



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

—

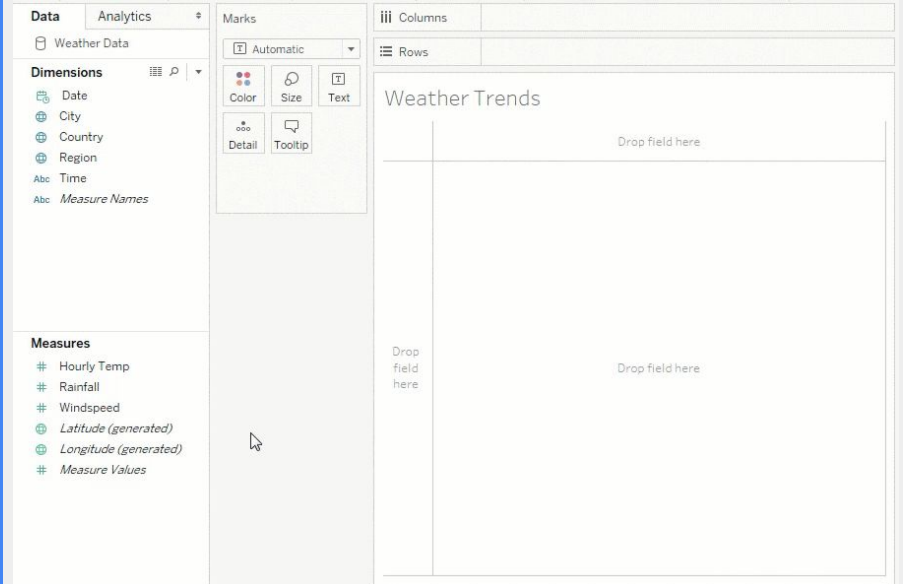
@ MICA – Oct 3 2022

About Tableau

“Helping people see and understand data...”

tableau.com, a Salesforce company

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



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

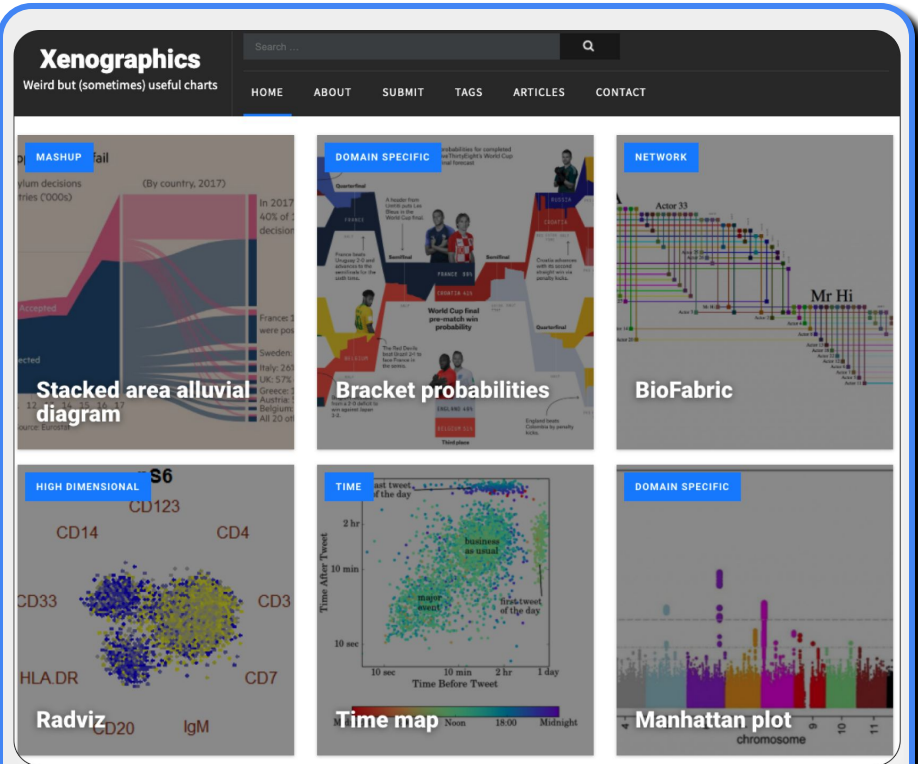
Filter by chart name or AKA

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

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

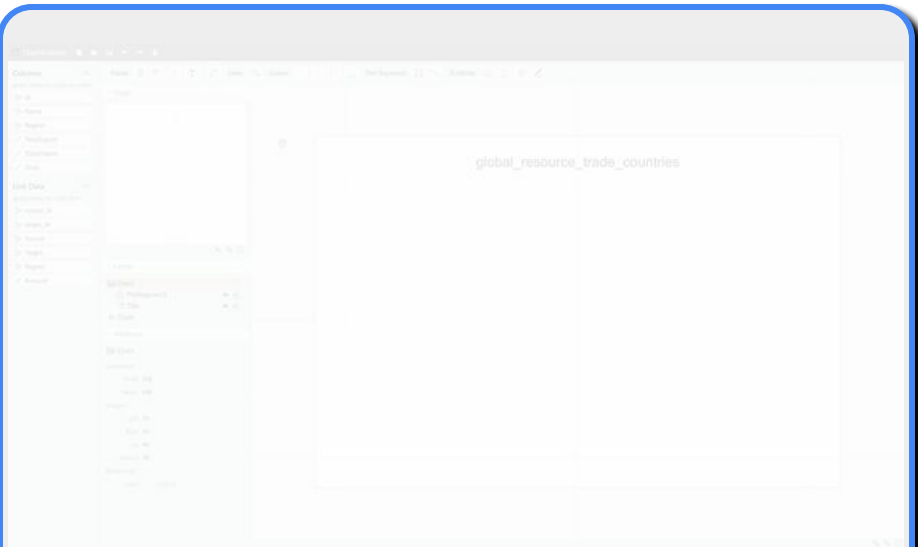
Andy Kirk's Chartmaker Directory 🖱️

chartmaker.visualisingdata.com



Maarten Lambrechts' xeno.graphics 🖱️

...weird but sometimes useful charts – OpenVisConf 2018



Chartculator

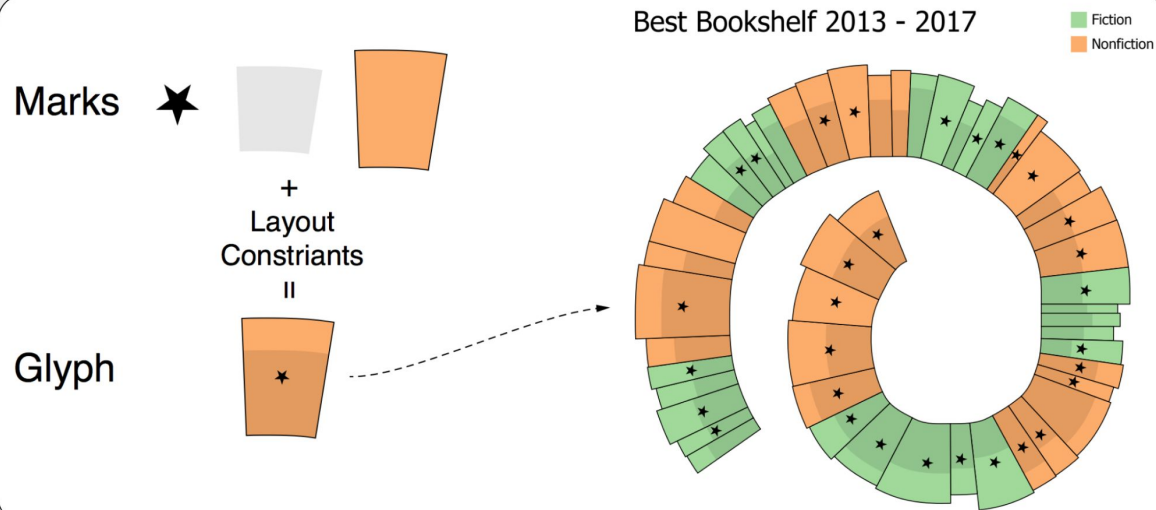
Interactive Construction of Bespoke Chart Layouts

Microsoft Research | chartculator.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

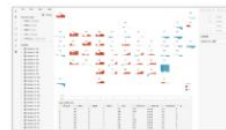
This article is a group effort, with contributions from the authors of our [InfoVis'19 paper](#).

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

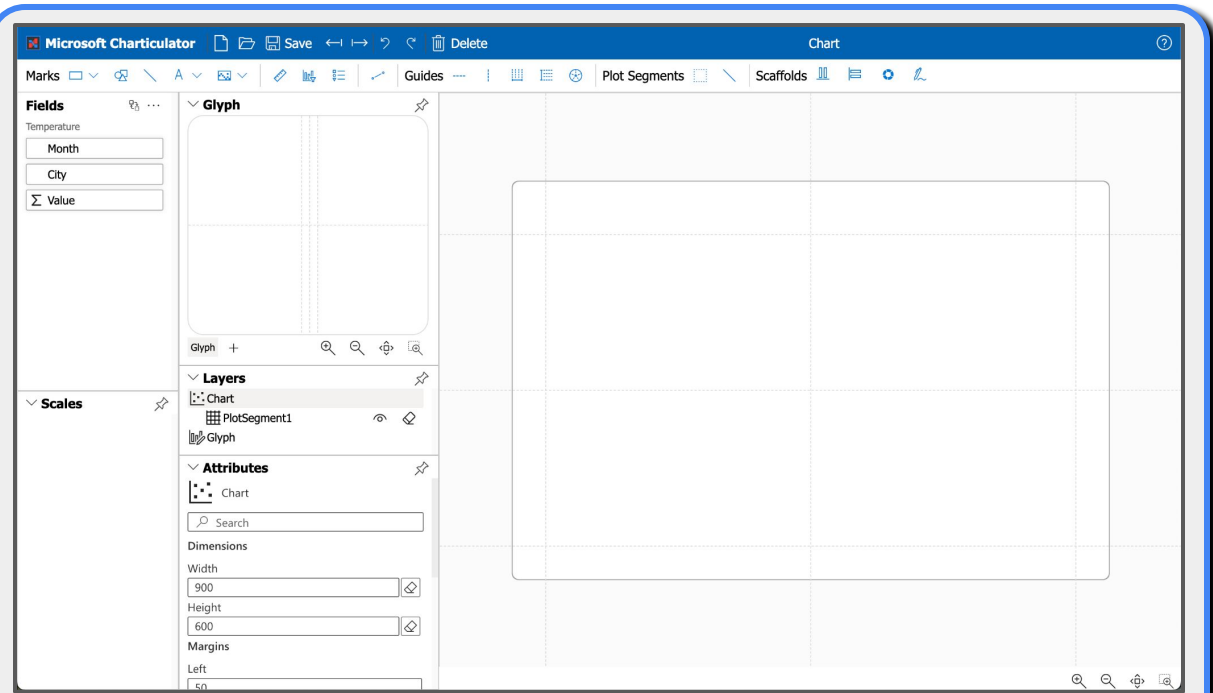


Data Illustrator



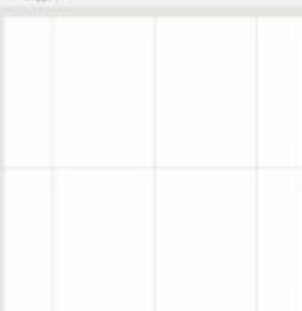
Charticulator



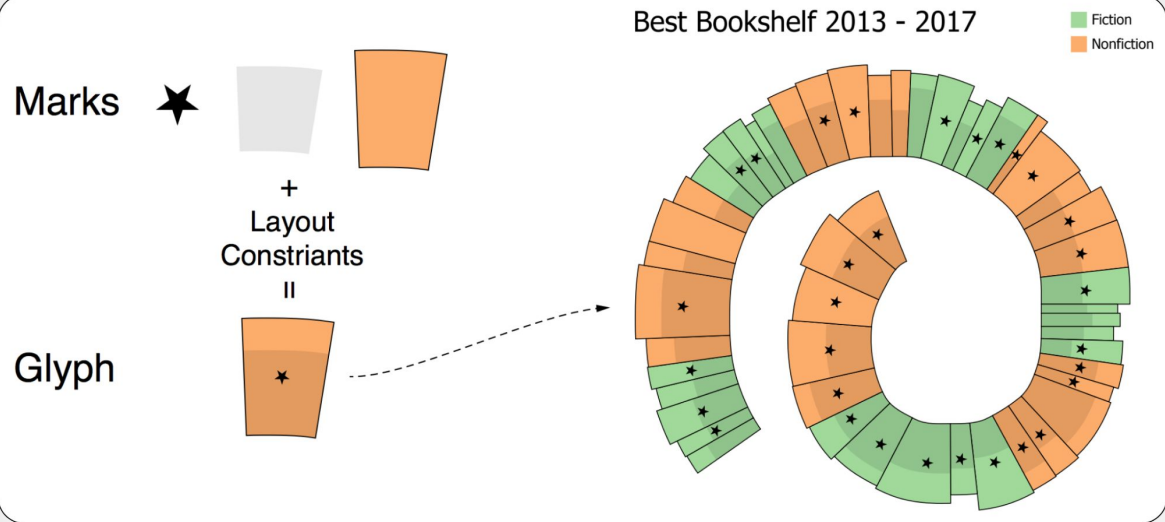


👉 the blank canvas in communication-oriented visualization
... missing design inspiration support in vis construction tools

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



best_bookshelf_2013_2017

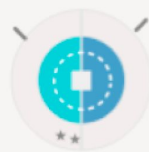


a **glyph** is “a small visual object that depicts attributes of a data record”

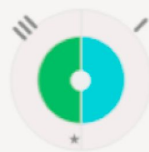
– Borgo et al (2013)

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

– Fuchs et al (2016)



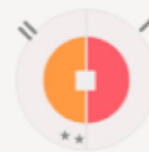
JUVENTUS
96



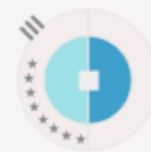
BORUSSIA DORTMUND
97



REAL MADRID
98



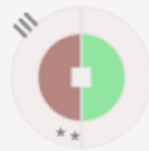
MANCHESTER UNITED
99



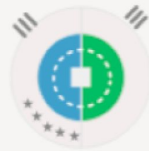
REAL MADRID
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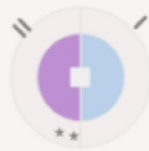
BAYERN
0



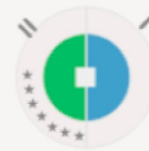
PORTO
04



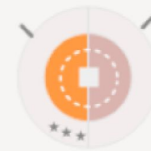
LIVERPOOL
05



BARCELONA
06



MILAN
07



MANCHESTER UNITED
08



BARCE
0



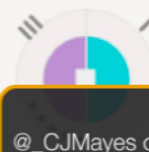
CHELSEA
12



BAYERN MUNICH
13



REAL MADRID
14



REAL MADRID
15



REAL MADRID
16



REAL
17

@_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

Pink shading = Independent;
Blue = Western;
Yellow = 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

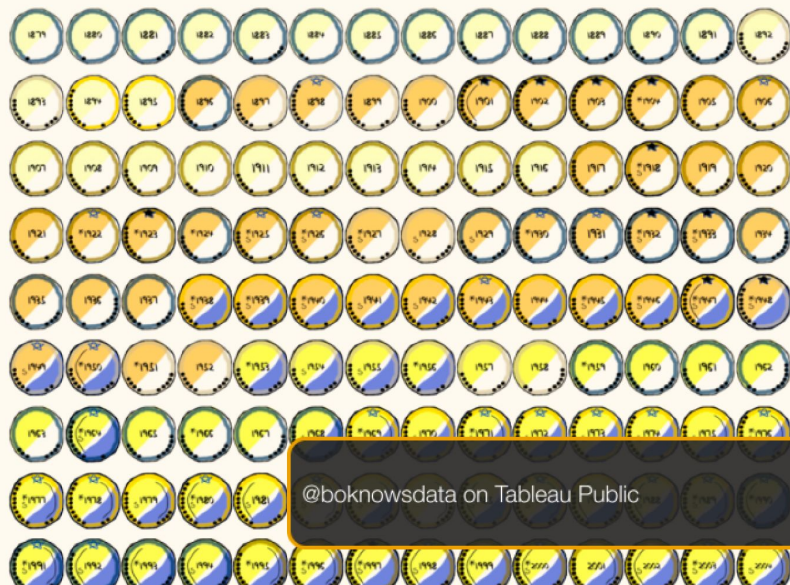
AN ARC ON THE RIGHT
IS A BOWL LOSS

* BEAT OHIO STATE

S BEAT MICHIGAN STATE



Year
1997



@boknowsdata on Tableau Public



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.

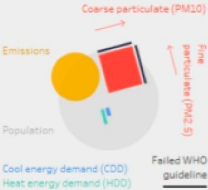
Context

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

Brain drain

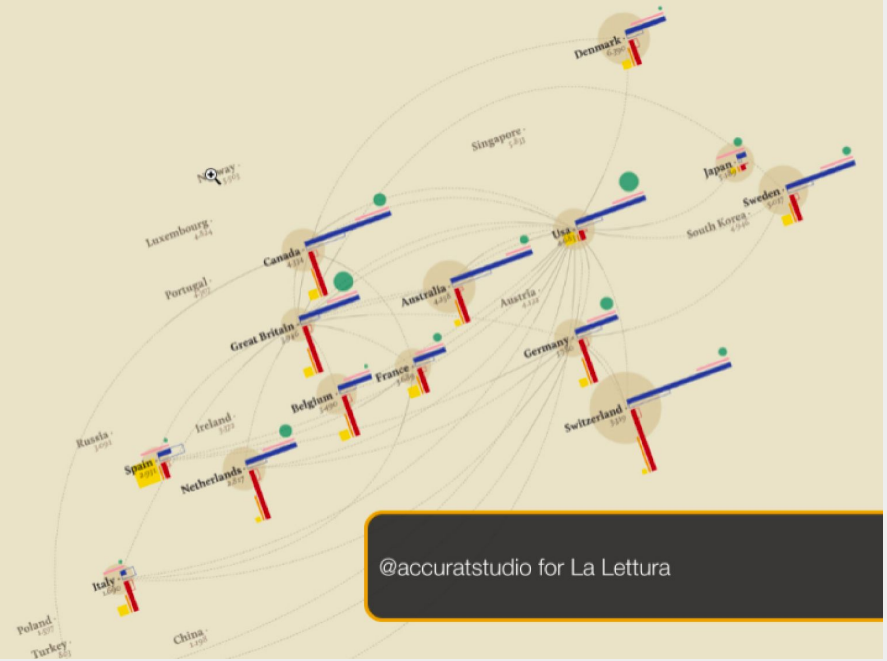
The phenomena of so-called brain drain is explored through a map showing incoming and outgoing flows of researchers in all countries. Using a series of parameters, the map is an attempt to discover the motivations that move researchers from one country to another. Each country is visualized through the representation of GDP per capita, female employment rate, overall unemployment rate, university rankings, percentage of foreign researchers, percentage of overall foreign population, percentage of emigrant researchers, percentage of overall emigrant population, percentage of researchers returning to their country of origin, and the main countries researchers come from and move to.

How to read it?

The countries are positioned according to:
 • % of GDP invested in R&D (x axis)
 • % of researchers per 1m people (y axis)
 The analysis is based on the following data:



y axis: n. of researchers per 1m people (2)



@accuratstudio for La Lettura

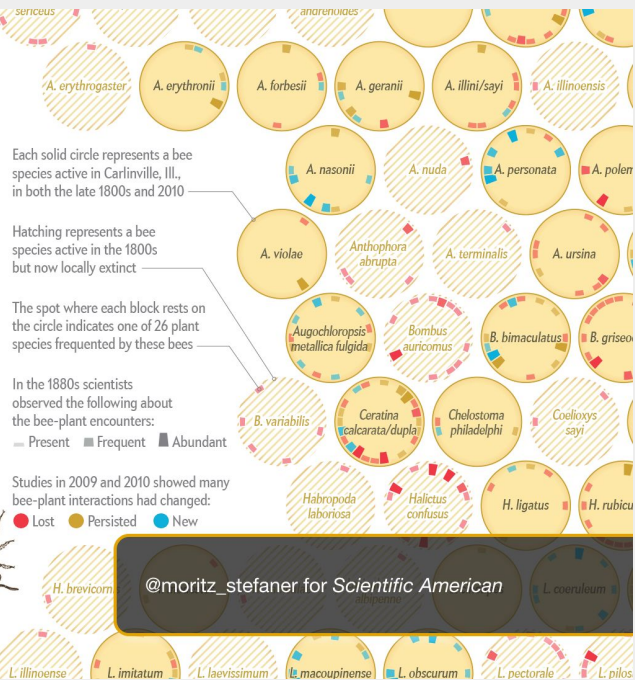
Graphic Science



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 in mass, 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. Burkle, 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 disappeared. Less than half as many interactions occurred in 2009 and '10 as in the 1800s. Increasingly, 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 has thrown off the bees' timing by shifting bloom cycles. But life is resilient: In 121 instances, Burkle observed bees strident flowers they had not pollinated in the past. —*Terri Lober*



How to inspire novel glyph design?

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

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

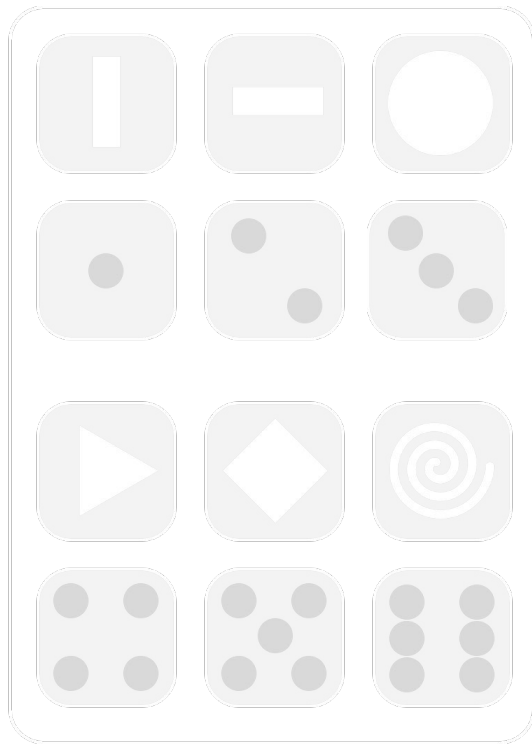


Inspiration at the Role of the Dice:

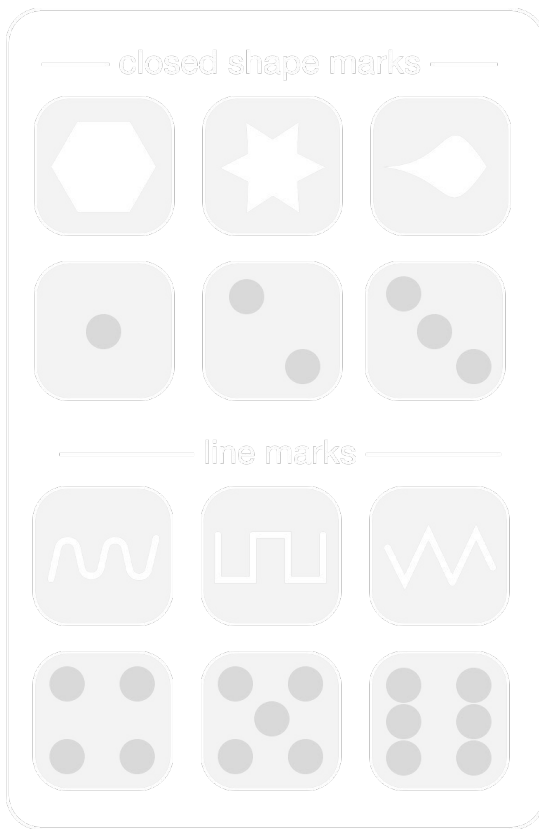
An Exercise in Aleatoric Visualization Design

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)

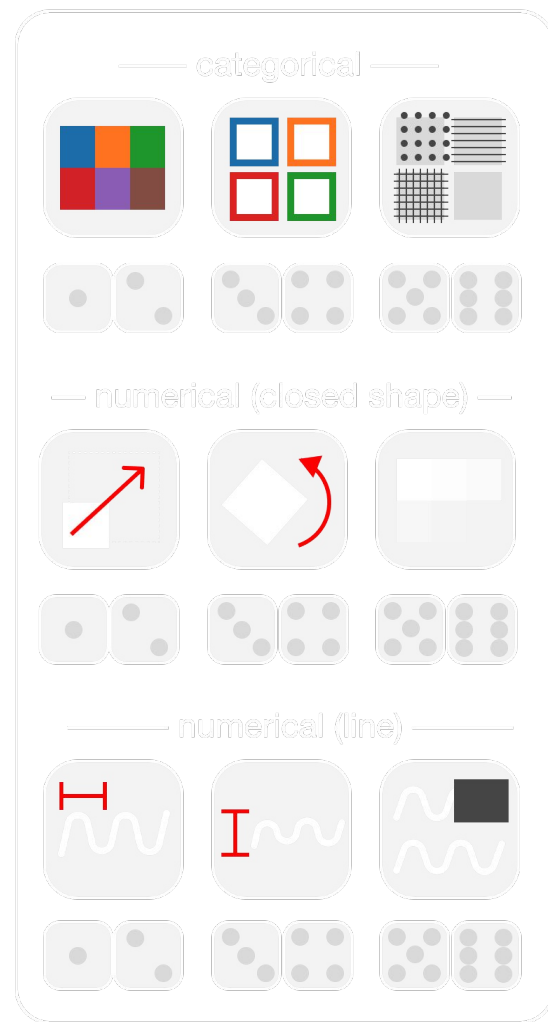
glyph scaffold palette

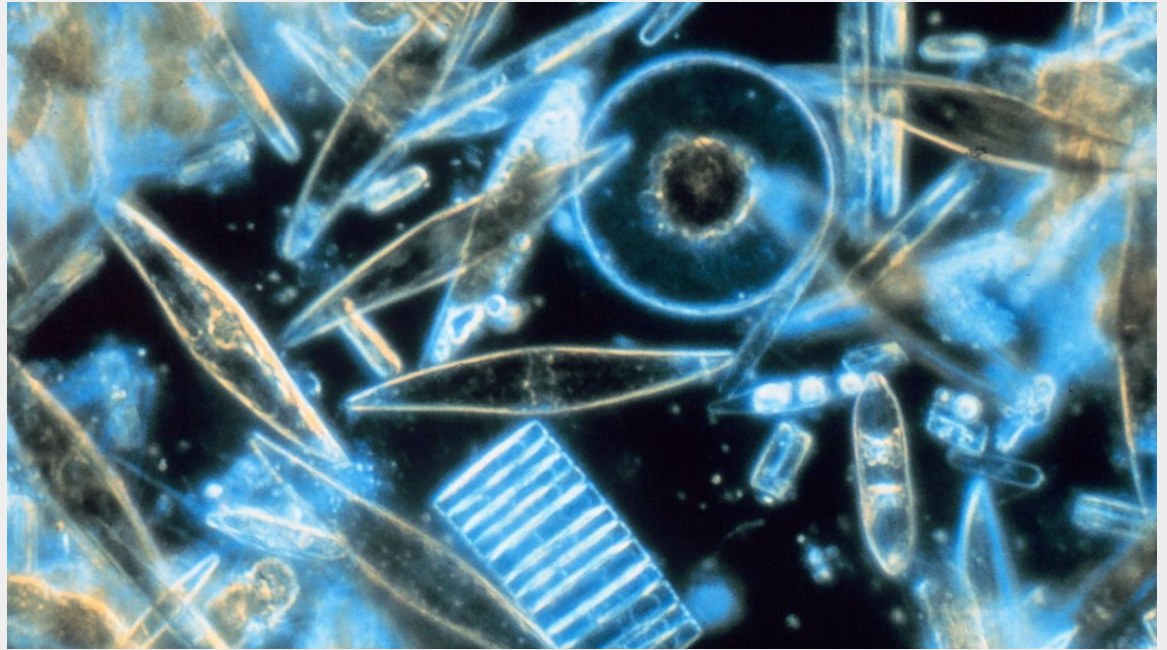


mark shape palette



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

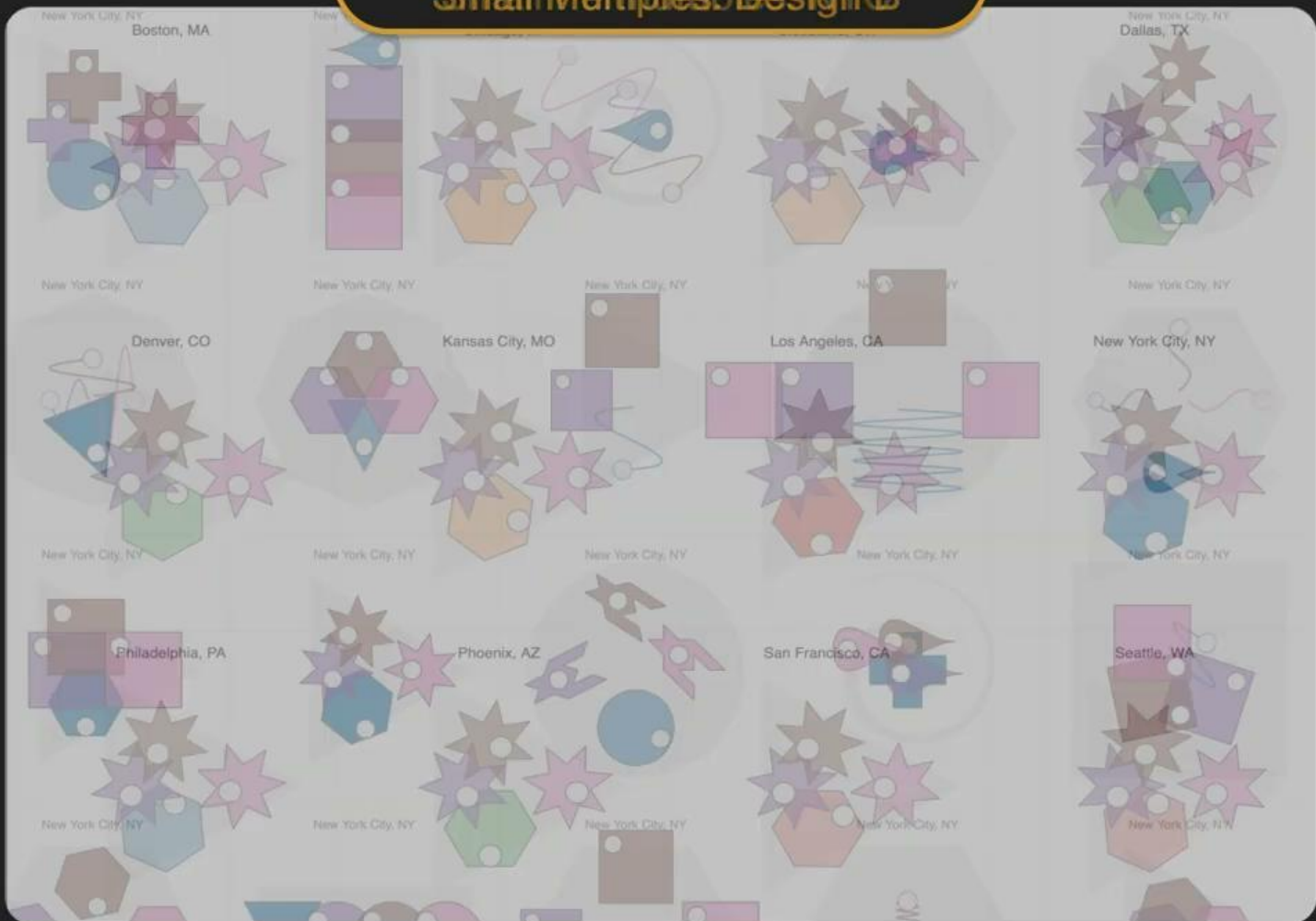
Mark Shapes

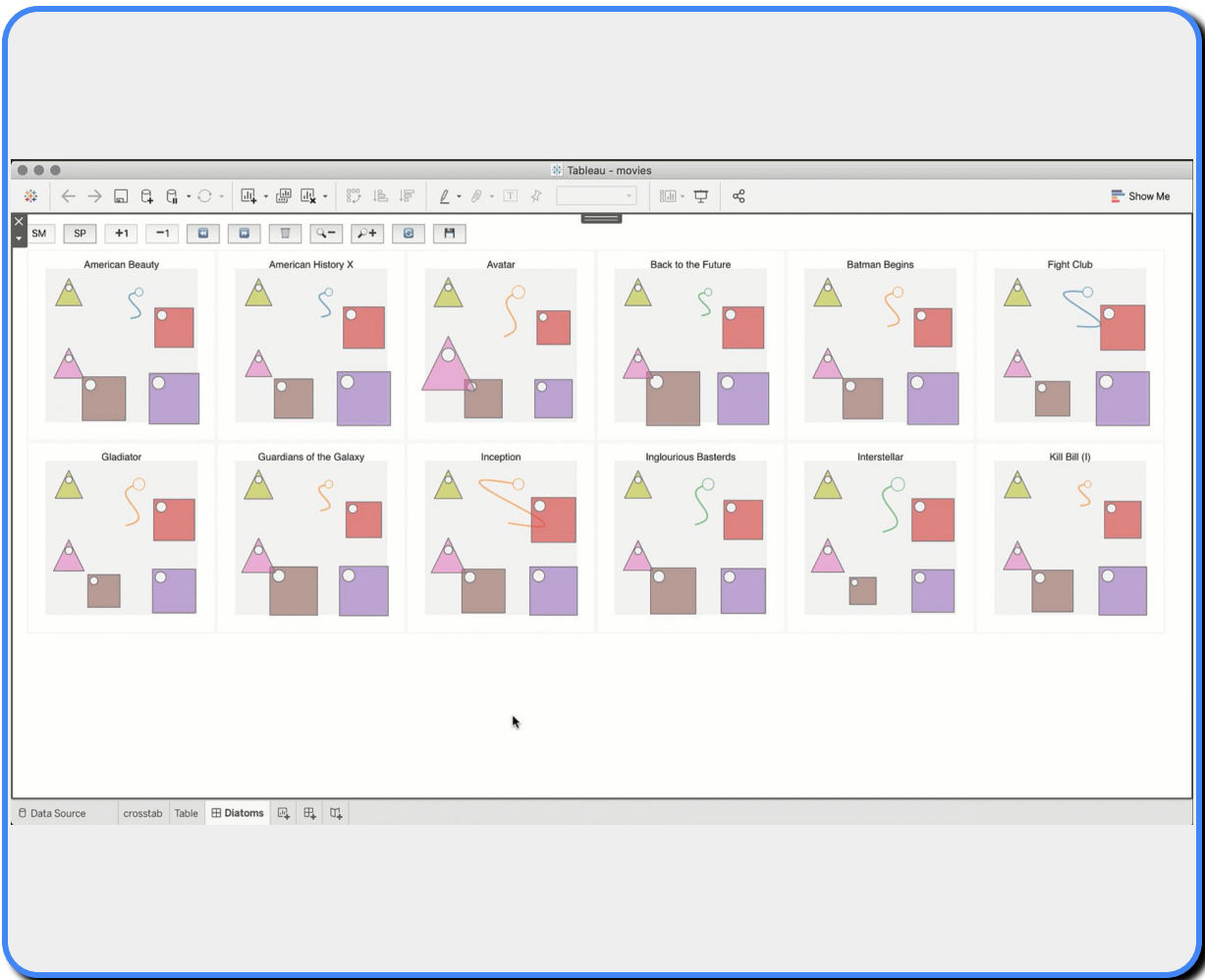


Encoding Channels



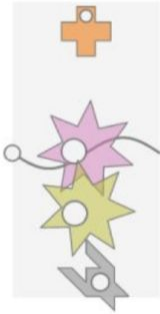
Glyph Scaffolds





P2's Glyph Designs

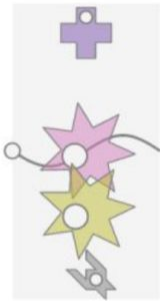
Australia



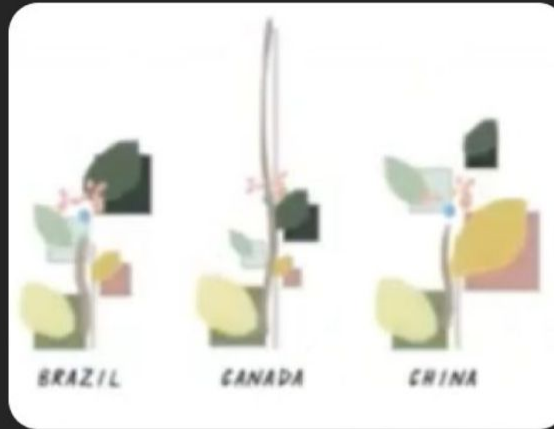
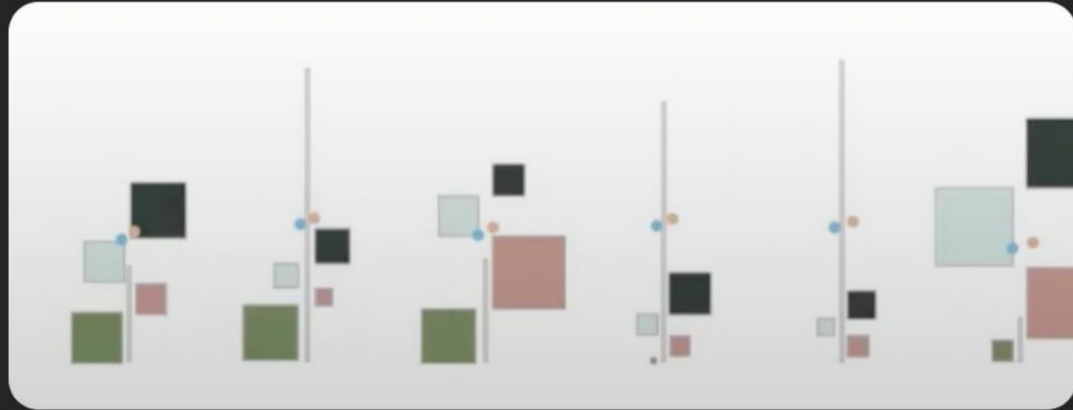
Brazil



United Kingdom

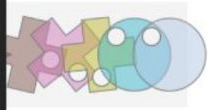


Indonesia



P3's Glyph Design

WALL-E



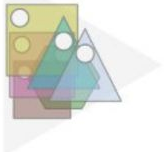
WALL-E



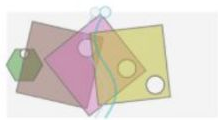
WALL-E



WALL-E



WALL-E



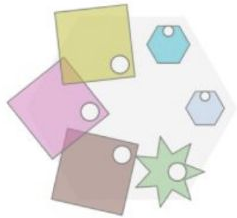
WALL-E



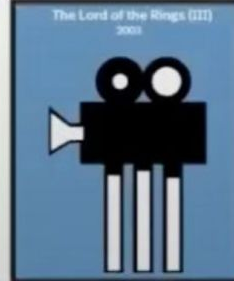
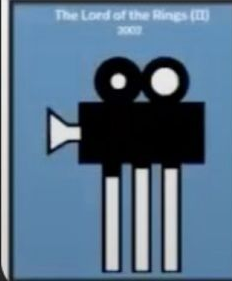
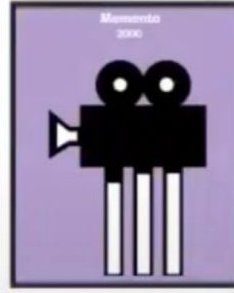
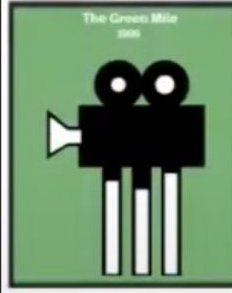
WALL-E



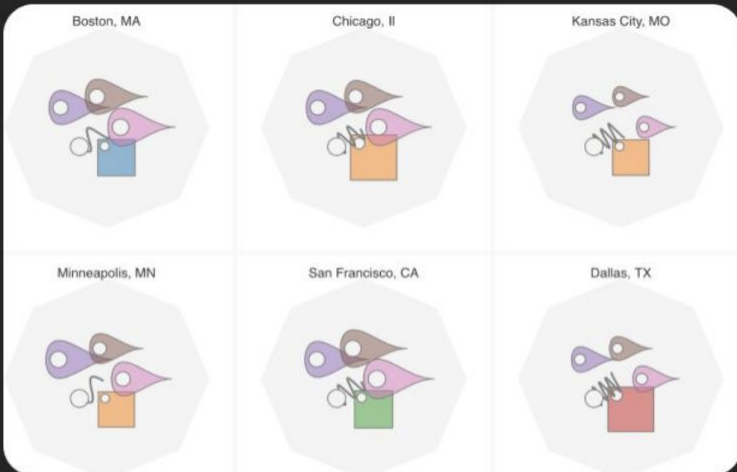
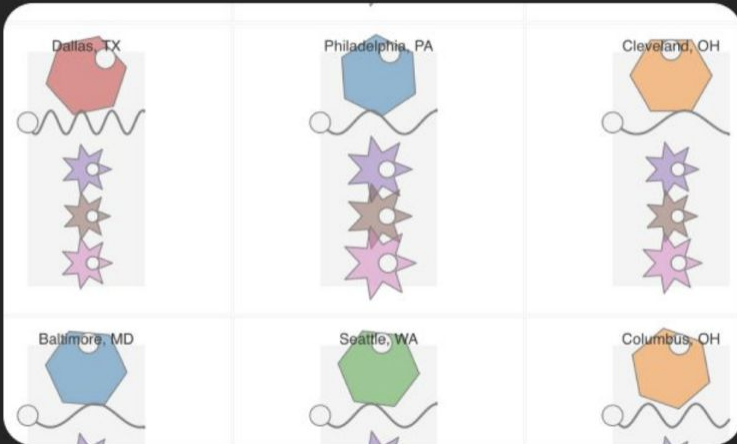
WALL-E



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

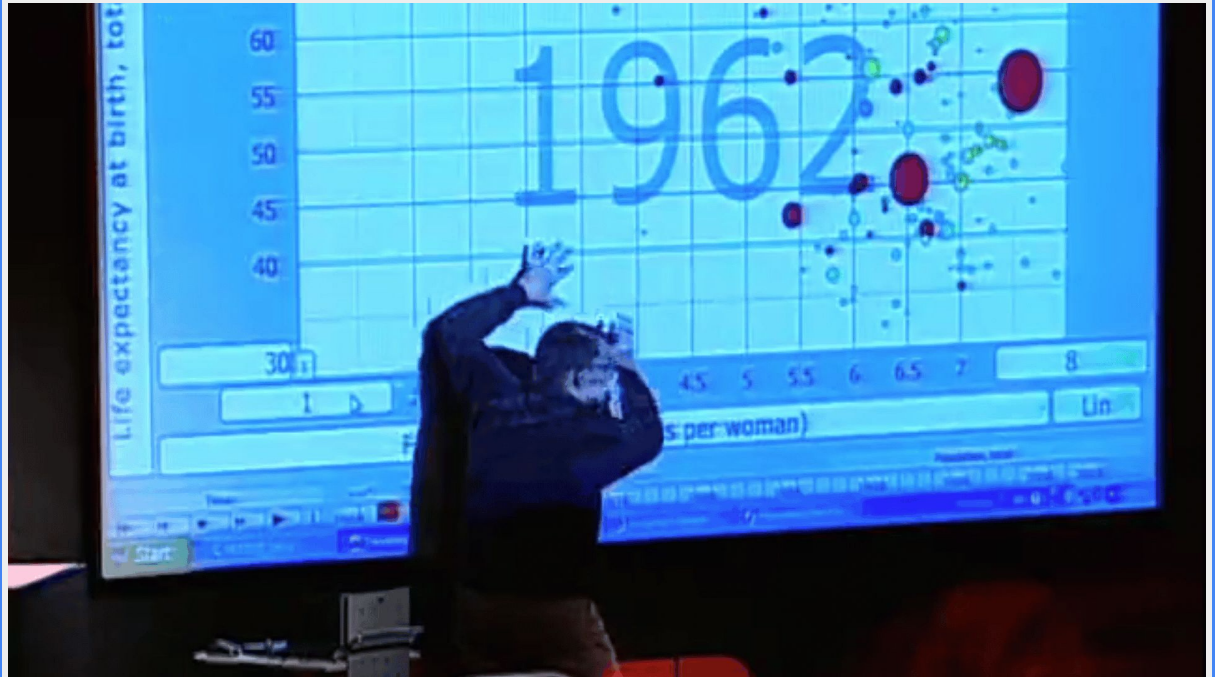
tools for bespoke communication-oriented
visualization design / construction

- ▶ **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



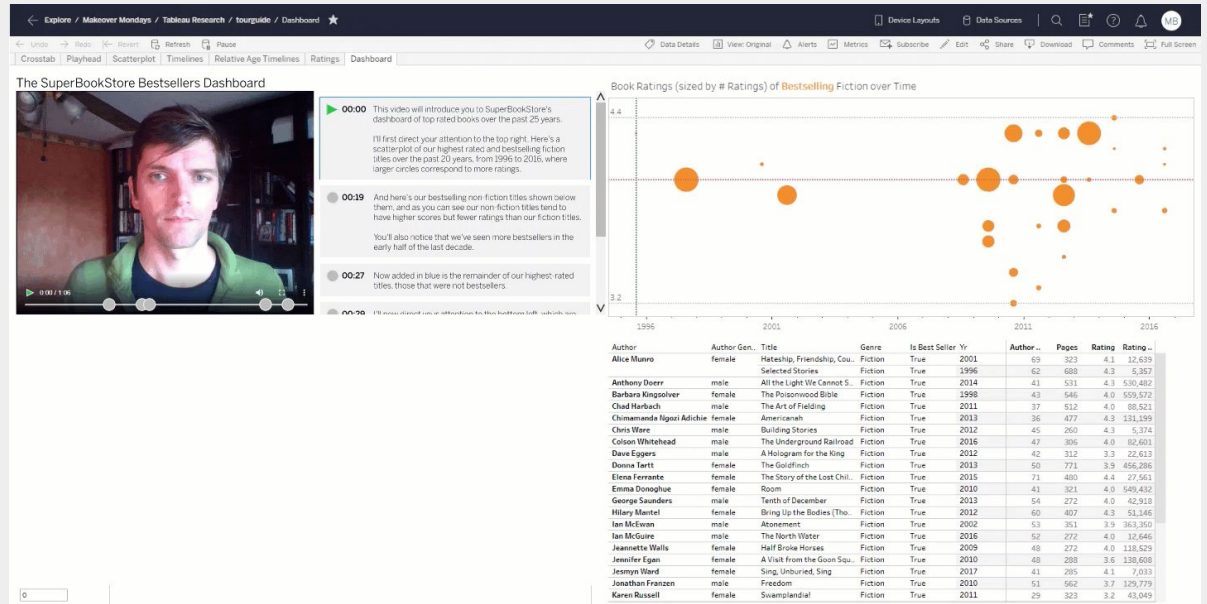
How Do People Communicate and Collaborate with Data in Organizations?

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.

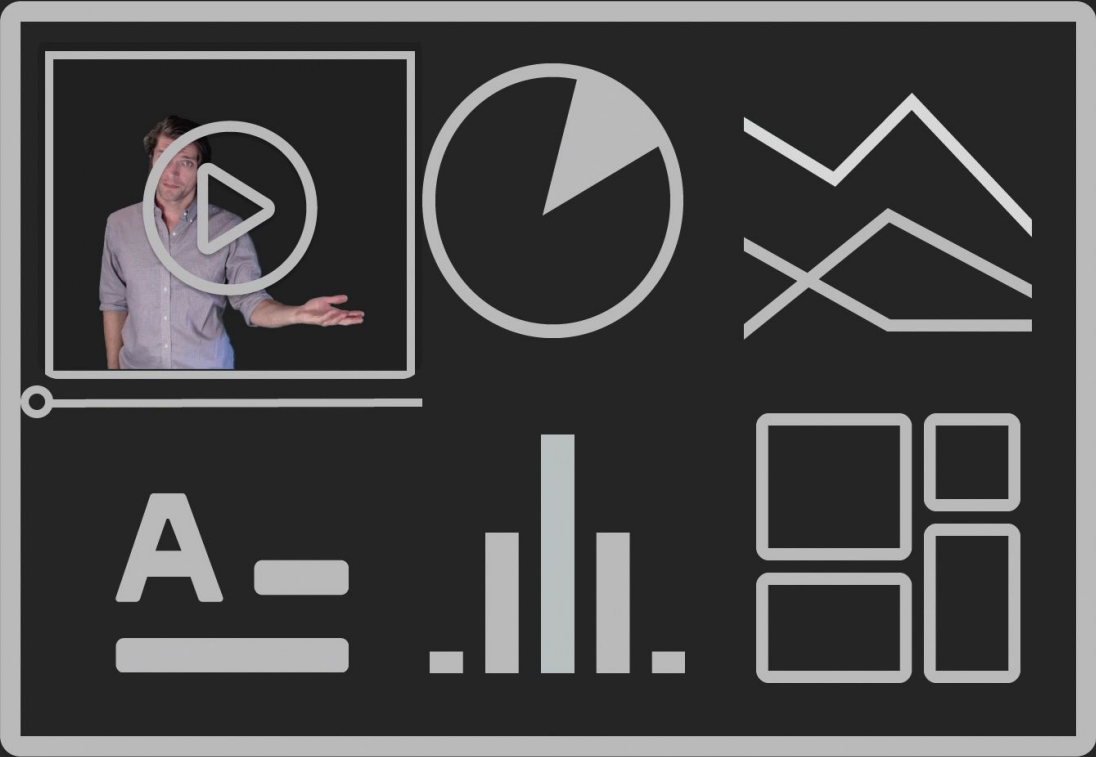
Adapted from:

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

Matthew Brehmer and Robert Kosara, IEEE VIS 2021



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

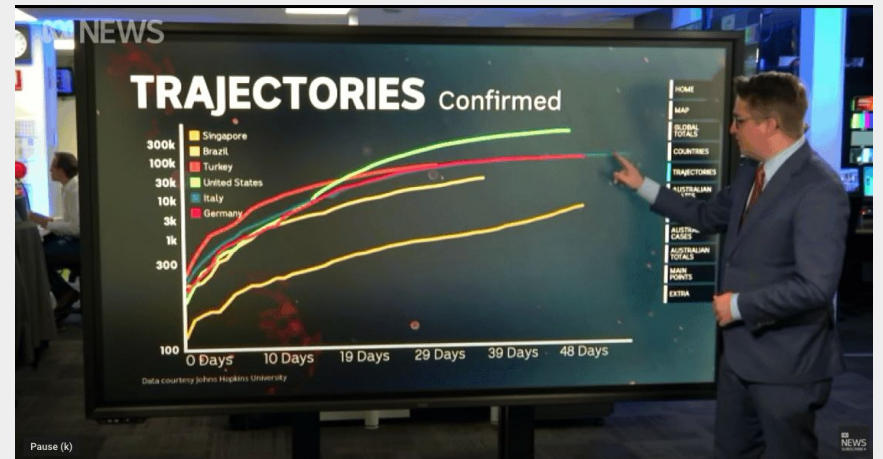


👉 a video “tour guide” for a business intelligence dashboard

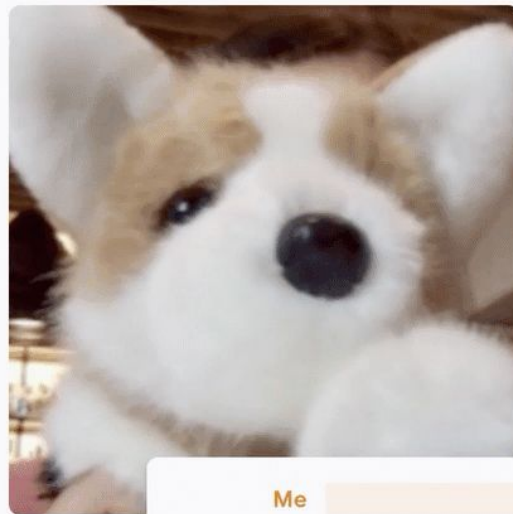


👉 Hans Rosling's TED Conference Talks (2006, 2007)

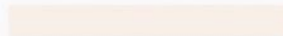
gapminder.com/videos



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

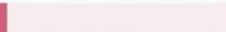


Me



Me + Dog <3

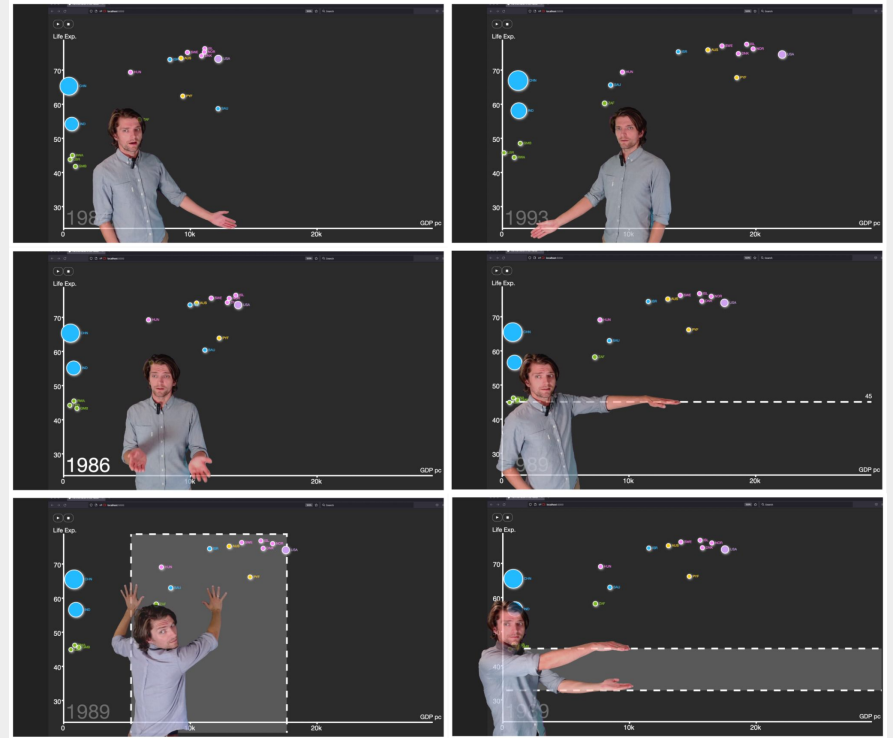
20%



Teachable Machine

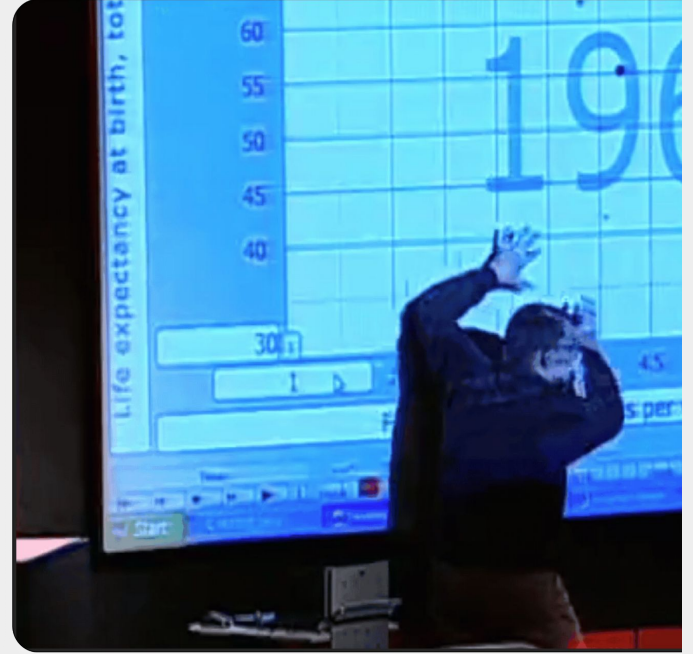
Train a computer to recognize your own images, sounds, & poses.

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



👉 **"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

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...

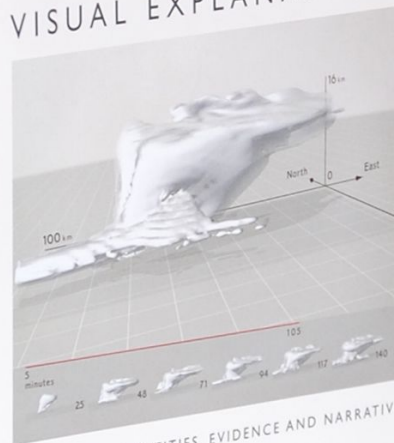
My Journey in Data Visualization



TUFTE VISUAL EXPLANATIONS

EDWARD R. TUFTE

VISUAL EXPLANATIONS



IMAGES AND QUANTITIES, EVIDENCE AND NARRATIVE

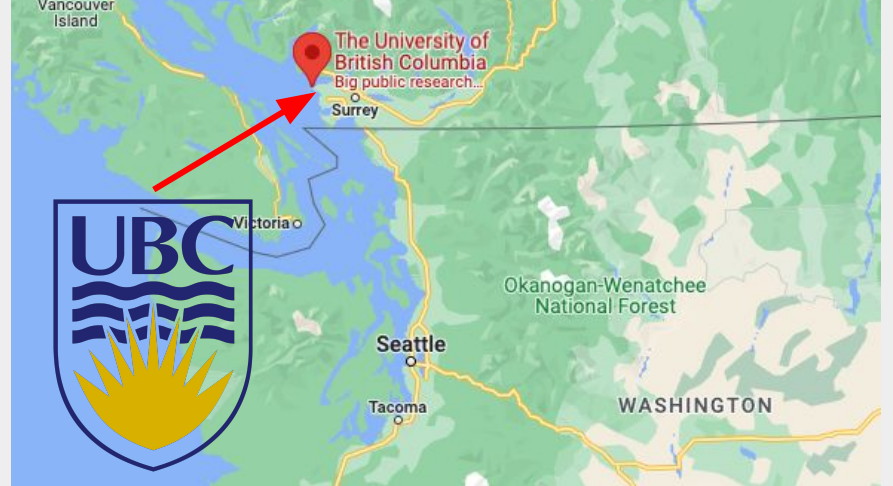
GRAPHICS PRESS



Cognitive Science

CS / Psych / Math / Linguistics / ...

Human-Computer Interaction + Data Mining = ?

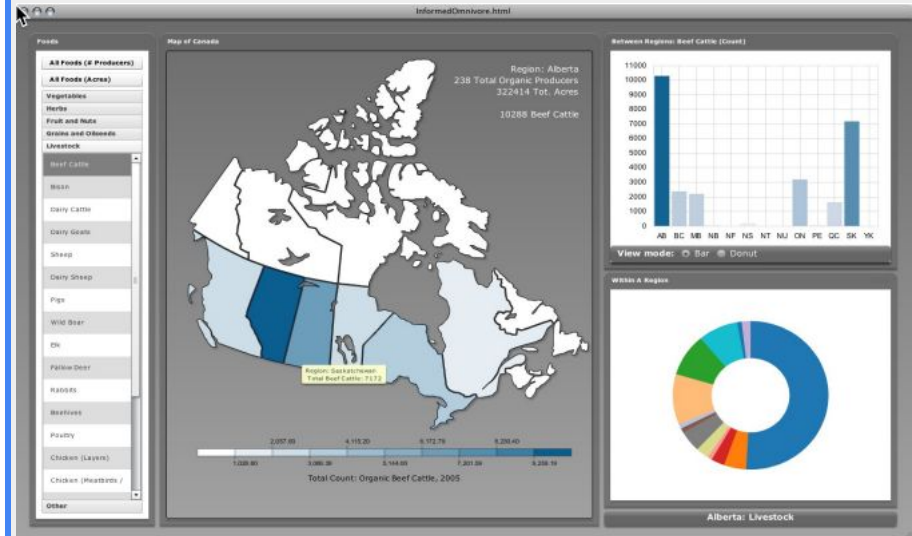


Human-Computer Interaction

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**

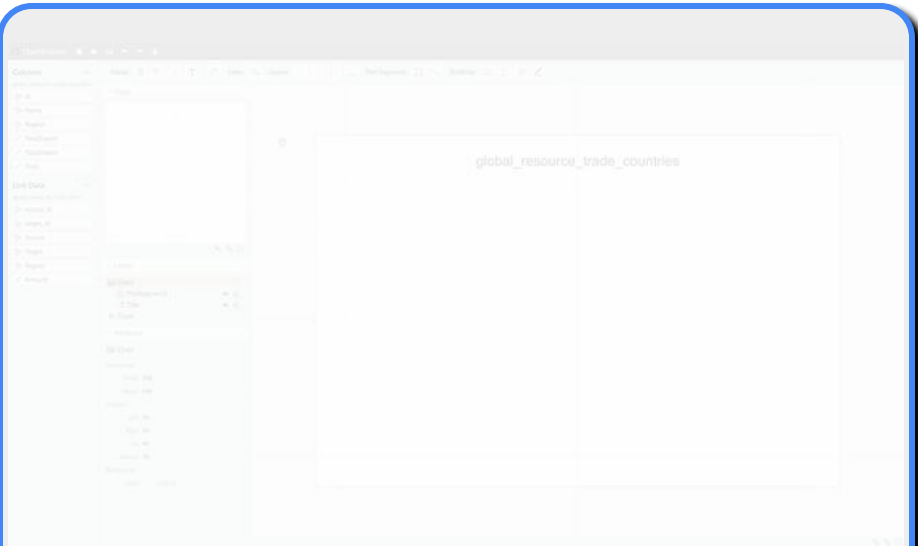


The screenshot shows a web browser window with a single tab titled "Timeline Storyteller". The main content area is mostly blank, with the text "The Daily Routines of Famous Creative People: A Timeline Story" centered. Below the content area is a horizontal toolbar containing various icons for navigation and visualization, including arrows, a search icon, and several grid and list icons. The bottom of the browser window shows a grey footer area with the following text:

Timeline Storyteller

Microsoft Research | timelifestoryteller.com

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



Charticulator

Interactive Construction of Bespoke Chart Layouts

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



shortlist, 2018 Information is Beautiful Awards

Tableau Research

2019 – present