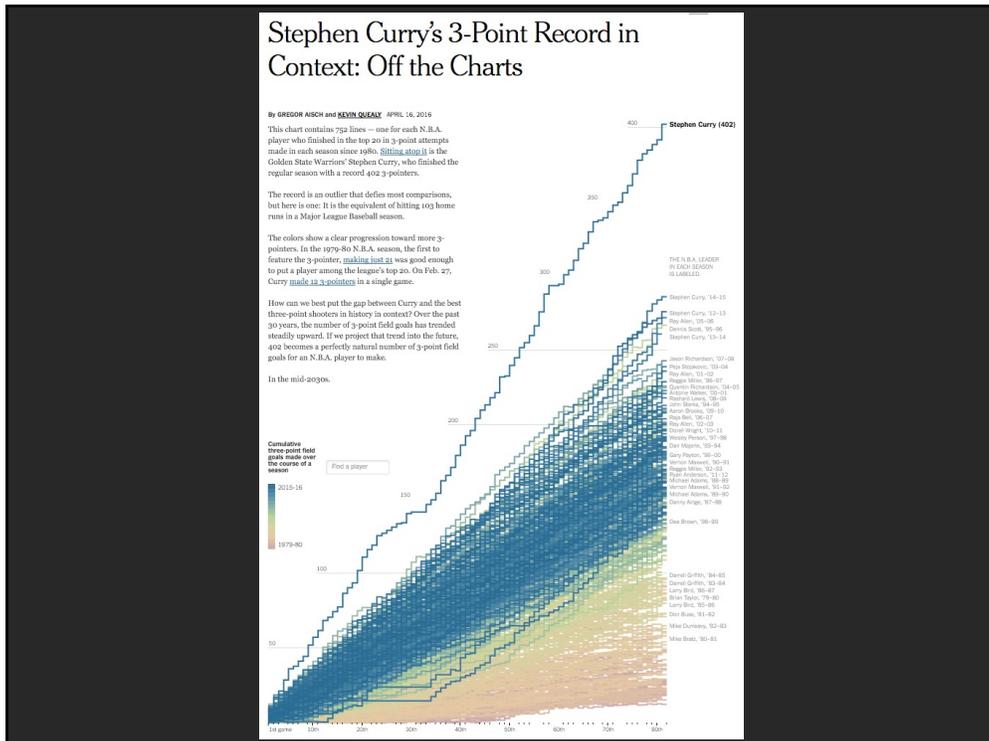


Interaction

Maneesh Agrawala

CS 448B: Visualization
Fall 2021

1

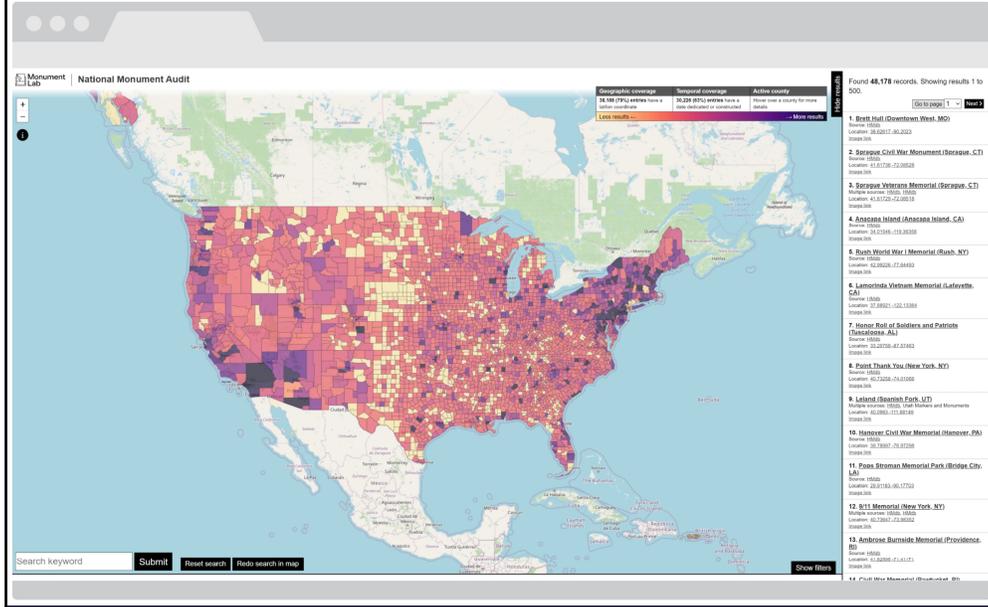


2

SEARCH THE DATA

Monument Study Set Search Interface

This search interface allows you to explore the 48,178 data records that make up the *National Monument Audit* "study set." We retrieved and analyzed data records from 42 data sources created and maintained by federal, state, local, tribal, institutional, and affinity organizations. These data sources were included because they provided publicly accessible digital records about a wide range of cultural and natural objects. A large part of the work of the Audit was accessing, converting, parsing, and mapping that data into a single, normalized dataset and identifying records representing monuments. The study set does not include every monument in the United States.

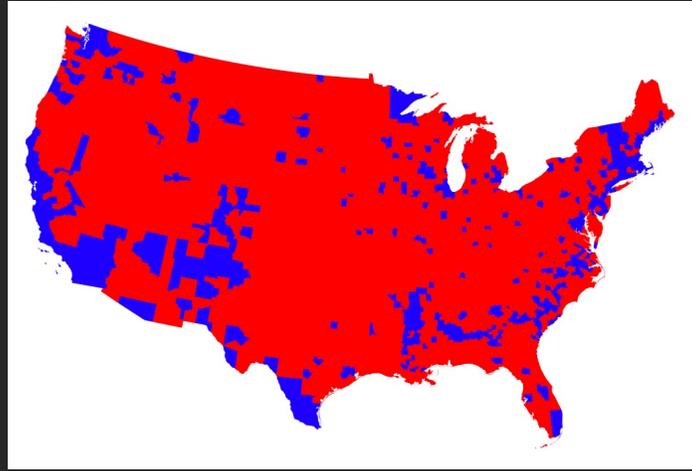


3

Last Time:
Using Space Effectively
Cartographic Distortion

5

Election 2016 map

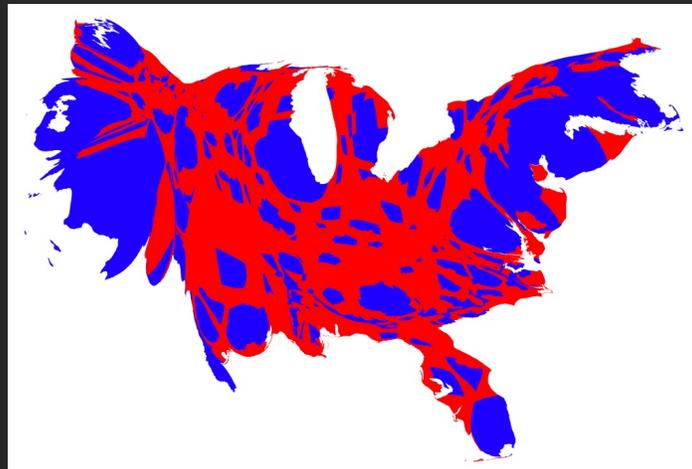


■ majority voted democrat
■ majority voted republican

<http://www-personal.umich.edu/~mejn/election/>

10

Election 2016 map

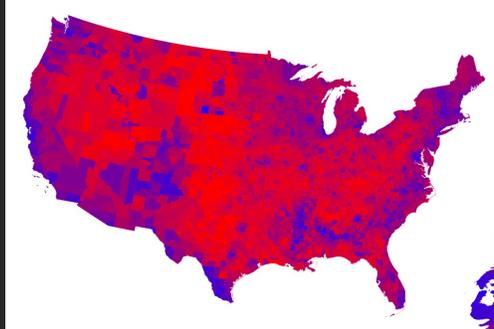


■ majority voted democrat
■ majority voted republican

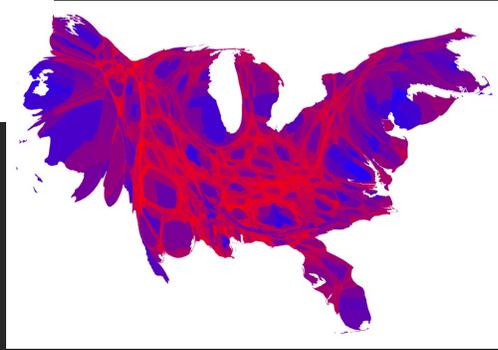
<http://www-personal.umich.edu/~mejn/election/>

11

Election 2016 map



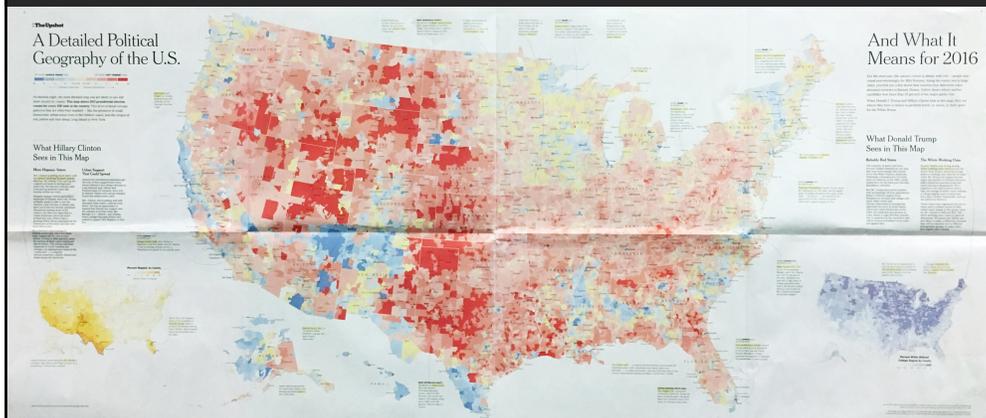
■ % voted democrat
■ % voted republican



<http://www-personal.umich.edu/~mejn/election/>

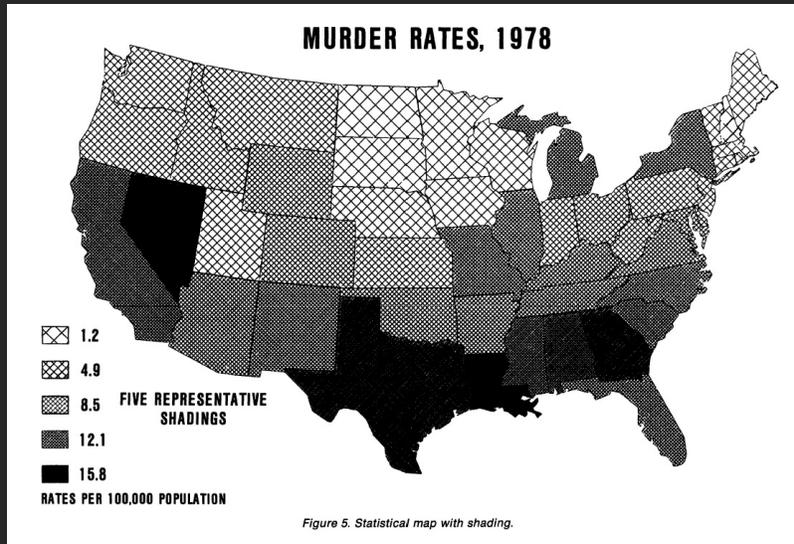
12

NYT Election 2016 (based on 2012)



13

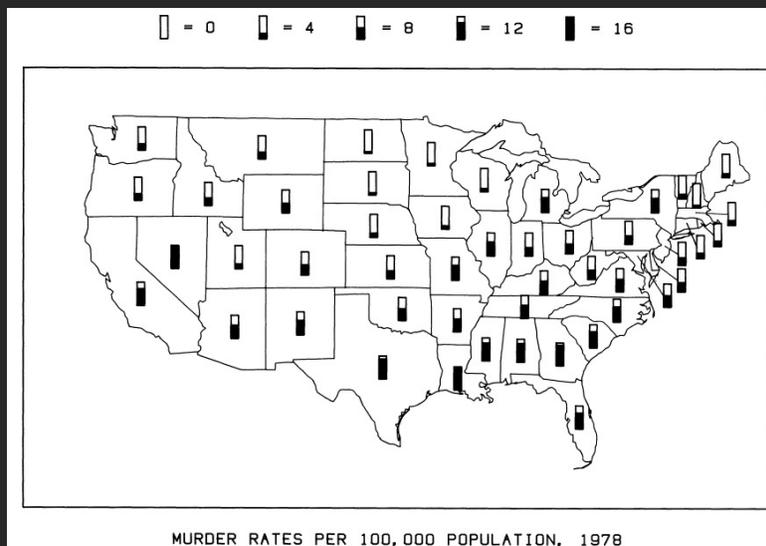
Statistical map with shading



[Cleveland and McGill 84]

14

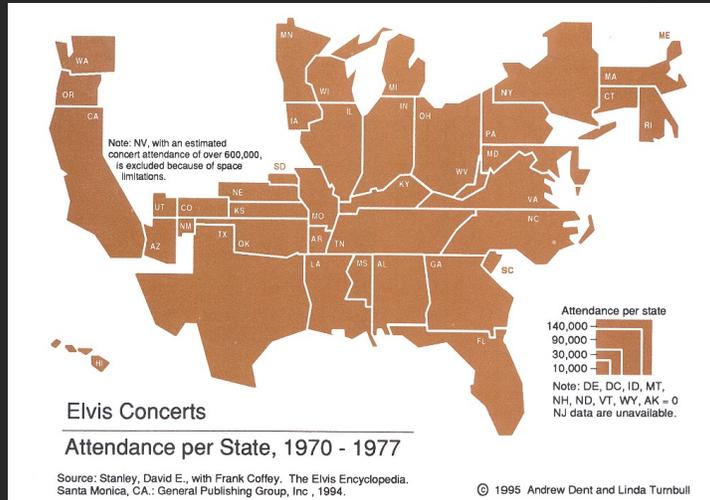
Framed rectangle chart



[Cleveland and McGill 84]

15

Cartograms: Distort areas

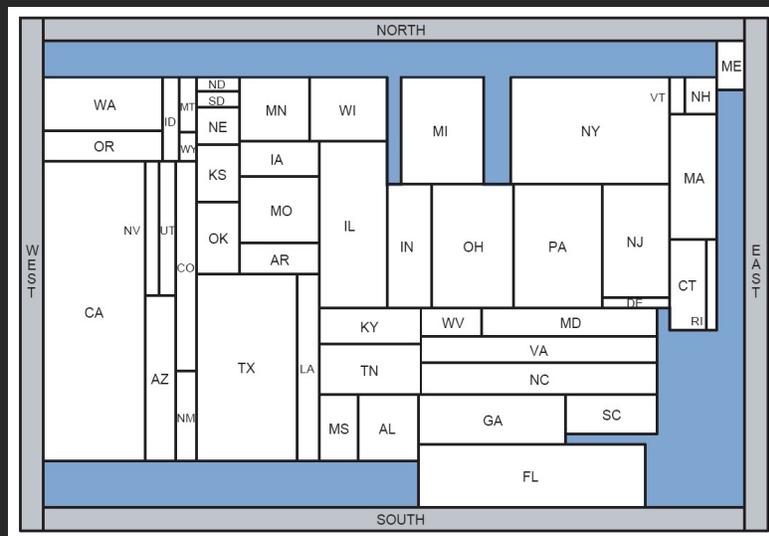


Scale area by data

[From Cartography, Dent]

16

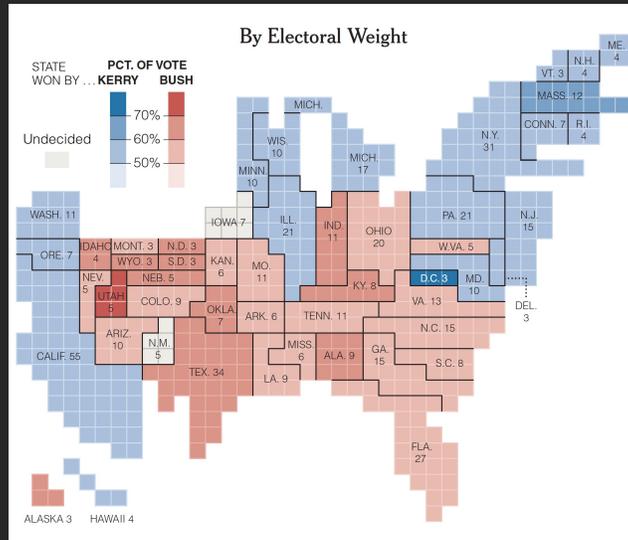
Rectangular cartogram



American population [van Kreveld and Speckmann 04]

17

New York Times Election 2004



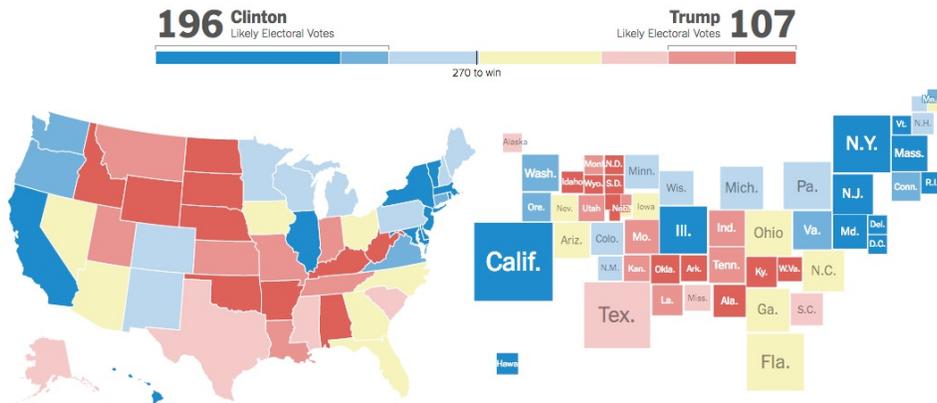
19

New York Times Election 2016

2016 Electoral Map Forecast

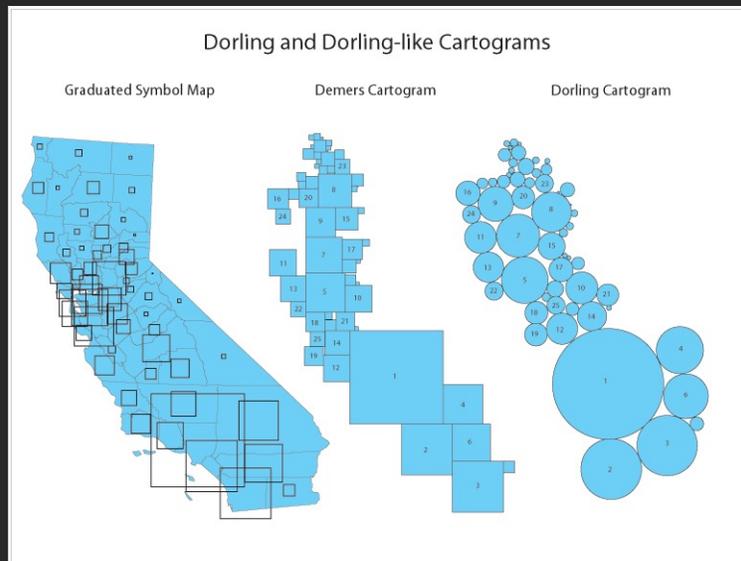
The Upshot's forecast for the presidential race, based on the latest national and state polls.

By JOSH KATZ and ADAM PEARCE UPDATED November 2, 2016



20

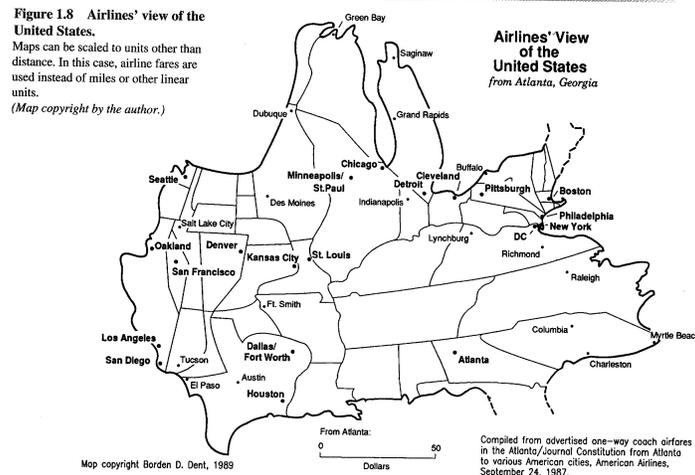
Dorling cartogram



http://www.ncgia.ucsb.edu/projects/Cartogram_Central/types.html

21

Distorting distances



Scale distance by data (airline fare)

[From Cartography, Dent]

22

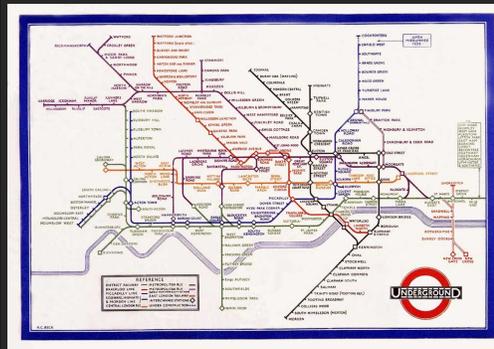
London underground



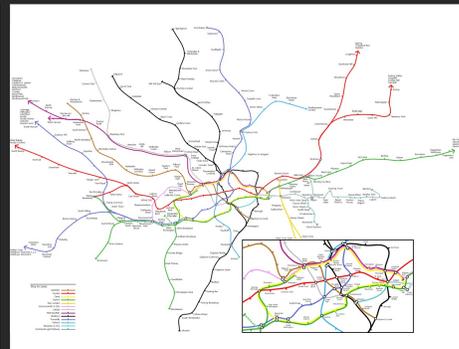
<http://www.thetube.com/content/history/map.asp>

23

Comparison to geographic map



Distorted



Undistorted

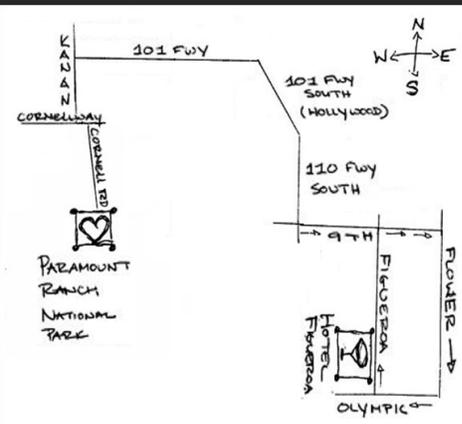
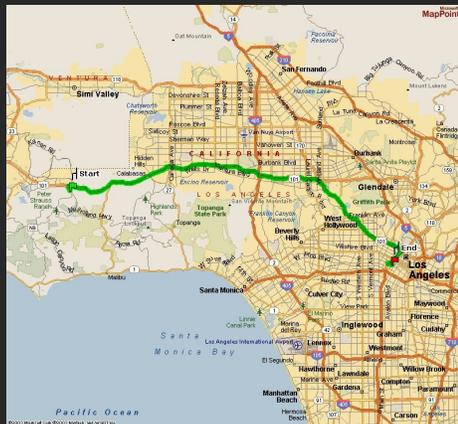
24

Visualizing Routes



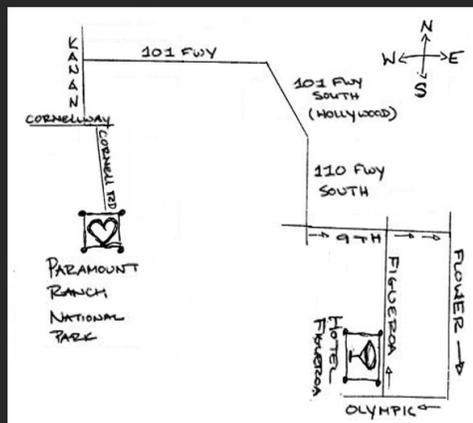
25

A Better Visualization

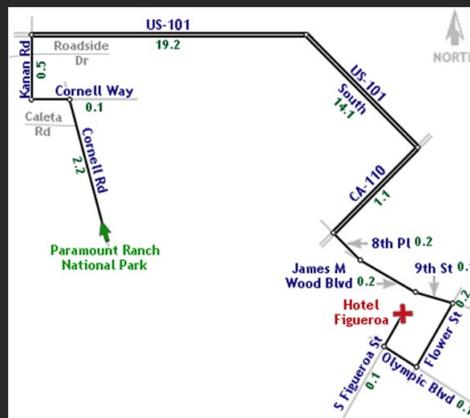


26

LineDrive [Agrawala & Stolte 2001]



Hand-drawn route map



LineDrive route map

27

Summary

- Space is the most important visual encoding
- Show data with as much resolution as possible
- Geometric properties of spatial transforms support geometric reasoning
- Use distortions to emphasize important information

28

Announcements

29

A2: Exploratory Data Analysis

Use **Tableau** or **Vega-Lite** to formulate & answer questions

First steps

- Step 1: Pick domain & data
- Step 2: Pose questions
- Step 3: Profile data
- Iterate as needed

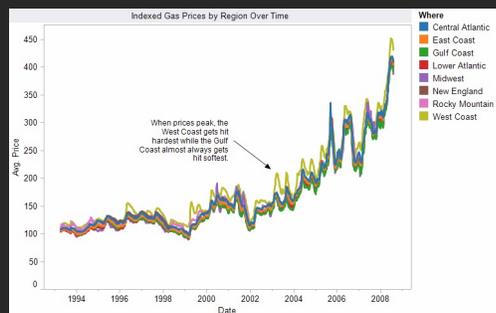
Create visualizations

- See different views of data
- Refine questions

Author a report

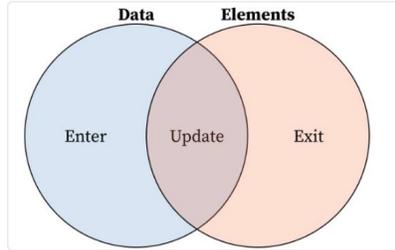
- Screenshots of most insightful views (8+)
- Include titles and captions for each view

Due before class on Oct 11, 2021



30

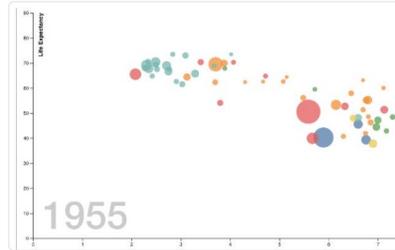
D3 Notebooks for Next Week



Team · Published

Introduction to D3

You republished 14 hours ago



You · Published

Making D3 Charts Interactive

You republished 14 hours ago

32

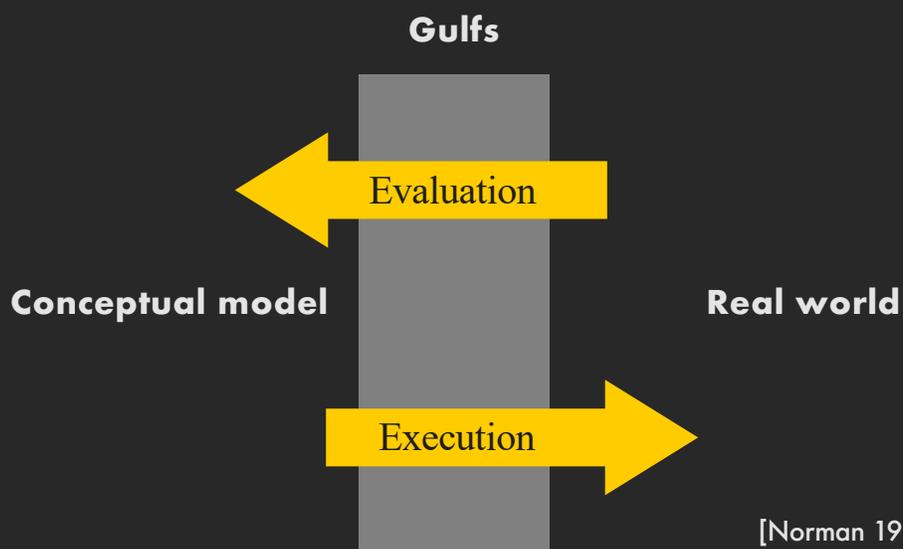
Interaction

33

Interaction between people and machines requires *mutual intelligibility* or *shared understanding*

34

Gulfs of execution & evaluation



35

Gulf of Execution

The difference between the user's intentions and the allowable actions.

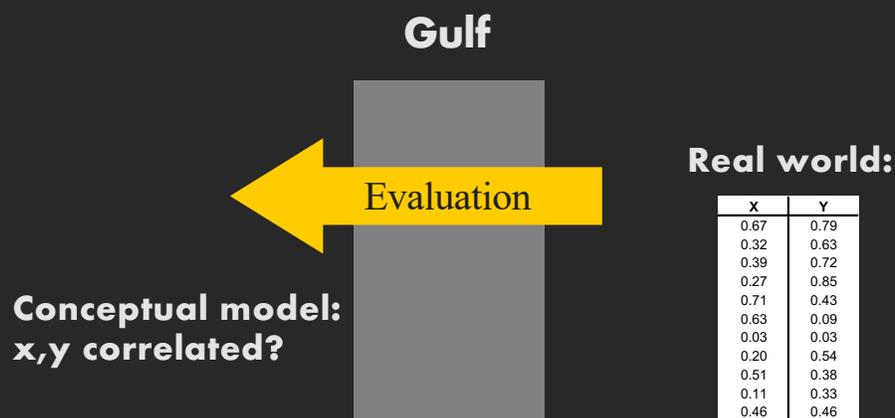
Gulf of Evaluation

The amount of effort that the person must exert to interpret the state of the system and to determine how well the expectations and intentions have been met.

[Norman 1986]

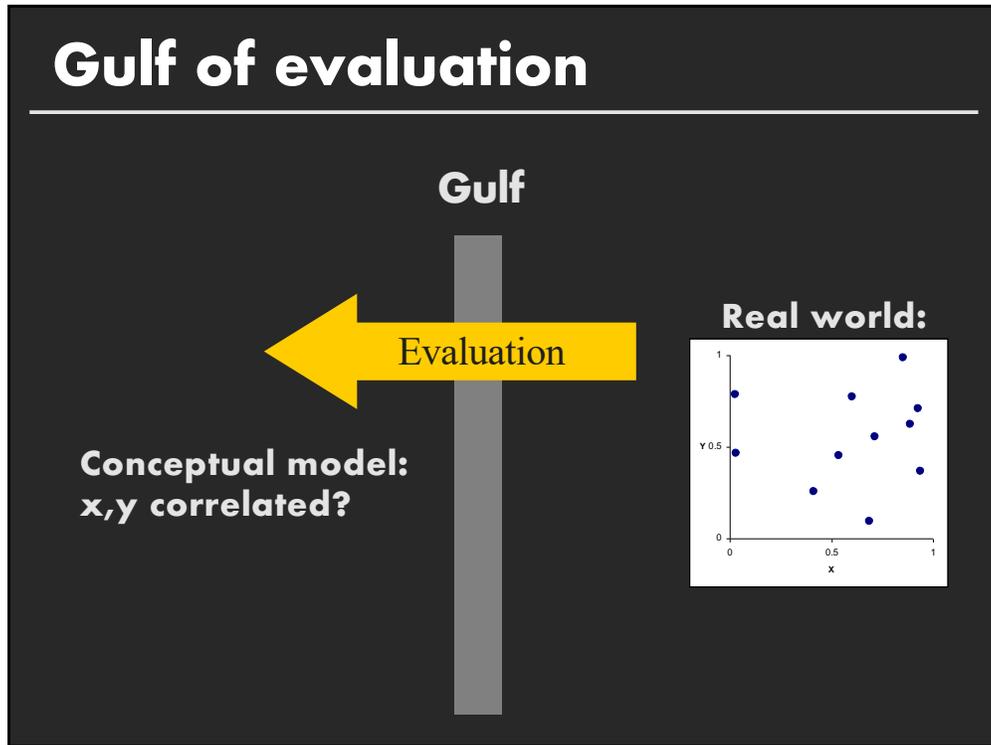
36

Gulf of evaluation



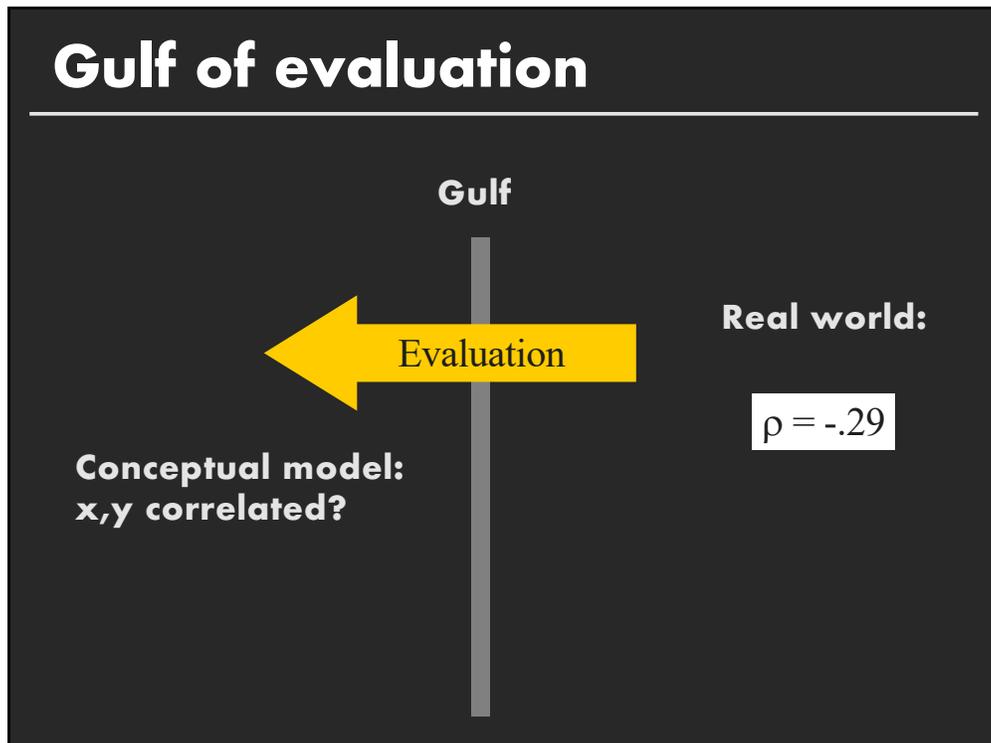
37

Gulf of evaluation



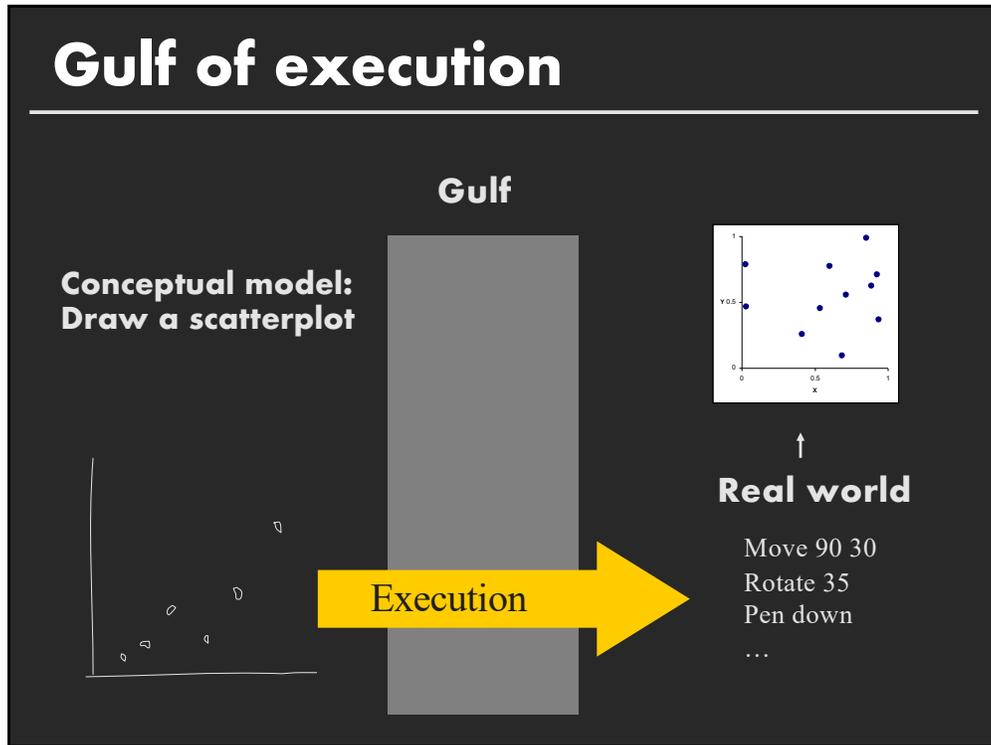
38

Gulf of evaluation



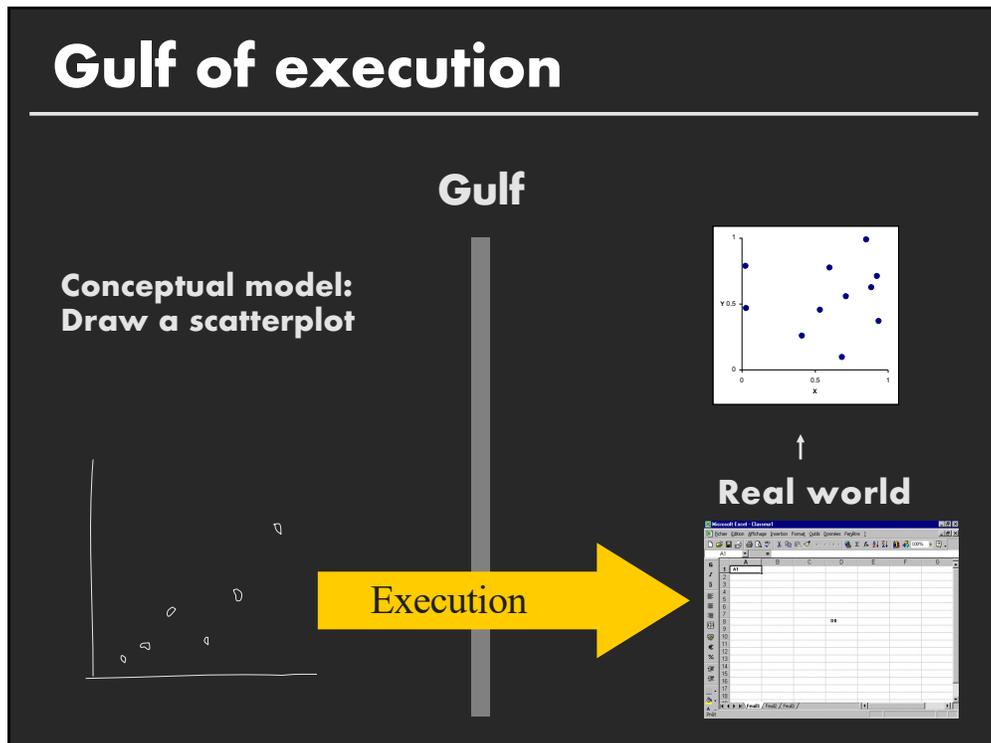
39

Gulf of execution



40

Gulf of execution



41

Gulf of Execution

The difference between the user's intentions and the allowable actions.

Gulf of Evaluation

The amount of effort that the person must exert to interpret the state of the system and to determine how well the expectations and intentions have been met.

[Norman 1986]

42

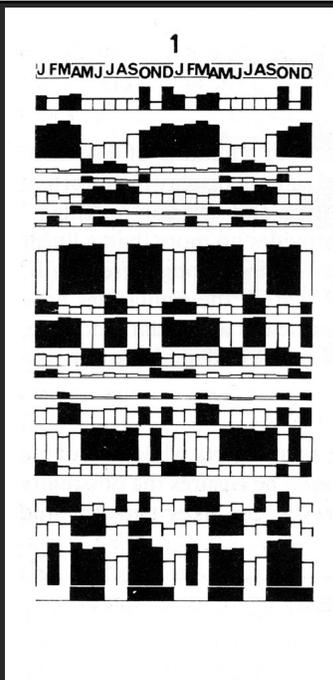
Early Systems

44

J	F	M	A	M	J	J	A	S	O	N	D		
26	21	26	28	20	20	20	20	20	40	15	40	1	% CLIENTELE FEMALE
69	70	77	71	37	36	39	39	55	60	68	72	2	% —" — LOCAL
7	6	3	6	23	14	19	14	9	6	8	8	3	% —" — U.S.A.
0	0	0	0	8	6	6	4	2	12	0	0	4	% —" — SOUTH AMERICA
20	15	14	15	23	27	22	30	27	19	19	17	5	% —" — EUROPE
1	0	0	8	6	4	6	4	2	1	0	1	6	% —" — M.EAST, AFRICA
3	10	6	0	3	13	8	9	5	2	5	2	7	% —" — ASIA
78	80	85	86	85	87	70	76	87	85	87	80	8	% BUSINESSMEN
22	20	15	14	15	13	30	24	13	15	13	20	9	% TOURISTS
70	70	75	74	69	68	74	75	68	68	64	75	10	% DIRECT RESERVATIONS
20	18	19	17	27	27	19	19	26	27	21	15	11	% AGENCY —" —
10	12	6	9	4	5	7	6	6	5	15	10	12	% AIR CREWS
2	2	4	2	2	1	1	2	2	4	2	5	13	% CLIENTS UNDER 20 YEARS
25	27	37	35	25	25	27	28	24	30	24	30	14	% —" — 20-35 —" —
48	49	42	48	54	55	53	57	55	46	55	43	15	% —" — 35-55 —" —
25	22	17	15	19	19	19	19	20	19	22	16	16	% —" — MORE THAN 55 —" —
163	167	166	174	152	155	145	170	157	174	165	156	17	PRICE OF ROOMS
1.65	1.71	1.65	1.91	1.90	2.	1.54	1.60	1.73	1.82	1.66	1.44	18	LENGTH OF STAY
67	82	70	83	74	77	56	62	90	92	78	55	19	% OCCUPANCY
			X	X	X			X	X	X	X	20	CONVENTIONS

[Graphics and Graphic Information Processing, Bertin 81]

45



[Graphics and Graphic Information Processing, Bertin 81]

47

Group similar rows and columns

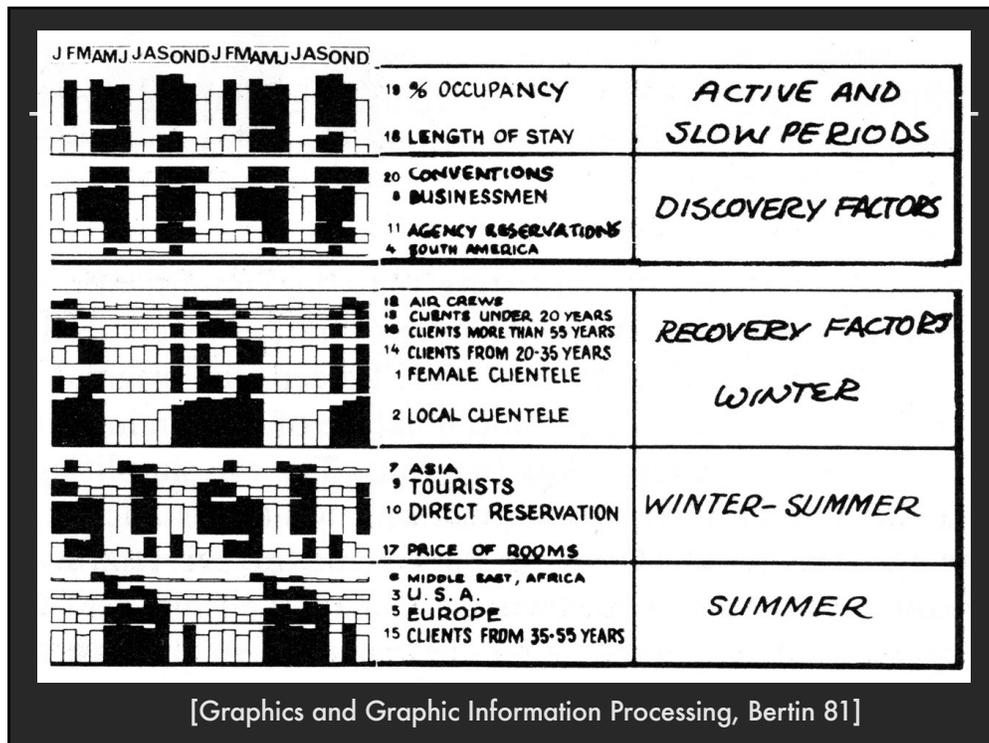
Choose a row with a particular visual aspect. Move to extremity of matrix

Move similar rows close, opposite rows to bottom. (Creates two opposing groups and a middle group)

Repeat for columns (only in some cases)

Iterate

48



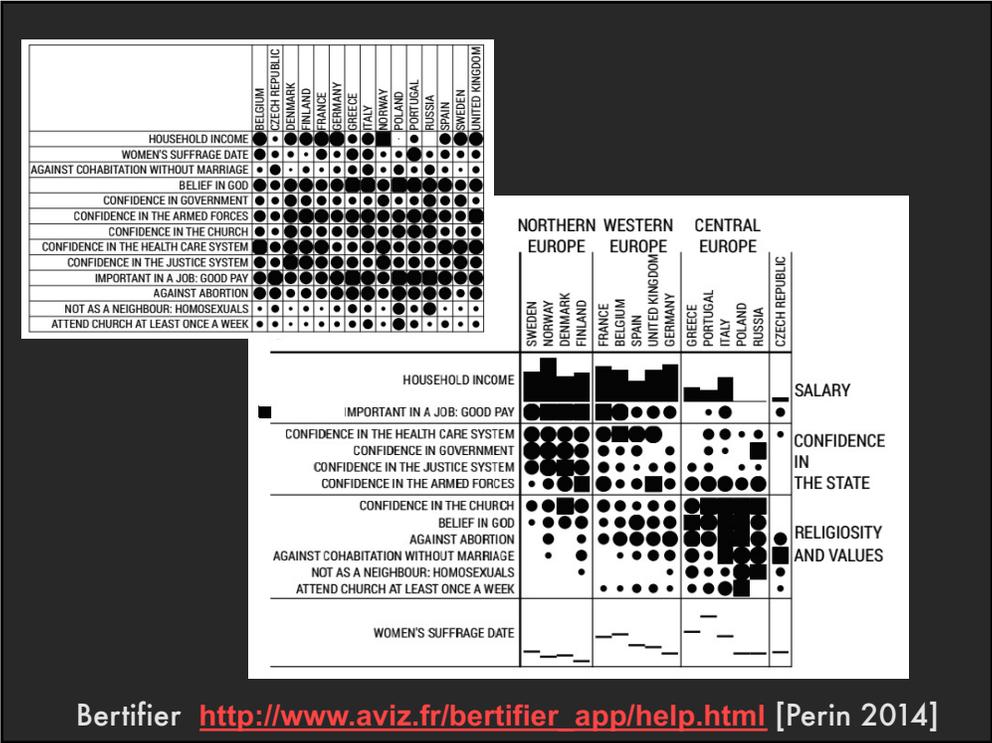
49



50



52

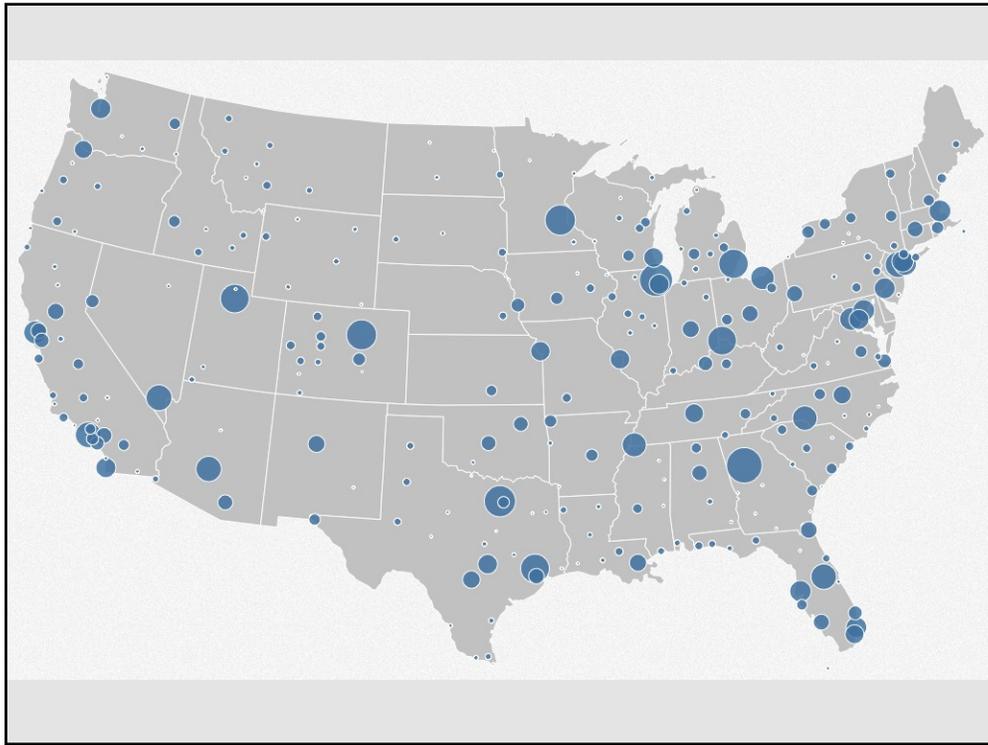


Bertifier http://www.aviz.fr/bertifier_app/help.html [Perin 2014]

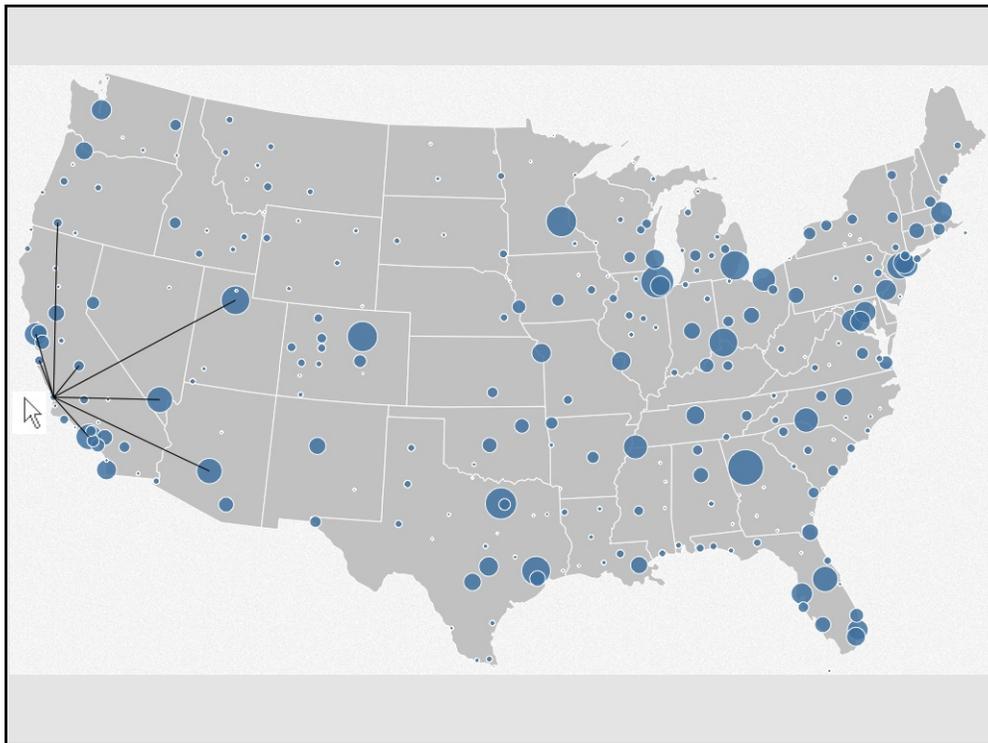
55



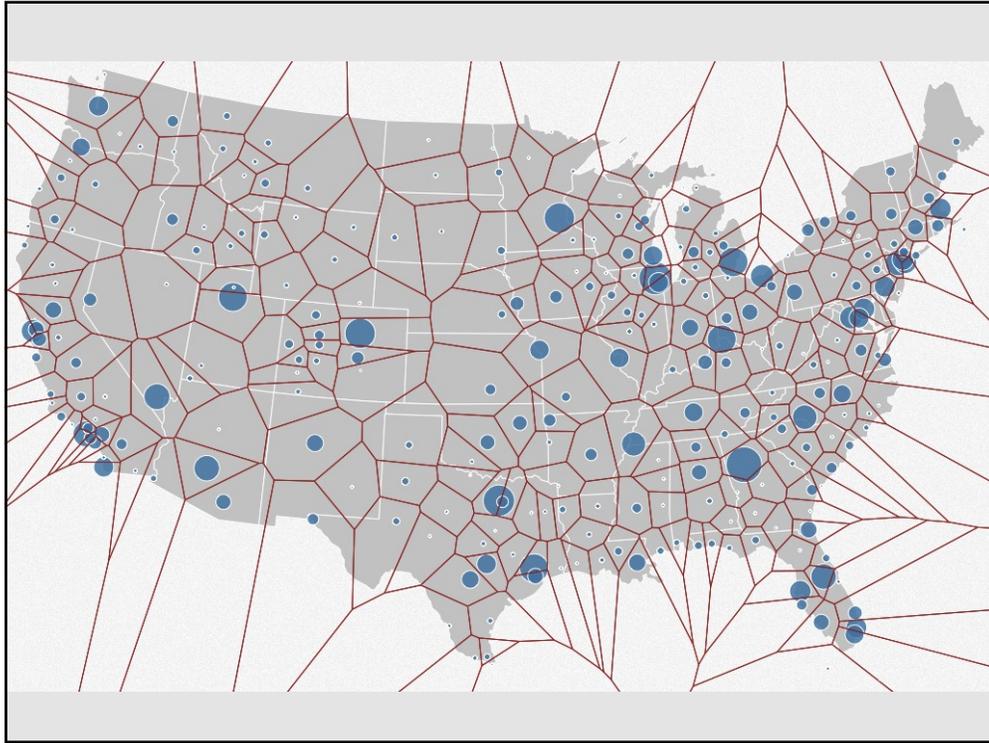
61



63



64



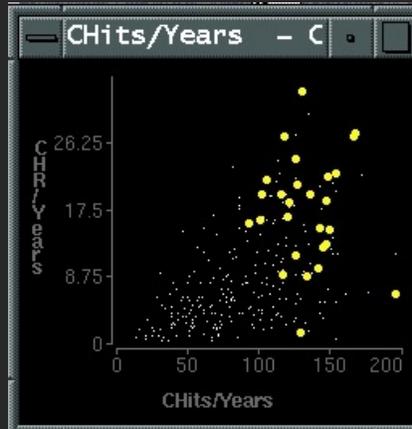
65

Brushing and Linking

67

Highlighting

Focus user attention on a subset of the data within one graph [from Wills 95]



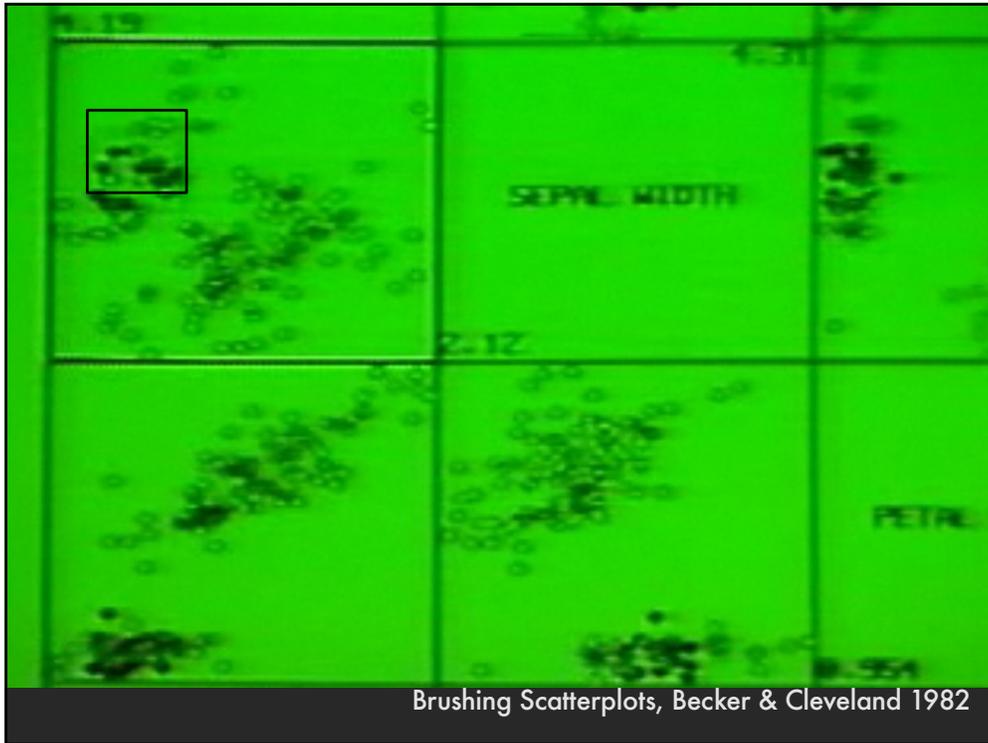
68

Brushing and Linking

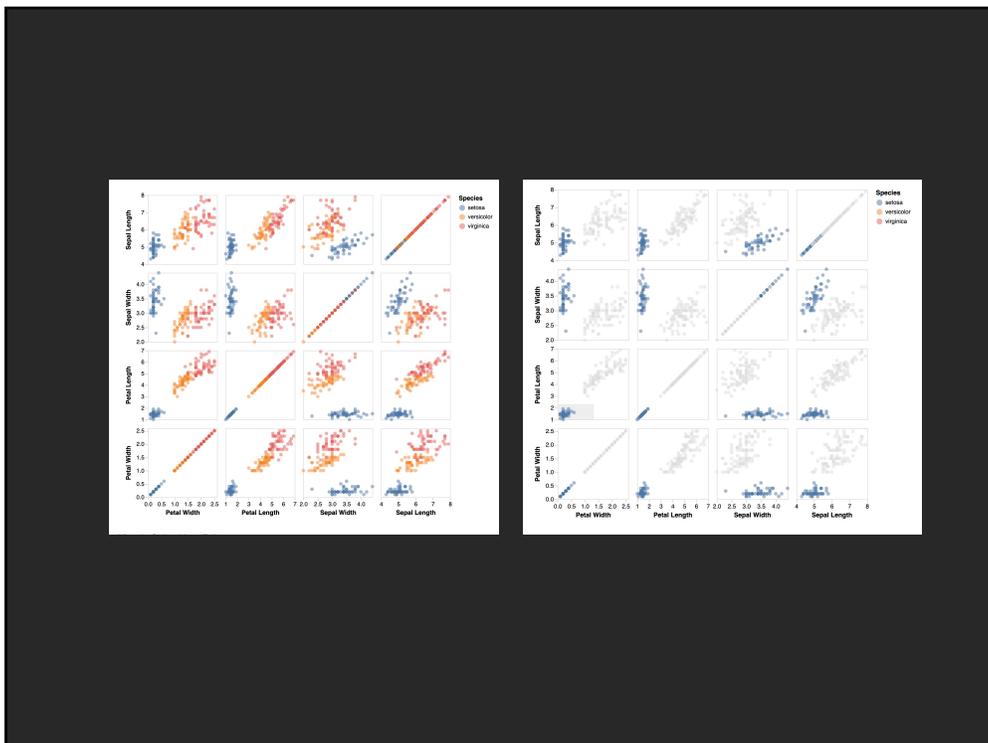
Select ("*brush*") a subset of data
See selected data in other views

The views must be *linked*
by *tuple* (matching data points), or
by *query* (matching range or values)

69

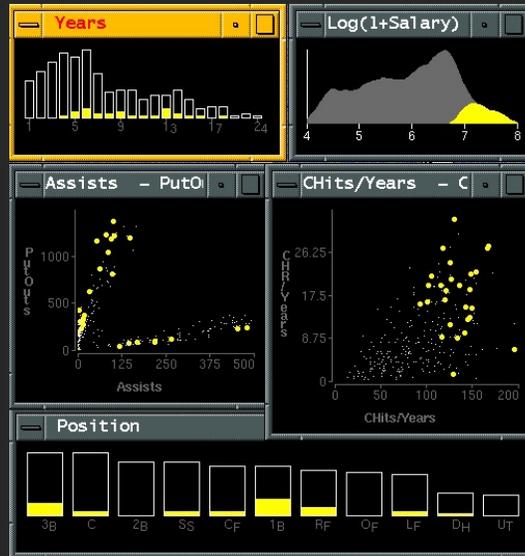


70



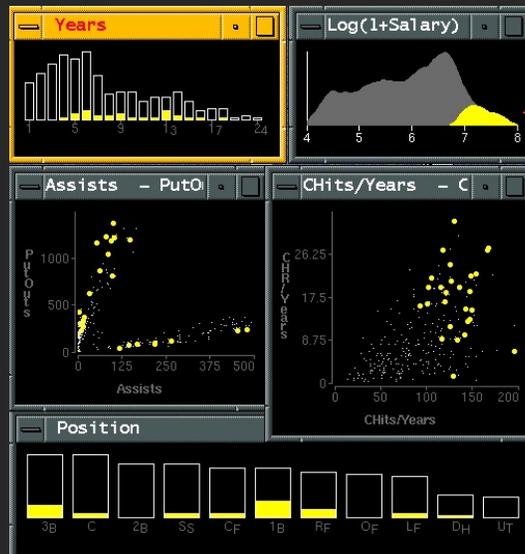
71

Baseball statistics [from Wills 95]



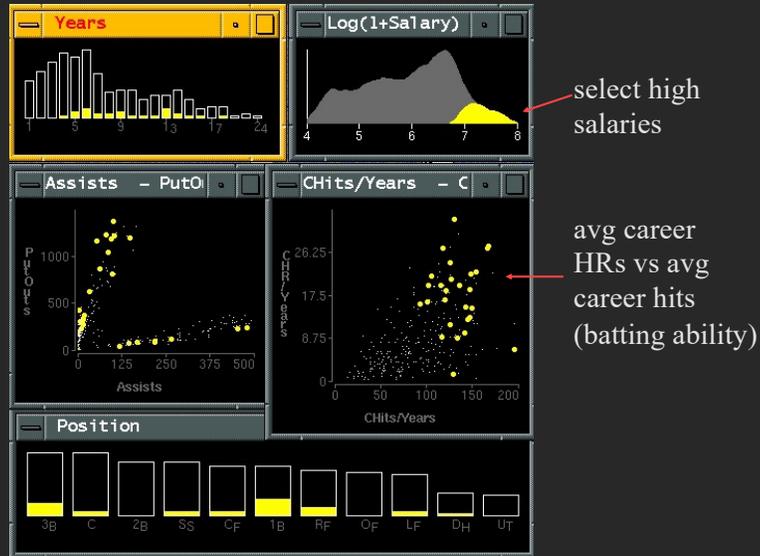
72

Baseball statistics [from Wills 95]



73

Baseball statistics [from Wills 95]



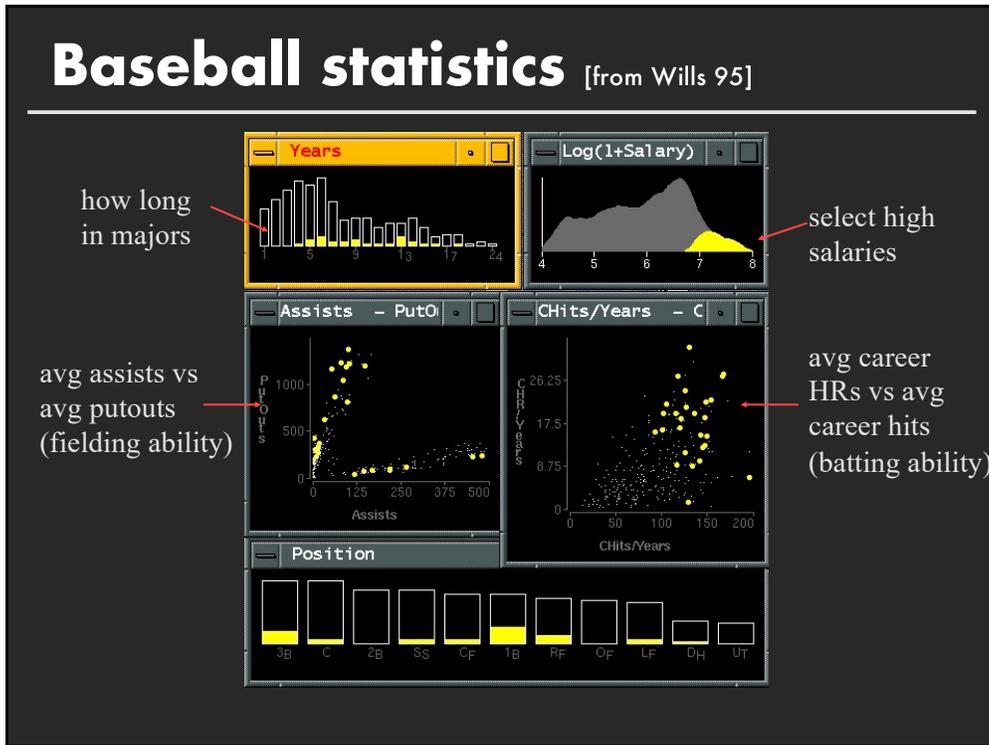
74

Baseball statistics [from Wills 95]



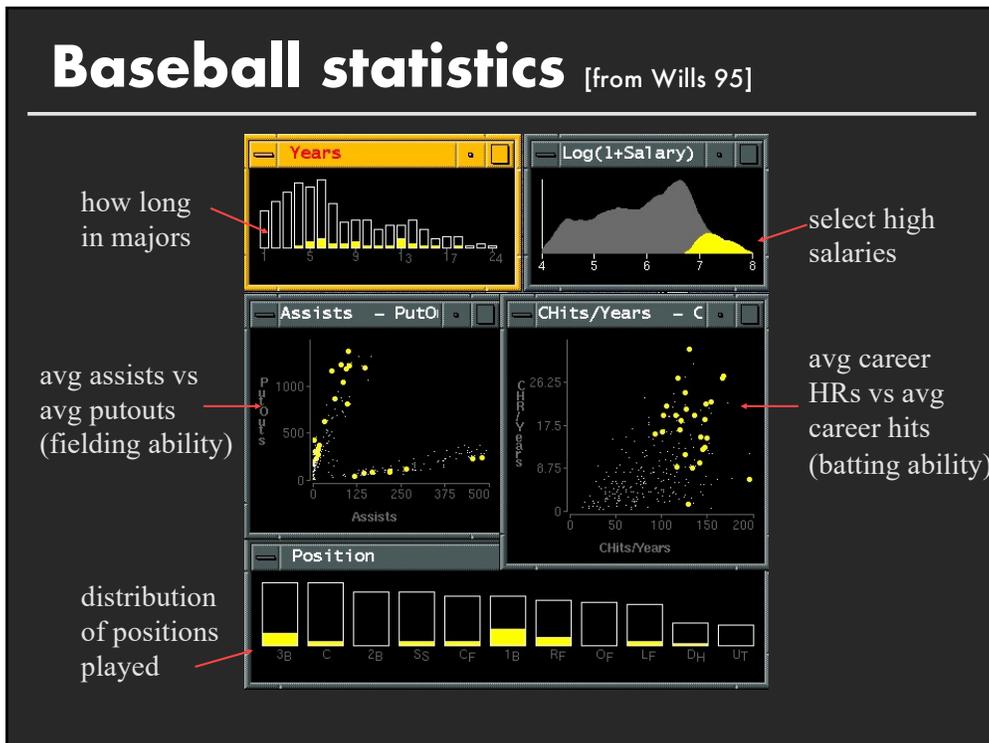
75

Baseball statistics [from Wills 95]



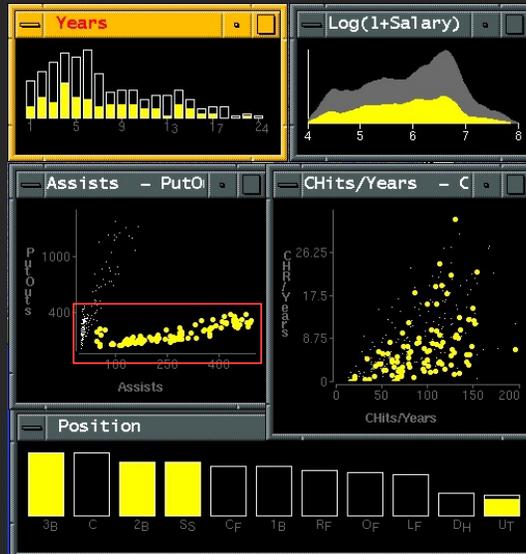
76

Baseball statistics [from Wills 95]



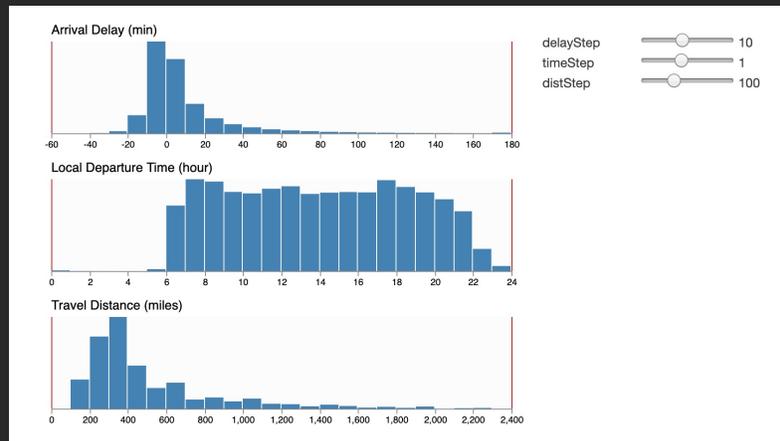
77

Linking assists to positions



78

CrossFiltering



79