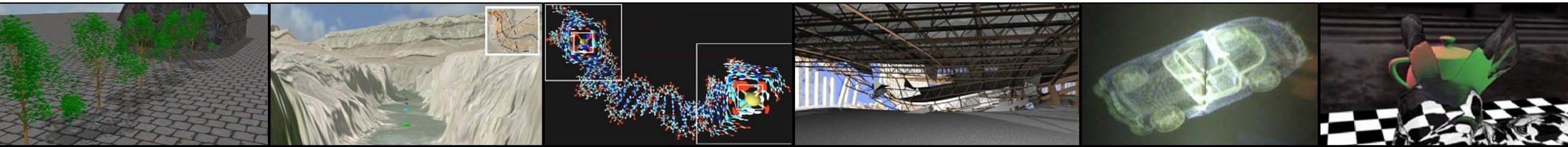
CIS 4930/6930-902
SCIENTIFIC VISUALIZATION

DATA ABSTRACTION

Paul Rosen
Assistant Professor
University of South Florida

slides credits Miriah Meyer (U of Utah)



ADMINISTRATIVE

first assignment out today

check the project presentation schedule

LAST TIME . . .

Tufte's integrity principles

Clear, detailed, and thorough labeling should be used to defeat graphical distortion and ambiguity.

The representation of numbers, as physically measured on the surface of the graphic itself, should be directly proportional to the numerical quantities represented.

Show data variation, not design variation.

TUFTE'S DESIGN PRINCIPLES

maximize the data-ink ratio

avoid chart junk (sometimes)

use multifunctioning elements

layer information

maximize the data density

shrink the graphics

maximize the amount of data shown (sometimes)

TODAY. . .

DATA ABSTRACTION

the what part of an analysis that pertains to the data

translation of domain-specific terms into words that are as generic as possible

TYPE VS SEMANTICS

DATA TYPES

Items

Attributes

Links

Positions

Grids

DATASET TYPES

Tables

Items

Attributes

A	B	C	S	T	U
Order ID	Order Date	Order Priority	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 Specified	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		7/17/07
32	7/16/07	2-High	Medium Box		7/18/07
32	7/16/07	2-High	Medium Box	[illegible]	7/18/07
35	10/23/07	4-Not Specified	Wrap Bag	0.52	10/24/07
35	10/23/07	4-Not Specified	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	[illegible]	5-Low	Wrap Bag	0.56	1/20/05
69	[illegible]	4-Not Specified	Small Pack	0.44	6/6/05
69	[illegible]	4-Not Specified	Wrap Bag	0.6	6/6/05
70	12/18/06	5-Low	Small Box	0.59	12/23/06
70	12/18/06	5-Low	Wrap Bag	0.82	12/23/06
96	4/17/05	2-High	Small Box	0.55	4/19/05
97	1/29/06	3-Medium	Small Box	0.38	1/30/06
129	11/19/08	5-Low	Small Box	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 Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	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

attribute

cell

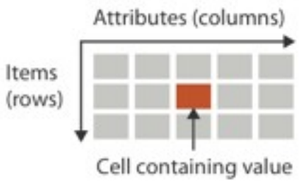
item

DATASET TYPES

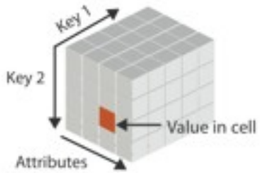
Tables

Items

Attributes

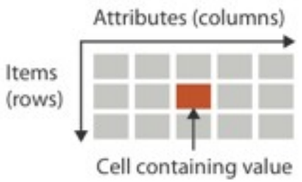


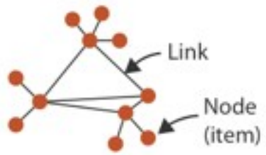
➔ *Multidimensional Table*



DATASET TYPES

Tables	Networks & Trees
Items	Items (nodes)
Attributes	Links
	Attributes





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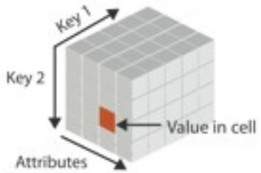

→ *Trees*

DATASET TYPES

Tables	Networks & Trees	Fields
Items	Items (nodes)	Grids
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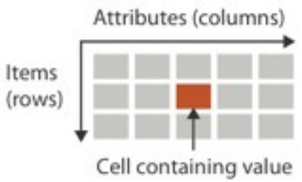

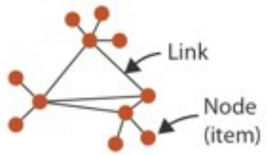

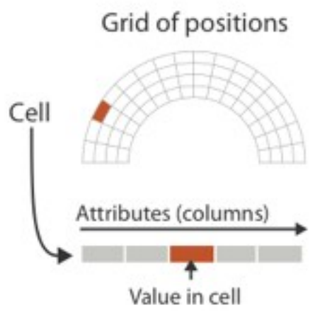

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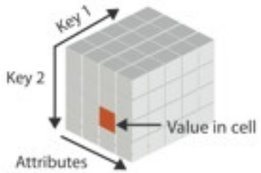

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TOSHIBA


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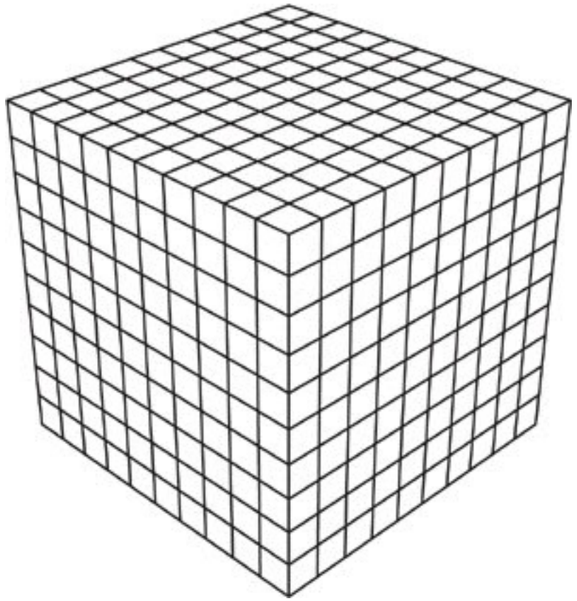
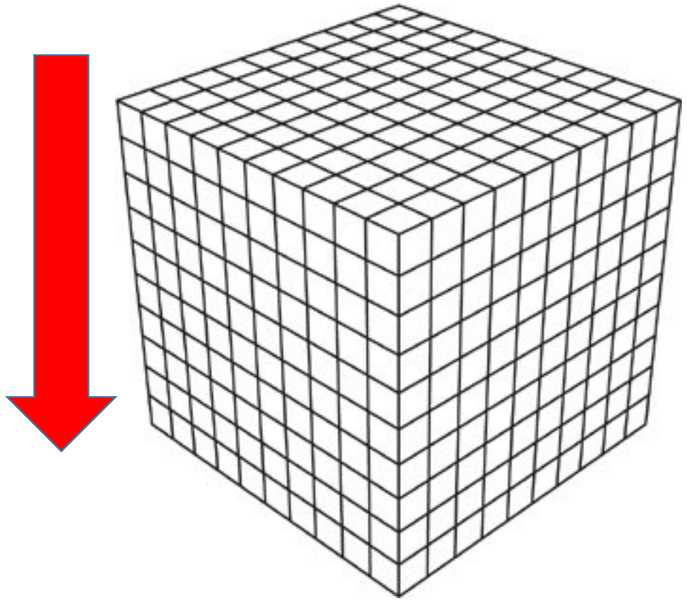
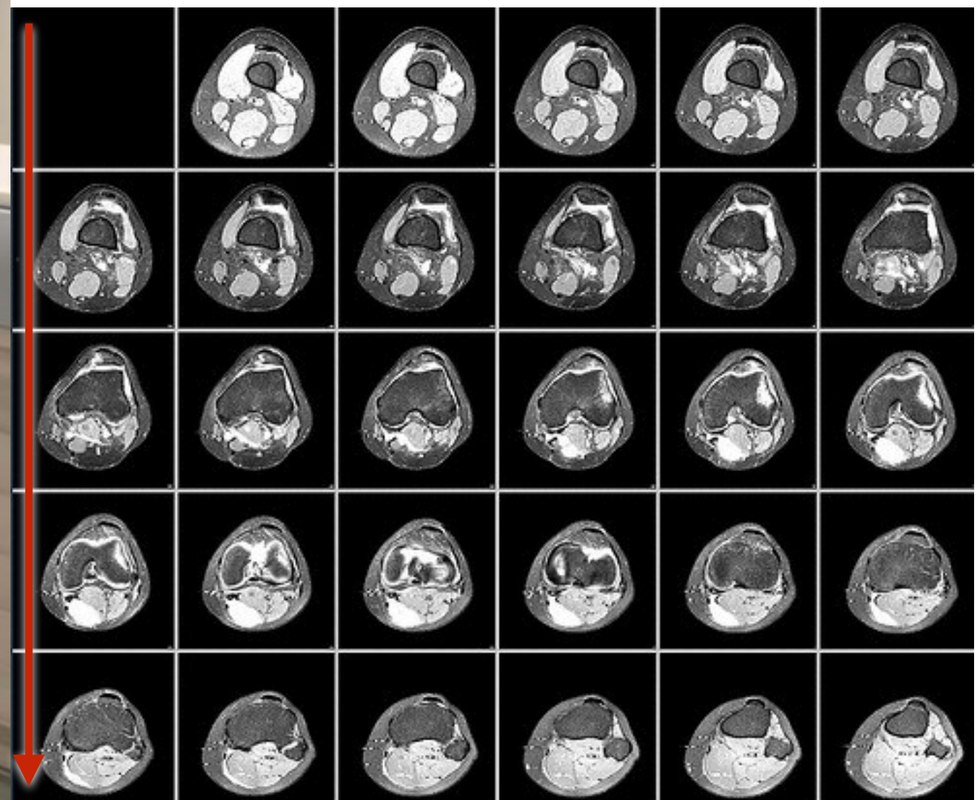
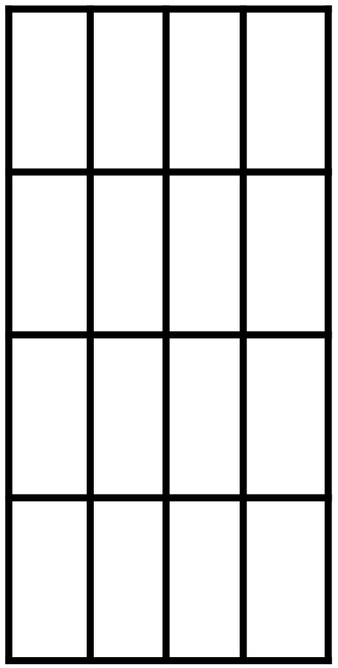



TOSHIBA

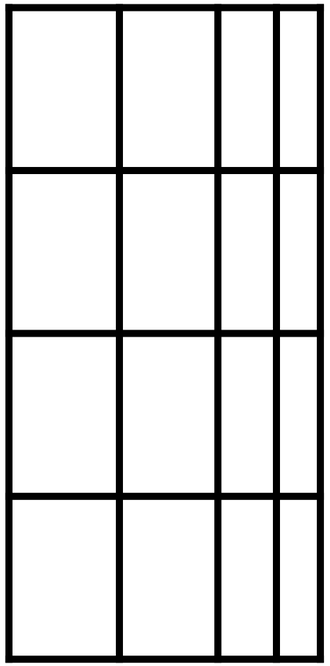




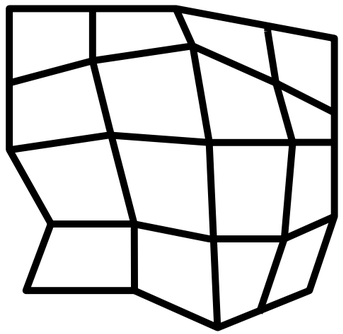
GRID TYPES



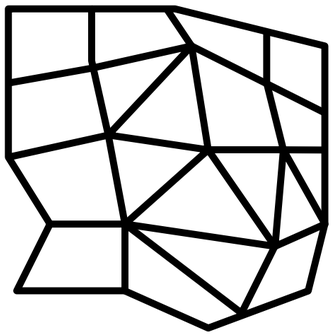
uniform



rectilinear



structured



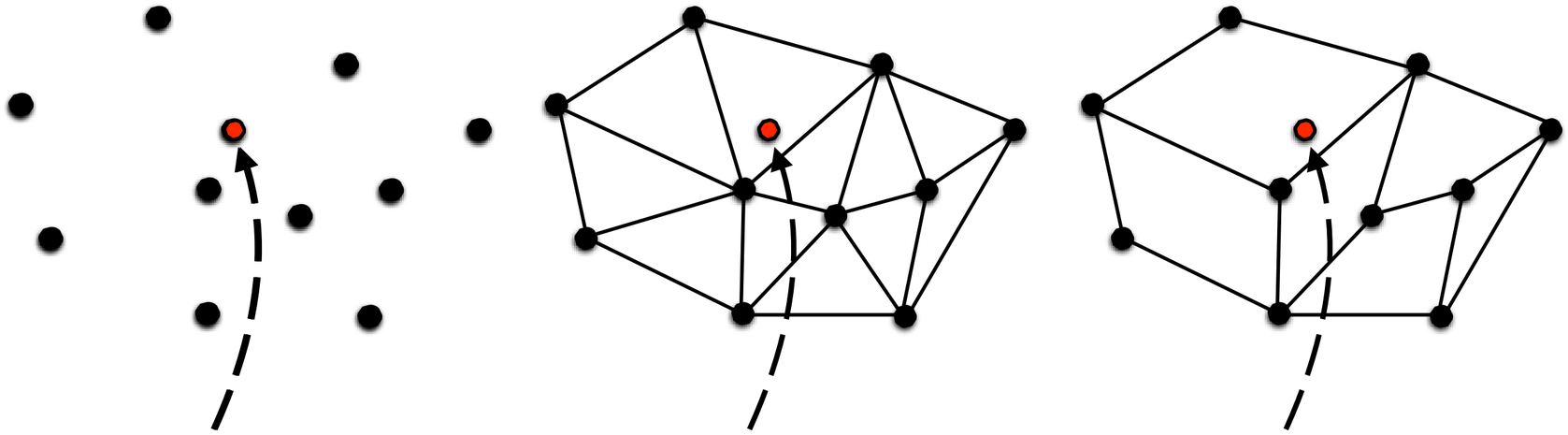
unstructured

GRID CHOICES IMPACT HOW CONTINUOUS DATA IS INTERPRETED

two key considerations:

sampling, or the choice of where attributes are measured

interpolation, or how to model the attributes in the rest of space



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Items	Items (nodes)	Grids
Attributes	Links	Positions
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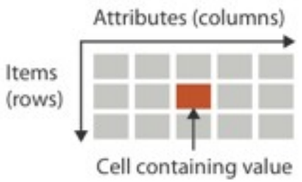

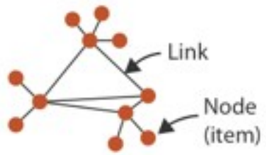

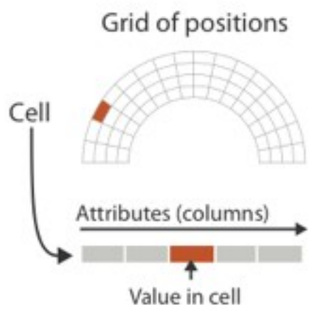

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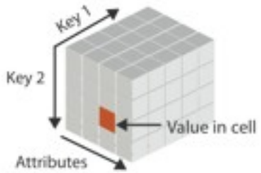

→ *Trees*

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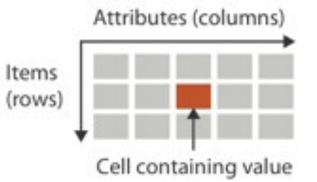

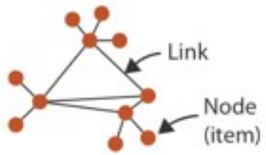

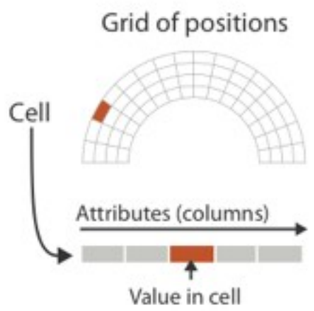

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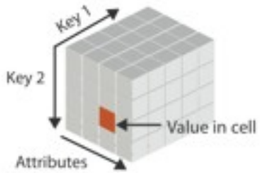
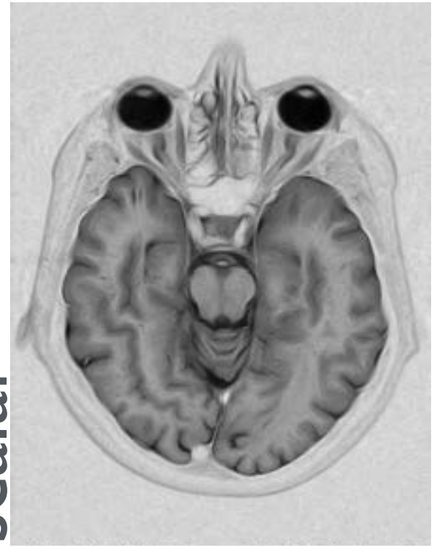


→ *Trees*

scalar



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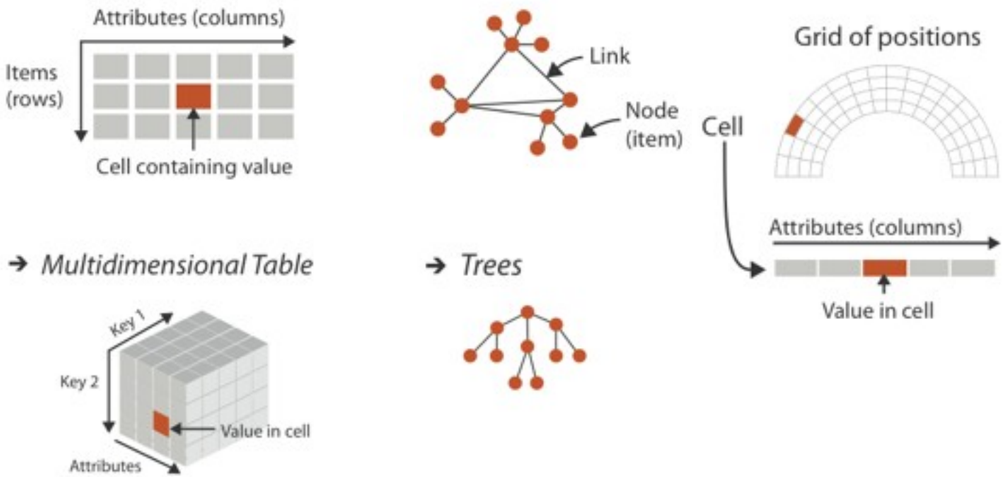

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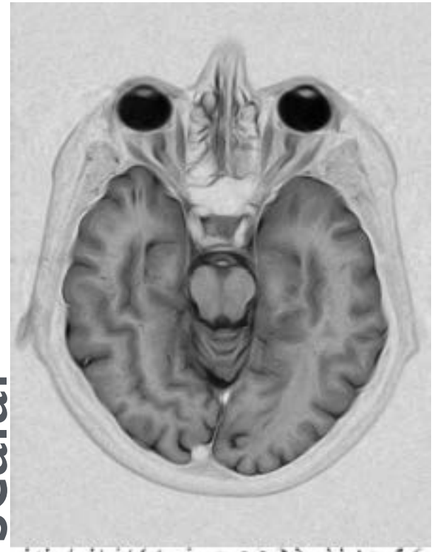

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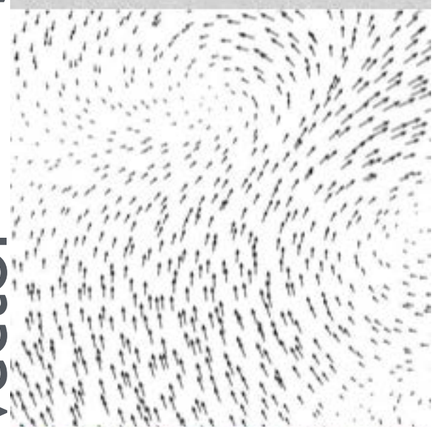

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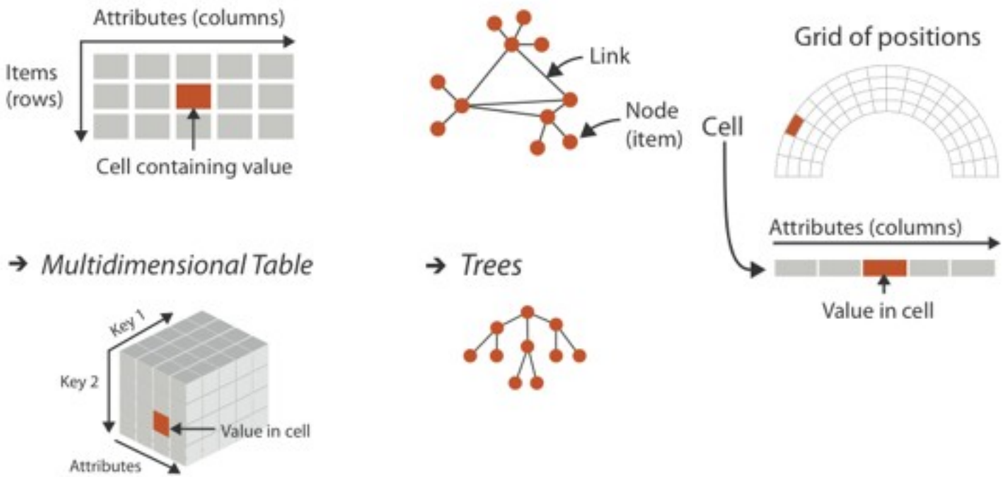
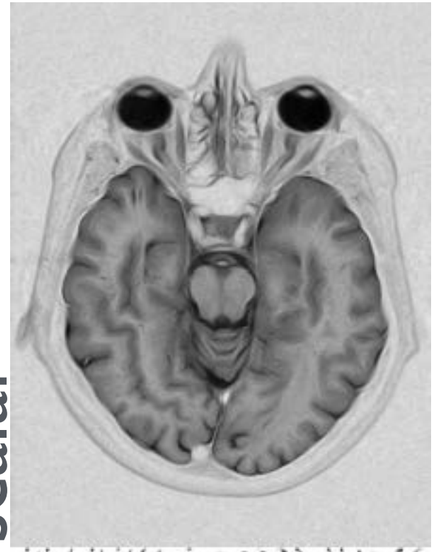
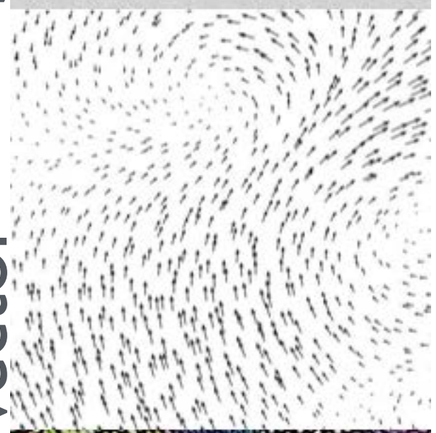


scalar



vector



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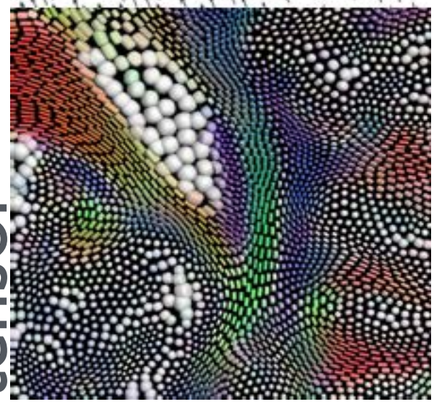
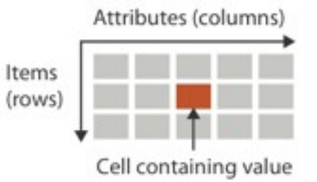


DATASET TYPES

Tables	Networks & Trees	Fields	Geometry
Items	Items (nodes)	Grids	Items
Attributes	Links	Positions	Positions
	Attributes	Attributes	



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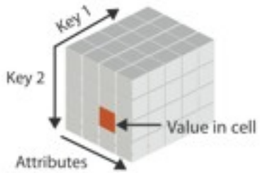

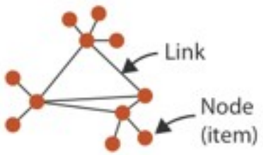

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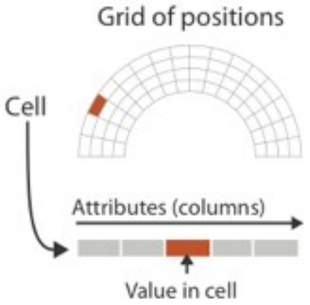
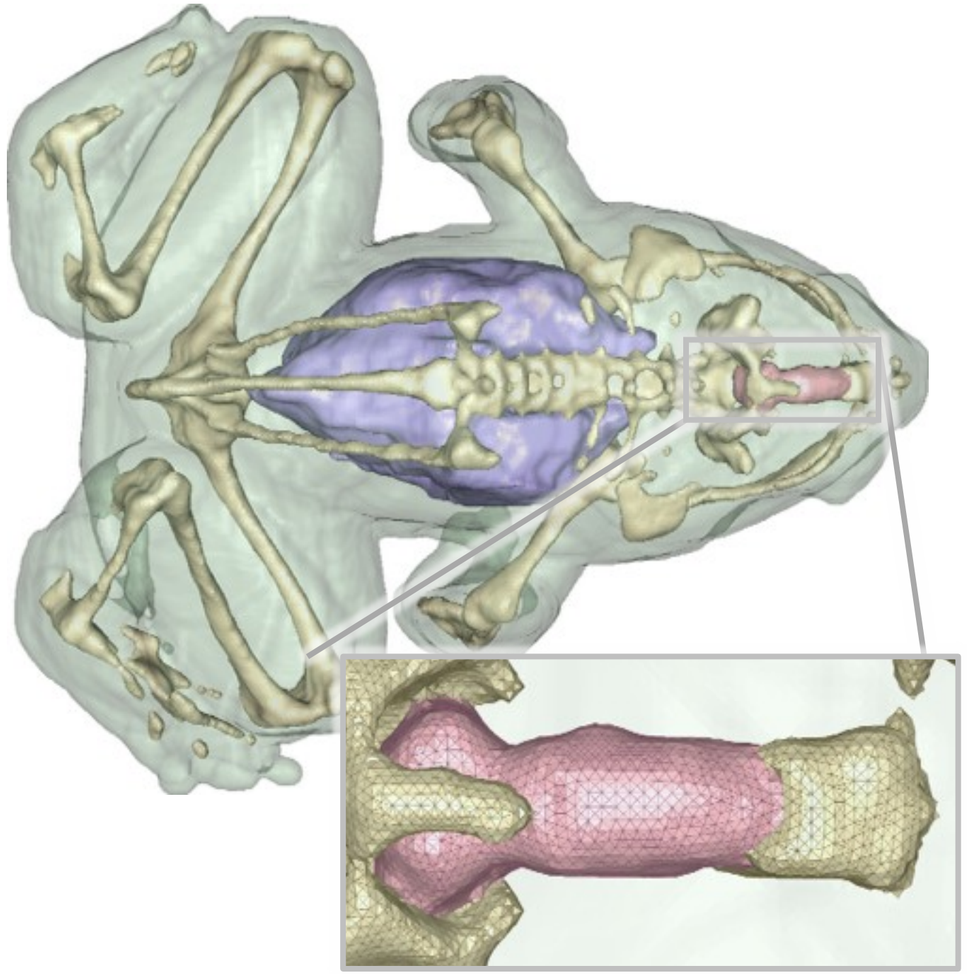
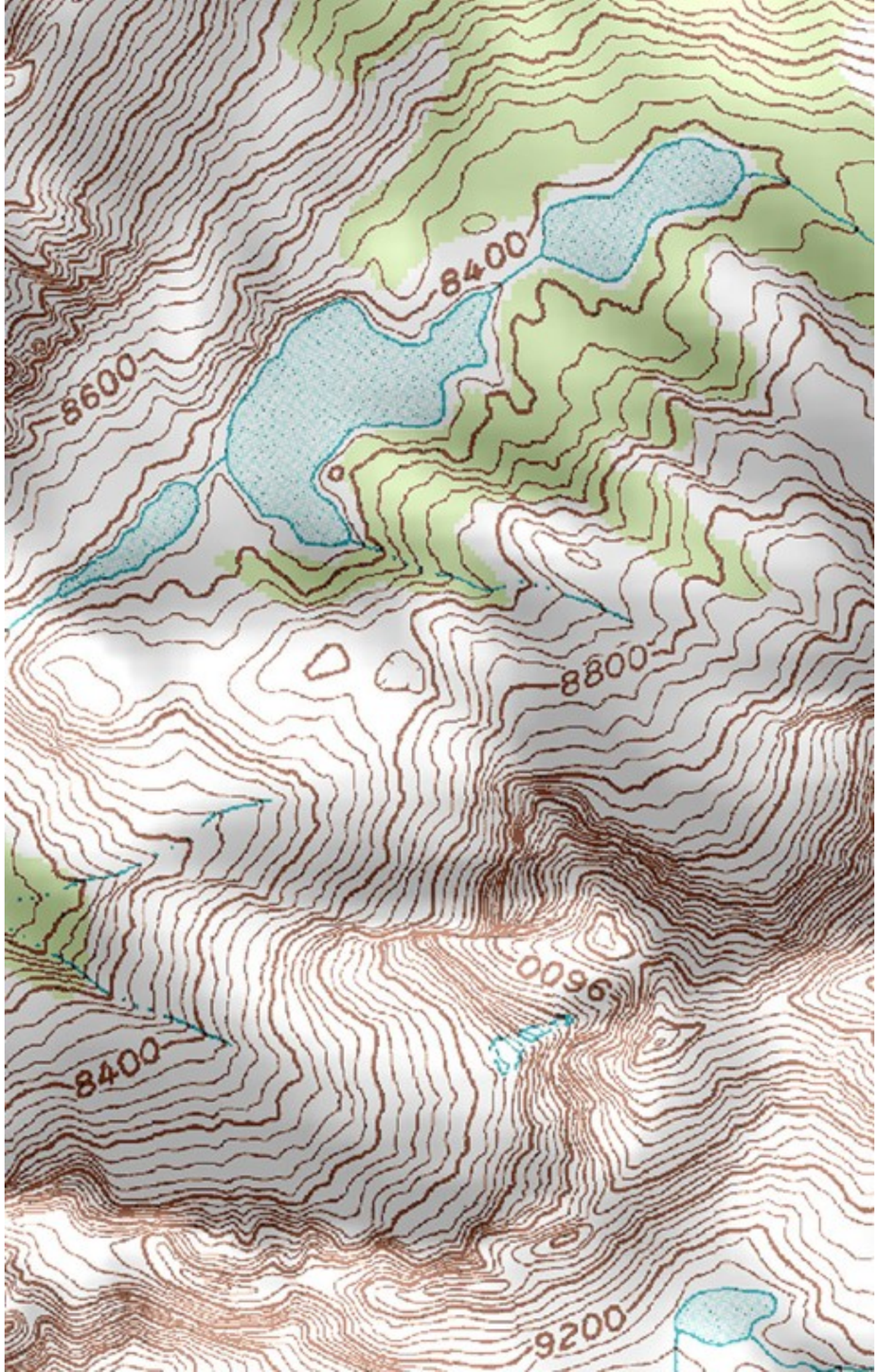
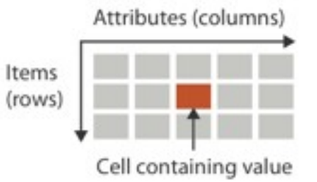





8400
8600
8800
9600
8400
9200

DATASET TYPES

Tables	Networks & Trees	Fields	Geometry	Clusters, Sets, Lists
Items	Items (nodes)	Grids	Items	Items
Attributes	Links	Positions	Positions	
	Attributes	Attributes		



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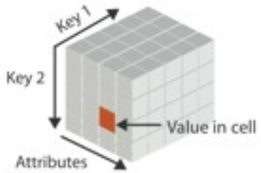

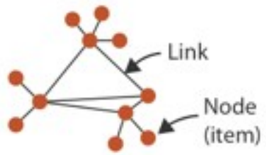

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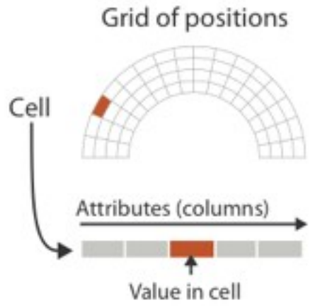

ATTRIBUTE TYPES

Categorical

no implicit ordering

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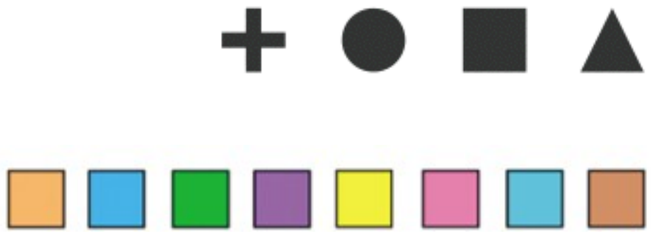
Categorical

no implicit ordering



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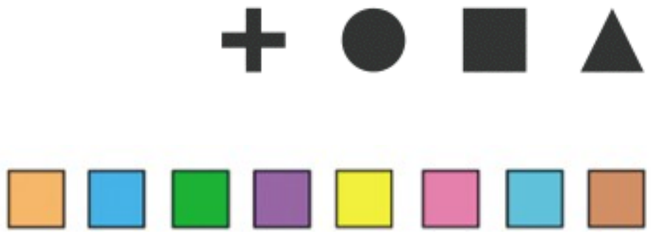
no implicit ordering



Ordered

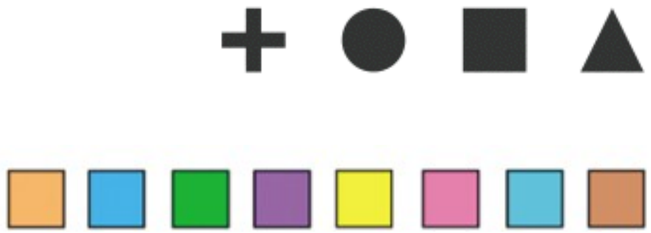
Ordinal

Quantitative

ATTRIBUTE TYPES

Categorical

no implicit ordering



Ordered

Ordinal

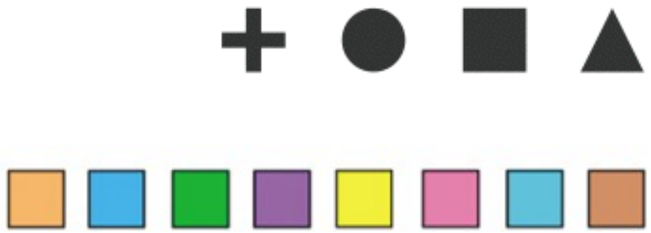
Quantitative

meaningful magnitude
(can do arithmetic)

ATTRIBUTE TYPES

Categorical

no implicit ordering



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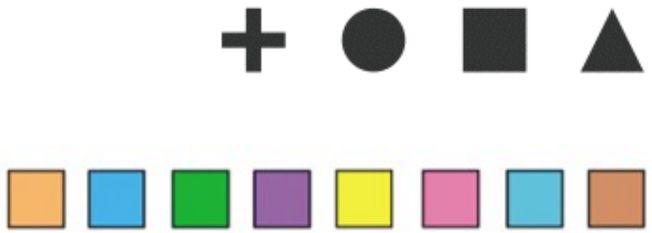

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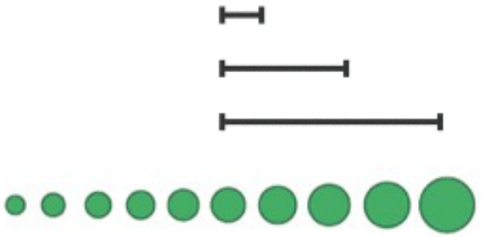
meaningful magnitude
(can do arithmetic)



A	B	C	S	T	U
Order ID	Order Date	Order Priority	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 Specified	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 Specified	Wrap Bag	0.52	10/24/07
35	10/23/07	4-Not Specified	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 Specified	Small Pack	0.44	6/6/05
69	6/4/05	4-Not Spec		0.6	6/6/05
70	12/18/06	5-Low		0.59	12/23/06
70	12/18/06	5-Low		0.82	12/23/06
96	4/17/05	2-High		0.55	4/19/05
97	1/29/06	3-Medium		0.38	1/30/06
129	11/19/08	5-Low		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 Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	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

quantitative
ordinal
categorical

A	B	C	S	T	U
Order ID	Order Date	Order Priority	Product Container	Product Base Margin	Ship Date
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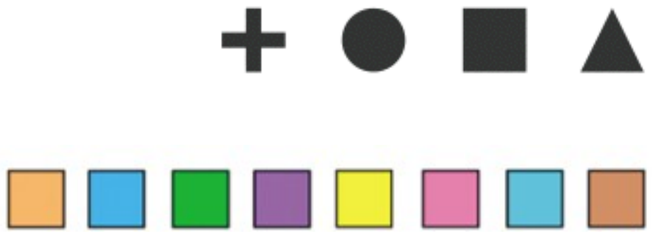
quantitative
ordinal
categorical

ATTRIBUTE TYPES

Categorical

no implicit ordering

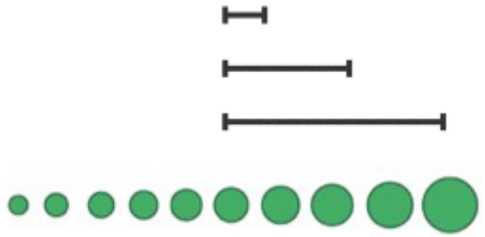


Ordered

Ordinal

Quantitative

meaningful magnitude
(can do arithmetic)



Hierarchical

Sequential

Divergent

Cyclic

DERIVED ATTRIBUTES

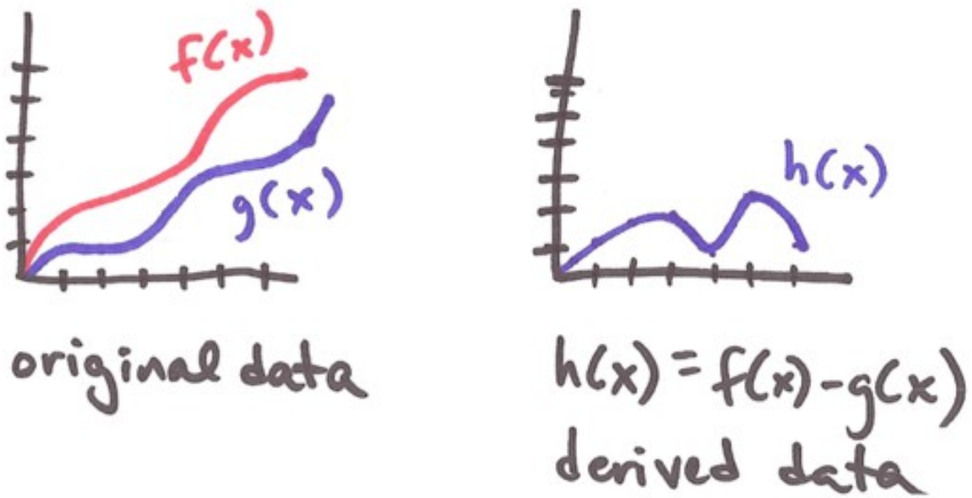
derived attribute: computed from originals

simple change of type

acquire additional data

complex transformation

transformation is abstraction choice



DATA MODEL vs CONCEPTUAL MODEL

data model: mathematical abstraction (data abstraction)

set with operations, e.g. floats with * / - +

conceptual model: mental construction (semantics)

includes semantics, supports reasoning

conceptual model motivates data abstraction choices

EXAMPLE

from data model . . .

- 32.52, 54.06, -17.35, . . . (floats)

using conceptual model . . .

temperature

to new data abstraction…

continuous to 2 significant figures (quantitative)

hot, warm, cold (ordinal)

above freezing, below freezing (categorical)

ABSTRACTION EXERCISE . . .

Projector

Process and Pitfalls in Writing Information Visualization Research Papers

Discuss 1-2 examples of what each paper type from Section 2 might "look like".

Discuss the pitfalls from Section 3. Which might you have been likely to commit before this course?