandia!	Fiction	True	2011	29	323	3.2	43,045

a prototype video “tour guide” for a Tableau dashboard

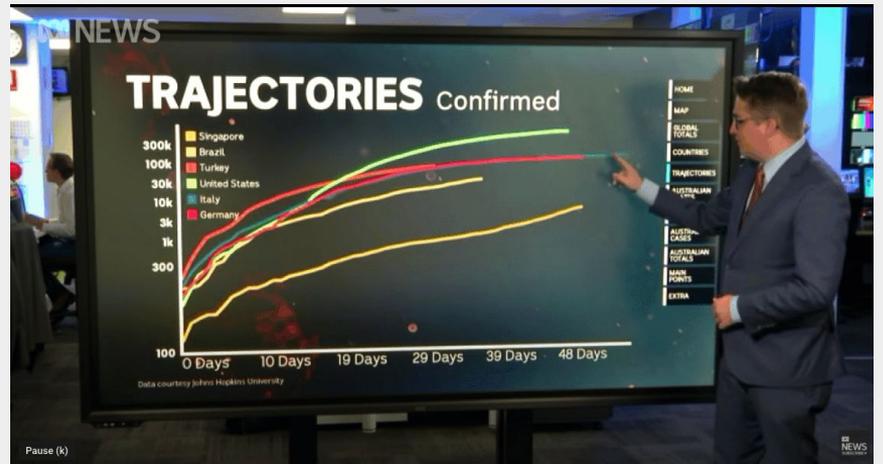


👉 a video “tour guide” for a business intelligence dashboard

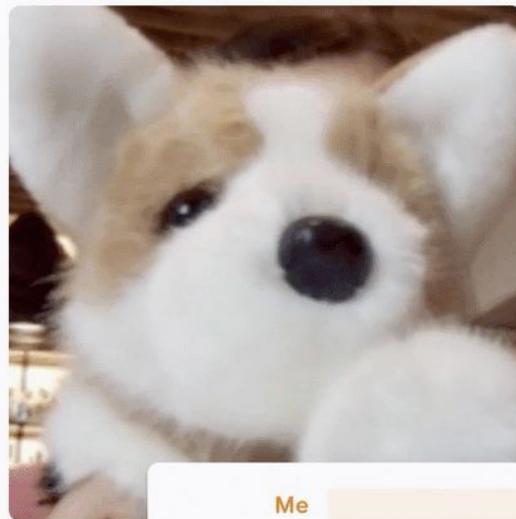


👉 Hans Rosling's TED Conference Talks (2006, 2007)

gapminder.com/videos



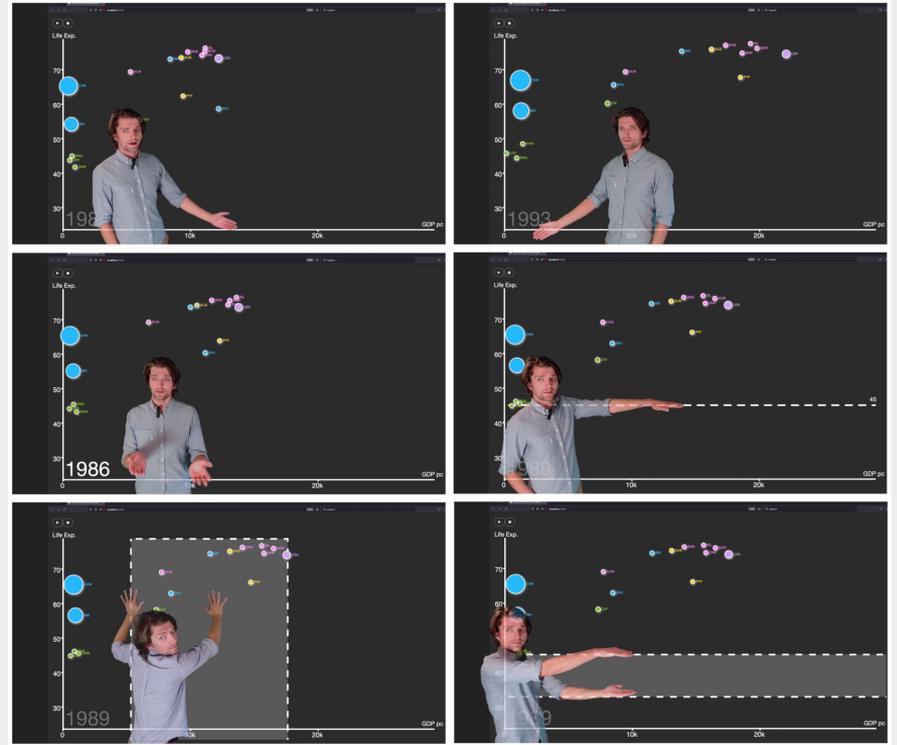
👉 ***"The Information in Our Hands"*** – Information+ Conference 2021



Teachable Machine

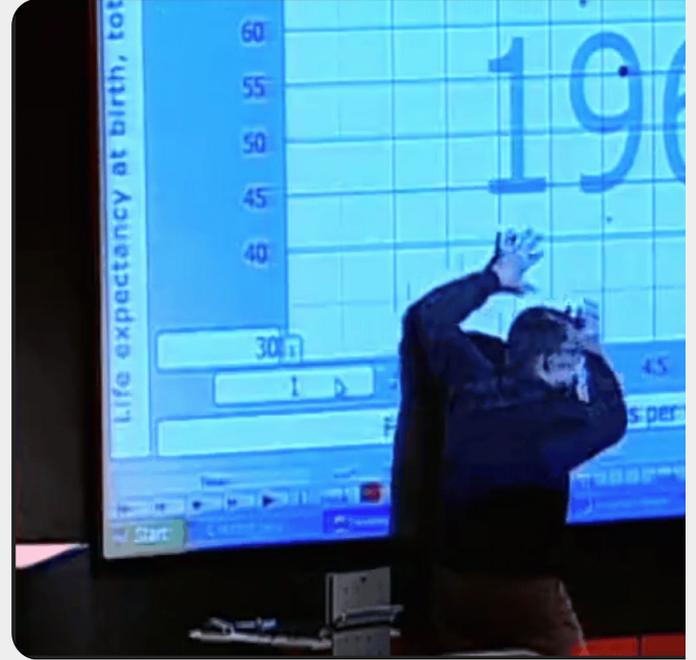
Train a computer to recognize your own images, sounds, & poses.

A fast, easy way to create machine learning models for



 ***“The Information in Our Hands”***

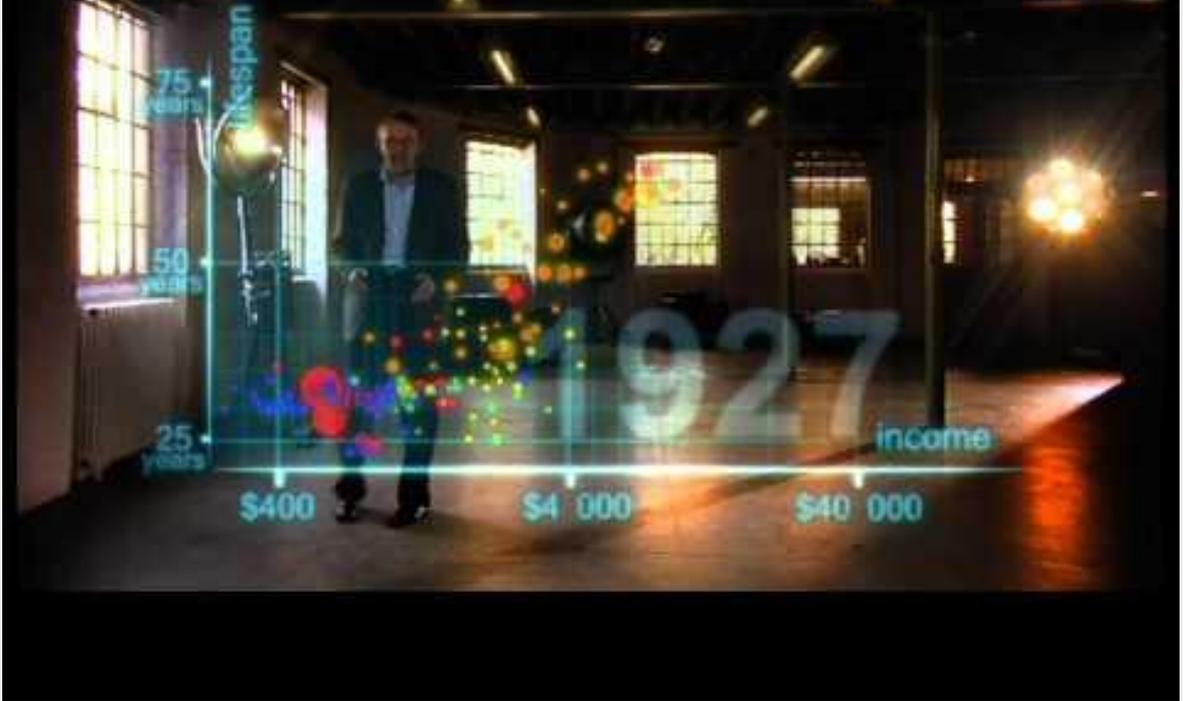
Information+ Conference 2021



👉 Hans Rosling's TED Conference Talks (2006, 2007)

gapminder.com/videos

BBC FOUR



👉 **"200 Countries, 200 Years, 4 Minutes"** – Hans Rosling, BBC 2010

BBC FOUR



👉 **"200 Countries, 200 Years, 4 Minutes"** – Hans Rosling, BBC 2010



Matthew Brehmer
TABLEAU RESEARCH



Live ML anywhere

MediaPipe offers open source cross-platform, customizable ML solutions for live and streaming media.



👉 ***Augmented Chironomia for Presenting Data to Remote Audiences***

– with Brian D. Hall and Lyn Bartram (to appear at ACM UIST 2022)

New Experiences for Communicating Using Visualization

**tools for bespoke communication-oriented
visualization design / construction**

**tools for preparing and delivering
presentations involving data visualization**



Donghao Ren
~~UC Santa Barbara~~
Apple



Bongshin Lee
Microsoft



Carmen Hull
~~Univ. Calgary~~
Northeastern Univ.



Robert Kosara
~~Tableau~~
Observable



Brian D. Hall
Univ. Michigan



Lyn Bartram
Simon Fraser Univ.



Charts in Context

How charts are shared in different settings and how context influences design, accessibility, and understanding

Featuring Matthew Brehmer, Frank Elavsky, and Keke Wu



Data Visualization Society fireside chat (Jan 24 2022)

youtu.be/rYVtNEH4e4o

New Experiences for Communicating with an Audience About Data

Matthew Brehmer, Tableau Research

–

@ MICA – Oct 3 2022



Matthew Brehmer | @mattbrehmer | mattbrehmer.ca

–
Senior Research Staff, Tableau Research, Seattle WA | research.tableau.com

Prologue...

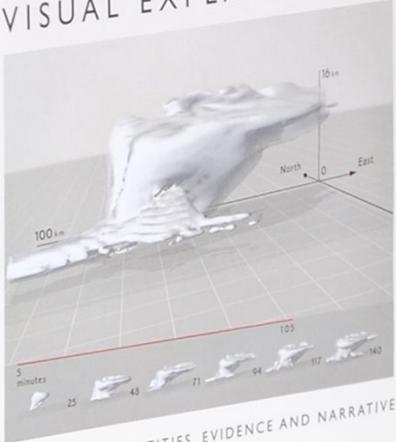
**My Journey in
Data Visualization**



TUFTE
VISUAL EXPLANATIONS

EDWARD R. TUFTE

VISUAL EXPLANATIONS



IMAGES AND QUANTITIES, EVIDENCE AND NARRATIVE

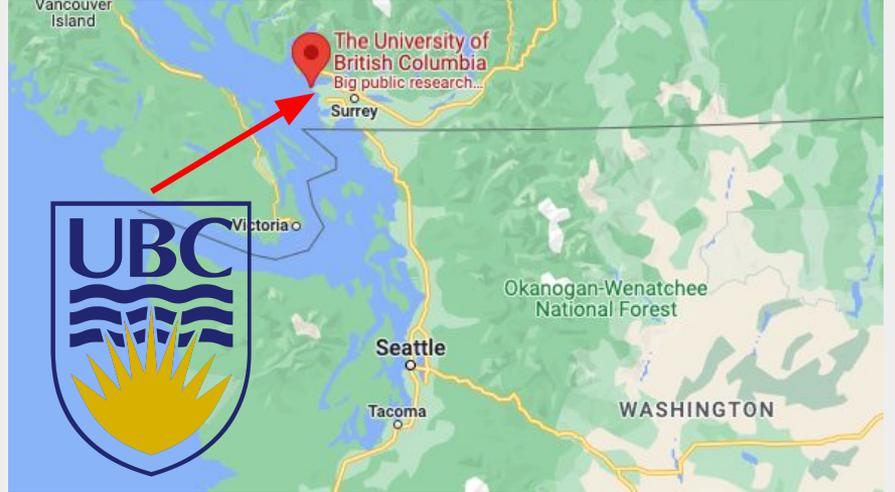
GRAPHICS
PRESS



Cognitive Science

CS / Psych / Math / Linguistics / ...

Human-Computer Interaction + Data Mining = ?

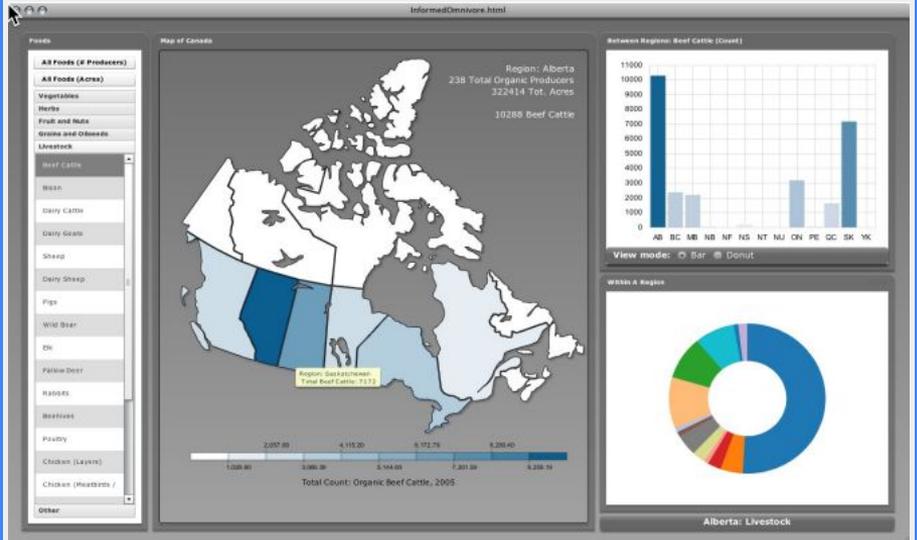


Human-Computer Interaction

with Joanna McGrenere

Information Visualization

with Tamara Munzner



Informed Omnivore

Visualizing Organic Food Production in Canada

... built in Flash!

Why Visualization?

Task Abstraction for Analysis and Design

dissertation projects:

a framework for describing visualization tasks ...

interviews with scientists re: high-dim data ...

visualizing document collections for journalists ...

visualization for energy conservation ...

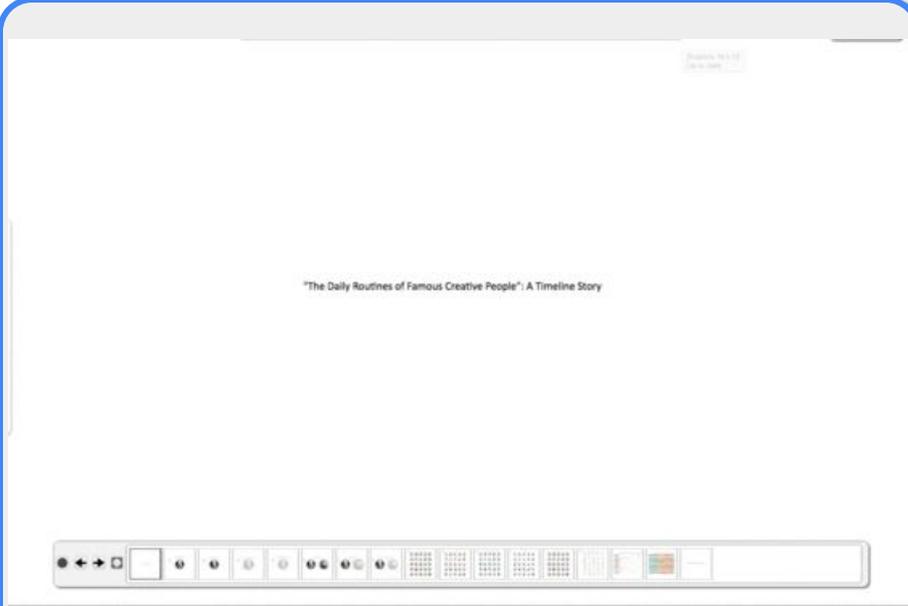
Microsoft Research

2015 – 2019

interactive visualization authoring tools ...

storytelling / narrative visualization ...

**visualization beyond the desktop /
beyond mouse + keyboard**



The screenshot shows a web browser window with a white background. At the top right, there is a small tab with the text "Timeline Storyteller". In the center of the page, the title "The Daily Routines of Famous Creative People: A Timeline Story" is displayed. Below the title is a large, empty white space. At the bottom of the browser window, there is a navigation toolbar with various icons for navigation and zooming. The browser's address bar is empty.

Timeline Storyteller

Microsoft Research | timelinestoryteller.com

 "What Story Does Your Timeline Tell?" – OpenVisConf 2017



Charticator

Interactive Construction of Bespoke Chart Layouts

Microsoft Research | charticator.com
w/ Donghao Ren and Bongshin Lee



shortlist, 2018 Information is Beautiful Awards

Tableau Research

2019 – present