Information Visualization

Visualization Review

Dr. David Koop





"Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively."

— T. Munzner















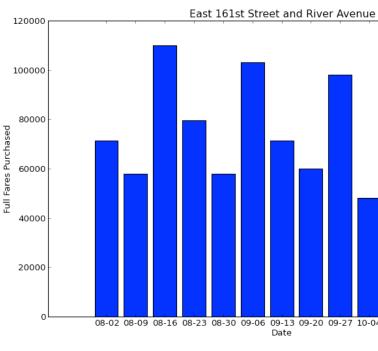
	REMOTE	STATION	FF V	SEN/DIS	7-D AFAS UNL	D AFAS/RMF I	JOINT RR TKT	7-D UNL	30-D UNL	0							
1	R011	42ND STREET & 8TH AVENUE	00228985	00008471	00000441	00001455	00000134	00033341	00071255								
2	R170	14TH STREET-UNION SQUARE	00224603	00011051	00000827	00003026	00000660	00089367	00199841								
3	R046	42ND STREET & GRAND CENTRAL	00207758	00007908	00000323	00001183	00003001	00040759	00096613								
4	R012	34TH STREET & 8TH AVENUE	00188311	00006490	00000498	00001279	00003622	00035527	00067483								
5	R293	34TH STREET - PENN STATION	00168768	00006155	00000523	00001065	0000503										
6	R033	42ND STREET/TIMES SQUARE	00159382	00005945	00000378	00001205	0000069										
7	R022	34TH STREET & 6TH AVENUE	00156008	00006276	00000487	00001543	000007:	N		\cap Cuby \circ							
8	R084	59TH STREET/COLUMBUS CIRCLE	00155262	00009484	00000589	00002071	0000054		JY	C Subway							
9	R020	47-50 STREETS/ROCKEFELLER	00143500	00006402	00000384	00001159	0000072										
10	R179	86TH STREET-LEXINGTON AVE	00142169	00010367	00000470	00001839	0000027										
11	R023	34TH STREET & 6TH AVENUE	00134052	00005005	00000348	00001112	0000064			are Data							
12	R029	PARK PLACE	00121614	00004311	00000287	00000931	0000079										
13	R047	42ND STREET & GRAND CENTRAL	00100742	00004273	00000185	00000704	0000124										
14	R031	34TH STREET & 7TH AVENUE	00095076	00003990	00000232	00000727	00001459	00024284	00038671								
15	R017	LEXINGTON AVENUE	00094655	00004688	00000190	00000833	00000754	00020018	00055066								
16	R175	8TH AVENUE-14TH STREET	00094313	00003907	00000286	00001144	00000256	00038272	00074661								
17	R057	BARCLAYS CENTER	00093804	00004204	00000454	00001386	00001491	00039113	00068119								
18	R138	WEST 4TH ST-WASHINGTON SO	00093562	00004677	00000251	00000965	00000127	00031628	00074458								







REMOTE STATION 42ND STREET & 8TH AVENUE R011 R170 14TH STREET-UNION SQUARE R046 42ND STREET & GRAND CENTRAL 34TH STREET & 8TH AVENUE R012 34TH STREET - PENN STATION R293 R033 42ND STREET/TIMES SQUARE R022 34TH STREET & 6TH AVENUE 59TH STREET/COLUMBUS CIRCLE R084 R020 47-50 STREETS/ROCKEFELLER 10 R179 86TH STREET-LEXINGTON AVE R023 34TH STREET & 6TH AVENUE 12 R029 PARK PLACE 42ND STREET & GRAND CENTRAL 13 R047 34TH STREET & 7TH AVENUE R031 R017 LEXINGTON AVENUE 16 R175 8TH AVENUE-14TH STREET R057 BARCLAYS CENTER 18 R138 WEST 4TH ST-WASHINGTON SO



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	00224603	00011051	00000827	00003026	00000660	00089367	00199841						
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	00188311	00006490	00000498	00001279	00003622	00035527	00067483						
	00168768	00006155	00000523	00001065	0000503								
	00159382	00005945	00000378	00001205	0000069								
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	00094655	00004688	00000190	00000833	00000754	00020018	00055066						
	00094313	00003907	00000286	00001144	00000256	00038272	00074661						
	00093804	00004204	00000454	00001386	00001491	00039113	00068119						
	00093562	00004677	00000251	00000965	00000127	00031628	00074458						









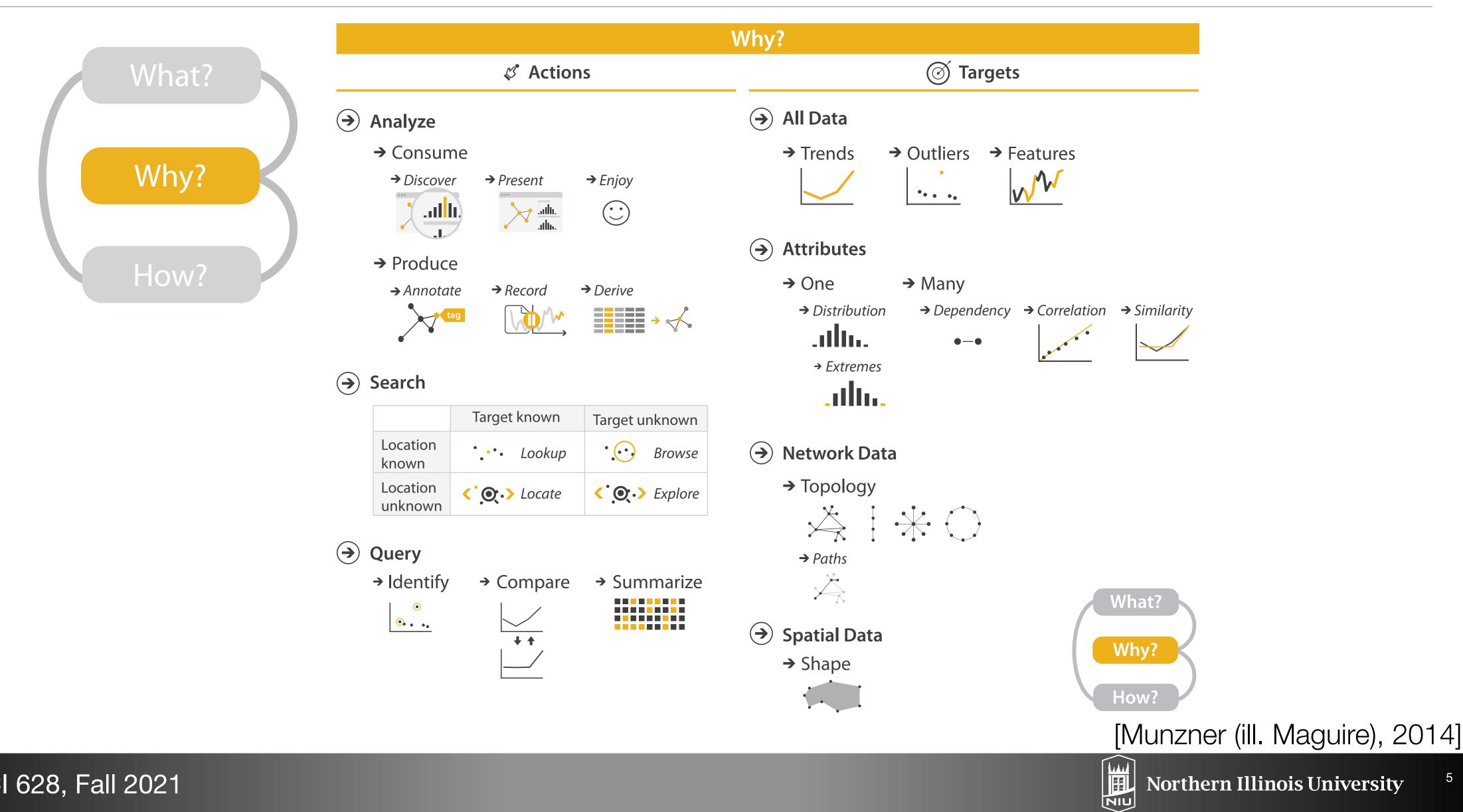
Categorial, Ordinal, and Quantitative

Α	В	(C	S	Т	U
Order ID	Order Date	Order Priori	ty	Product Container	Product Base Margin	Ship Date
3	10/14/06	5-Low		Large Box	0.8	10/21/06
6	2/21/08	4-Not Speci	ified	Small Pack	0.55	2/22/08
32	7/16/07	2-High		Small Pack	0.79	7/17/07
32	7/16/07	2-High		Jumbo Box	0.72	7/17/07
32	7/16/07	2-High		Medium Box	0.6	7/18/07
32	7/16/07	2-High		Medium Box	0.65	7/18/07
35	10/23/07	4-Not Speci	ified	Wrap Bag	0.52	10/24/07
35	10/23/07	4-Not Speci	ified	Small Box	0.58	10/25/07
36	11/3/07	1-Urgent		Small Box	0.55	11/3/07
65	3/18/07	1-Urgent		Small Pack	0.49	3/19/07
66	1/20/05	5-Low		Wrap Bag	0.56	1/20/05
69	6/4/05	4-Not Spec	fied	Small Pack	0.44	6/6/05
69	6/4/05	4-Not Spec	ana	ntitative	0.6	6/6/05
70	12/18/06	5-Low	yuai	illative	0.59	12/23/06
70	12/18/06	5-Low	ordi	nal	0.82	12/23/06
96	4/17/05	2-High		1101	0.55	4/19/05
97	1/29/06	3-Medium	cate	gorical	0.38	1/30/06
129	11/19/08	5-Low	cute	Sorrear	0.37	11/28/08
130	5/8/08	2-High		Small Box	0.37	5/9/08
130	5/8/08	2-High		Medium Box	0.38	5/10/08
130	5/8/08	2-High		Small Box	0.6	5/11/08
132	6/11/06	3-Medium		Medium Box	0.6	6/12/06
132	6/11/06	3-Medium		Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Speci	ified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Speci	ified	Small Pack	0.64	10/23/07
166	9/12/07	2-High		Small Box	0.55	9/14/07
193	8/8/06	1-Urgent		Medium Box	0.57	8/10/06
194	4/5/08	3-Medium		Wrap Bag	0.42	4/7/08

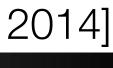




Tasks



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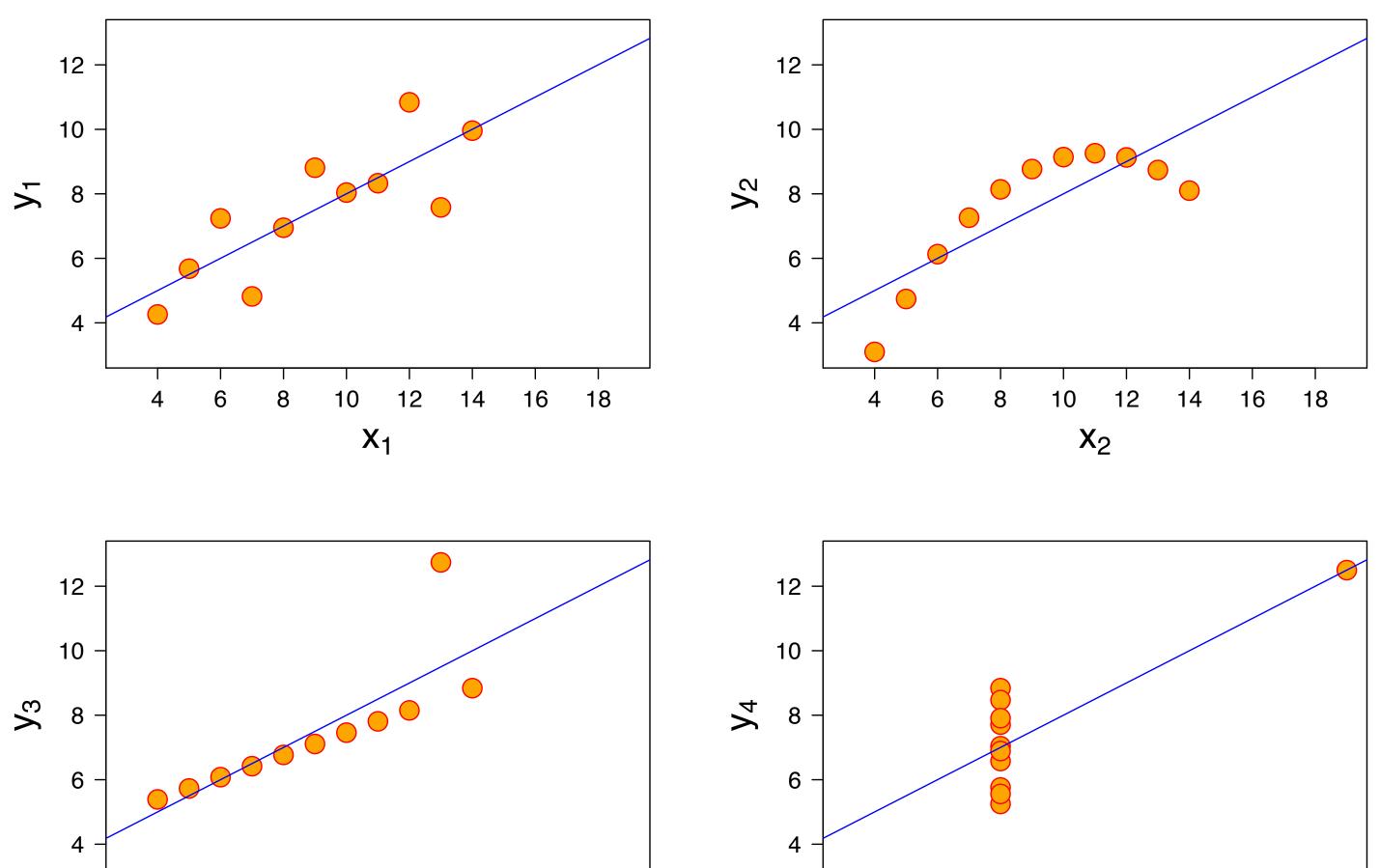
5

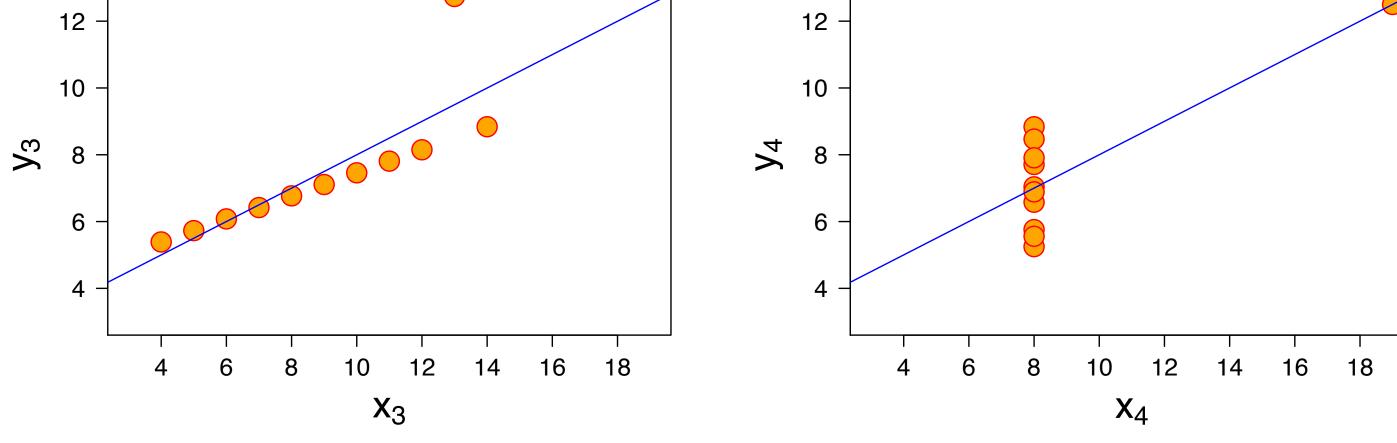






Why Visual?





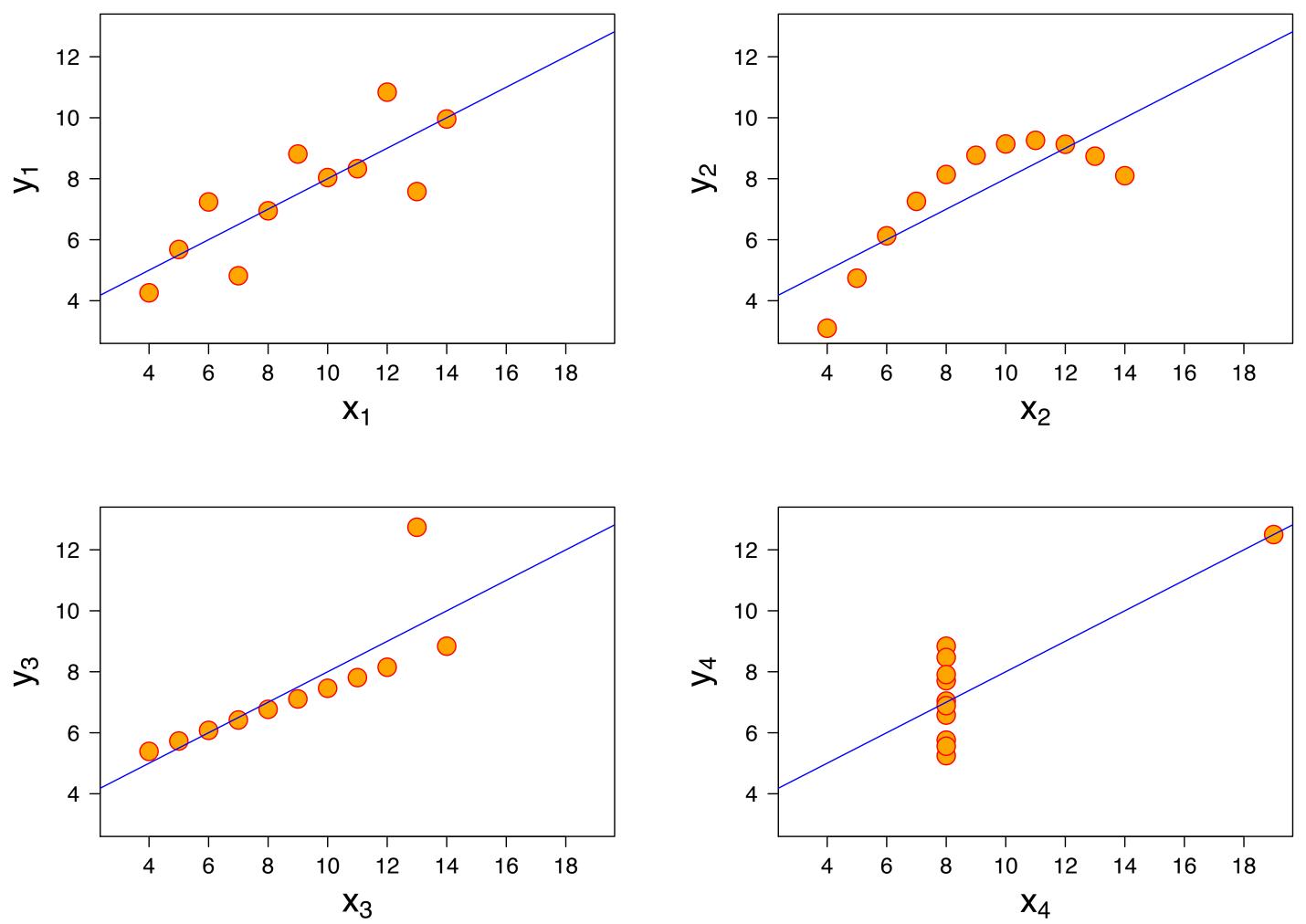


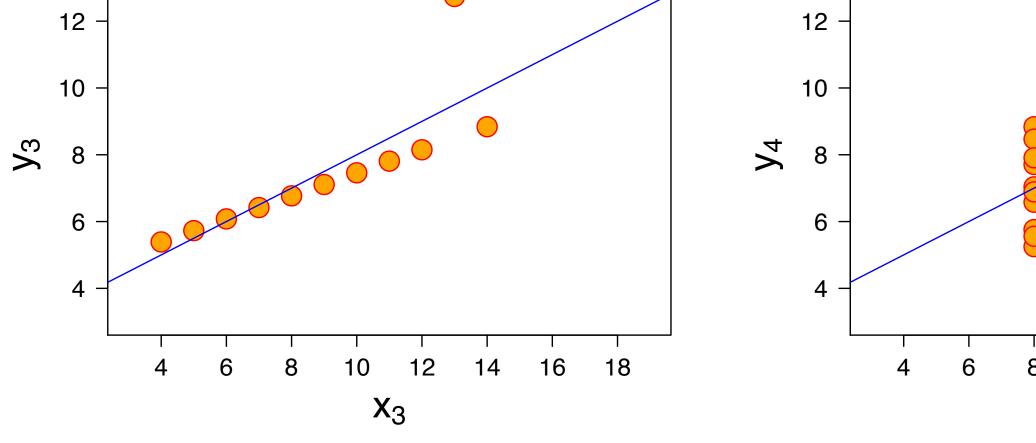






Why Visual?





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Mean of x	9
Variance of x	11
Mean of y	7.50
Variance of y	4.122
Correlation	0.816









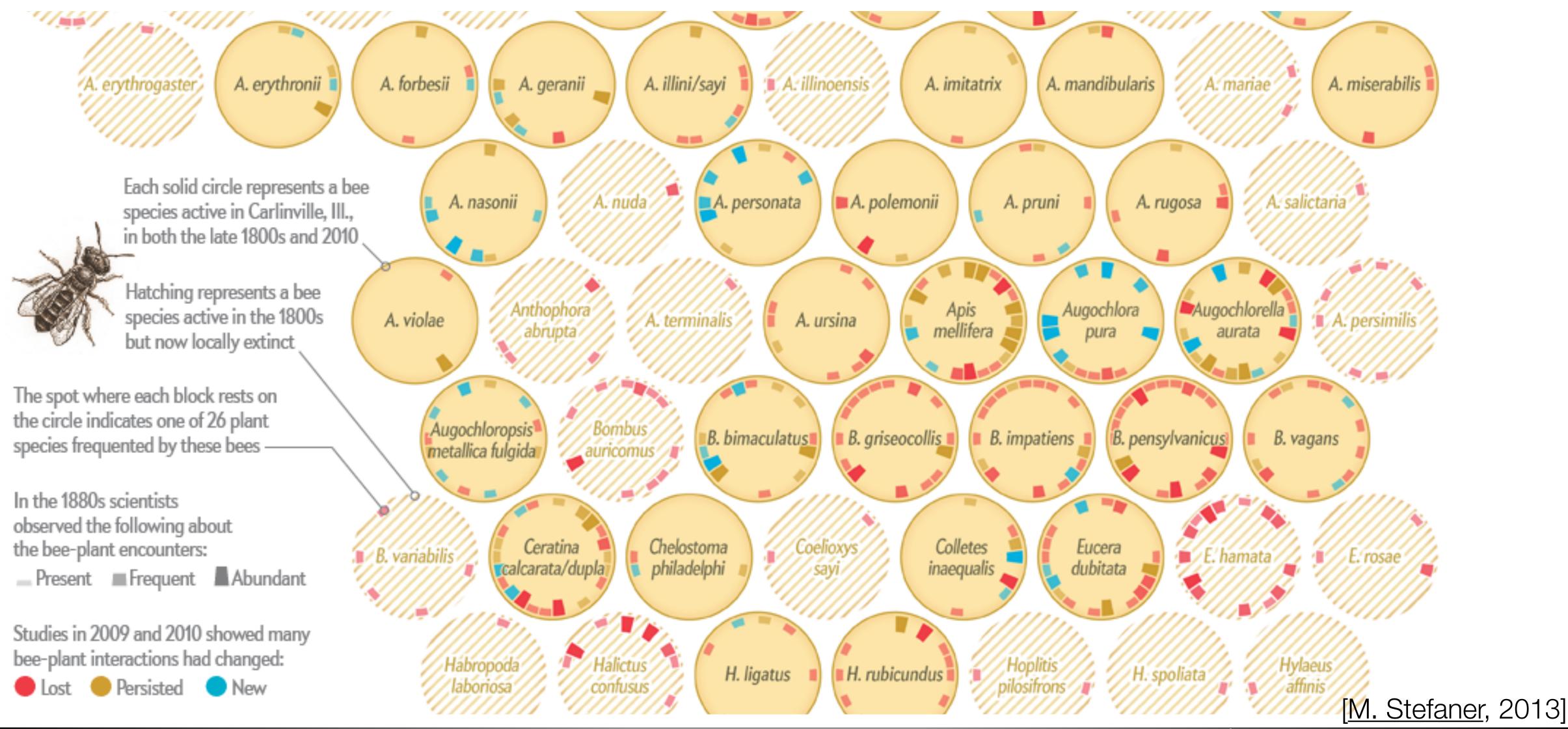
7







Design Example



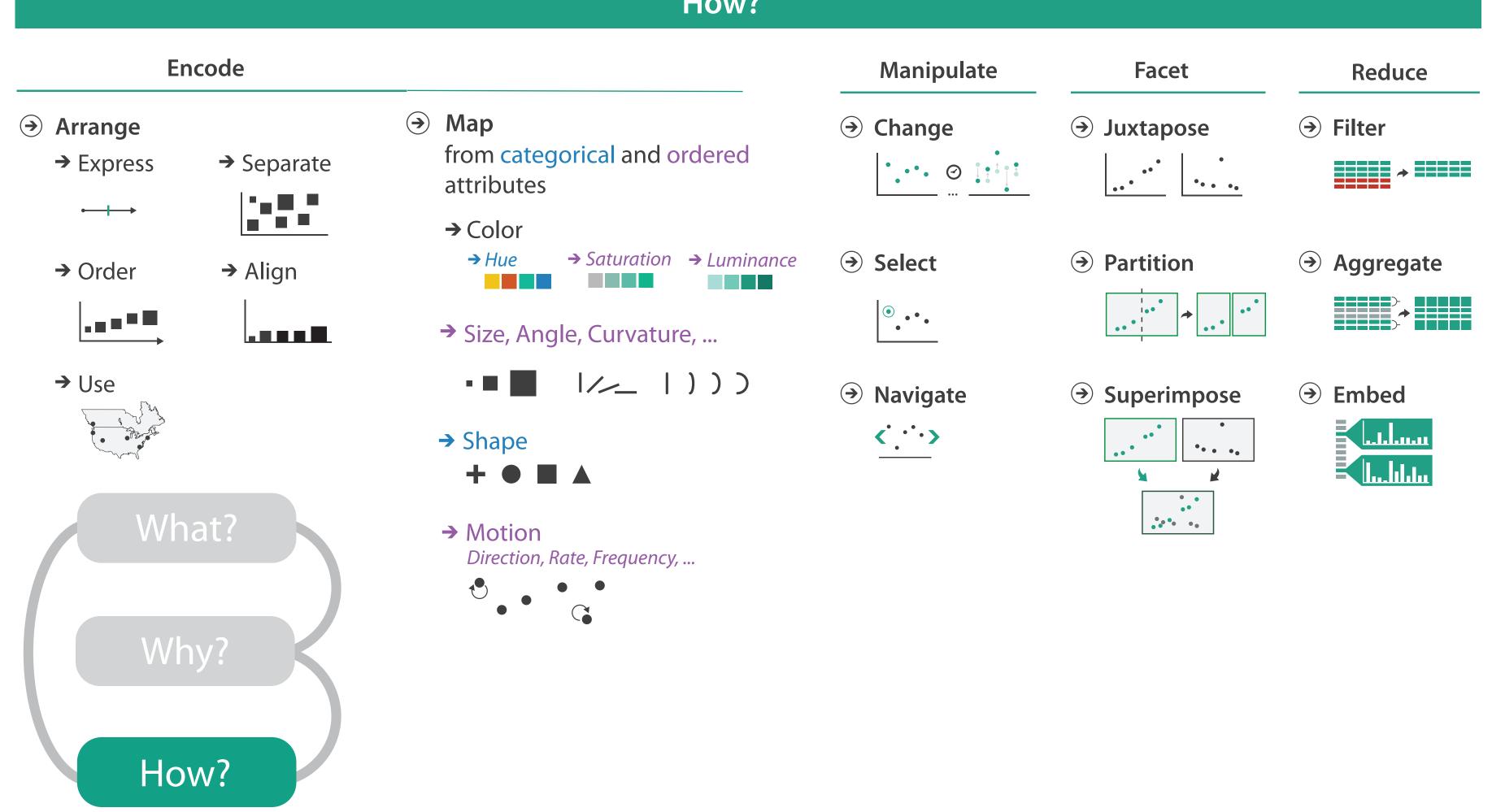








How do we do visualization?



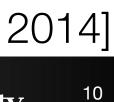
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How?





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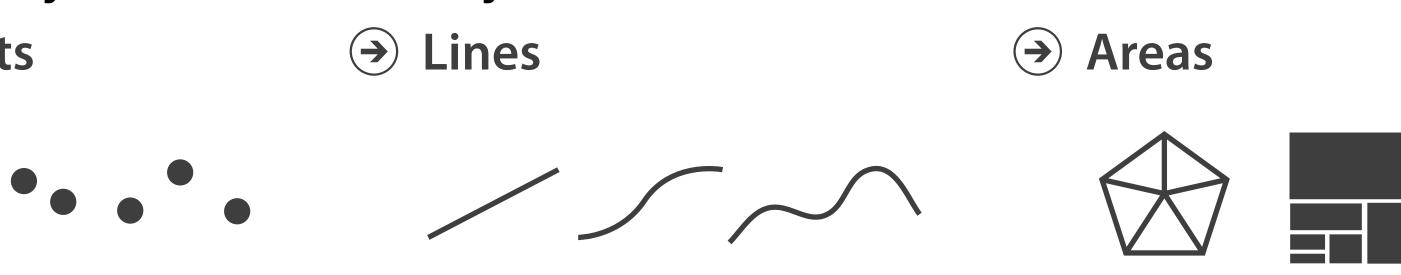


Visual Encoding

- How do we encode data visually?
 - Marks are the basic graphical elements in a visualization
 - Channels are ways to control the appearance of the marks
- Marks classified by dimensionality: → Points \rightarrow Lines

- Also can have surfaces, volumes

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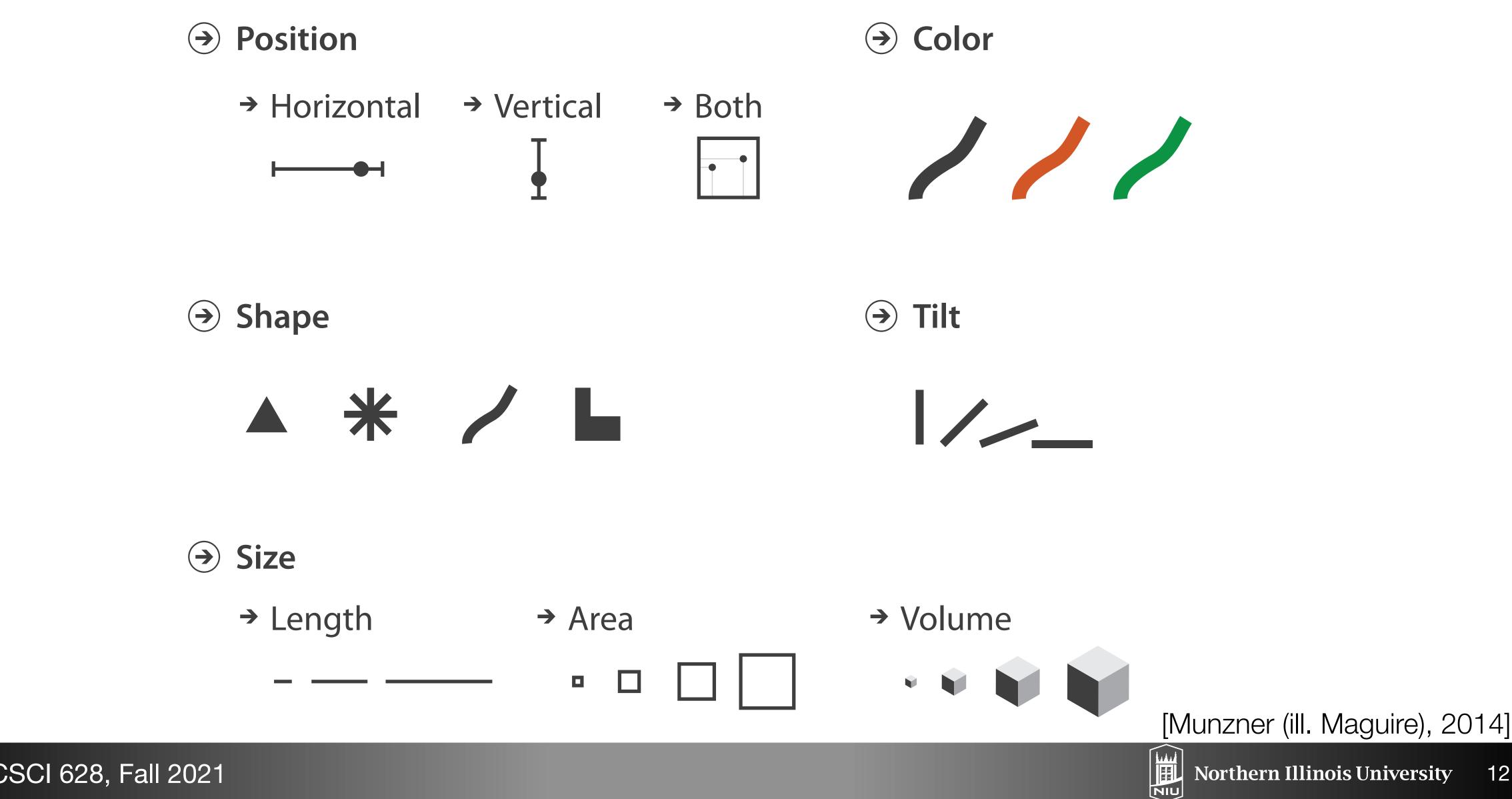
• Think of marks as a mathematical definition, or if familiar with tools like Adobe







Visual Channels





Channels by Effectiveness

Channels: Expressiveness Types and Effectiveness Ranks

Magnitude Channels: Order	ed Attributes
Position on common scale	
Position on unaligned scale	⊢- ● -1 ⊢●1
Length (1D size)	
Tilt/angle	
Area (2D size)	•
Depth (3D position)	$\longmapsto \bullet \longmapsto \bullet$
Color luminance	
Color saturation	
Curvature)))
Volume (3D size)	• • •

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Effectiveness

Least

Same

Same

Identity Channels: Categorical Attributes







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Topic Survey

- Thanks for completing
- Will be finalizing the topics soon an dates to present

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• Will be finalizing the topics soon and releasing another survey to rank topics/







Next Unit

- Reading & Writing for InfoVis
- Critiquing InfoVis
- ...but also in general



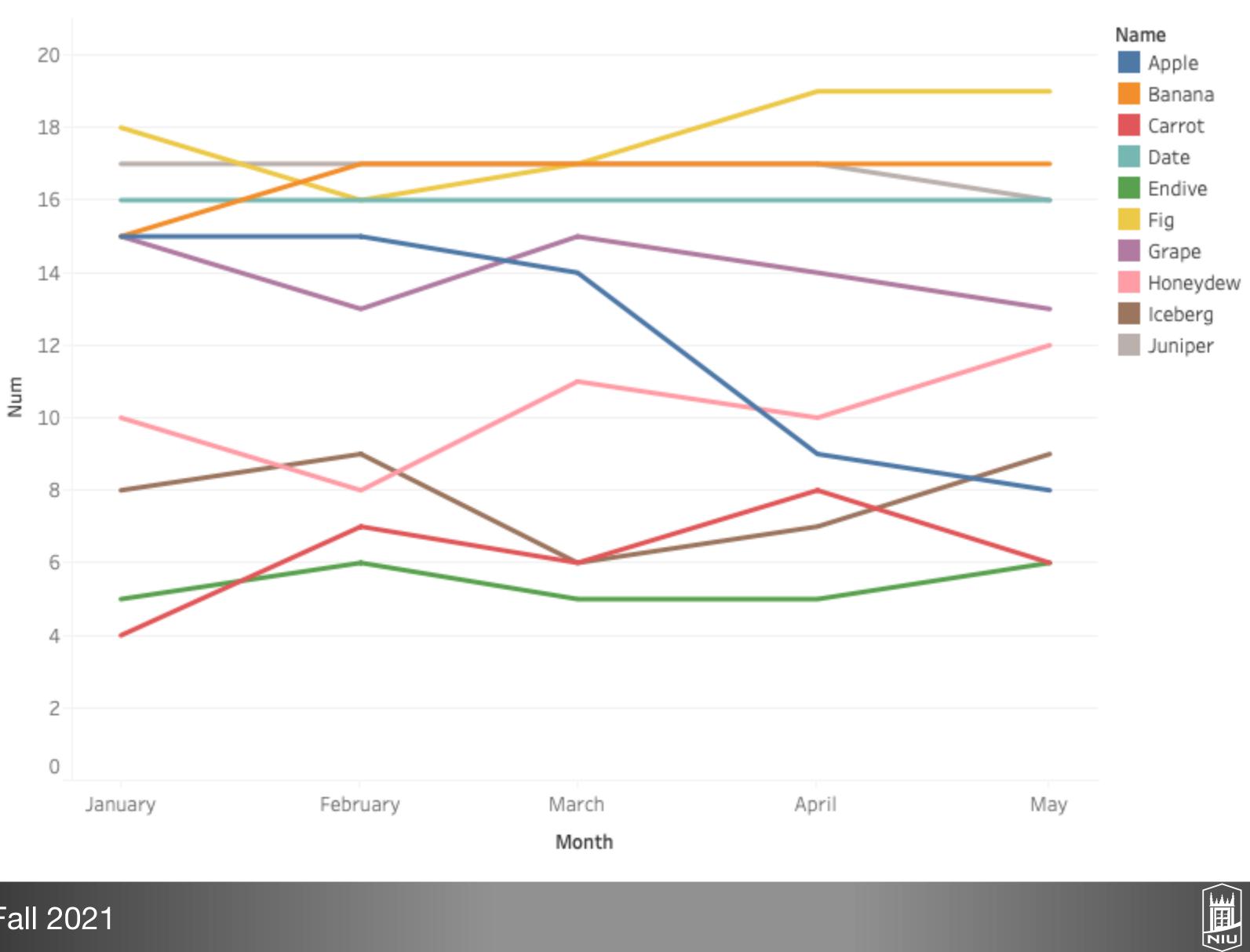


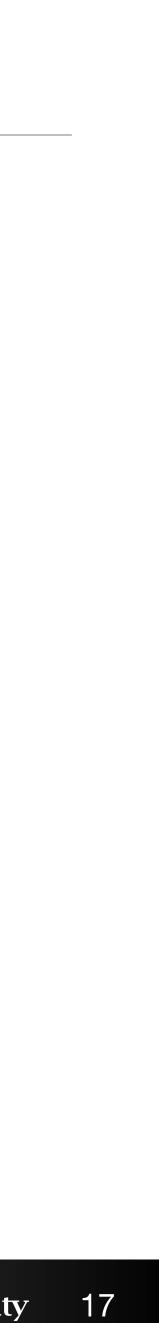
Tools



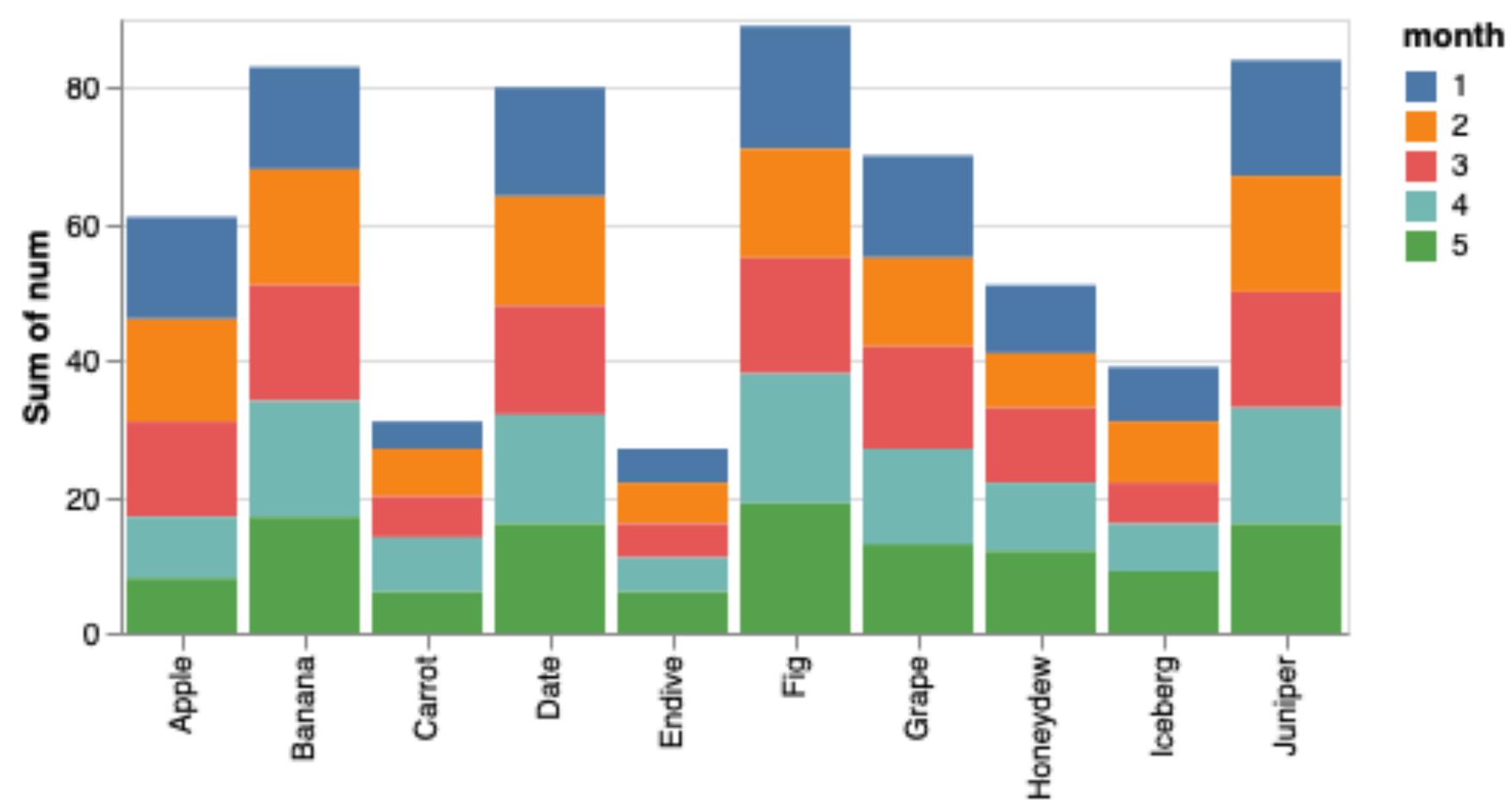


Tableau





Vega-Lite



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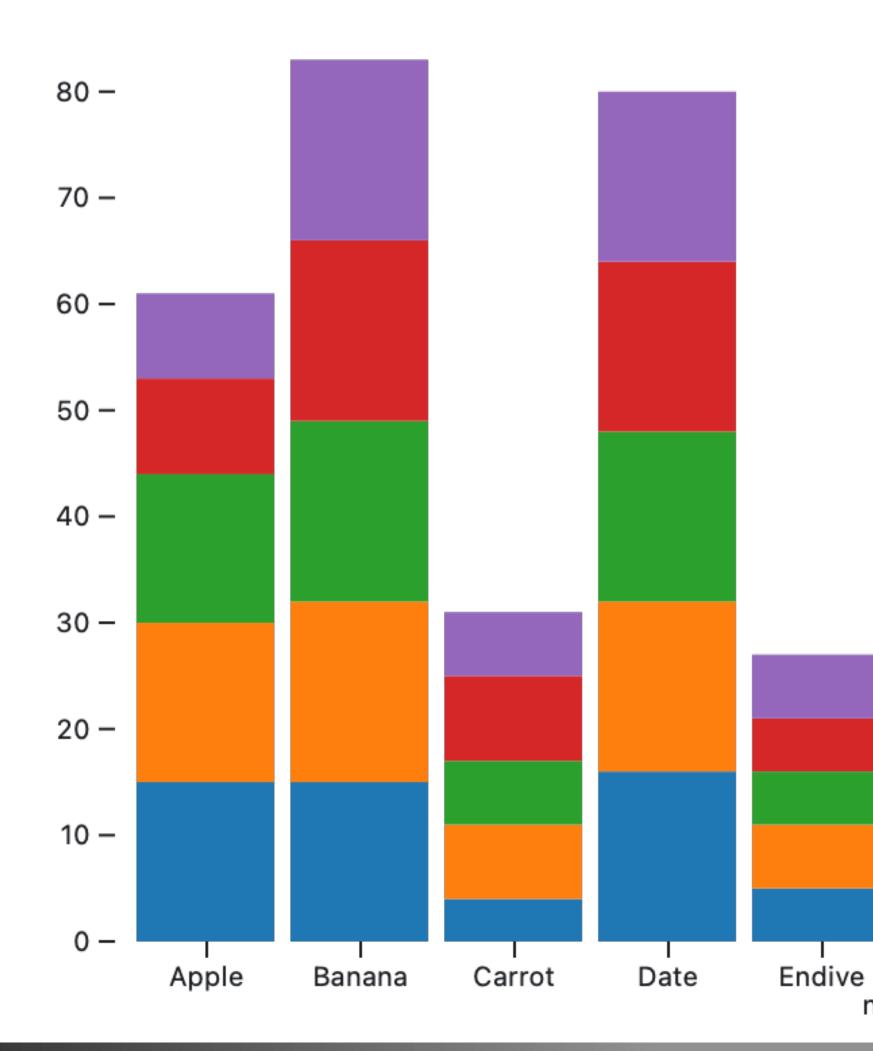
Produce Item

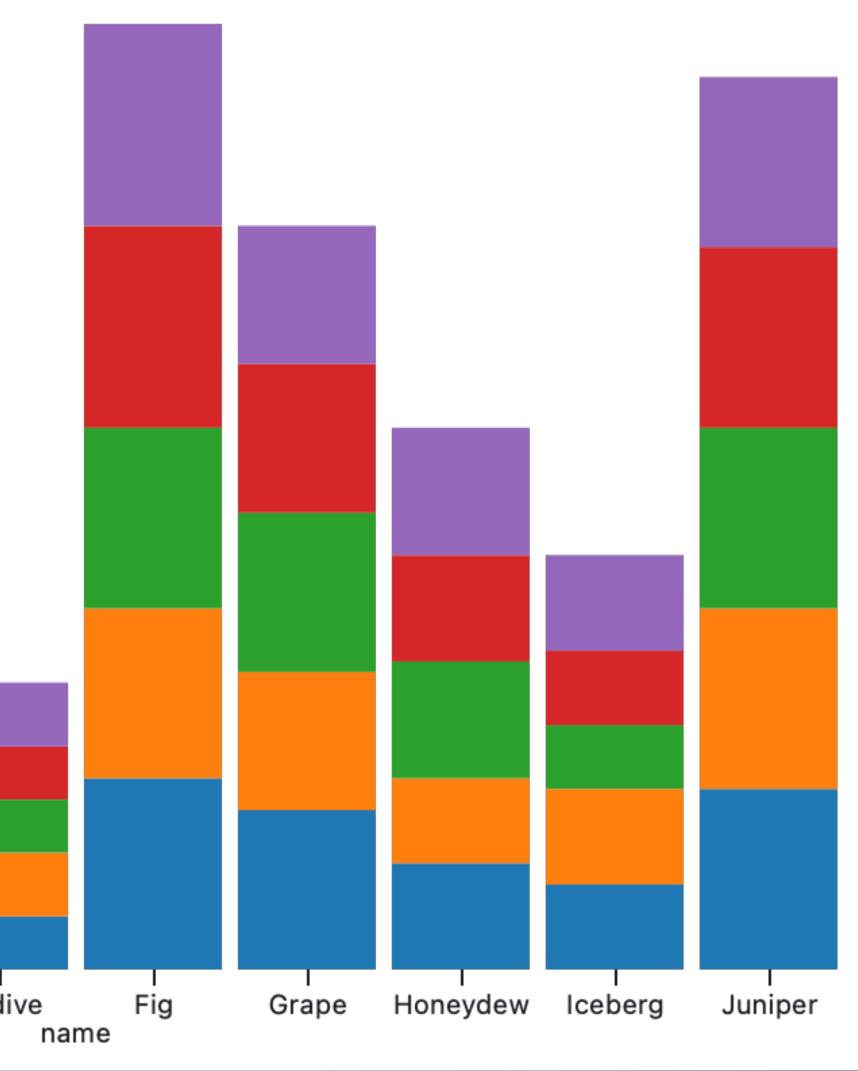




Observable Plot

↑ num









d3

- http://d3js.org/
- Supports data as a core piece of Web elements
 - Correspondence between data and DOM elements
 - Dealing with changing data (joins, enter/update/exit)
 - Data drives the marks and channels
- Selections (similar to CSS) that allow greater manipulation
- Integrated layout algorithms, axes calculations, etc.
- Focus on interaction support
 - Straightforward support for transitions
 - Event handling support for user-initiated changes





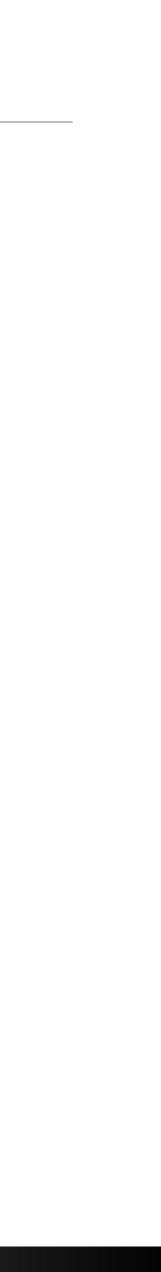


Visualization Tools & Tradeoffs

- Fast, turnkey approaches
- Control over all visual elements
- You can use **multiple** tools! Think about purpose
 - Exploration
 - Explanation (custom design, handle interaction)



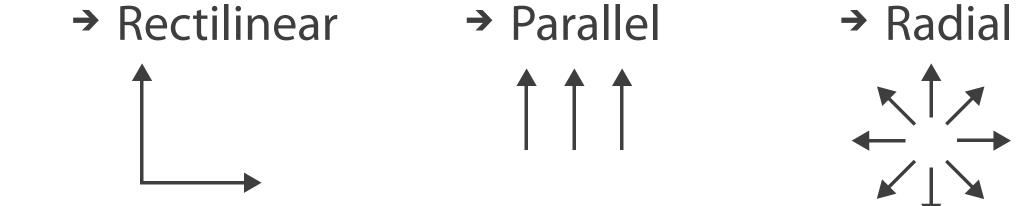








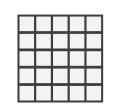
Arrange Tables **Express Values** Separate, Order, Align Regions → Align → Separate → Order → 1 Key (\rightarrow) **Axis Orientation**



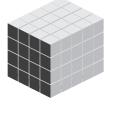
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List















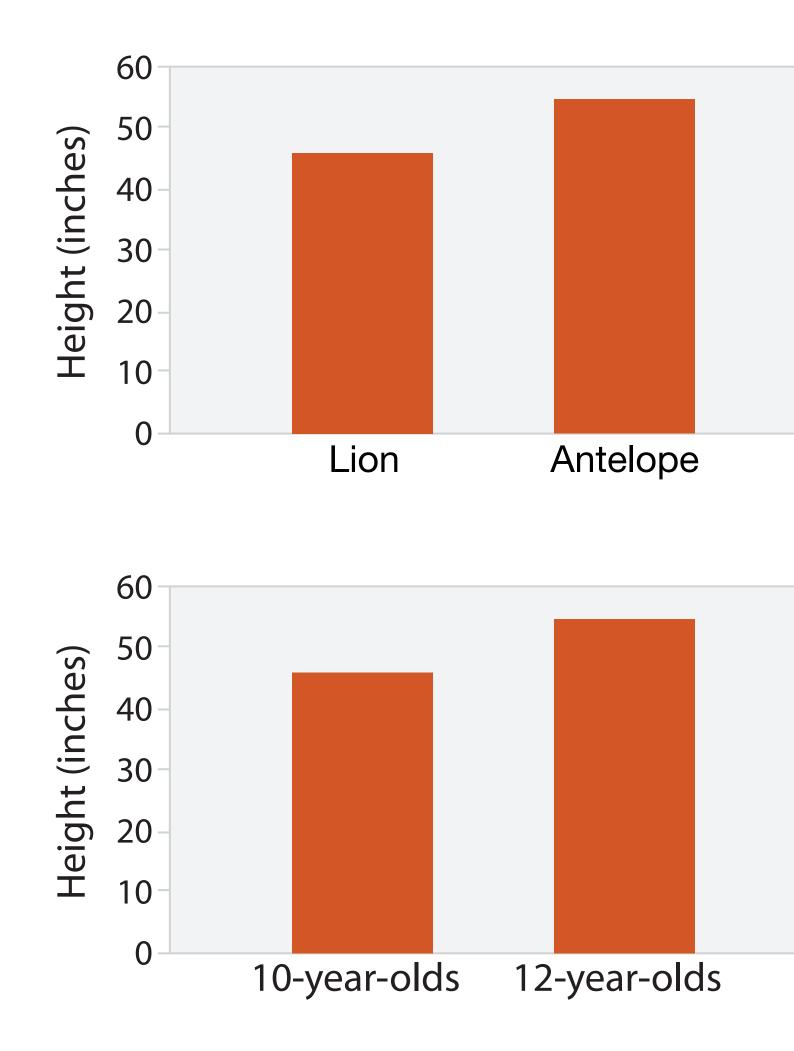
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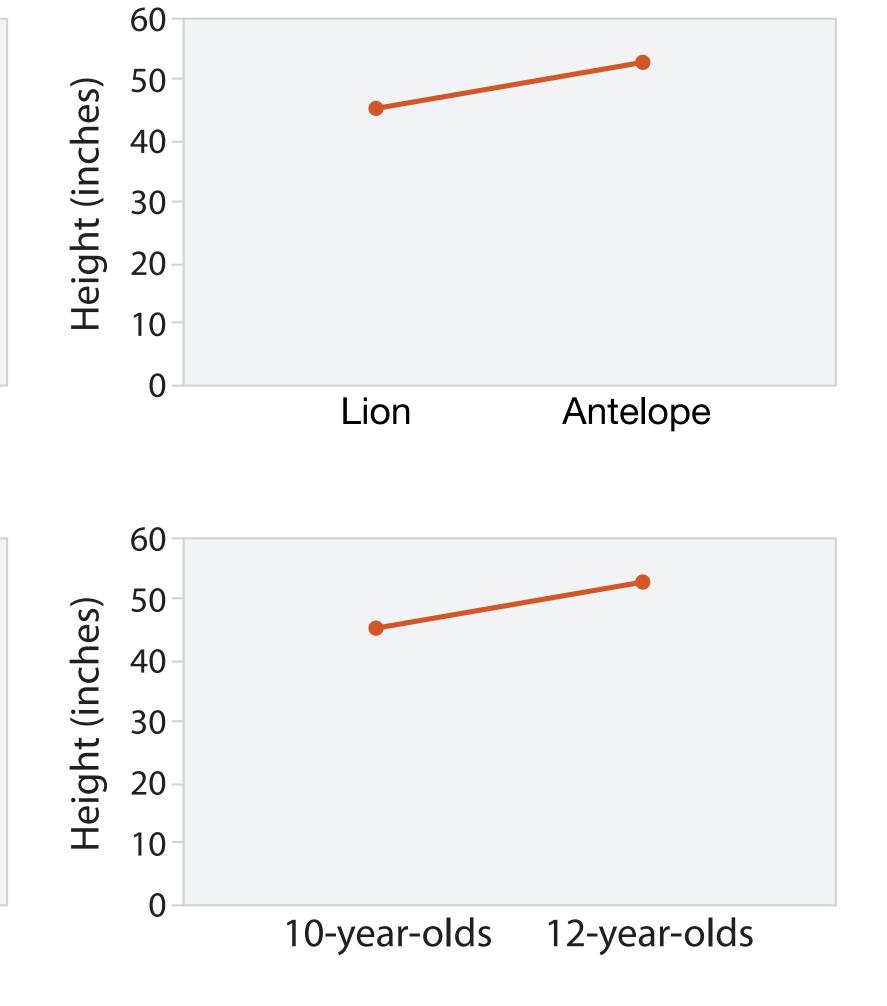




Proper Use of Line and Bar Charts



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[Adapted from Zacks and Tversky, 1999, Munzner (ill. Maguire), 2014]









Scatterplot Matrices and Parallel Coordinates

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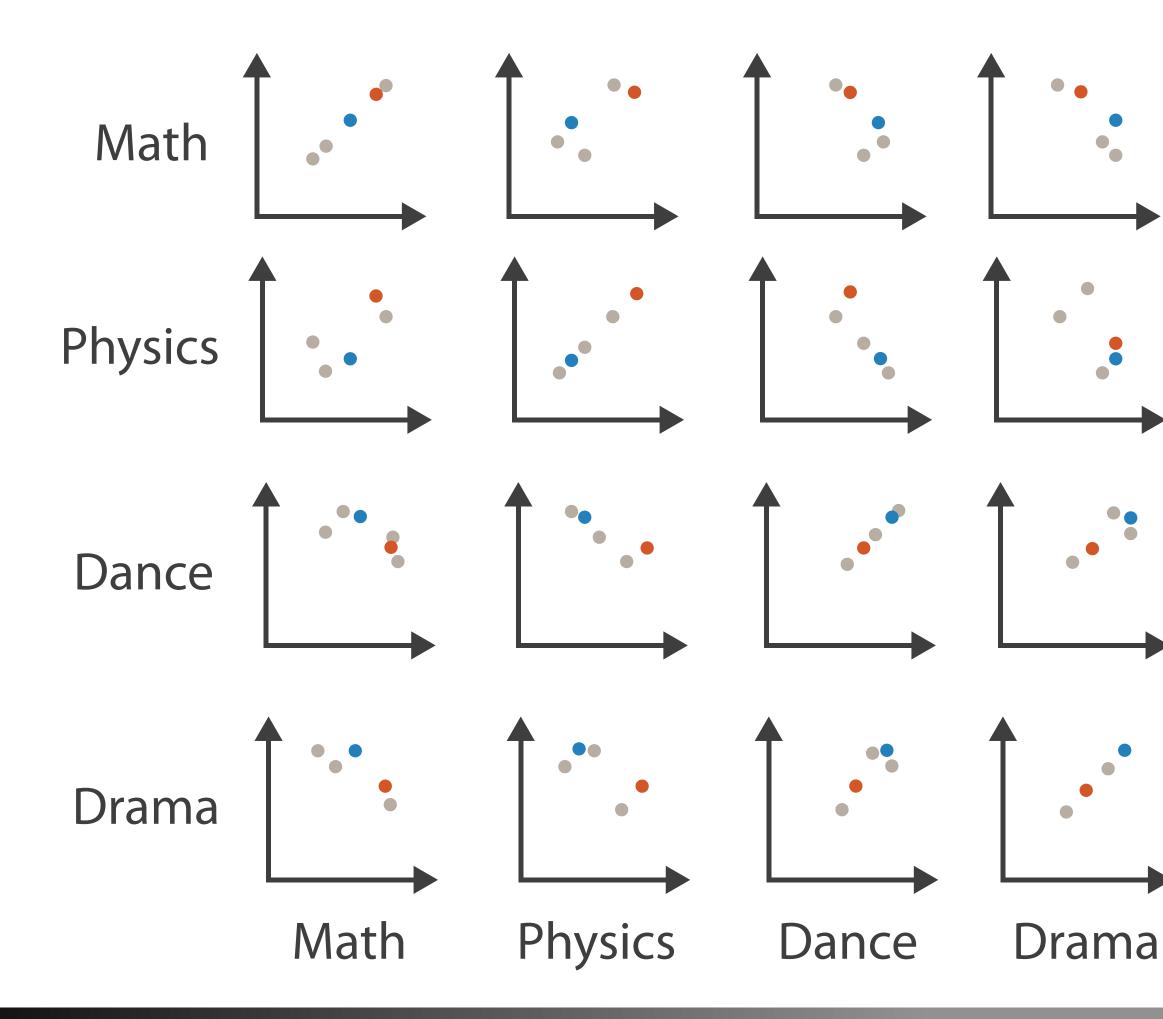
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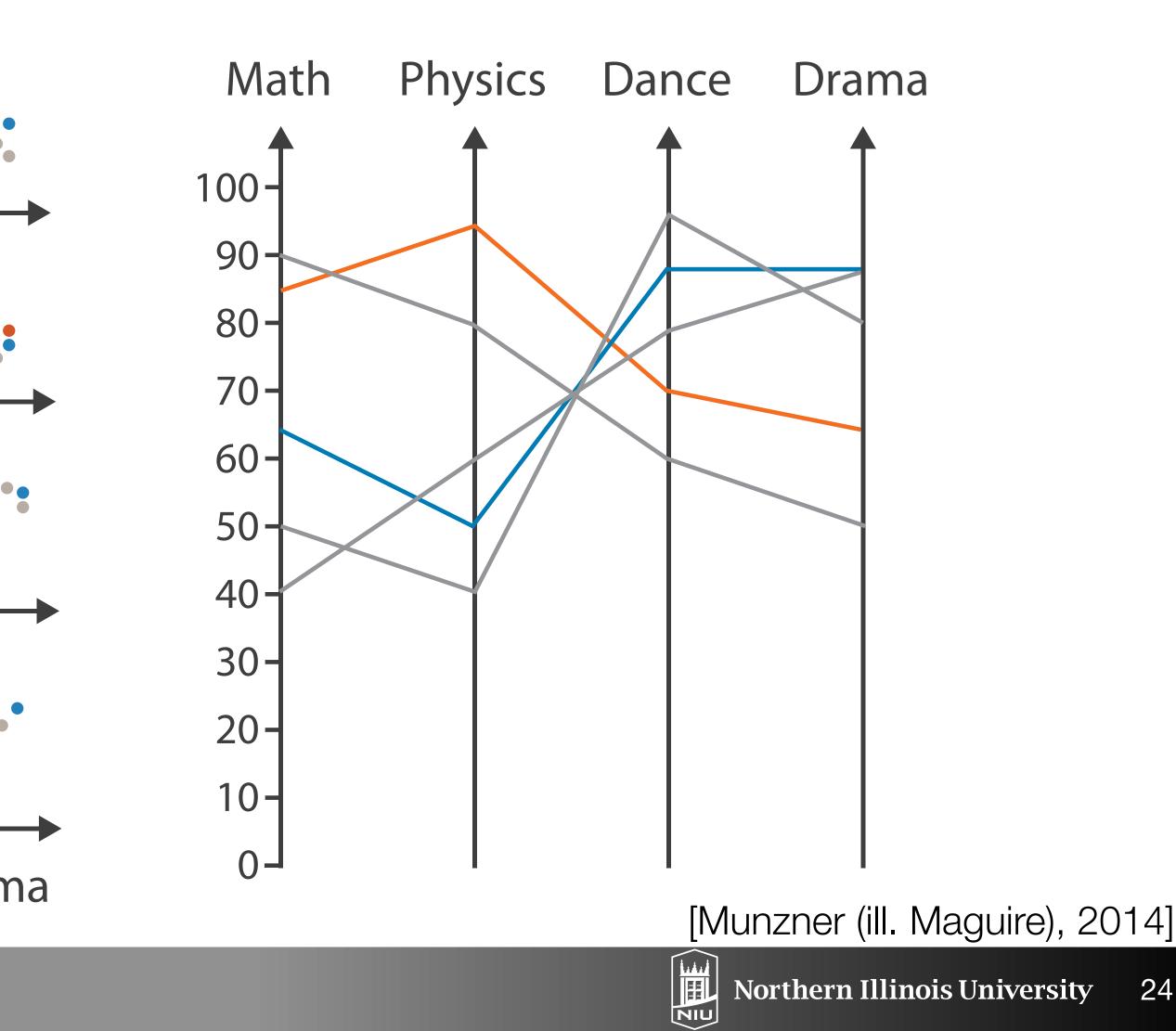
Scatterplot Matrices and Parallel Coordinates

Scatterplot Matrix



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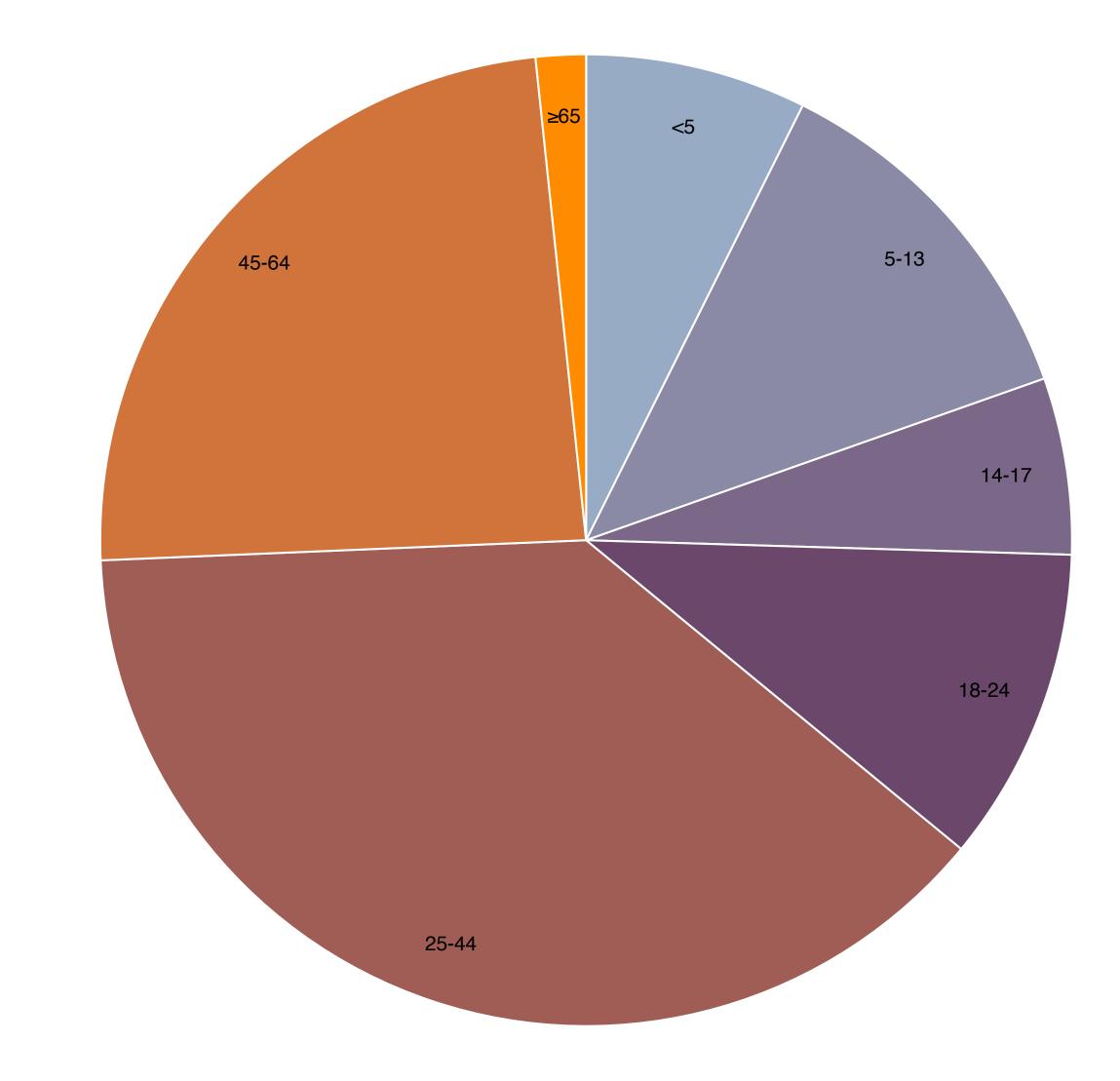
Parallel Coordinates







Pie Chart





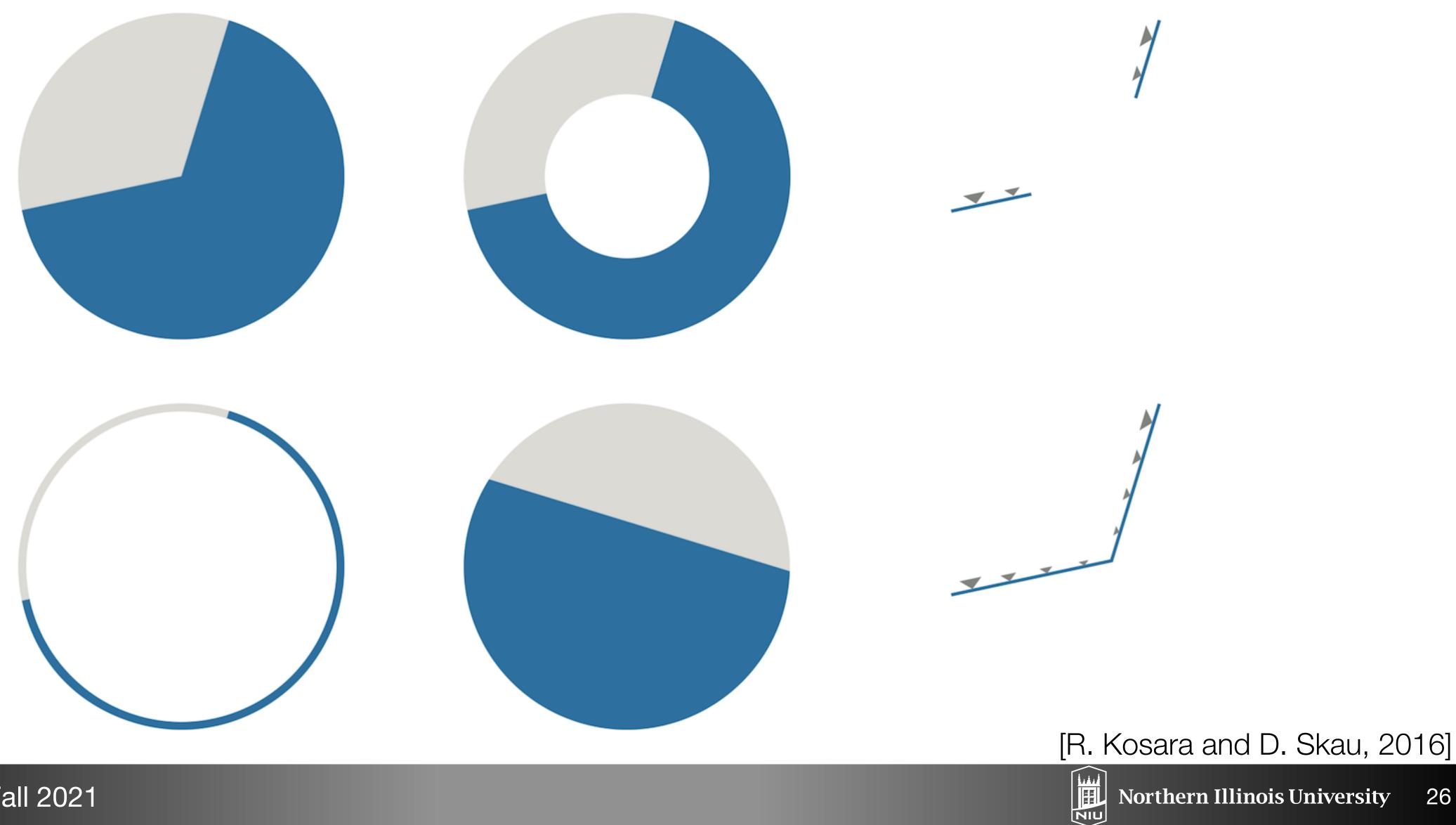








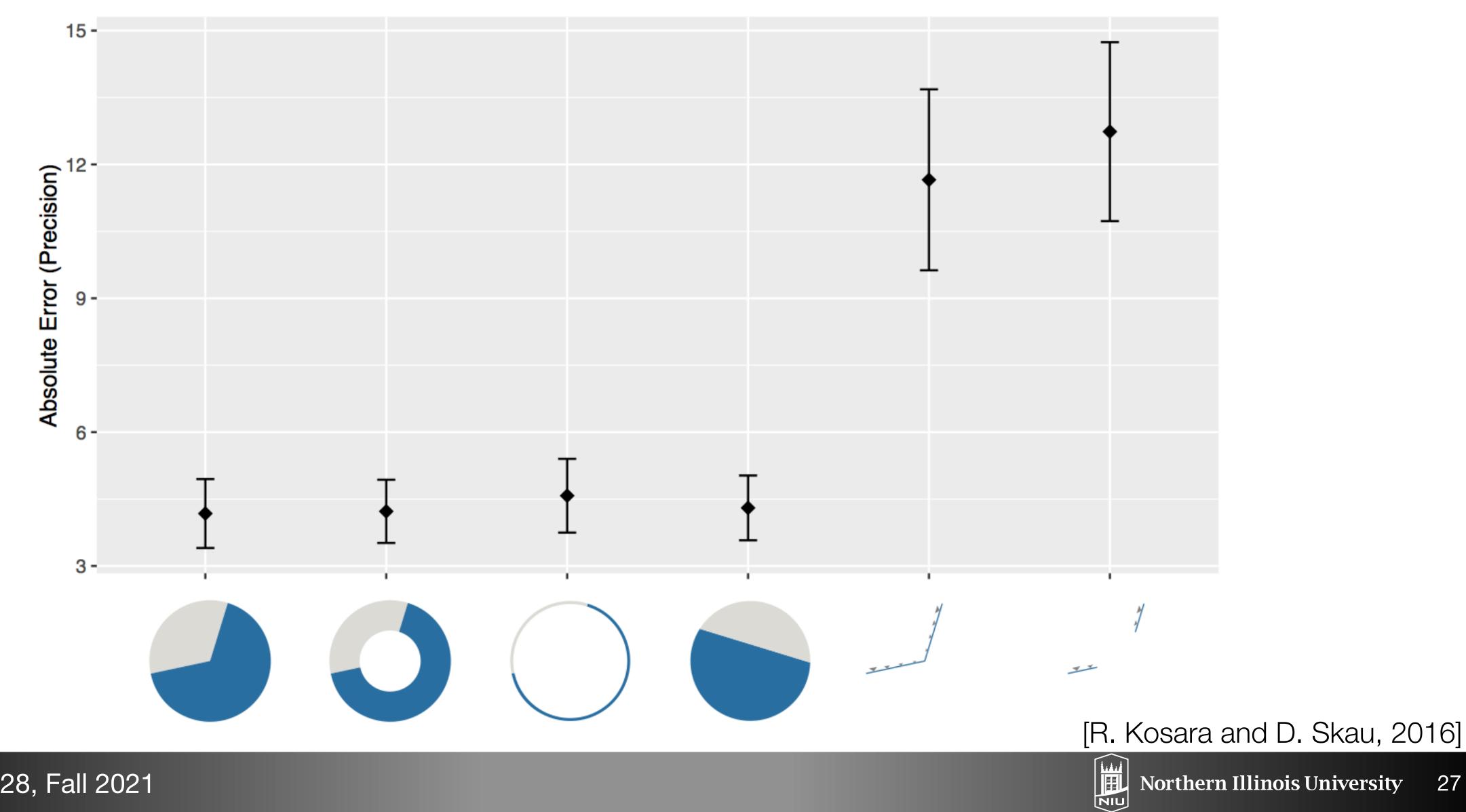
Judging Pie Charts: Arcs, Angles, or Areas?







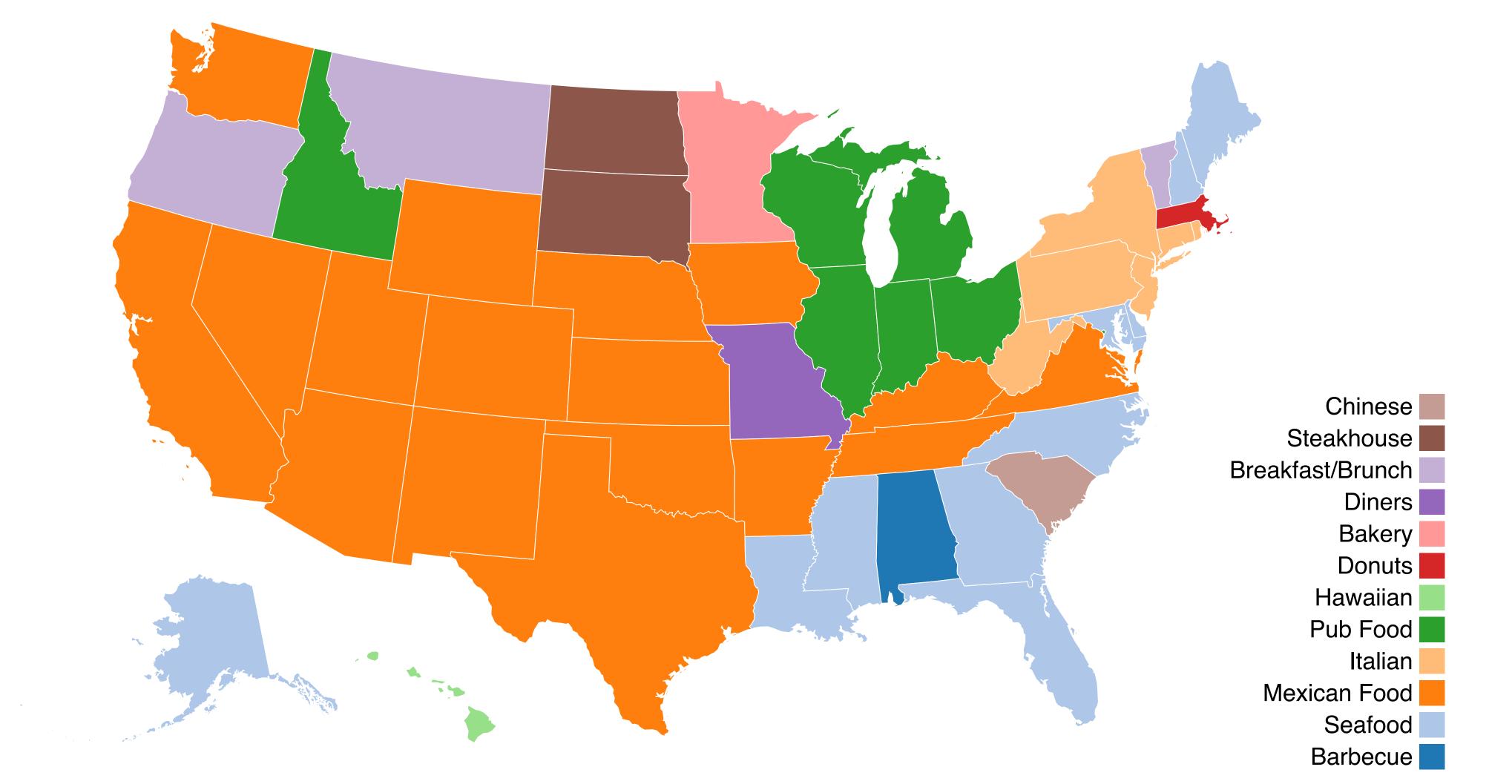
How do we judge pie charts?







Categorical Map

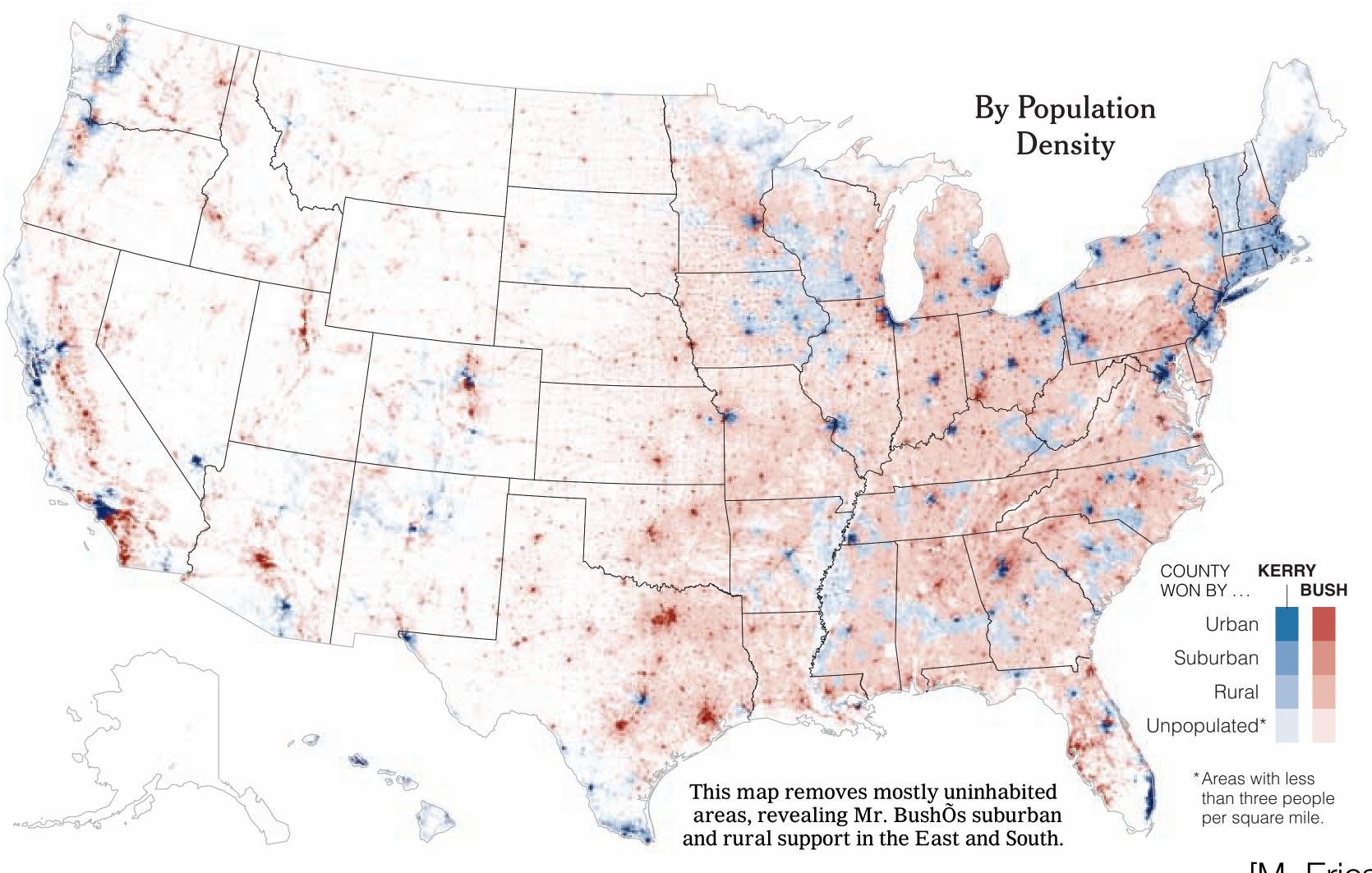








Map with Two Variables







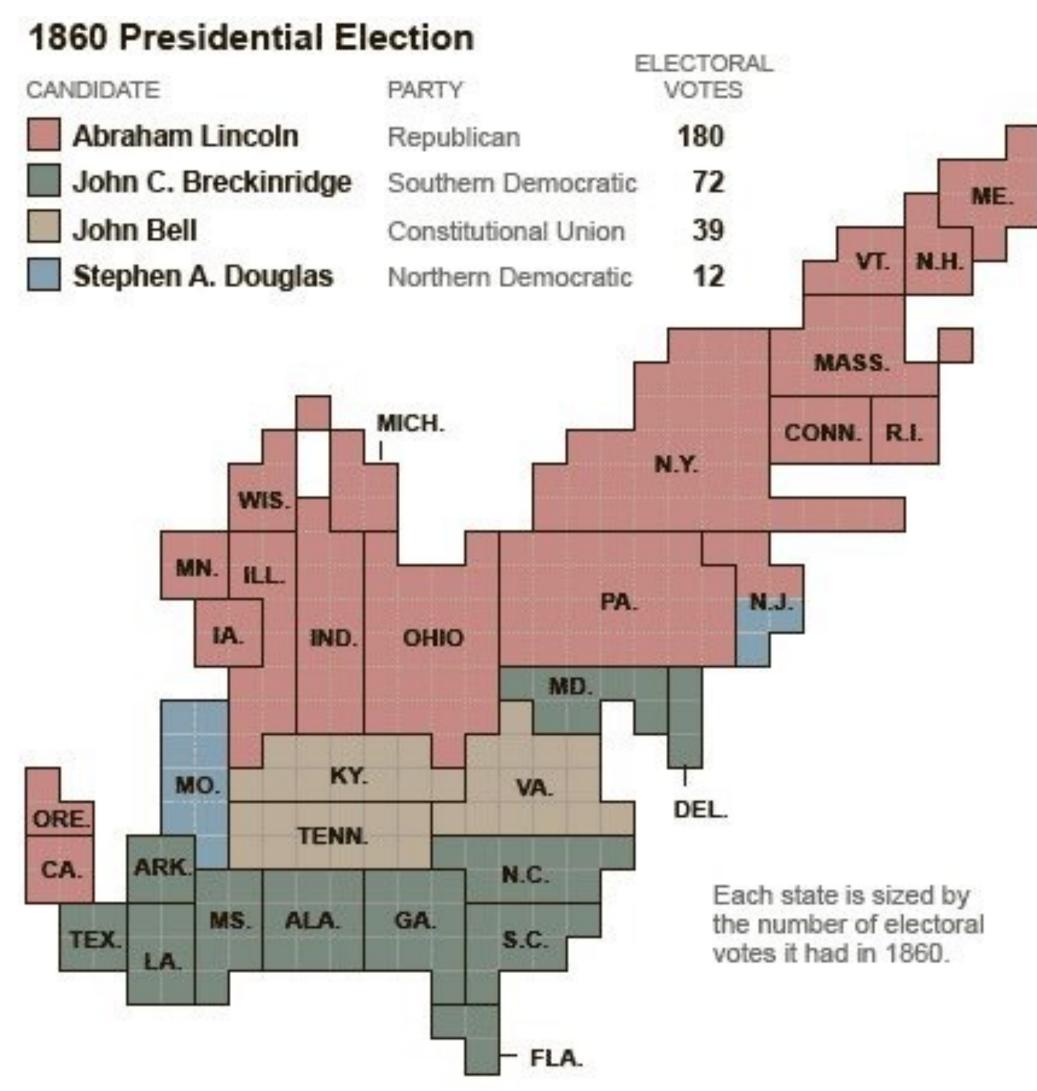


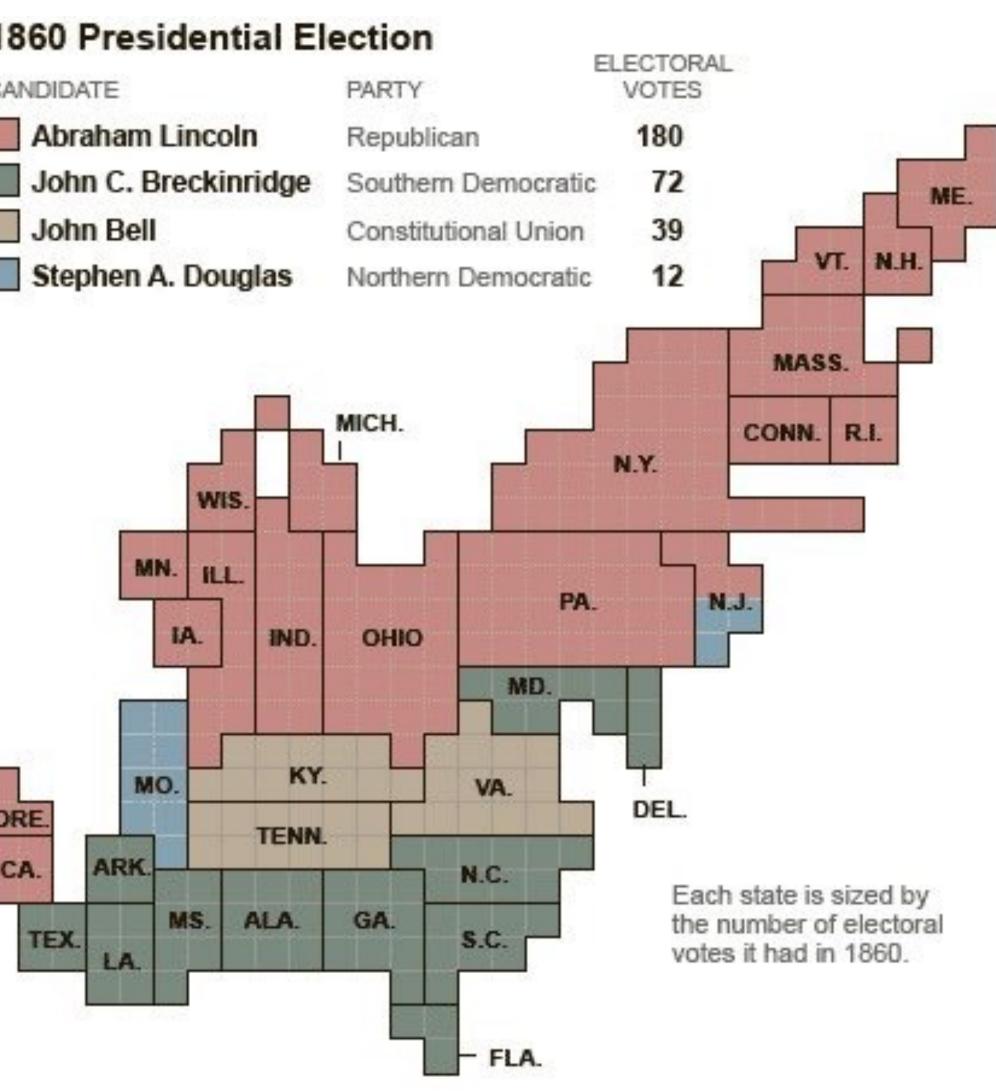






Rectangular Cartogram







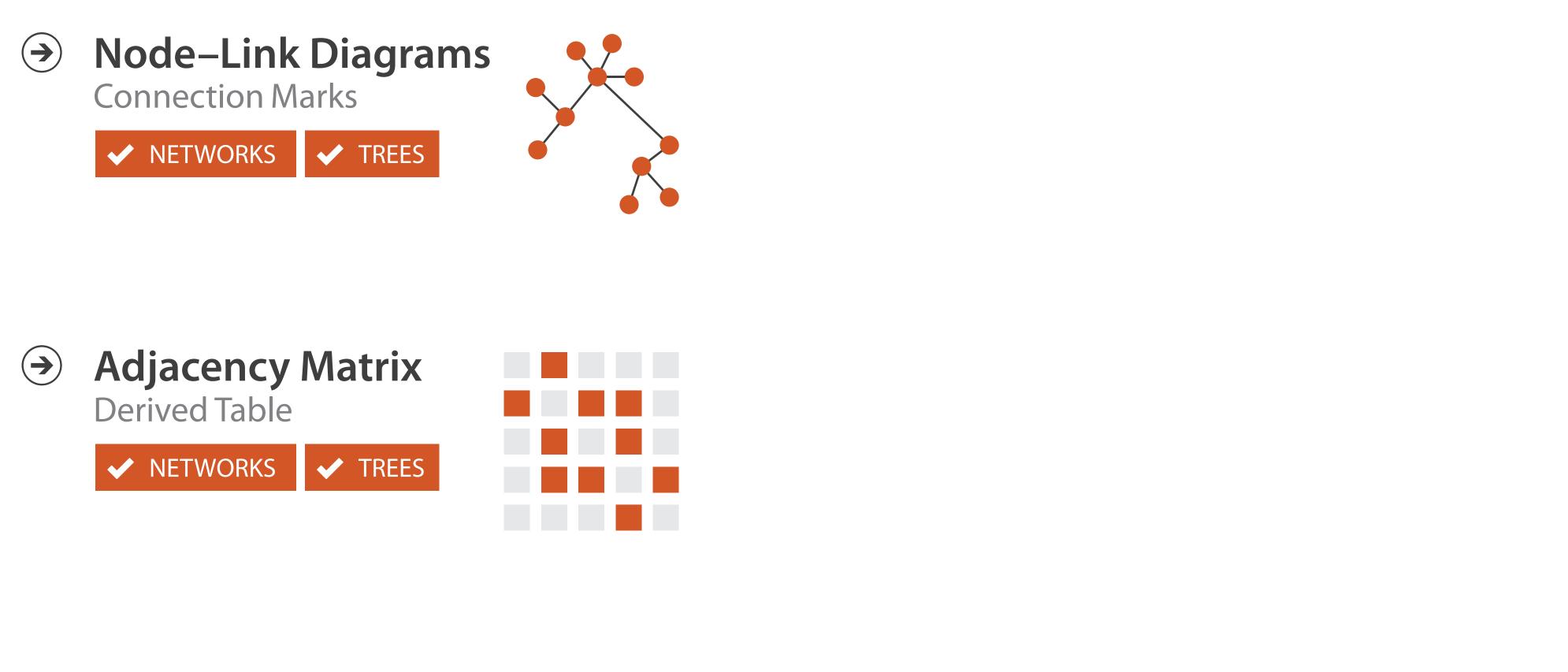








Arrange Networks and Trees







 (\rightarrow)

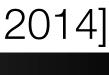


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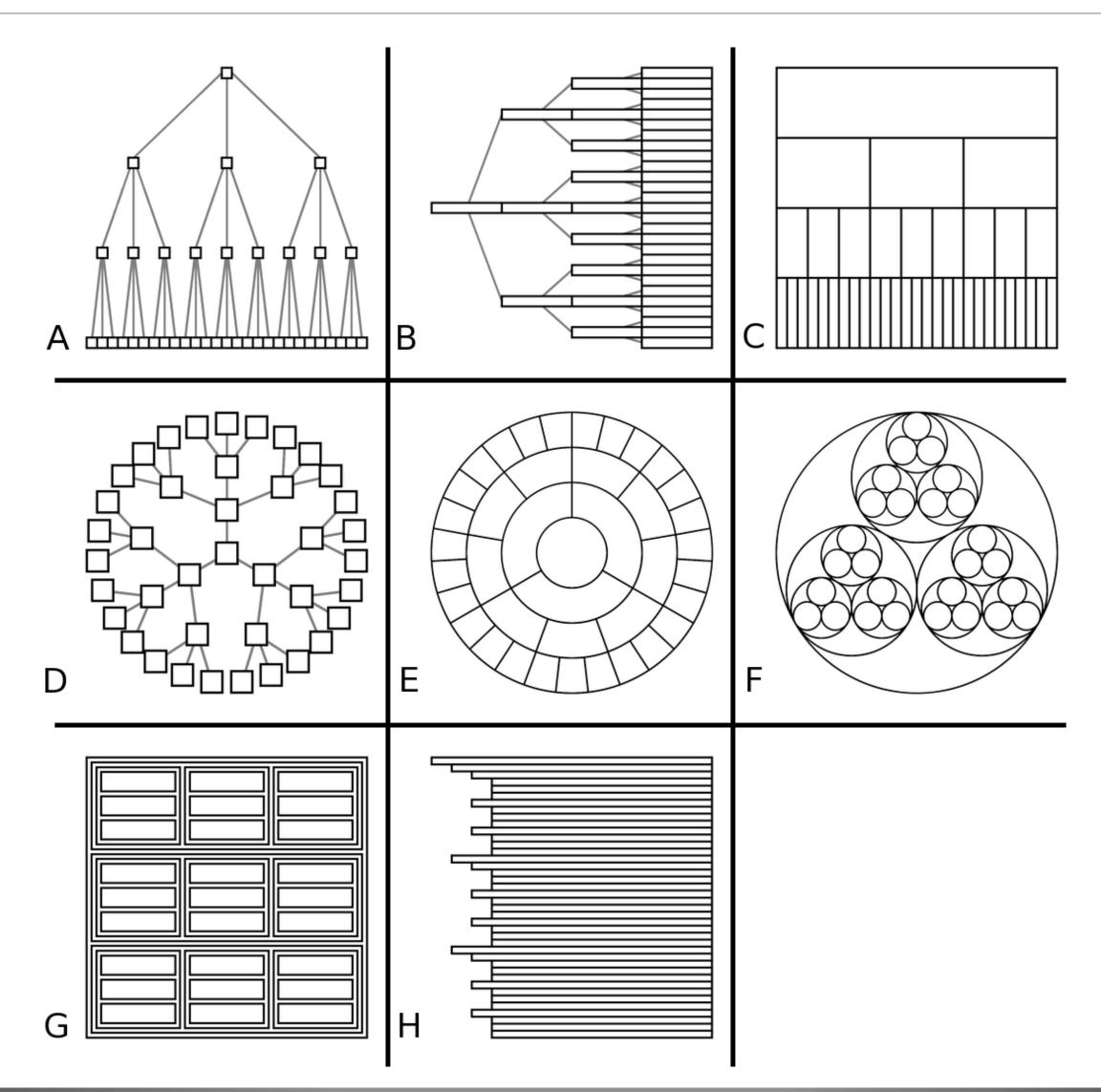


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Tree Visualizations



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Ireemaps

- Containment marks instead of connection marks
- Encodes some attribute of the items as the **size** of the rectangles
- Not as easy to see the intermediate rectangles
- Scalability: millions of leaf nodes and links possible
- Need a layout algorithm!
 - Slice-and-Dice vs. Squarify
- Viewing Hierarchy: Cushion Treemap

Node Link Tree Layout 12,870		Circle Layout 9,317		Tree Map Layout 9,191		ee Stac ap Area iyout Layo 191 9,12				20.544			Data List 19,788			Interpolator 8,746		ransitior 9,975	ner	gt m 60: 6		28 619 ne It 59 59	Query 13,896	
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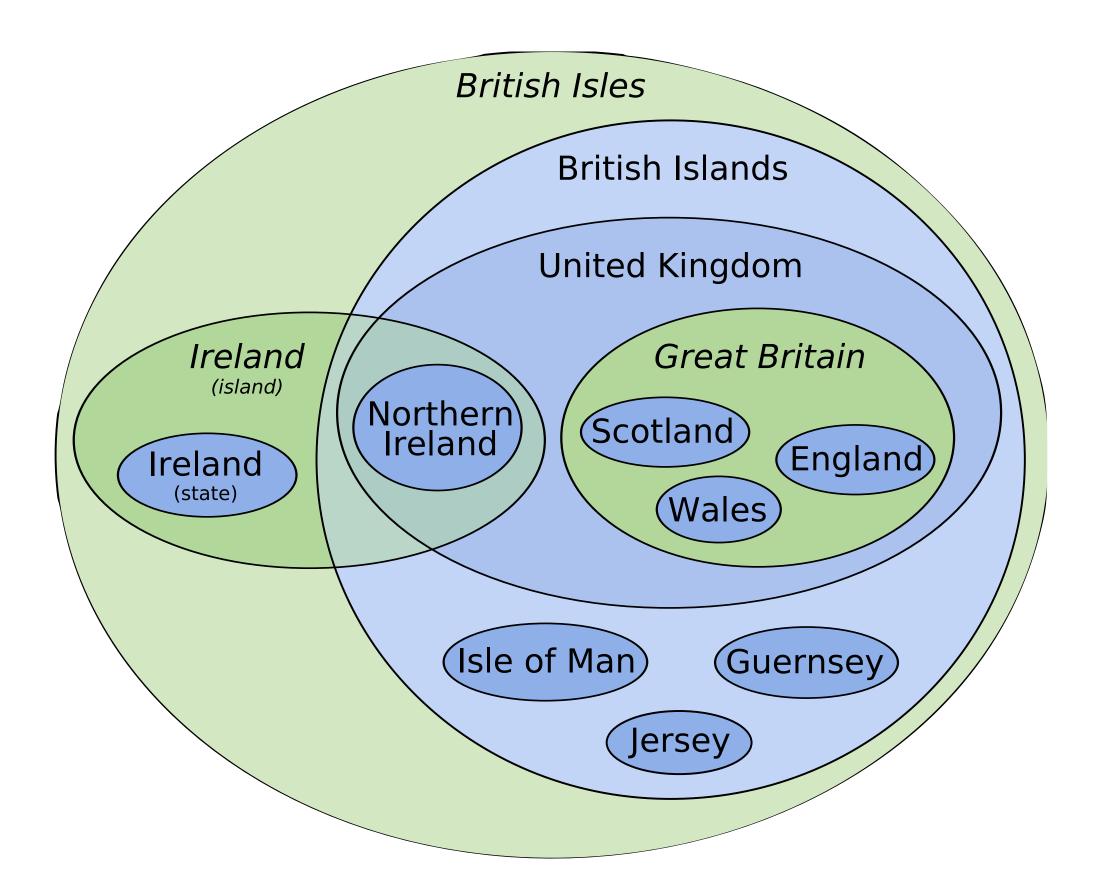


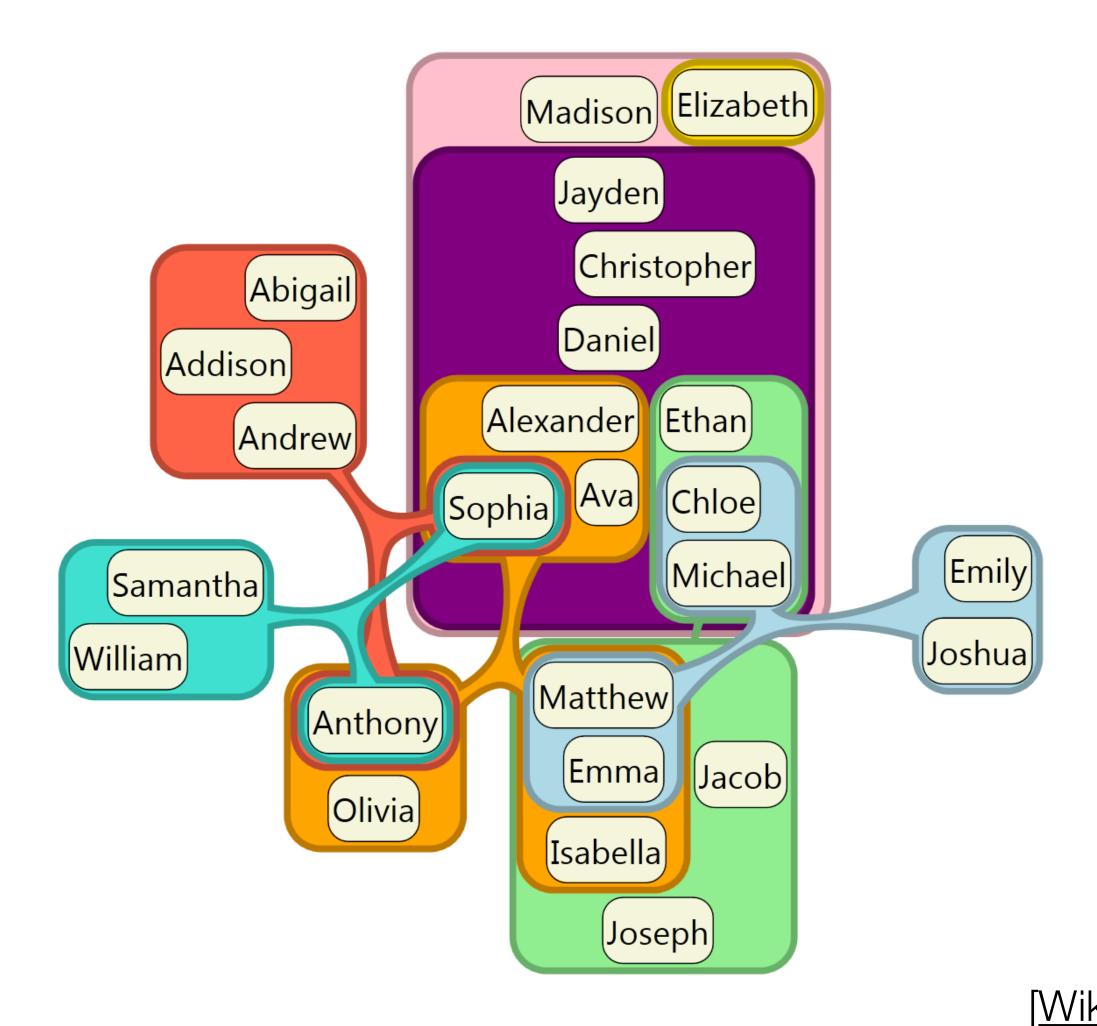




Set Visualizations

• How to show the intersection of sets?





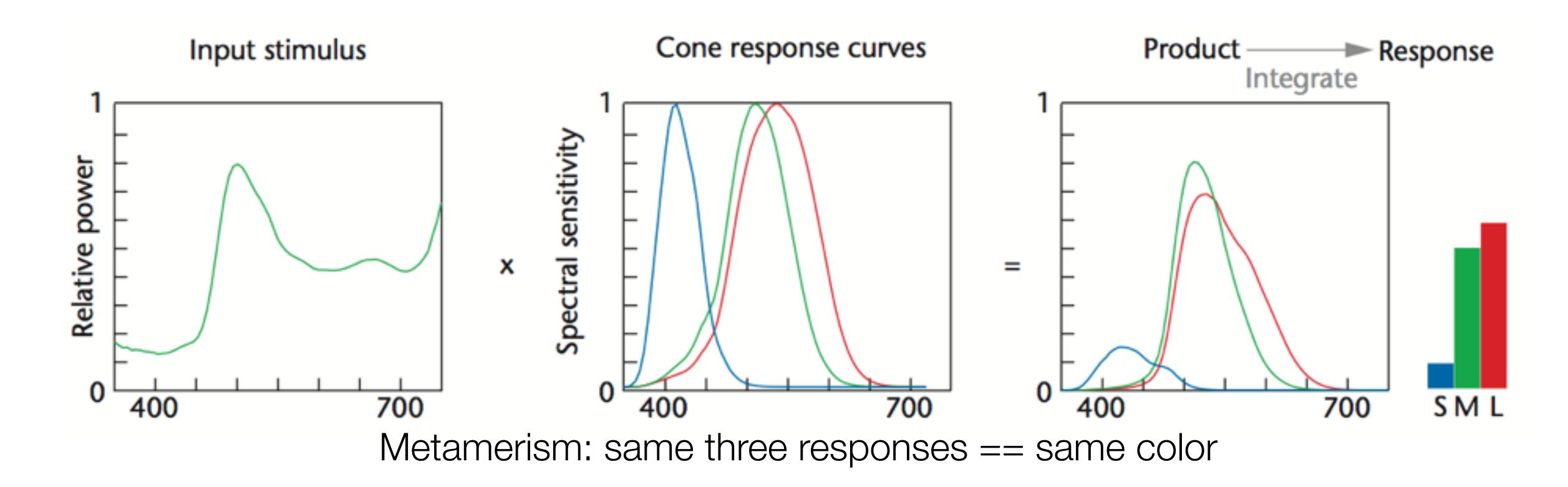








Human Color Perception



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[via M. Meyer]







Avoid Rainbow Colormaps!

(a) (b)

