



**Matthew Brehmer** | @mattbrehmer | mattbrehmer.ca

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

# 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 shows the Tableau Data Prep interface. On the left, the 'Data' pane displays a connection to 'Weather Data' with sections for 'Dimensions' (Date, City, Country, Region, Time) and 'Measures' (Hourly Temp, Rainfall, Windspeed, Latitude (generated), Longitude (generated), Measure Values). The 'Analytics' pane is visible above the data pane. The main workspace is titled 'Weather Trends' and contains three blank white canvas areas with placeholder text 'Drop field here' in each.

## About Tableau Research

[research.tableau.com](http://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**

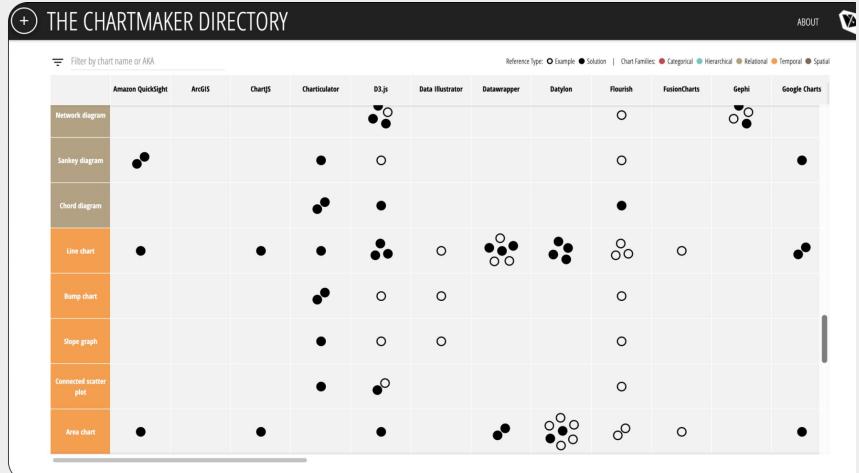
**tools for preparing and delivering  
presentations involving data visualization**

## 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...



Andy Kirk's Chartmaker Directory 

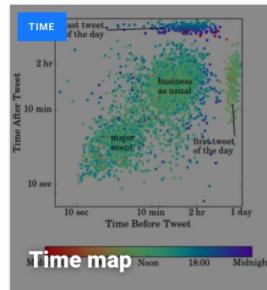
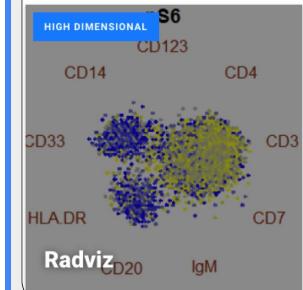
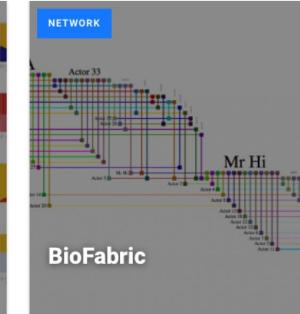
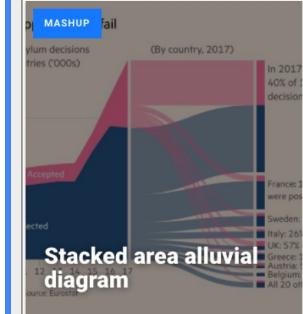
[chartmaker.visualisingdata.com](http://chartmaker.visualisingdata.com)

# Xenographics

Weird but (sometimes) useful charts

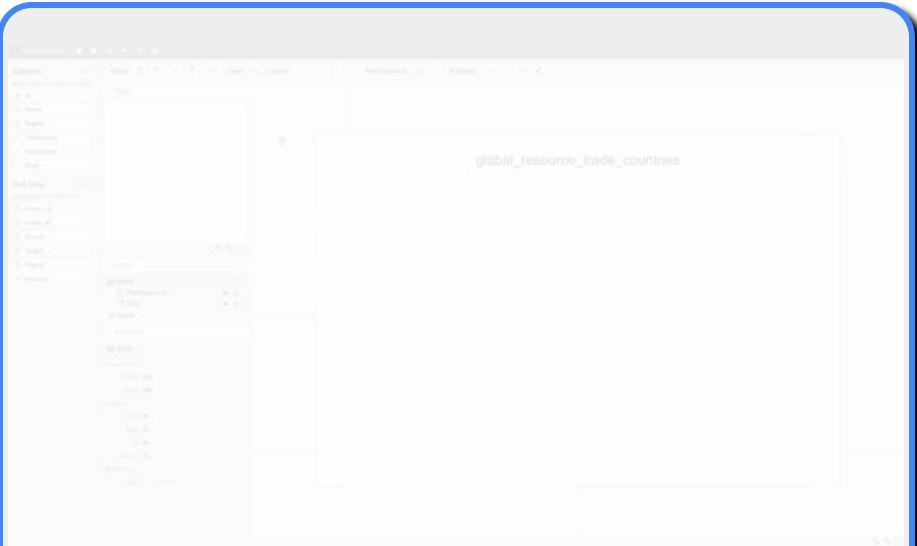
Search ...

HOME ABOUT SUBMIT TAGS ARTICLES CONTACT



Maarten Lambrechts' xeno.graphics

...weird but sometimes useful charts – OpenVisConf 2018



# Charticulator

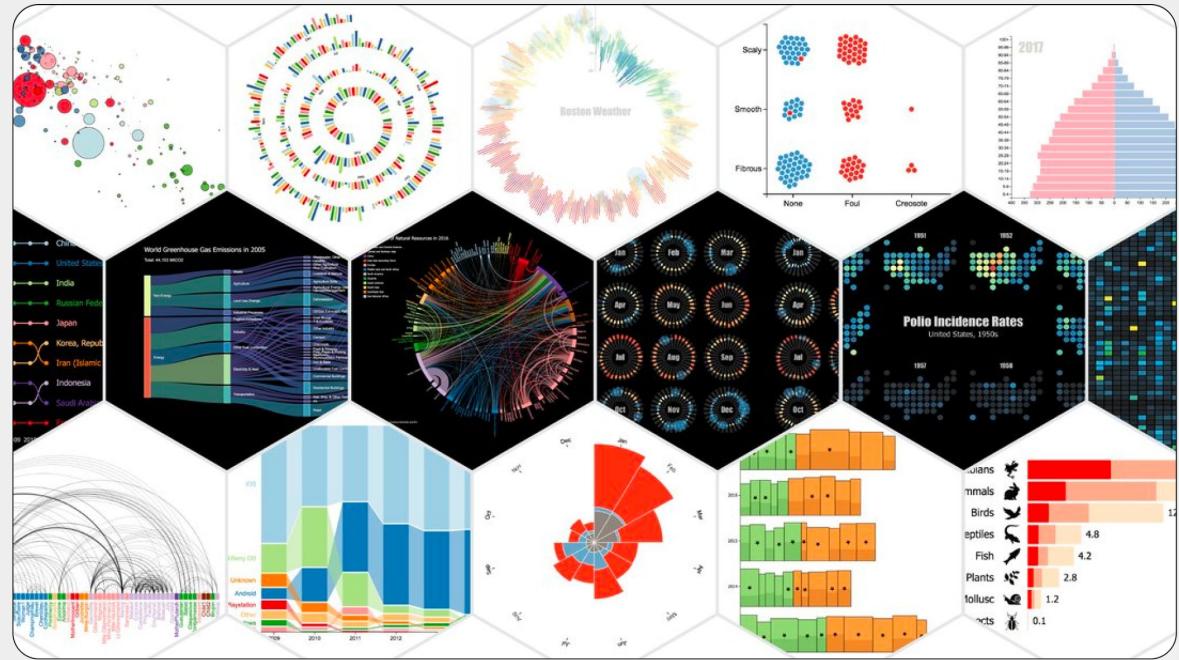
Interactive Construction of Bespoke Chart Layouts

Microsoft Research | [charticulator.com](http://charticulator.com)

Donghao Ren, Bongshin Lee, and Matthew Brehmer



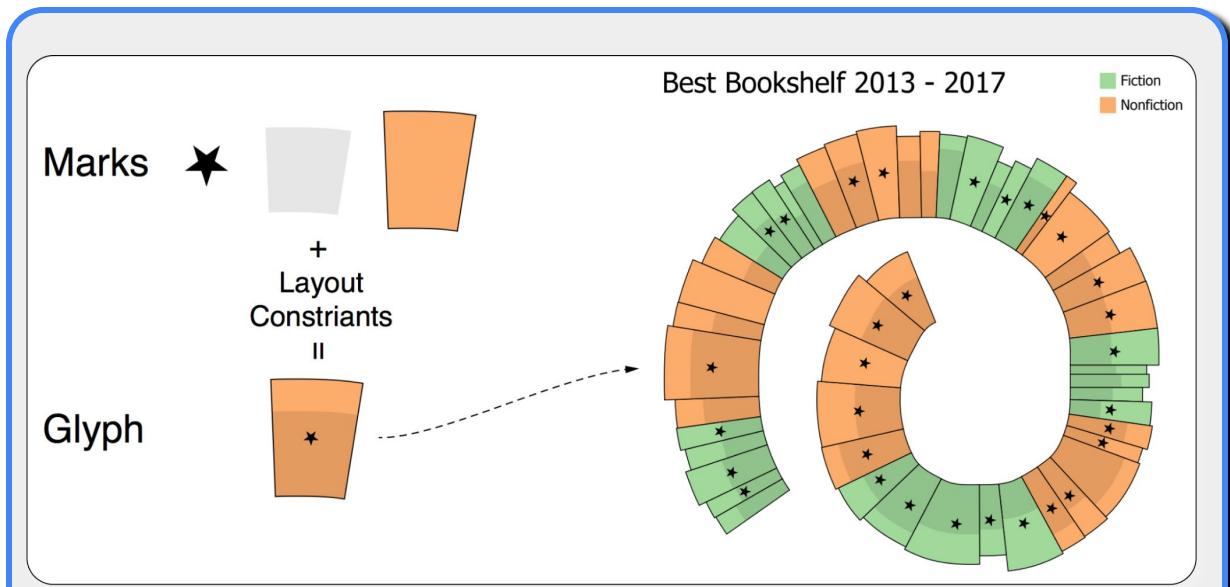
shortlist, 2018 Information is Beautiful Awards



## Charticulator: Interactive Construction of Bespoke Chart Layouts

Microsoft Research | [charticulator.com](http://charticulator.com)

Donghao Ren, Bongshin Lee, and Matthew Brehmer



**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

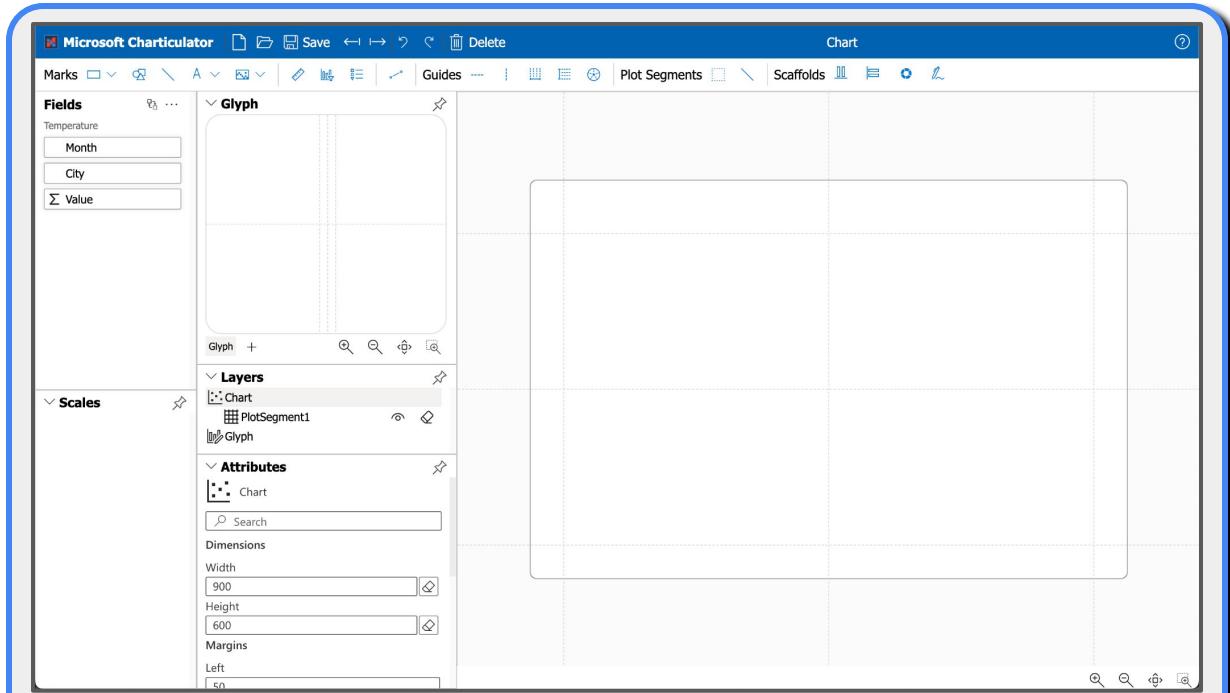


Data Illustrator



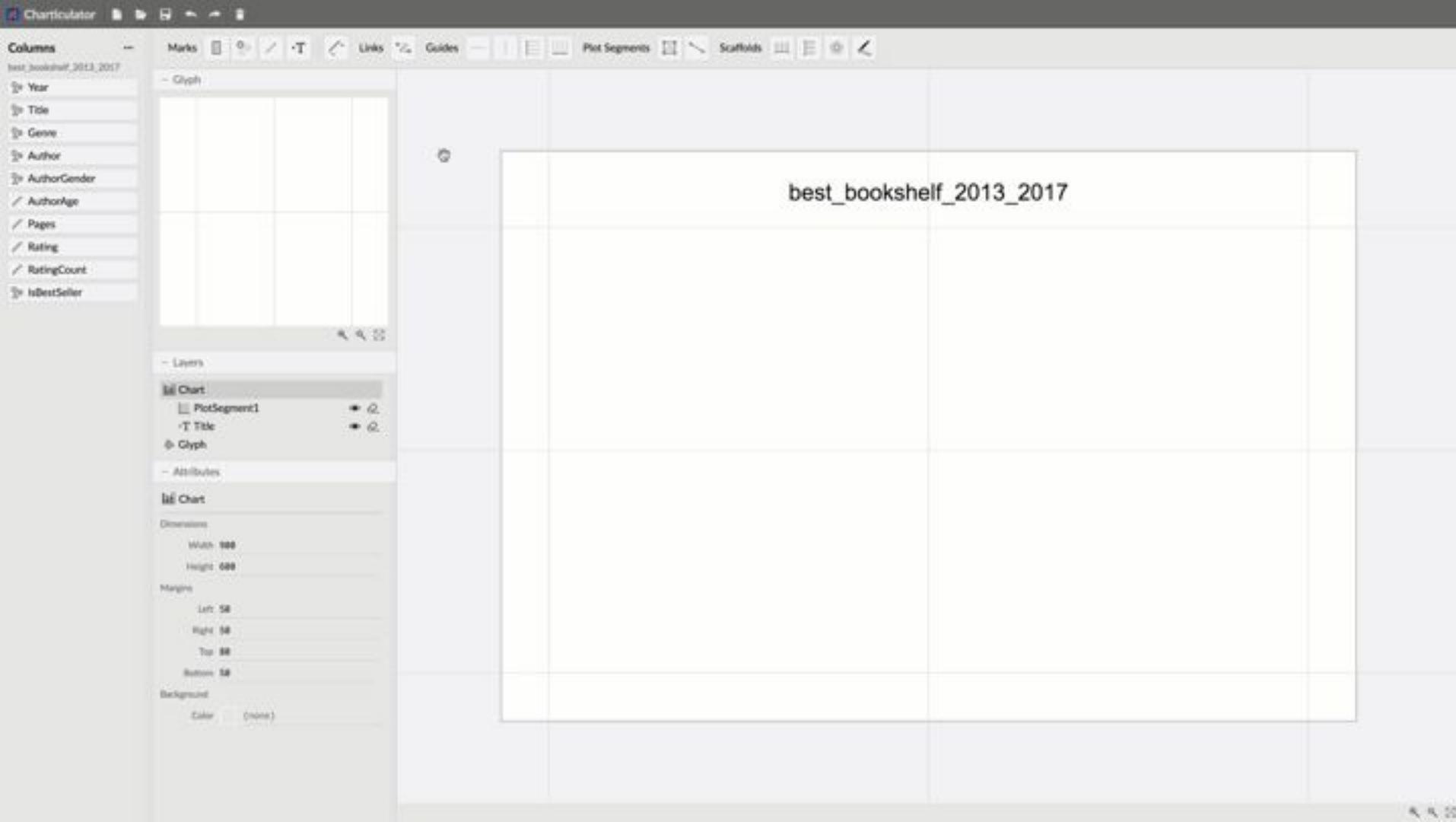
Charticulator

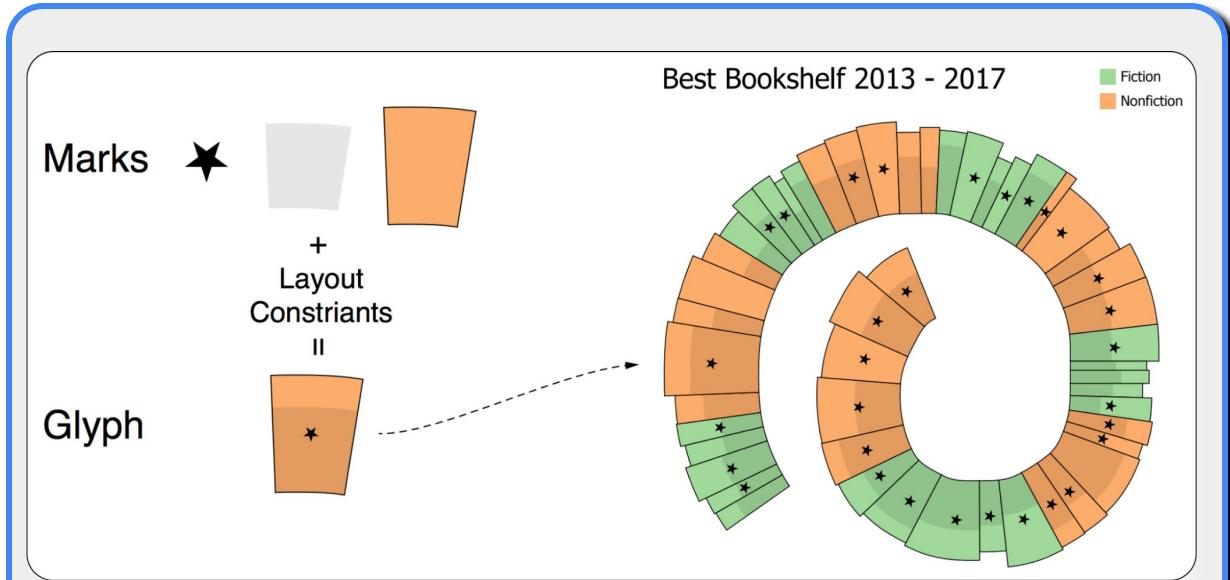




👉 the blank canvas in communication-oriented visualization

... missing design inspiration support in vis construction tools



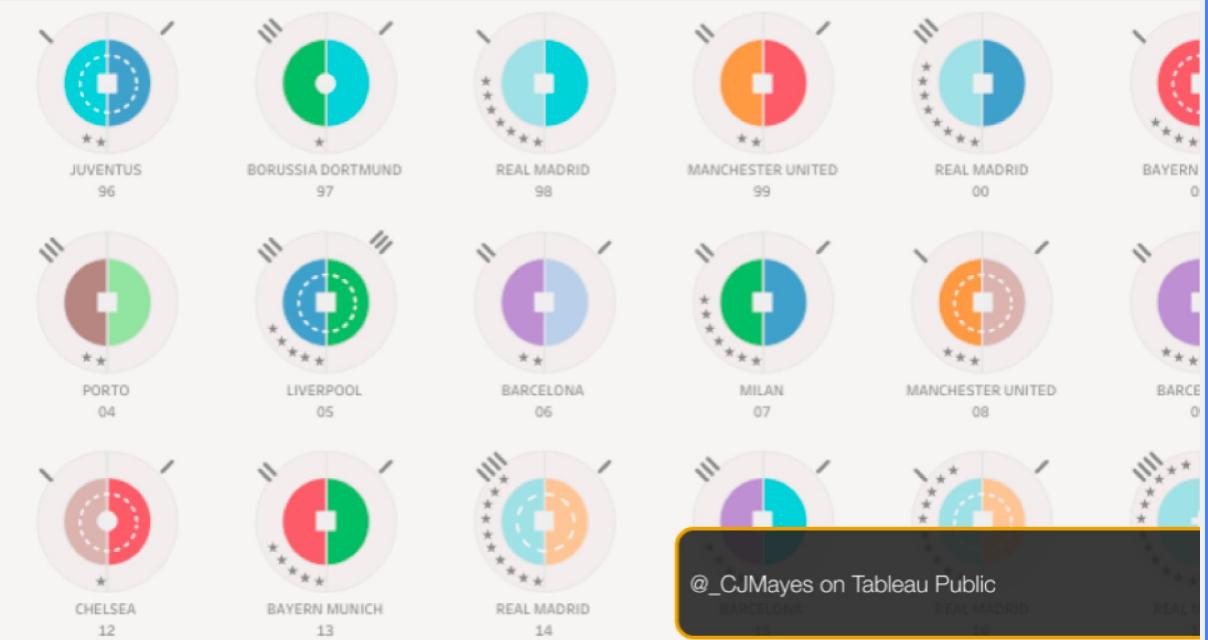


a **glyph** is “*a small visual object that depicts attributes of a data record*”

– 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)



@\_CJMayes 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  
PIPE YELLOW = INDEPENDENT;  
TAN = WESTERN;  
PELTING = BIG TEN



DOTS ON THE  
LEFT ARE WINS

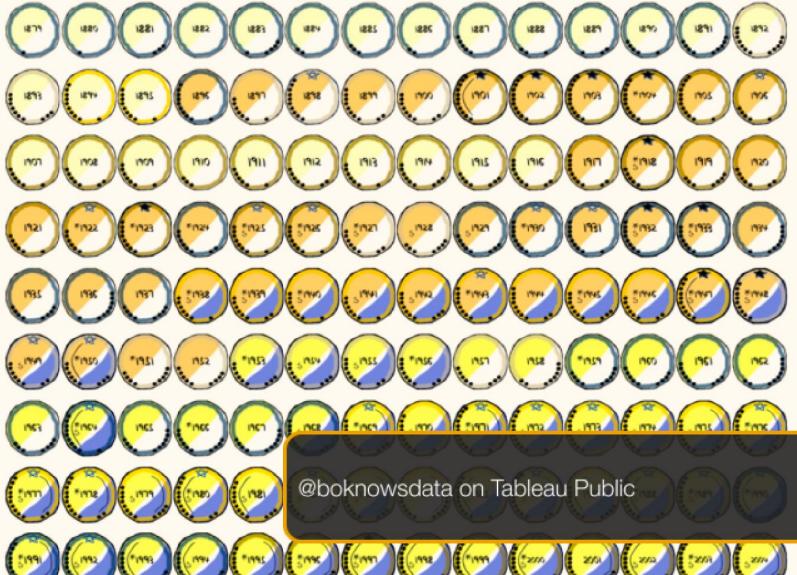
AN ARC ON THE LEFT  
IS A BOWL WIN  
AN ARC ON THE RIGHT  
IS A BOWL LOSS

A FILLED BLACK STAR UP HERE IS A  
NATIONAL CHAMPIONSHIP  
AN OUTLINED BLUE STAR IS A  
CONFERENCE CHAMPIONSHIP

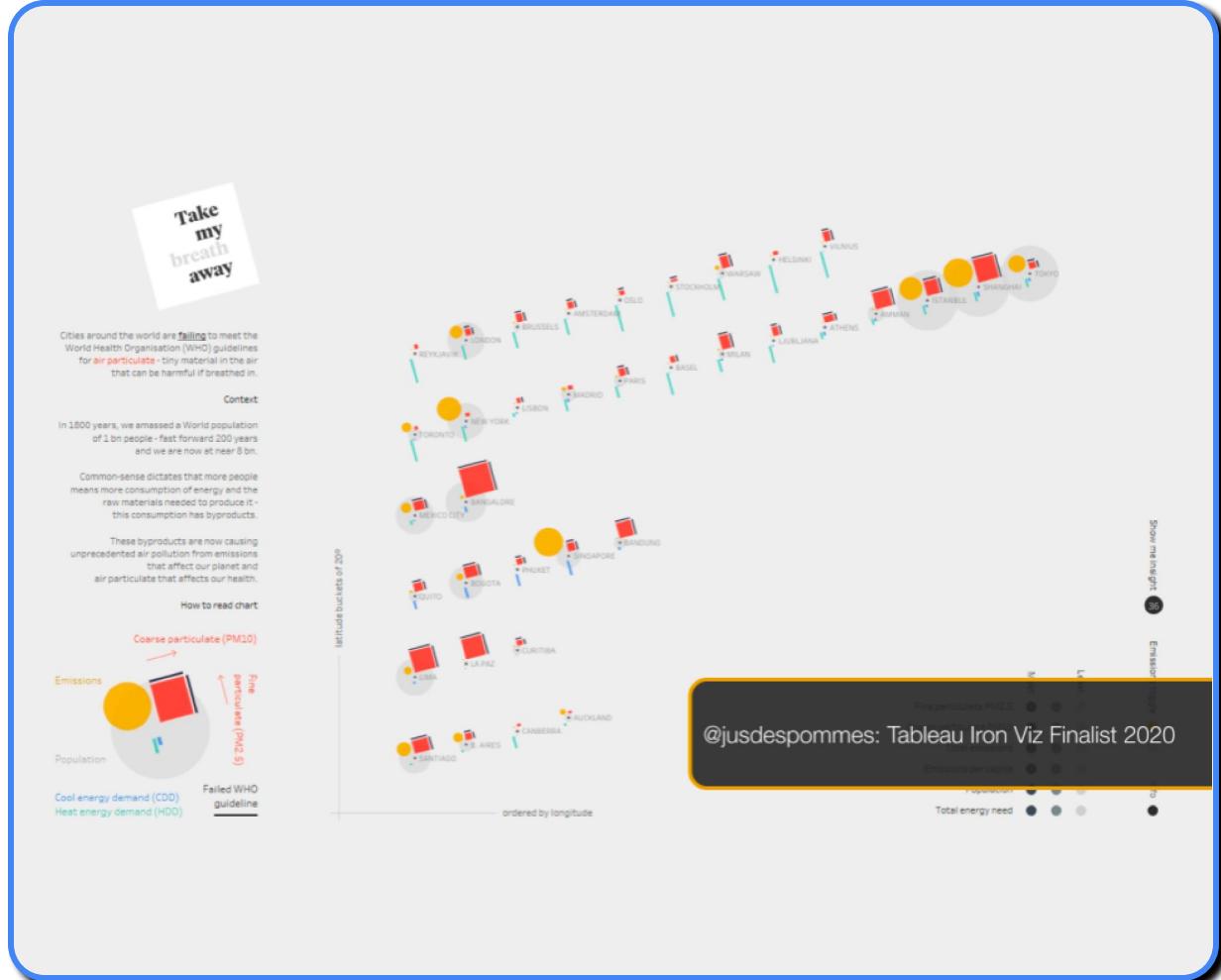
Year  
1997

DOTS ON THE  
RIGHT ARE LOSSES  
BLUE SHADING  
REPRESENTS A TOP 25  
RANKING AT THE END  
OF THE YEAR

\* BEAT OHIO STATE  
S BEAT MICHIGAN STATE

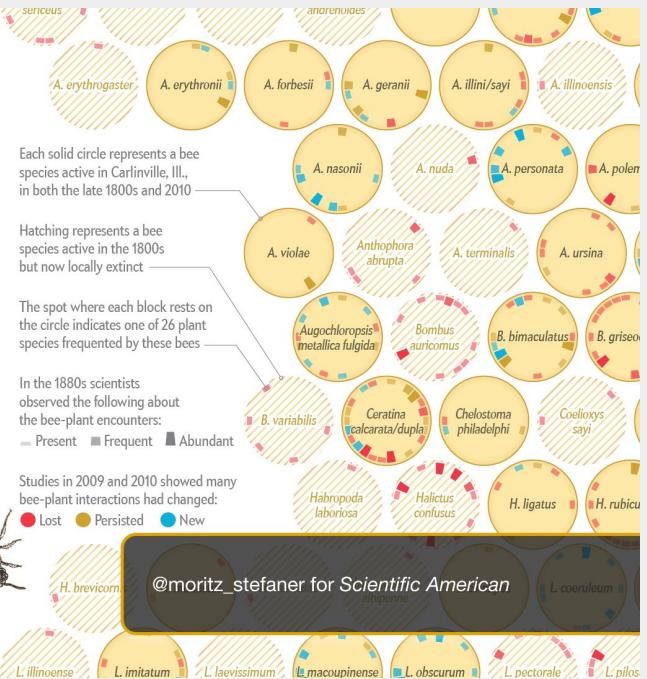
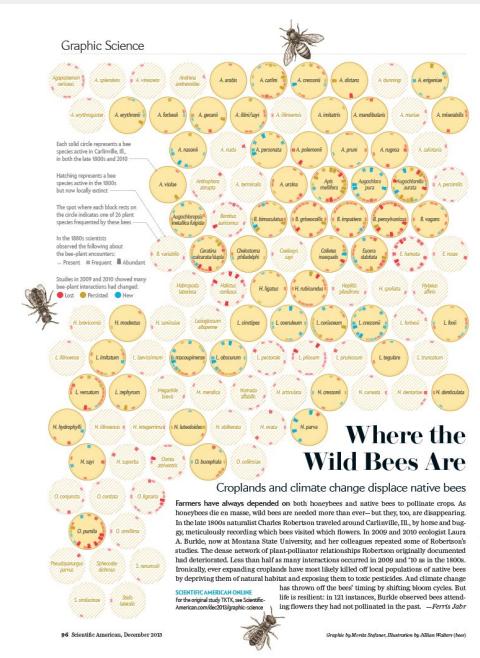


@boknowsdata on Tableau Public





@accuratstudio for La Lettura



## **How to inspire novel glyph design?**

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

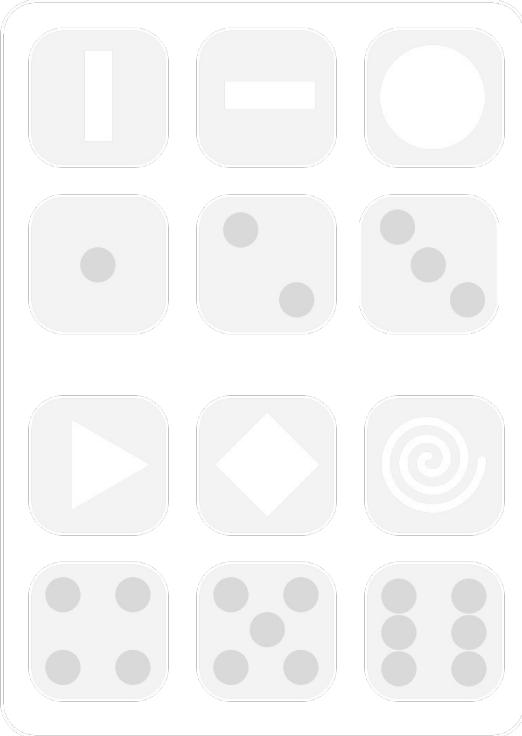
**Evoke (memorable) figurative  
associations ...**



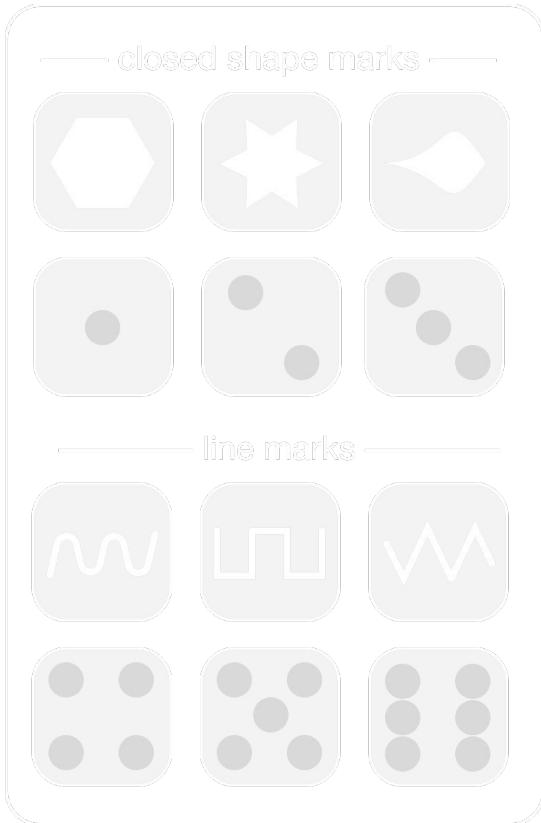
## Inspiration at the Role of the Dice: An Exercise in Aleatoric Visualization Design

forthcoming article in *Nightingale*  
adapted from “Generative Design Inspiration for Glyphs with **Diatoms**” IEEE VIS 2021  
with Carmen Hull and Robert Kosara  
image: unsplash (@nicreates)

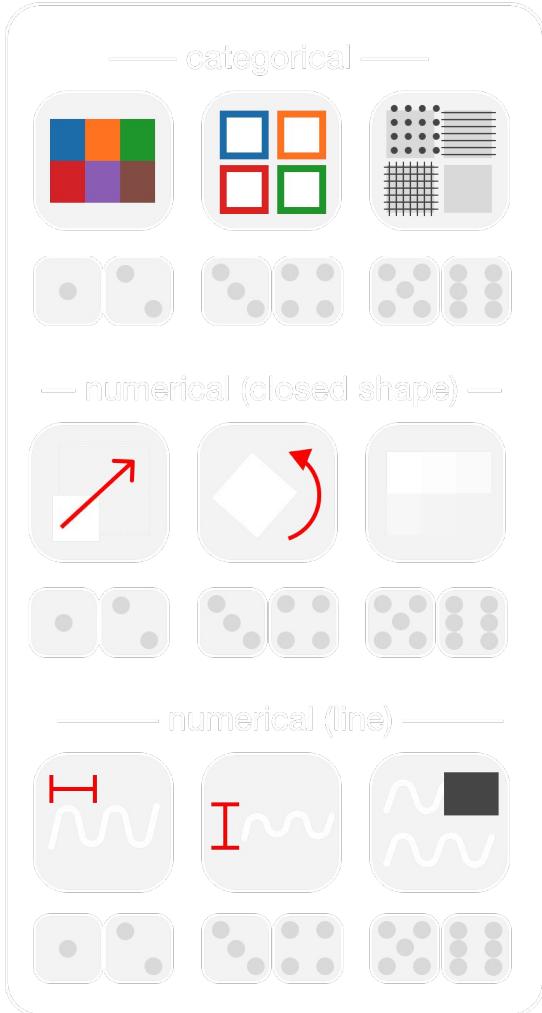
— glyph scaffold palette —

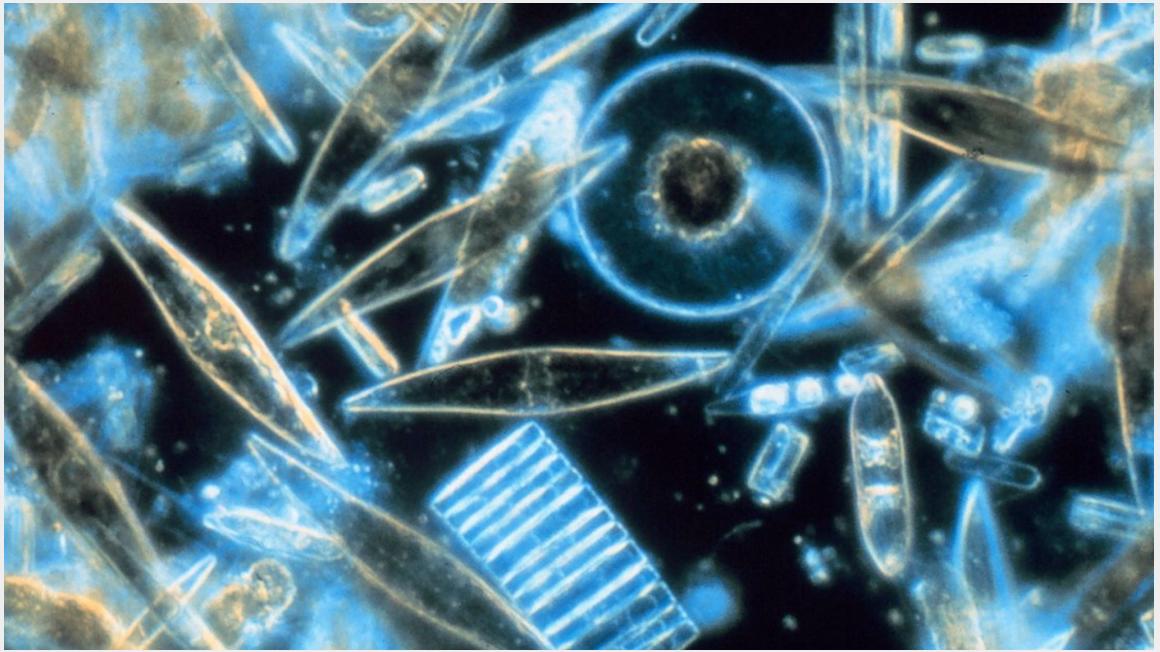


— mark shape palette —



— visual properties palette —



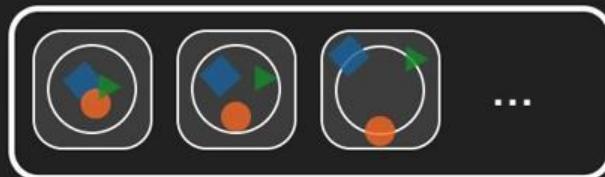


## Generative Design Inspiration for Glyphs with Diatoms

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

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

Scaffold  
Gravity



Scaffold



Channel Assignment



Mark Assignment



Conjunction



Repeat

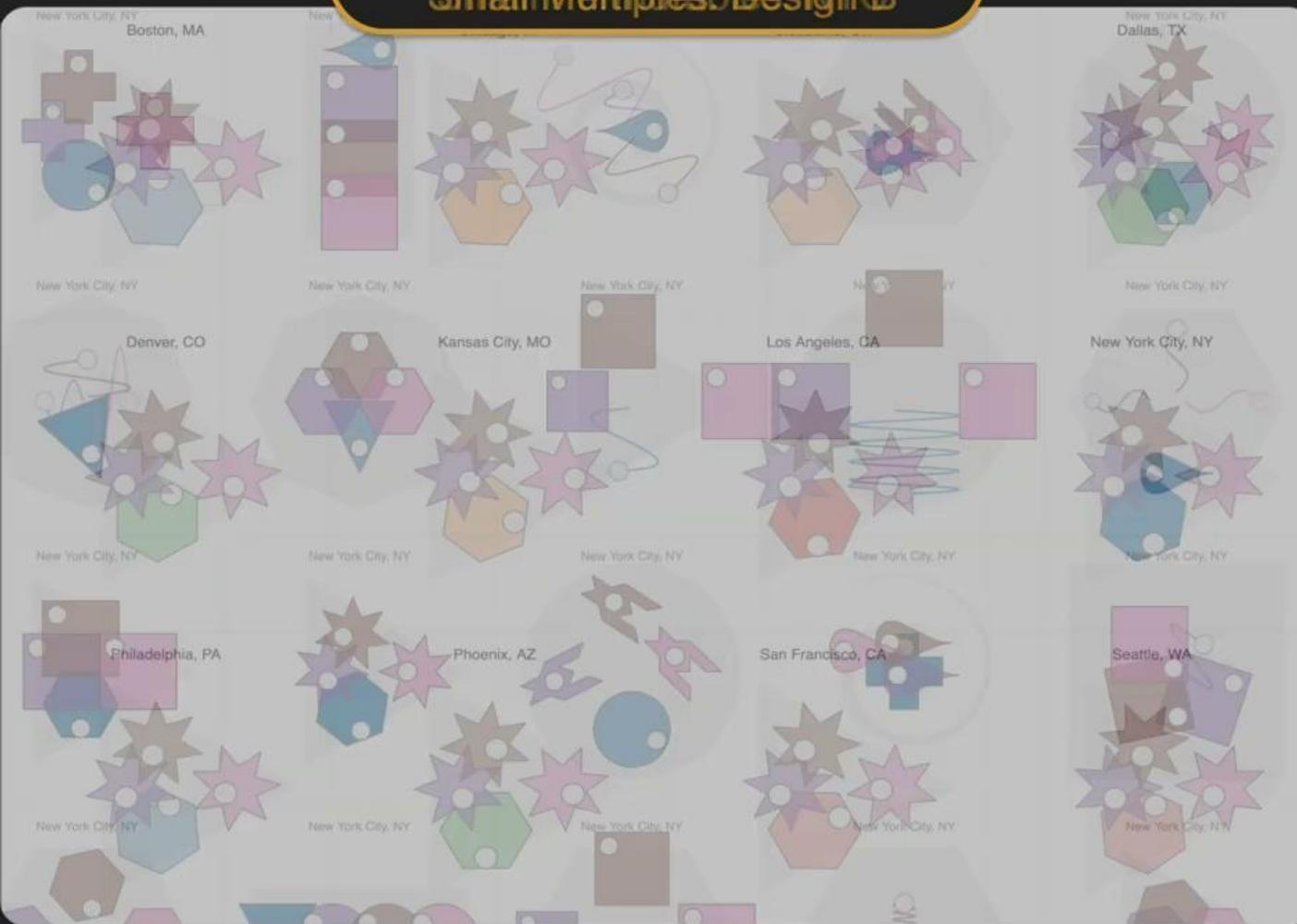
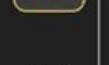
Place	Region	Column Set #1		Column Set #2		
		Area	Population	Bike Score	Transit Sc.	Walk Score
Boston	Northeast	232	672,840	70	73	81
Chicago	Midwest	607	2,704,965	70	65	78
...	...	...	...	...	...	...

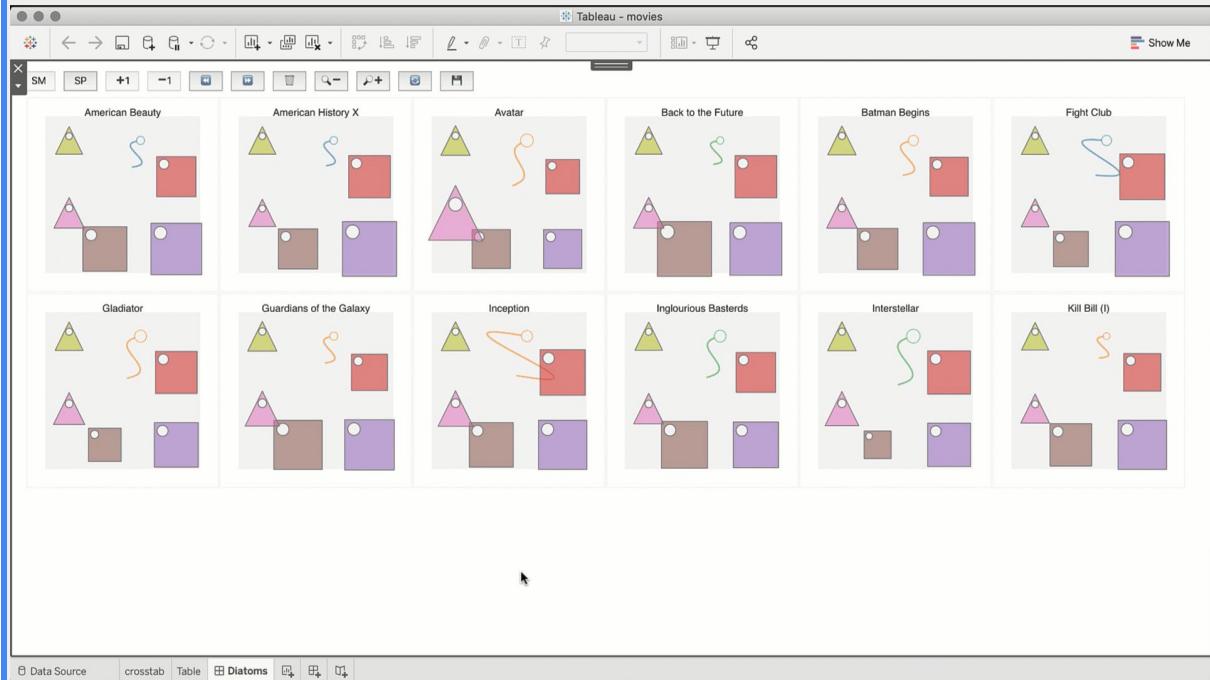
# Small Multiples Design B

Mark  
Shapes

Encoding  
Channels

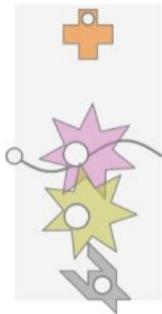
Glyph  
Scaffolds





## P2's Glyph Designs

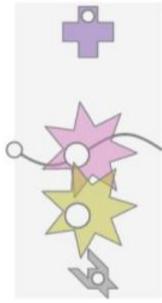
Australia



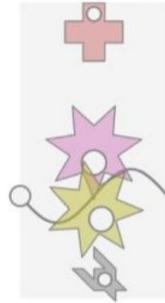
Brazil



## United Kingdom

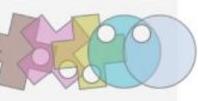


## Indonesia



# P3's Glyph Design

WALL-E



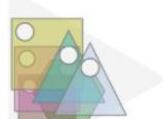
WALL-E



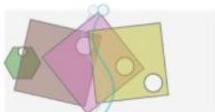
WALL-E



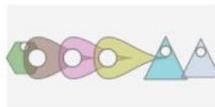
WALL-E



WALL-E



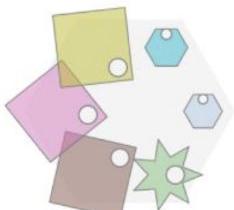
WALL-E



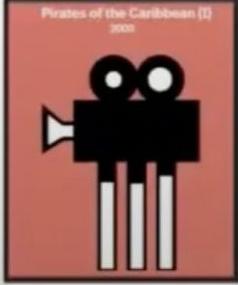
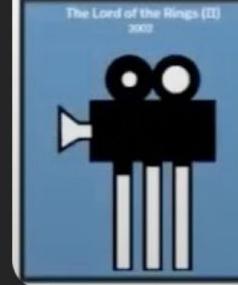
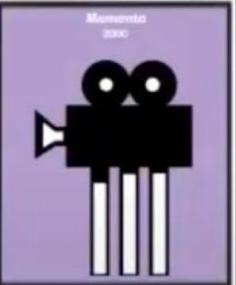
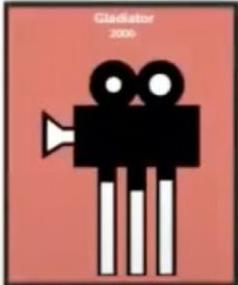
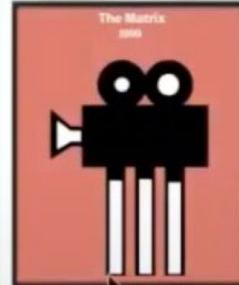
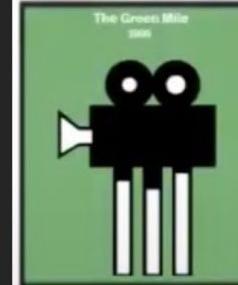
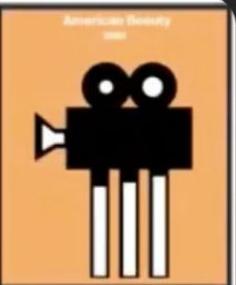
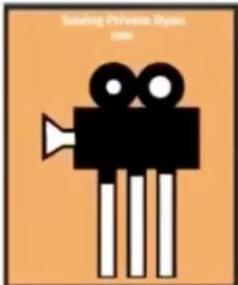
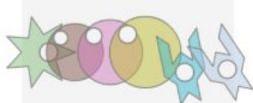
WALL-E



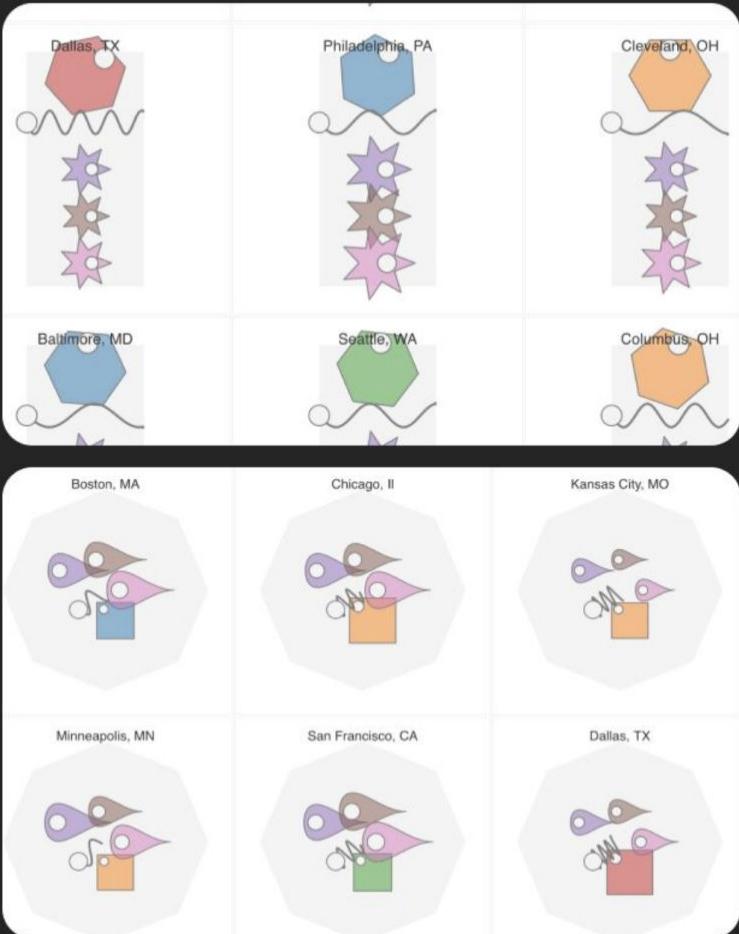
WALL-E



WALL-E



# P5's Glyph Design



San Antonio



## 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**

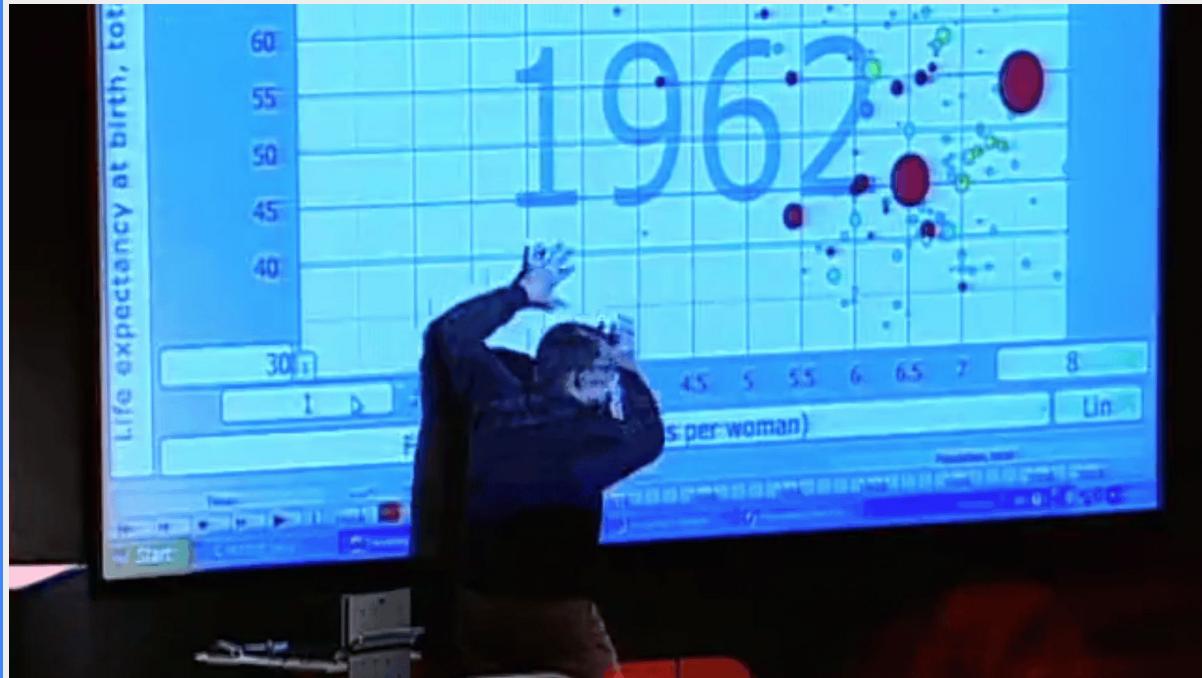
tools for bespoke communication-oriented  
visualization design / construction

- ▶ 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](http://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

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 scatterplot 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 is 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.

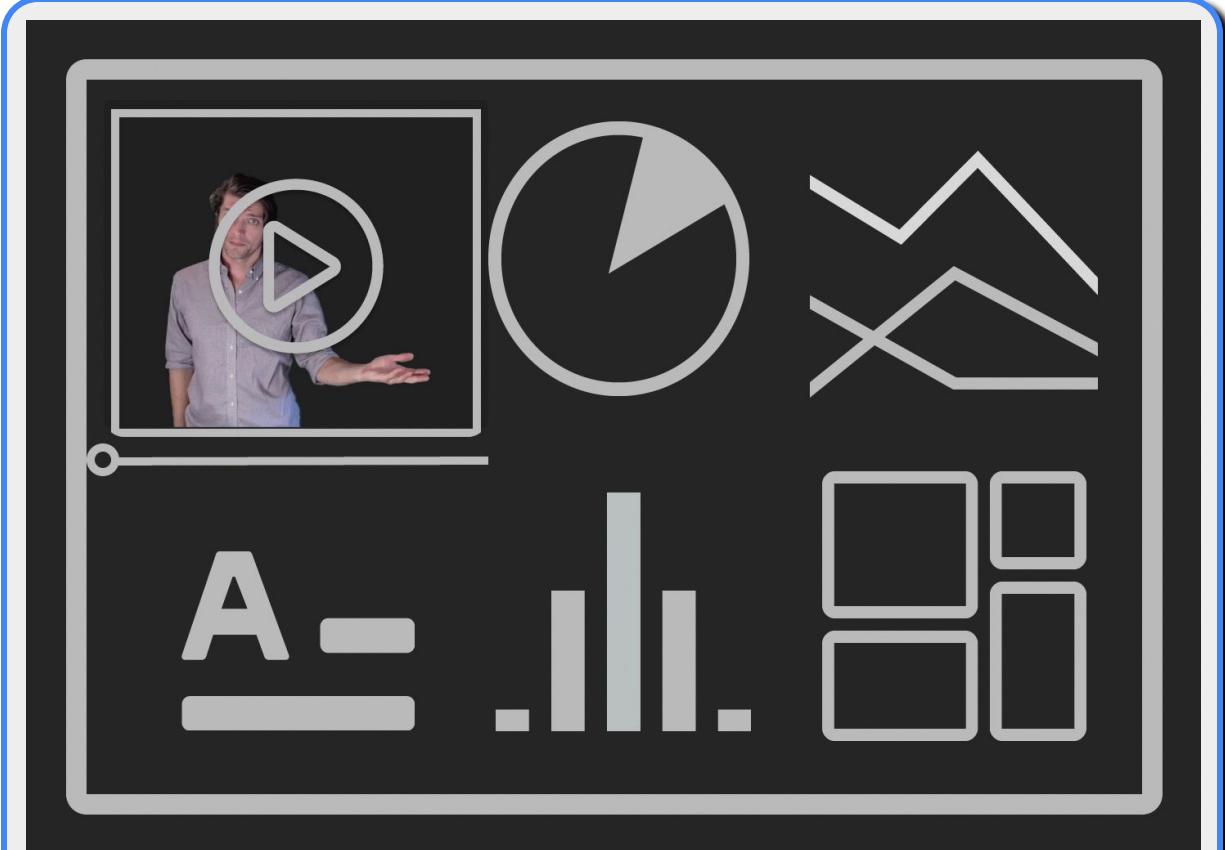
00:38 I'll now click back on additional tabs on this dashboard to include more

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

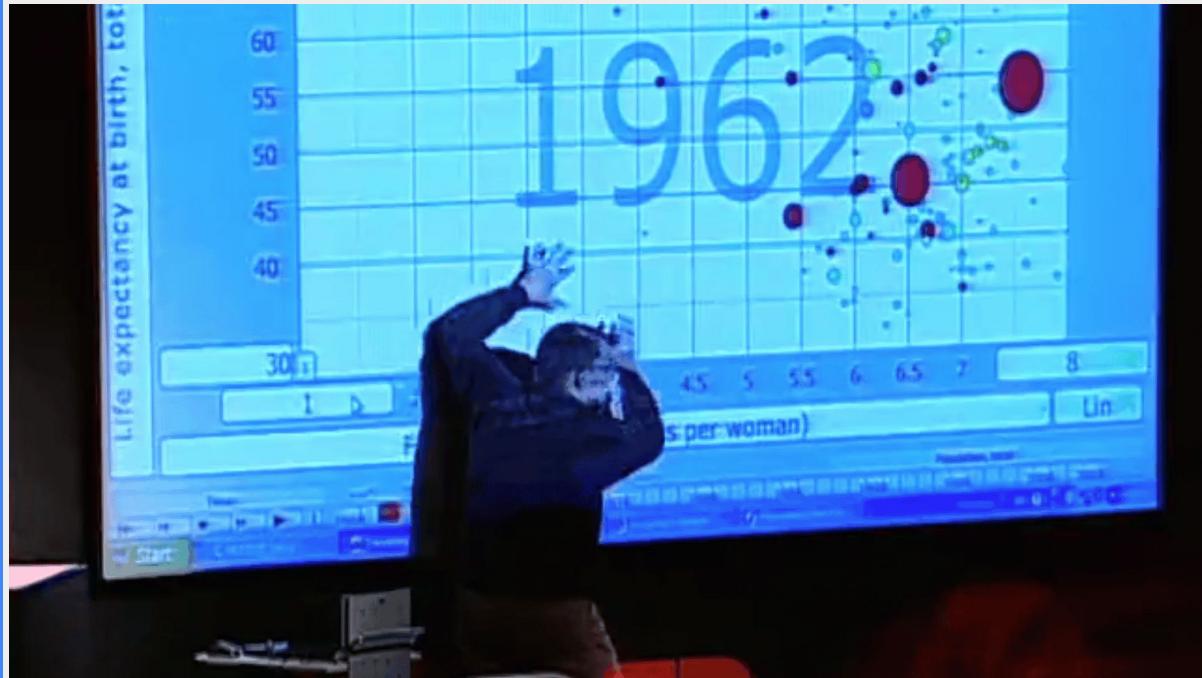
A scatterplot showing the relationship between publication year (X-axis, 1996 to 2016) and rating (Y-axis, 3.2 to 4.4). The size of the orange circles represents the number of ratings for each title. A horizontal dotted line is drawn at approximately 4.0. A vertical dotted line is drawn at approximately 2001. A blue circle highlights a point in the lower-left quadrant.

Author	Author Gen.	Title	Genre	Is Best Seller	Yr	Author ..	Pages	Rating ..	Rating _
Alice Munro	female	Hateship, Friendship, Cour	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	50,482
Barkley Kingsover	female	The Postmodern Bible	Fiction	True	1998	43	546	4.0	559,572
Clive Hedges	male	The Last of the Fielding	Fiction	True	2011	37	512	4.0	88,523
Chimamanda Nigara Adichie	female	Americanah	Fiction	True	2013	36	477	3.9	159,595
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
Donna Tartt	female	The Goldfinch	Fiction	True	2013	50	771	3.9	456,286
Elena Ferrante	female	The Story of the Lost Chil	Fiction	True	2015	71	480	4.4	27,561
Emma Donoghue	female	Room	Fiction	True	2010	41	401	4.0	42,432
George Saunders	male	Tenth of December	Fiction	True	2013	54	272	4.0	42,946
Hilary Mantel	female	Bring Up 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	12,646
Jeanineette Walls	female	Half Broke Horses	Fiction	True	2009	48	272	4.0	118,529
Jonathan Franzen	male	A Gentleman in His O	Fiction	True	2010	48	288	3.6	138,608
Jessyca Ward	female	Sing, Unbound, Sing	Fiction	True	2017	41	295	4.1	1,031
Jonathan Franzen	male	Freedom	Fiction	True	2010	53	351	3.9	126,779
Karen Russell	female	Swamplandia!	Fiction	True	2011	29	323	3.2	43,049

👉 a prototype video “tour guide” for a Tableau dashboard

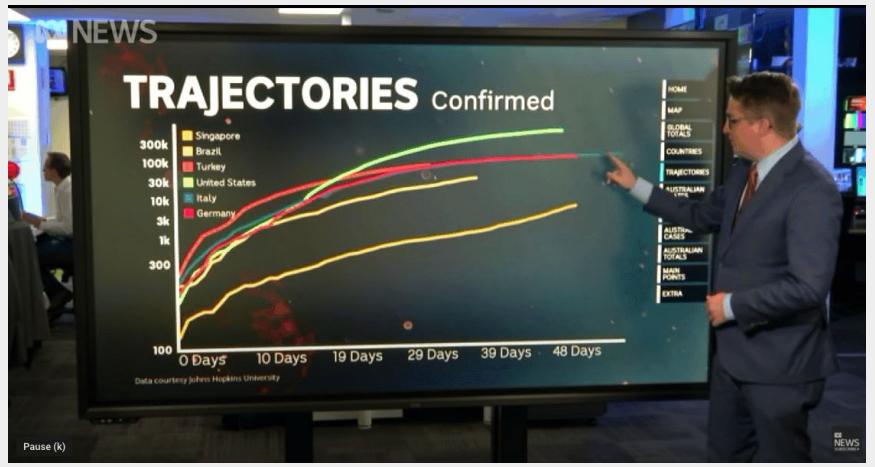


👉 a video “tour guide” for a business intelligence dashboard



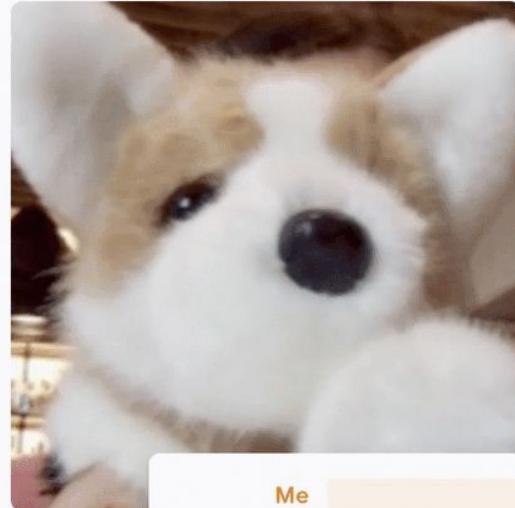
👉 **Hans Rosling's TED Conference Talks (2006, 2007)**

[gapminder.com/videos](http://gapminder.com/videos)





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



Me

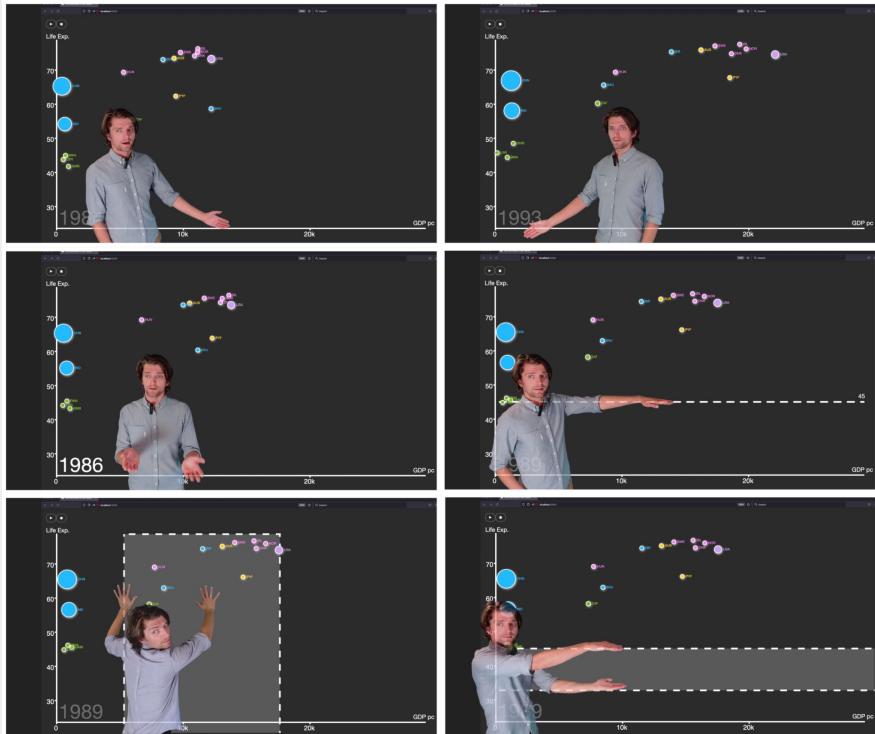
Me + Dog <3

20%

## 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"***

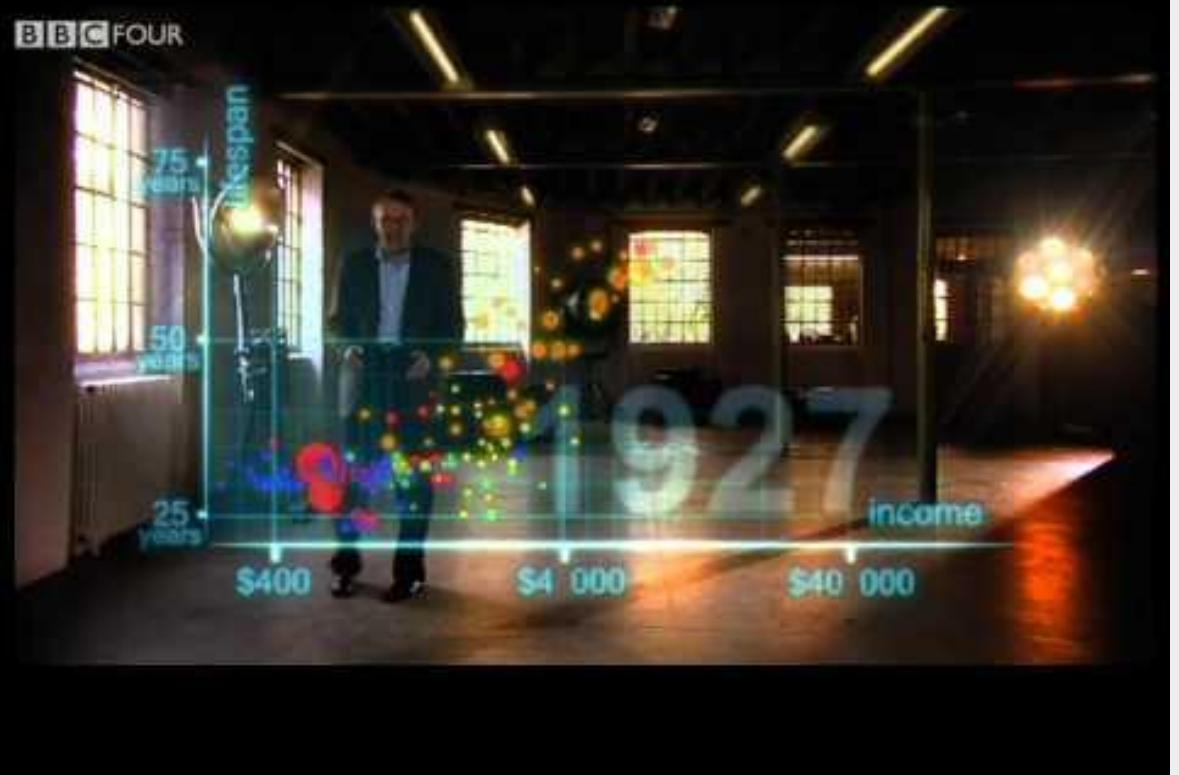
Information+ Conference 2021



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

[gapminder.com/videos](http://gapminder.com/videos)

BBC FOUR



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



👉 "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](https://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

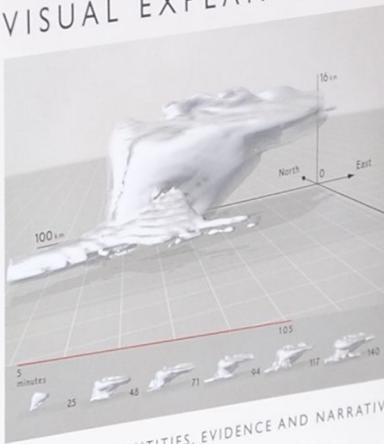
Prologue...

# My Journey in Data Visualization



TUFTS VISUAL EXPLANATIONS

EDWARD R. TUFTS  
VISUAL EXPLANATIONS



GRAPHICS  
PRESS

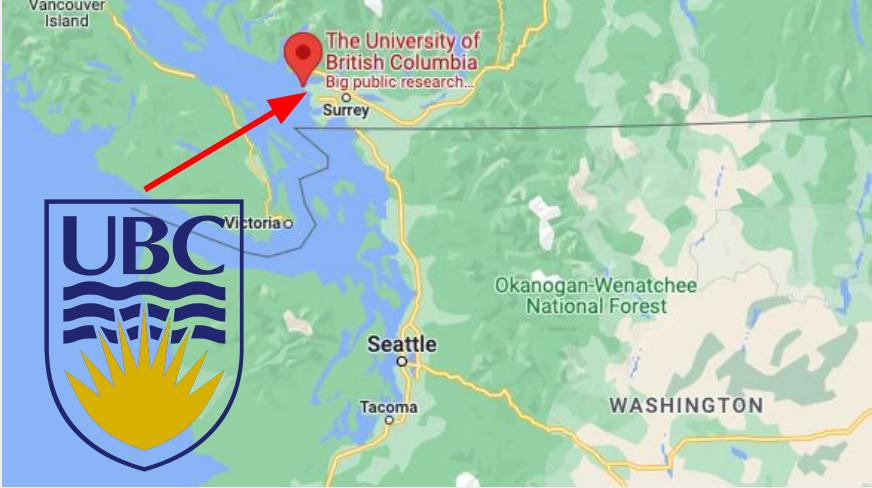


Queen's  
UNIVERSITY

## **Cognitive Science**

CS / Psych / Math / Linguistics / ...

**Human-Computer Interaction + Data Mining = ?**

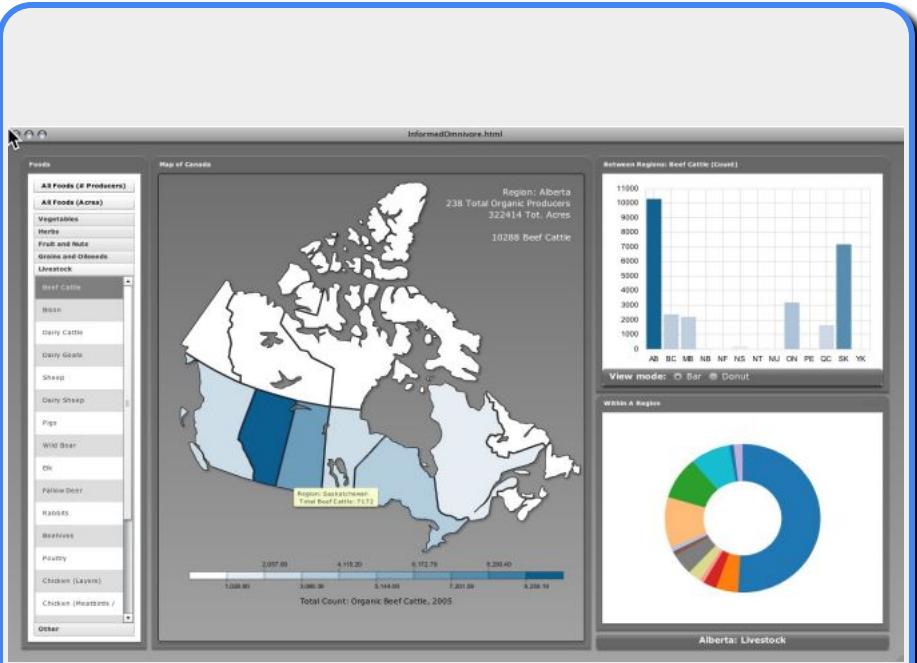


## **Human-Computer Interaction**

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**

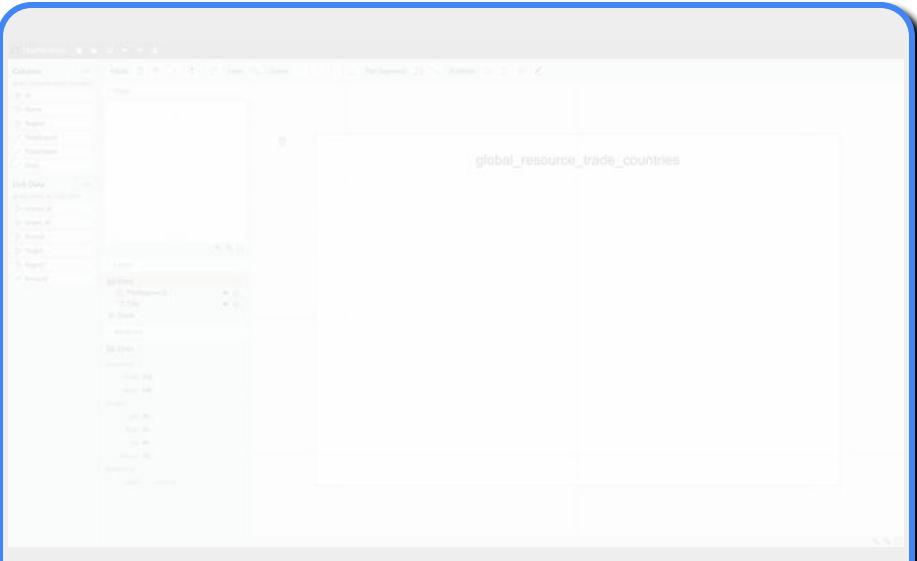
**interactive visualization authoring tools ...**

**storytelling / narrative visualization ...**

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



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



# Charticulator

Interactive Construction of Bespoke Chart Layouts

Microsoft Research | [charticulator.com](http://charticulator.com)  
w/ Donghao Ren and Bongshin Lee

🥇 shortlist, 2018 Information is Beautiful Awards

**Tableau Research**  
**2019 – present**