IAT 814
Visualization

Representation: Design Idioms 1

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These slides borrow heavily from T. Munzner and S. Few, and may be incompletely attributed. Work in progress.

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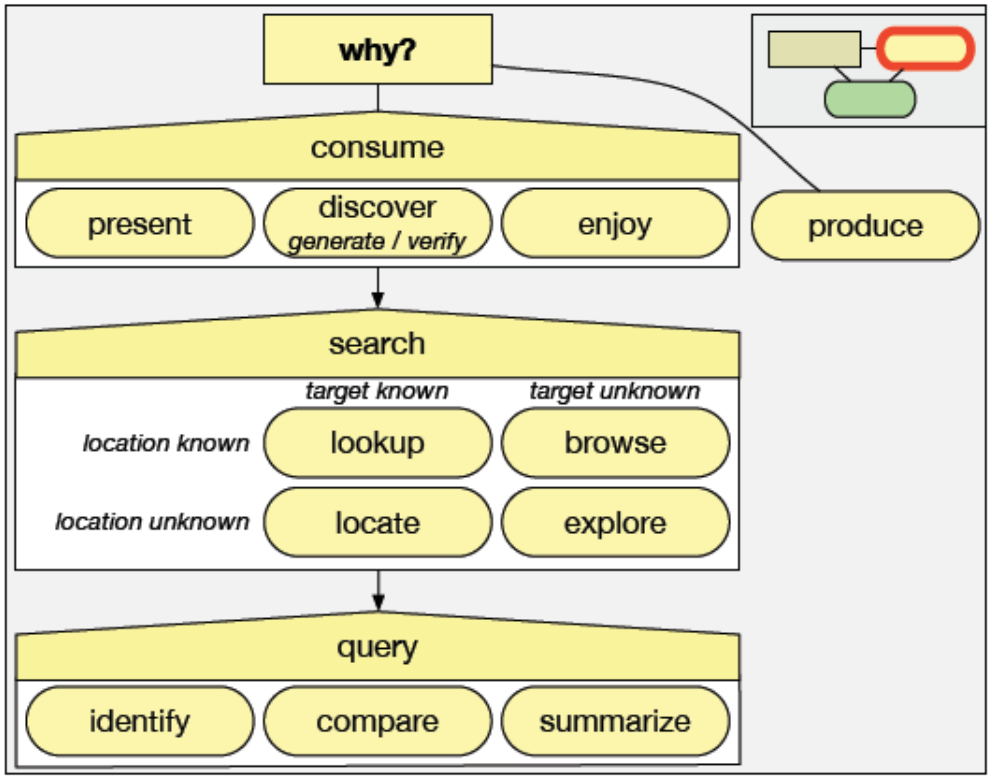
Recall: Data Abstractions

- Tables
  - Data item (row) with attributes (columns) : row=key, cells = values
- Networks
  - Item (node) with attributes (features) and relations (links)
  - Trees (hierarchy)
  - Node = key, node-node, link = key, cell = value
- Text/Logs
  - Grammar
  - Bag of words
  - Derived values
- Image
  - 2d location = key, pixel value expresses single attribute or combo of attributes according to coding (RGB)

Recall: Why


why?
consume
present
discover
generate / verify
enjoy
produce
search
target known
target unknown
location known
lookup
browse
location unknown
locate
explore
query
identify
compare
summarize

Vis tasks and targets [Munzner]

User Tasks (why)

- Amar & Stasko created a taxonomy of user tasks in visualization environments
- 10 basic actions
- Retrieve Value, Filter, Compute Derived Value, Find Extremum, Sort, Determine Range, Characterize Distribution, Find Anomalies, Cluster, Correlate

1. Retrieve Value

- General Description:
  - Given a set of specific items, find attributes-related values of those items.

- Examples:
  - What is the mileage per gallon of the Audi TT?
  - How long is the movie Gone with the Wind?

2. Filter

- General Description:
  - Given some concrete conditions on attribute values, find data cases satisfying those conditions.

- Examples:
  - What Kellogg's cereals have high fiber?
  - What comedies have won awards?
  - Which funds underperformed the S&P-500?

3. Compute Derived Value

- General Description:
  - Given a set of data cases, compute an aggregate numeric representation of those data cases.

- Examples:
  - What is the gross income of all stores combined?
  - How many manufacturers of cars are there?
  - What is the average calorie content of Post cereals?

4. Find Extreme

- General Description:
  - Find data cases possessing an extreme value of an attribute over its range within the data set.

- Examples:
  - What is the car with the highest MPG?
  - What director/film has won the most awards?
  - Which national hockey team has won the most Olympic Gold medals since 1912?

5. Sort/Order

- General Description:
  - Given a set of data cases, rank them according to some ordinal metric.

- Examples:
  - Order the cars by weight.
  - Rank the cereals by calories.

6. Determine Range

- General Description:
  - Given a set of data cases and an attribute of interest, find the span of values within the set.

- Examples:
  - What is the range of film lengths?
  - What is the range of car horsepowers?
  - What actresses are in the data set?

7. Characterize Distribution

- General Description:
  - Given a set of data cases and a quantitative attribute of interest, characterize the distribution of that attribute values over the set.

- Examples:
  - What is the distribution of carbohydrates in cereals?
  - What is the age distribution of shoppers?

7a. Part-whole

- General Description:
  - Given a set of data items that differ in values in one category, reveal the portion that each value represents to some whole.

- Examples:
  - How many Conservatives are women?
  - How do our tax dollars get spent?
  - What is the recommended daily caloric intake across food types for pregnant women?

8. Find Anomalies

- General Description:
  - Identify any anomalies within a given set of data cases with respect to a given relationship or expectation, e.g. statistical outliers.

- Examples:
  - Are there any cereals that have high calories but low sugar?
  - Are there exceptions to the **relationship** between horsepower and acceleration?

9. Cluster

- General Description:
  - Given a set of data cases, find clusters of similar attribute values.
  - Note: you need to determine what “similar” is

- Examples:
  - Are there groups of cereals w/ similar fat/calories/sugar?
  - Are all comedies the same length?

10. Correlate

- General Description:
  - Given a set of data cases and two attributes, determine useful relationships between the values of those attributes.

- Examples:
  - Is there a correlation between carbohydrates and fat?
  - Is there a correlation between country of origin and MPG?
  - Do different genders have a preferred payment method?
  - Is there a trend of increasing film length over the years?

Discussion: Compound Tasks

- “Sort the cereal manufacturers by average fat content”
  - Compute derived value; Sort
- “Which actors have co-starred with Julia Roberts?”
  - Filter; Retrieve value

- “What’s the variation in cereal sugar content”?
  - Compute derived value; determine range; characterise distribution

What was left out? Aha analytics!

- Basic math
  - “Which cereal has more sugar, Cheerios or Special K?”
  - “Compare the average MPG of American and Japanese cars.”
- Uncertain criteria
  - “Does cereal (X, Y, Z…) sound tasty?”
  - “What are the characteristics of the most valued customers?”
- Higher-level tasks
  - “How do mutual funds get rated?”
  - “Are there car aspects that Toyota has concentrated on?”
- More qualitative comparison
  - “How does the Toyota RAV4 compare to the Honda CRV?”
  - “What other cereals are most similar to Trix?”

Fundamental principles: how

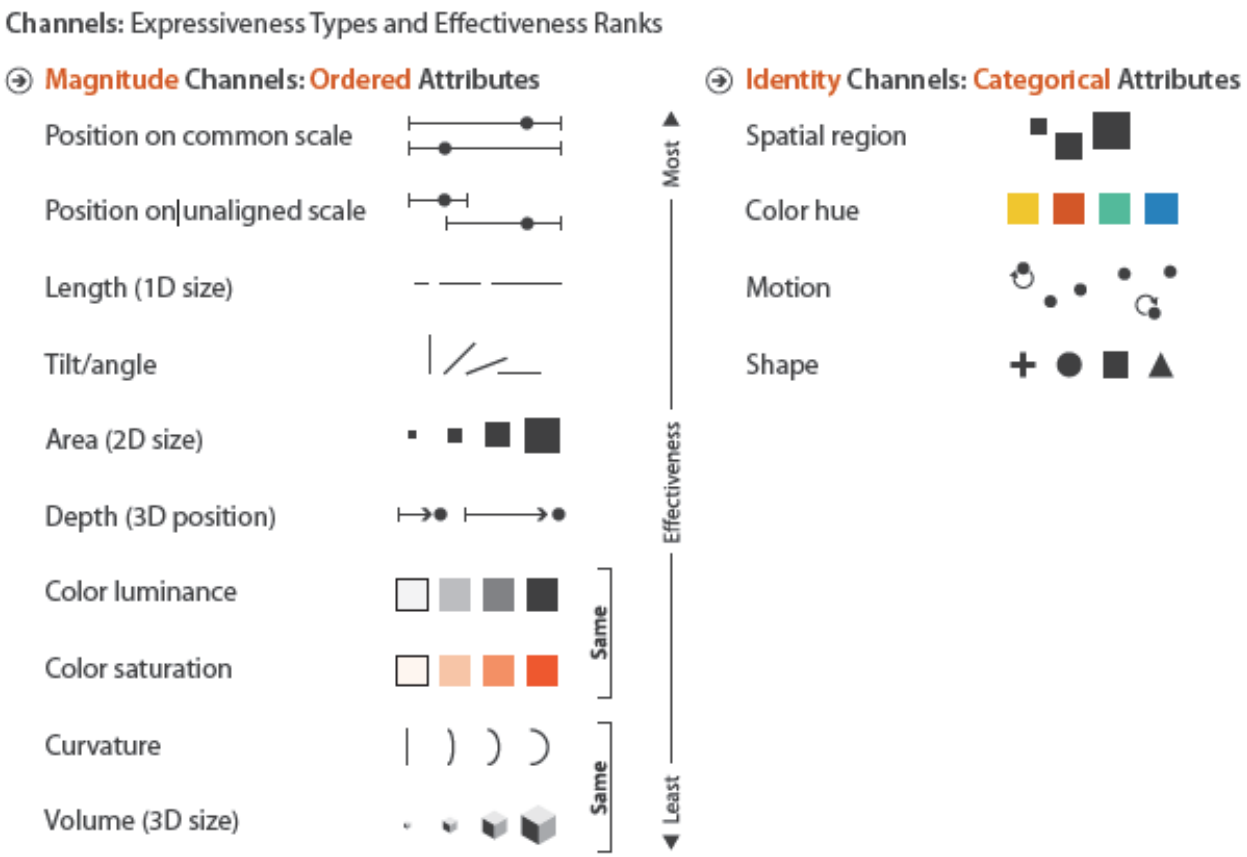
Expressiveness:

- the visual encoding should express all of, and **only**, the information in the dataset attributes

Effectiveness:

- the **importance** of the attribute should match the **salience** of the channel.
- Use the strongest and most accurate channels for the most important interpretation tasks (data)

Recall How version 1: Channel Expressiveness and Effectiveness



Roadmap so far

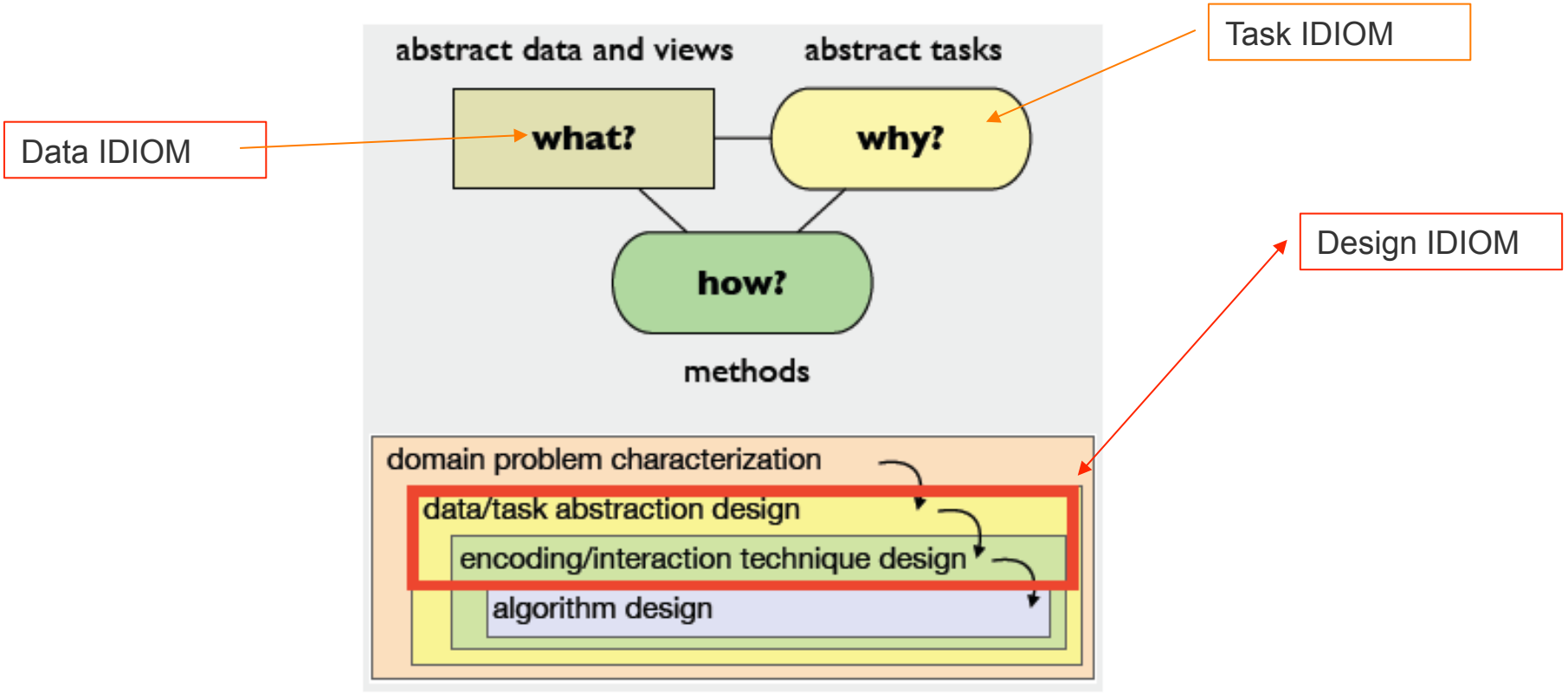
Part 1: principles

- Data
- Perception
- Visual encoding
- (interaction to come later)

Part 2: Methods (How v2!)

- What defines the design space?
- Taxonomy of design considerations
- How many views?
- How to reduce

A Framework for Analysis (Munzner)



- A visualisation **idiom** is a distinct approach to creating and manipulating visual representations.
  - Data: the types and hierarchical salience of the information to represent
  - Design: the visual encoding and organisation choices
  - Interaction: the methods to man

From dat

ID	Sepal Length	Sepal Width	Petal Length	Petal Width	Species
14	4.3	3	1.1	0.1	setosa
39	4.4	3	1.3	0.2	setosa
43	4.4	3.2	1.3	0.2	setosa
9	4.4	2.9	1.4	0.2	setosa
42	4.5	2.3	1.3	0.3	setosa
23	4.6	3.6	1	0.2	setosa
48	4.6	3.2	1.4	0.2	setosa
4	4.6	3.1	1.5	0.2	setosa
7	4.6	3.4	1.4	0.3	setosa
3	4.7	3.2	1.3	0.2	setosa
30	4.7	3.2	1.6	0.2	setosa
13	4.8	3	1.4	0.1	setosa
12	4.8	3.4	1.6	0.2	setosa
31	4.8	3.1	1.6	0.2	setosa
25	4.8	3.4	1.9	0.2	setosa
46	4.8	3	1.4	0.3	setosa
38	4.9	3.6	1.4	0.1	setosa
10	4.9	3.1	1.5	0.1	setosa
2	4.9	3	1.4	0.2	setosa
35	4.9	3.1	1.5	0.2	setosa
58	4.9	2.4	3.3	1	versicolor
107	4.9	2.5	4.5	1.7	virginica
36	5	3.2	1.2	0.2	setosa
5	5	3.6	1.4	0.2	setosa
50	5	3.3	1.4	0.2	setosa

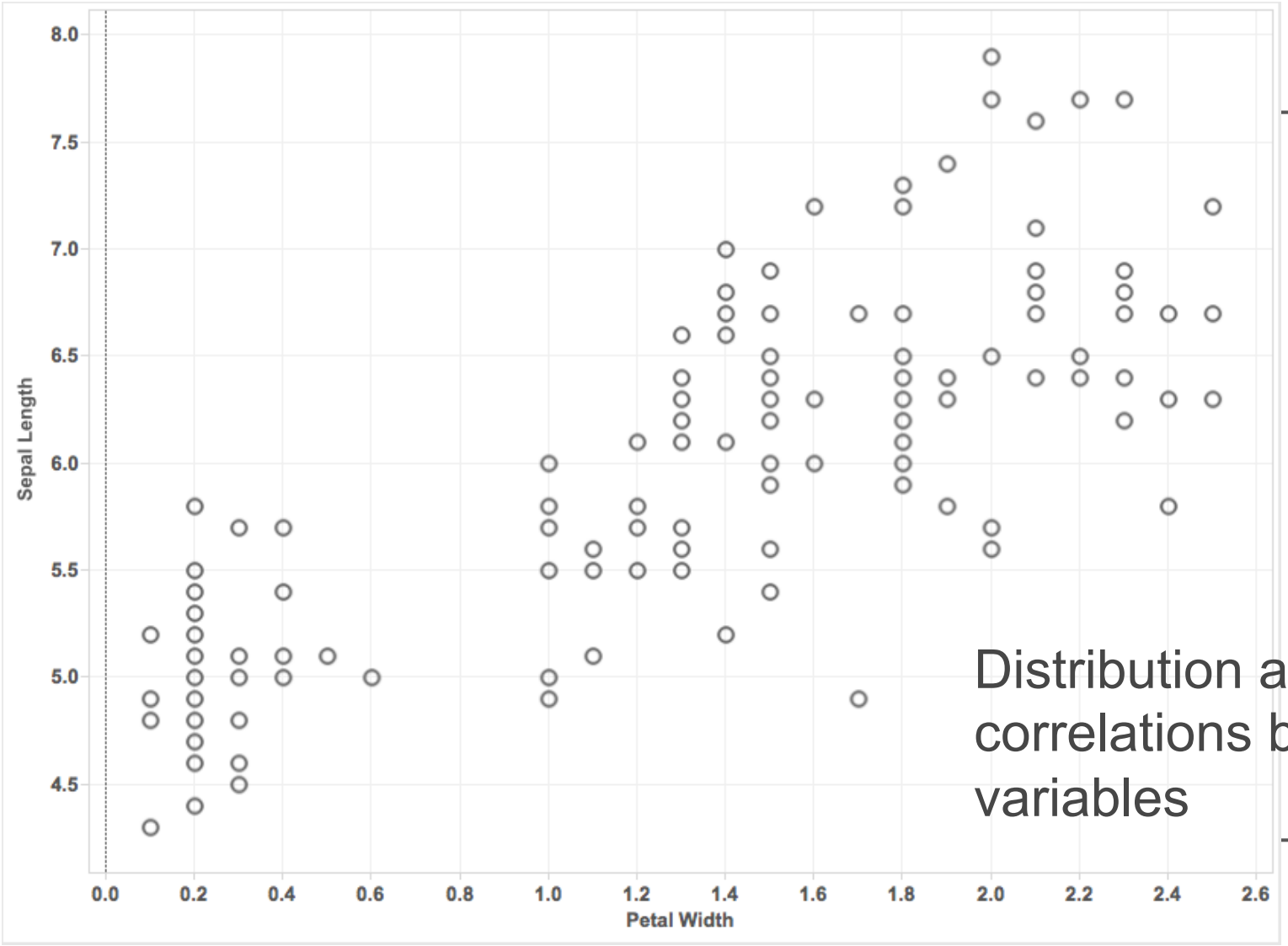
Q

O

N

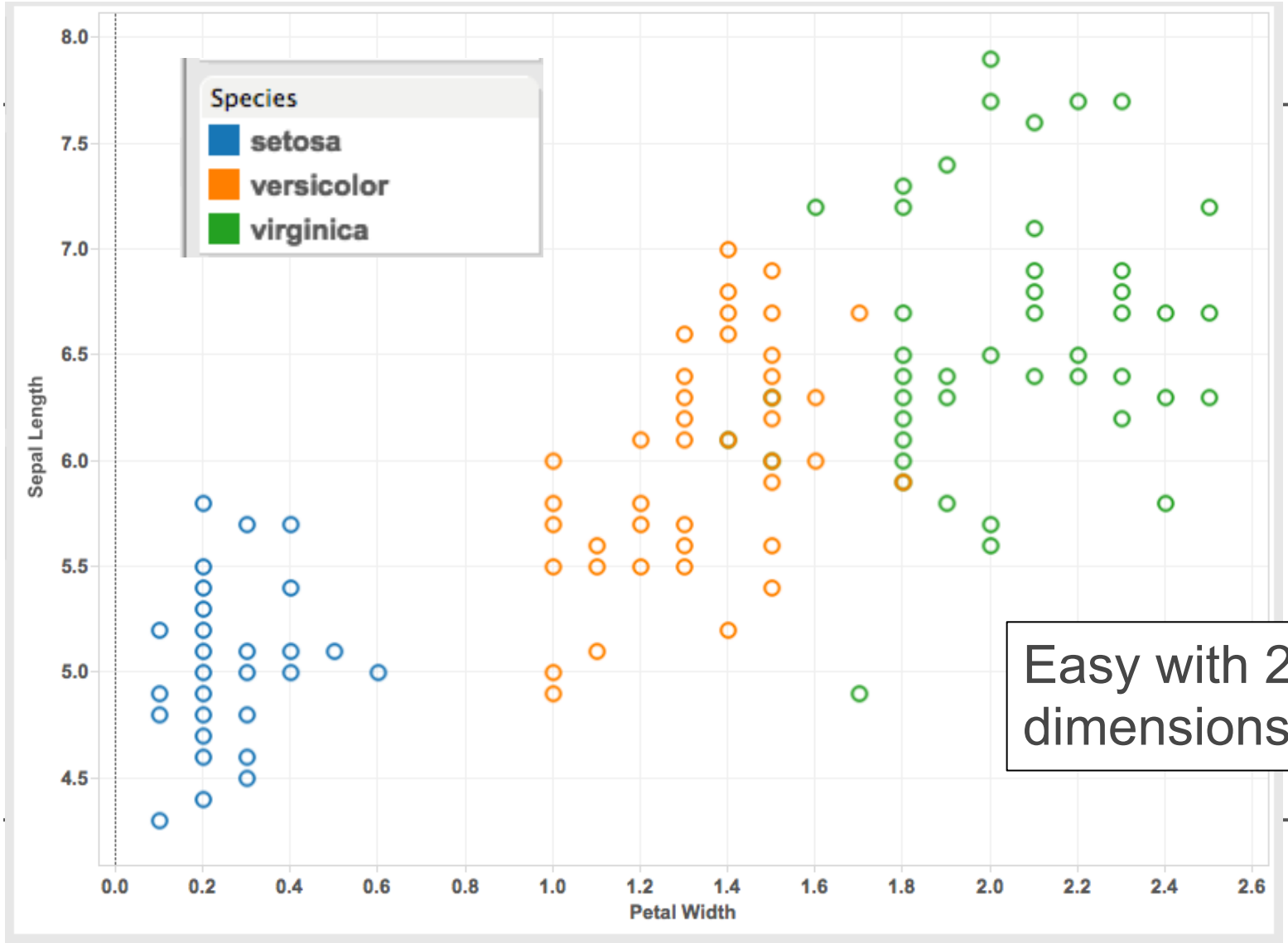
Sepia and petal length for three species of iris [Fisher 1936]

Possible views – scatter plot – why?

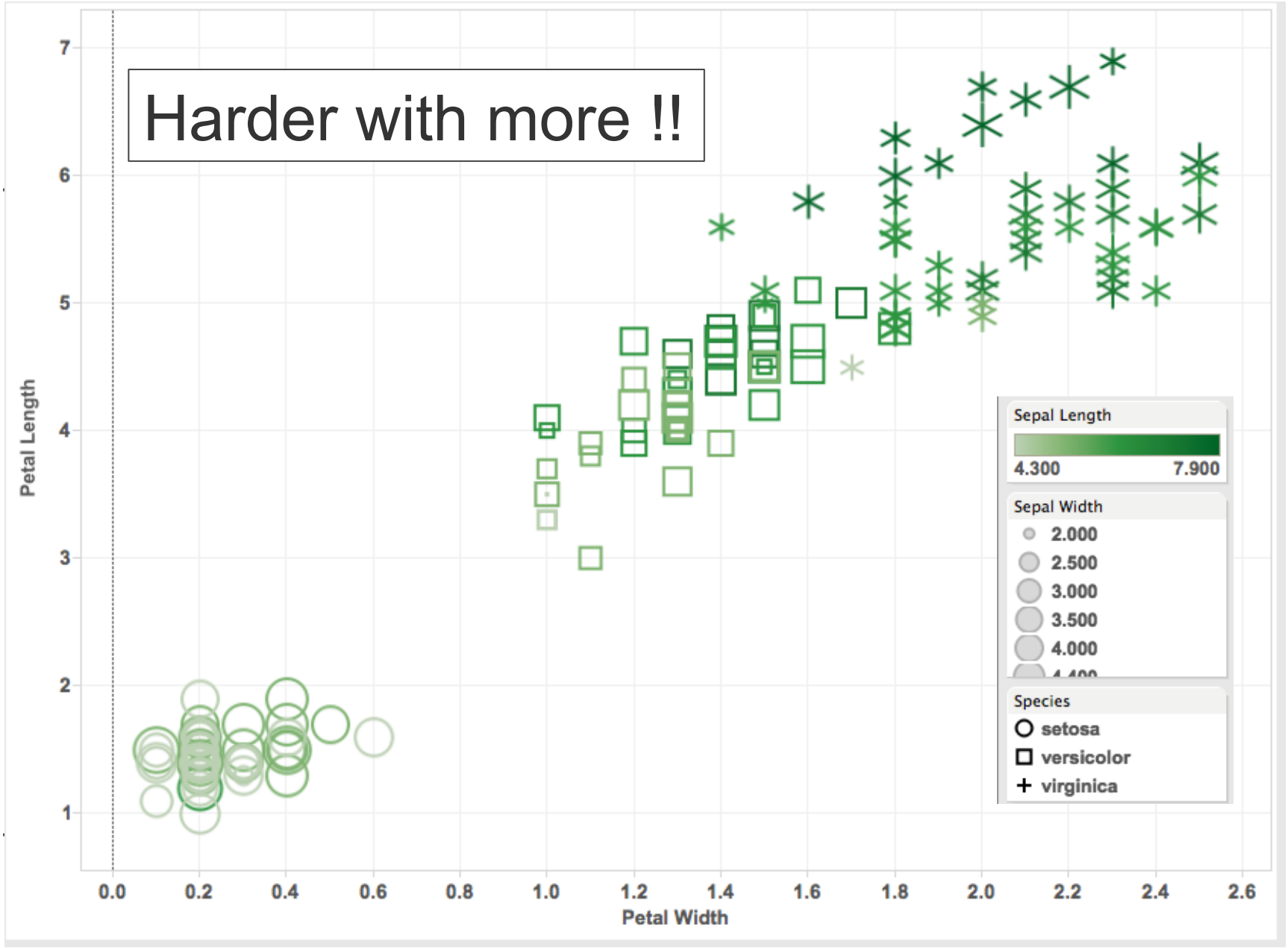


Distribution and correlations between variables

Possible views – scatter plot – why?



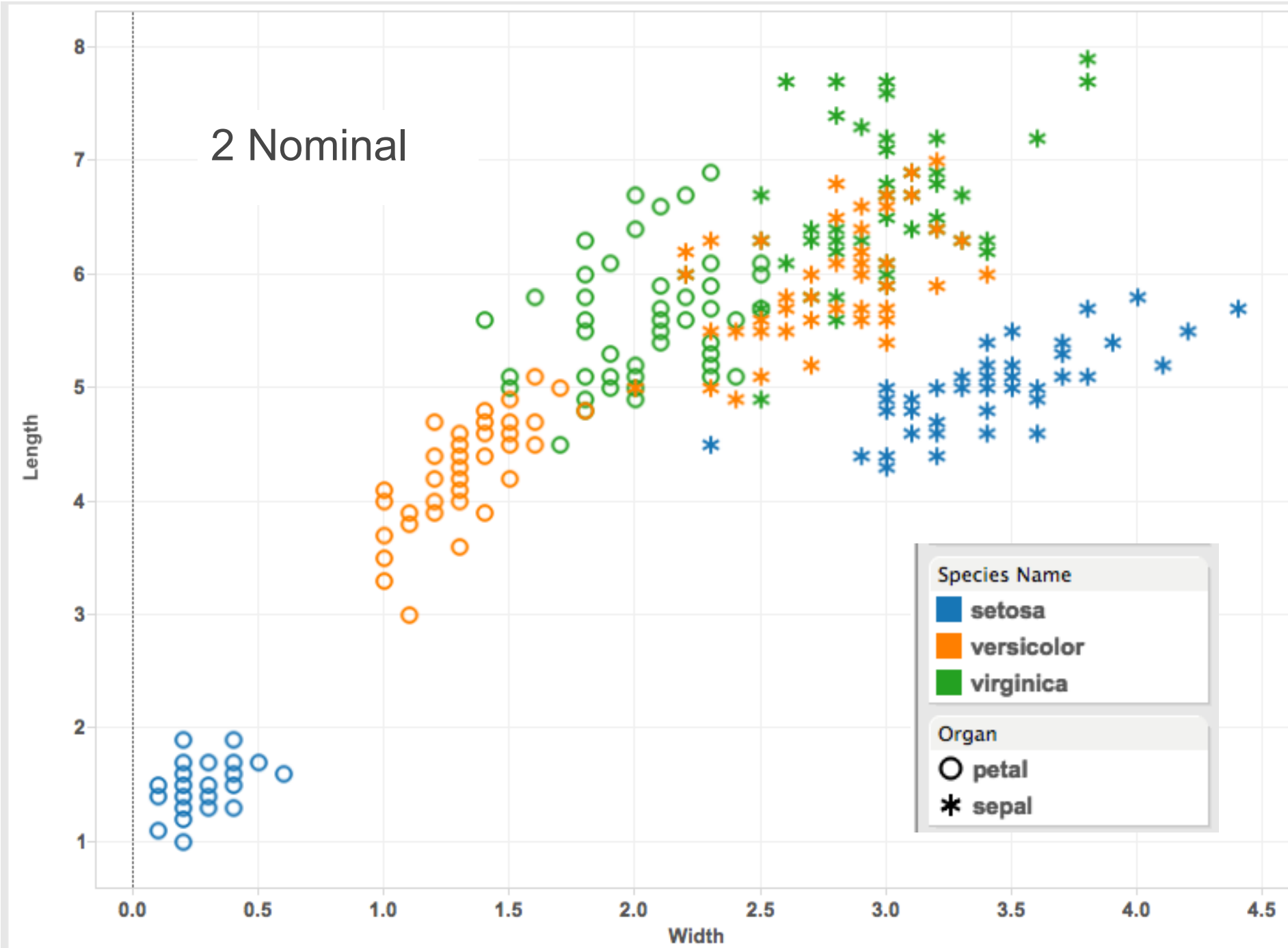
Easy with 2/3 dimensions

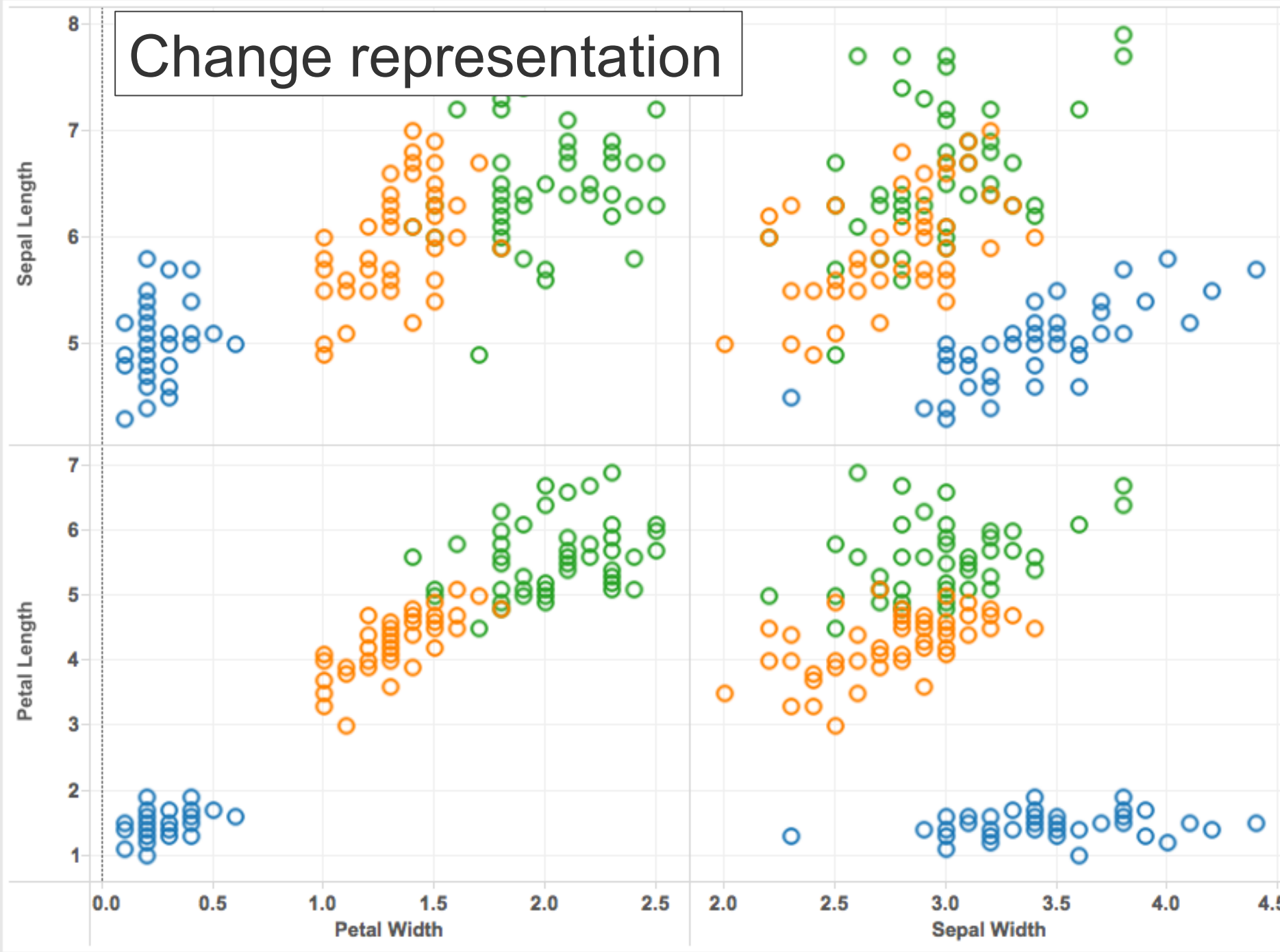

Harder with more !!
Petal Length
Petal Width
7
6
5
4
3
2
1
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
Sepal Length
4.300
7.900
Sepal Width
2.000
2.500
3.000
3.500
4.000
Species
setosa
versicolor
virginica

We can remodel the data

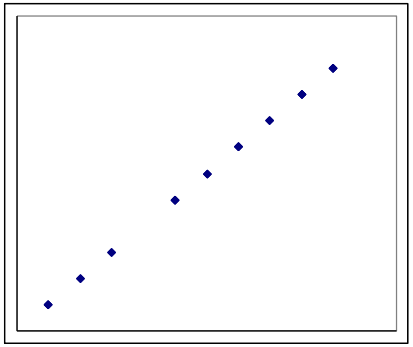
ID	Species No	Organ	Length	Width	Species Nam
1	1.1	sepal	5.1	3.5	setosa
2	1.1	sepal	4.9	3	setosa
3	1.1	sepal	4.7	3.2	setosa
4	1.1	sepal	4.6	3.1	setosa
5	1.1	sepal	5	3.6	setosa
6	1.1	sepal	5.4	3.9	setosa
7	1.1	sepal	4.6	3.4	setosa
8	1.1	sepal	5	3.4	setosa
9	1.1	sepal	4.4	2.9	setosa
10	1.1	sepal	4.9	3.1	setosa
11	1.1	sepal	5.4	3.7	setosa
12	1.1	sepal	4.8	3.4	setosa
13	1.1	sepal	4.8	3	setosa
14	1.1	sepal	4.3	3	setosa
15	1.1	sepal	5.8	4	setosa
16	1.1	sepal	5.7	4.4	setosa
17	1.1	sepal	5.4	3.9	setosa
	1.1	sepal	5.1	3.5	setosa
	1.1	sepal	5.7	3.8	setosa
	1.1	sepal	5.1	3.8	setosa
21	1.1	sepal	5.4	3.4	setosa
22	1.1	sepal	5.1	3.7	setosa
23	1.1	sepal	4.6	3.6	setosa
24	1.1	sepal	5.1	3.3	setosa
25	1.1	sepal	4.8	3.4	setosa

- Add abstraction

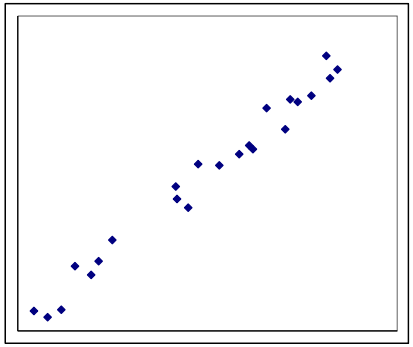

2 Nominal
Length
Width
8
7
6
5
4
3
2
1
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Species Name
setosa
versicolor
virginica
Organ
petal
sepal


Change representation
Sepal Length
Petal Length
Petal Width
Sepal Width
8
7
6
5
4
3
2
1
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

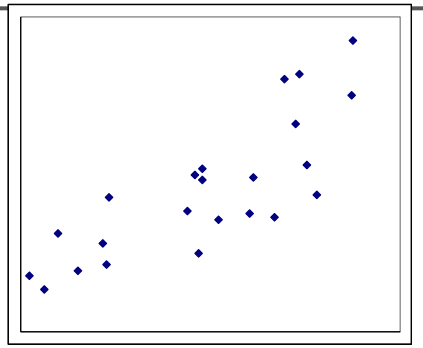
Scatter plots show correlations



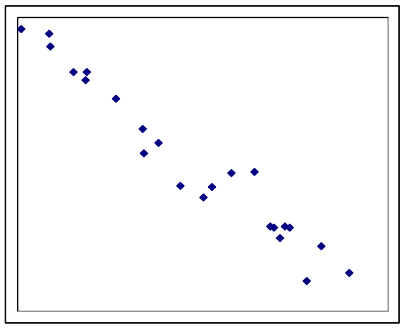
Perfect positive : r=1



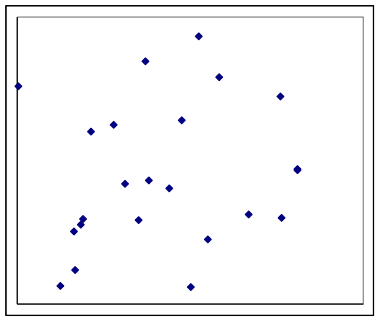
Strong positive : r=0.97



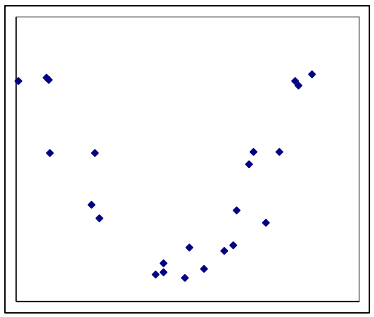
positive : r=0.8



Strong negative : r=10.98



No correlation: r = 0.16

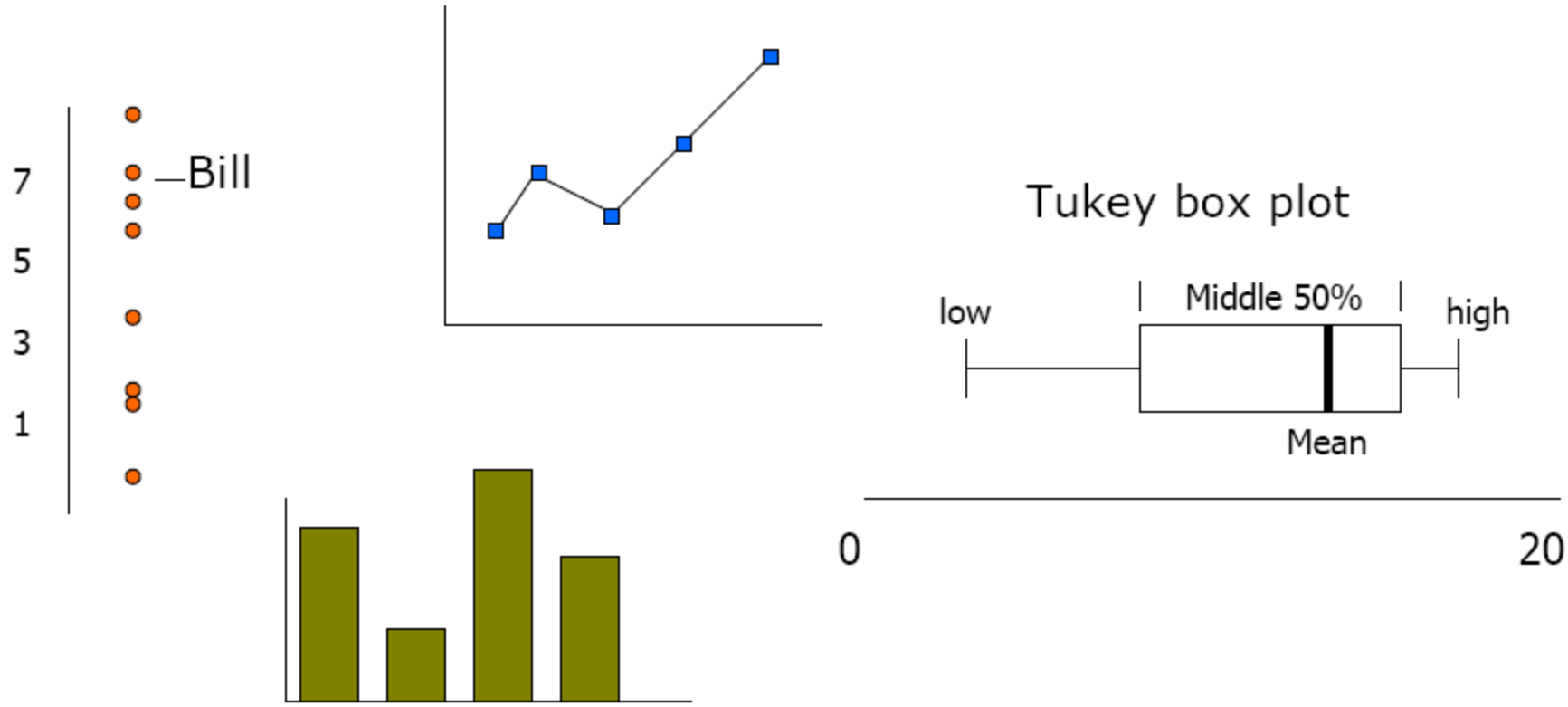


Nonlinear correlation

However …

- Scatter plots can be difficult to understand
- What alternatives are there?
- More generally, what kinds of techniques are best for what kinds of problems?

Common 2D design idioms



Design choices for tabular data

Tabular data are Key→Value vectors.

- Key/Attribute: property of the data that can be used to index into (sort by/look up) the set. (independent variable)
  - **N, O**
- Value : the actual value of an individual item
  - **N,O,Q,**

Credit: T. Munzner, 2014

If all you want is a single precise value ….

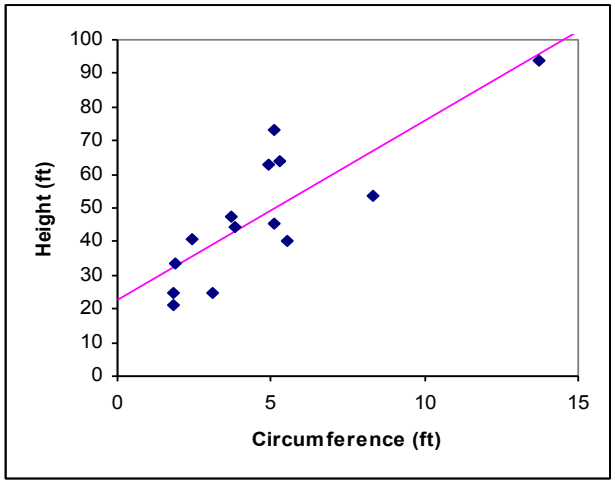
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1990	127.4	128.0	128.7	128.9	129.2	129.9	130.4	131.6	132.7	133.5	133.8	133.8	130.7
1991	134.6	134.8	135.0	135.2	135.6	136.0	136.2	136.6	137.2	137.4	137.8	137.9	136.2
1992	138.1	138.6	139.3	139.5	139.7	140.2	140.5	140.9	141.3	141.8	142.0	141.9	140.3
1993	142.6	143.1	143.6	144.0	144.2	144.4	144.4	144.8	145.1	145.7	145.8	145.8	144.5
1994	146.2	146.7	147.2	147.4	147.5	148.0	148.4	149.0	149.4	149.5	149.7	149.7	148.2
1995	150.3	150.9	151.4	151.9	152.2	152.5	152.5	152.9	153.2	153.7	153.6	153.5	152.4
1996	154.4	154.9	155.7	156.3	156.6	156.7	157.0	157.3	157.8	158.3	158.6	158.6	156.9
1997	159.1	159.6	160.0	160.2	160.1	160.3	160.5	160.8	161.2	161.6	161.5	161.3	160.5
1998	161.6	161.9	162.2	162.5	162.8	163.0	163.2	163.4	163.6	164.0	164.0	163.9	163.0
1999	164.3	164.5	165.0	166.2	166.2	166.2	166.7	167.1	167.9	168.2	168.3	168.3	166.6
2000	168.8	169.8	171.2	171.3	171.5	172.4	172.8	172.8	173.7	174.0	174.1	174.0	172.2
2001	175.1	175.8	176.2	176.9	177.7	178.0	177.5	177.5	178.3	177.7	177.4	176.7	177.1
2002	177.1	177.8	178.8	179.8	179.8	179.9	180.1	180.7	181.0	181.3	181.3	180.9	179.9

The first question: Table or graph? []

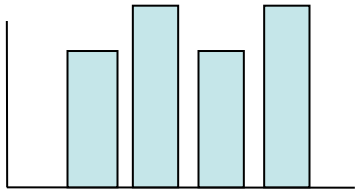
- Will the data be used to look up and compare individual values, or will the data need to be precise? If so, you should display it in a table.
- Is the message contained in the shape of the data—in trends, patterns, exceptions, or comparisons that involve more than a few values? If so, you should display it in a graph.
- NOTE: (You can use both. Next time and beyond).

Key-value question defines idiom choice (1)
[Munzner]

- 2values



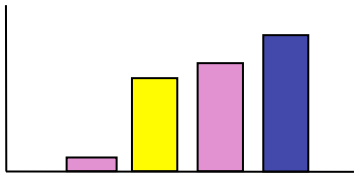
- 1 Key and 1 value



1

- 2 Keys and 1 value

2



Compared to what defines choice (2) [Few]

S. Few, Effectively Communicating Numbers:Selecting the Best Means and Manner of Display

7 interesting relationships

1. Time Series
   - Quantitative across equal intervals (of time)
2. Ranking
   - Sequenced by size of attribute value
3. Part-Whole
   - portion that each value represents to some whole,
4. Deviation
   - Differ from reference (baseline)
5. Distribution
6. Correlation
   - How one value affects another
7. Nominal
   - Simple categorical

The Power of Space

Categorical

What/where

Planar position

Hue

Shape

Stipple/texture

Relational/Same category

Grouping

Containment (2D)

Connection

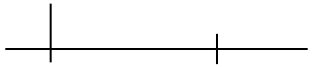
Similarity (other channels)

Proximity (position)

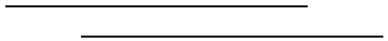
Ordered/Quantitiative

How Much

Position common scale



Position unaligned scale



Length

Tilt/angle

Area

Curvature

Lightness

Saturation

Texture

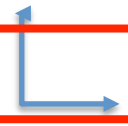
density

The Power of Space

Categorical

What/where

Planar position



Hue

Shape

Stipple/texture

Relational/Same category

Grouping

Containment (2D)

Connection

Similarity (other channels)

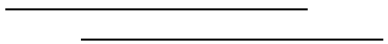
Proximity (position)

Ordered/Quantitiative

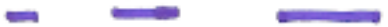
How Much

Position common scale

Position unaligned scale



Length



Tilt/angle

Area

Curvature

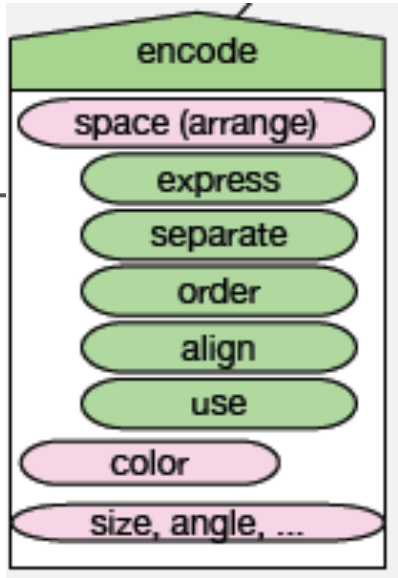
Lightness

Saturation

Texture

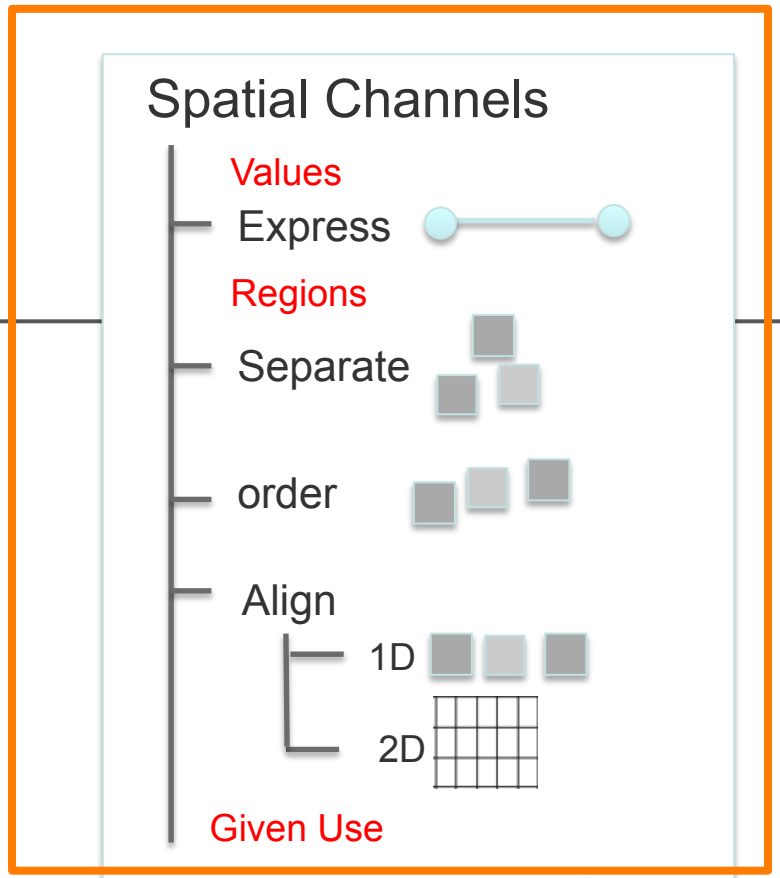
density

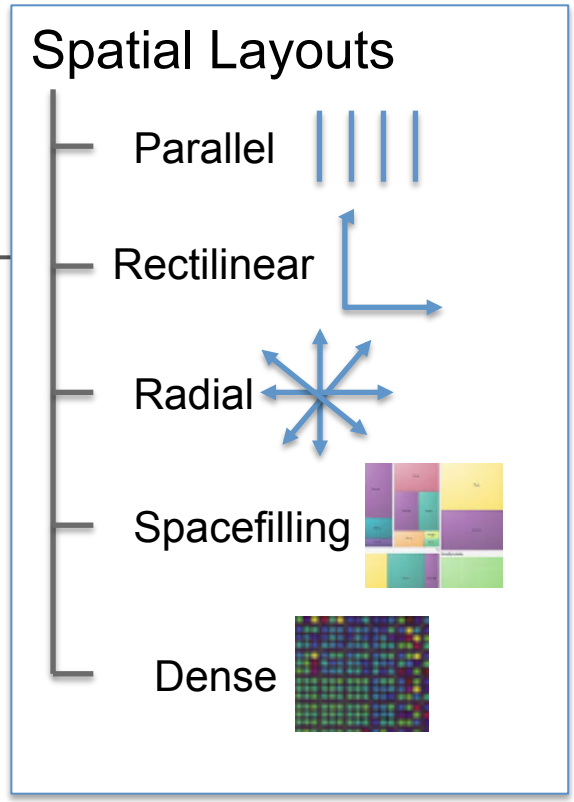
We encode data spatially to



- Express (show) values
- Arrange data groupings
  - Separate /distinguish regions by categorical key
  - Order groups by ordinal key
  - Align for visual comparison along reference value

Space


Spatial Channels
Values
Express
Regions
Separate
order
Align
1D
2D
Given Use
Geographic
Fields
scalar


Spatial Layouts
Parallel
Rectilinear
Radial
Spacefilling
Dense

Design choices [Munzner]

Arrange Tables

- **Express Values**

- **Separate, Order, Align Regions**
  - **Separate**

  - **Order**

  - **Align**

    - *1 Key* — *List*

    - *2 Keys* — *Matrix*

    - *3 Keys* — *Volume*

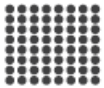
    - *Many Keys* — *Recursive Subdivision*

- **Axis Orientation**
  - **Rectilinear**

  - **Parallel**

  - **Radial**

- **Layout Density**
  - **Dense**



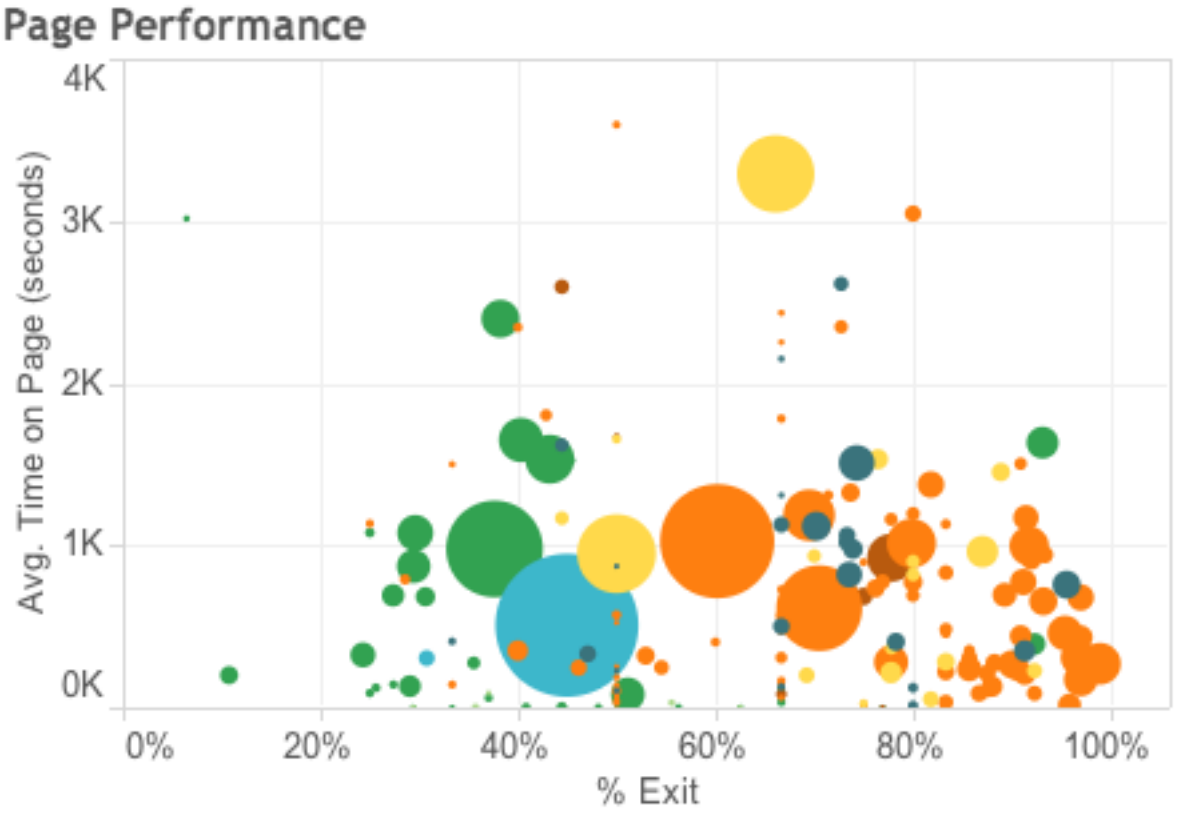
  - **Space-Filling**

Single view methods

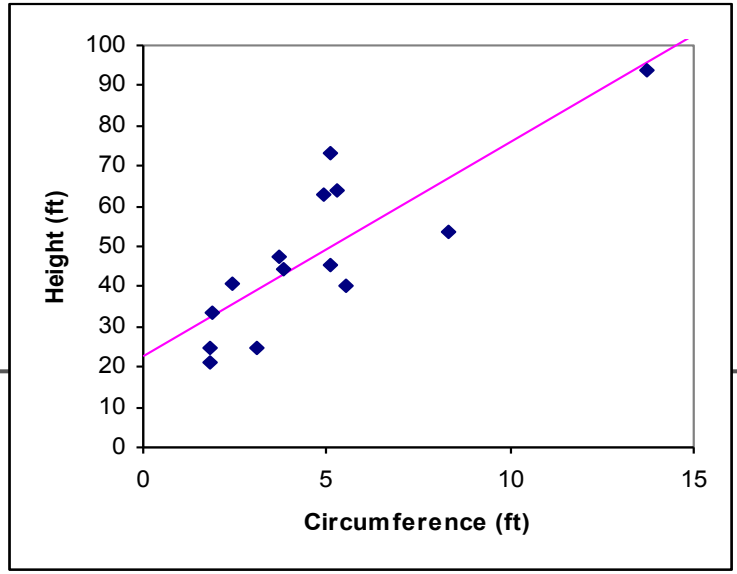
- All information integrated in one view
- basic visual encodings
  - spatial position
  - color
  - other channels
  - pixel-oriented techniques
- visual layering
  - global compositing
  - item-level stacking
- glyphs

Expressing values

- Scatterplots
- Axes encode 2D values
- Color for key/ category
- Additional value in size

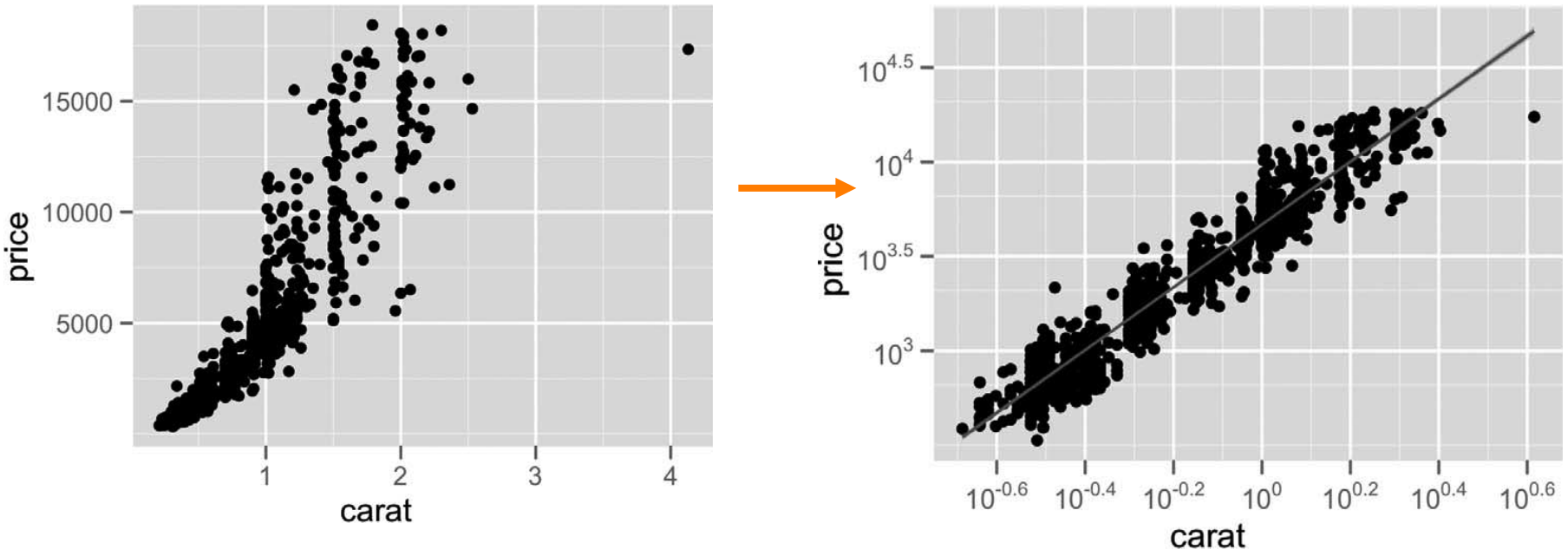


Scatterplot idiom



Idiom	Scatterplots
What: Data	Table: two quantitative value attributes.
How: Encode	Express values with horizontal and vertical spatial position and point marks.
Why: Task	Find trends, outliers, distribution, correlation; locate clusters.
Scale	Items: hundreds.

Data transformations can enhance value

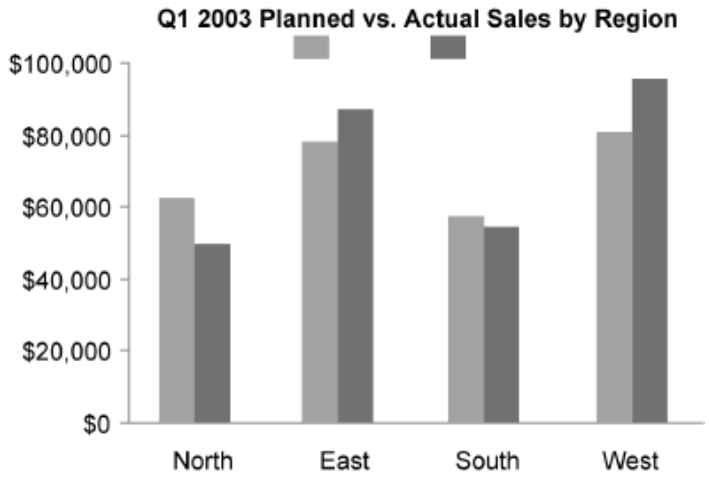


Log transformations show strong correlation between size and price

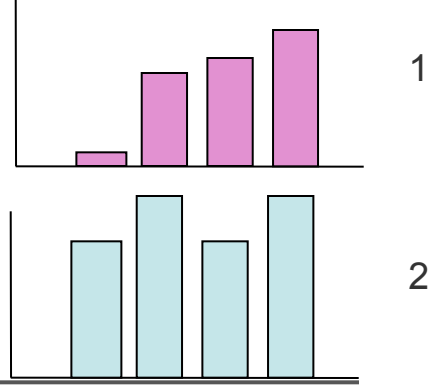
Organising data

- List alignment

- Can be ordered along the list axis or by value
- Nominal and ranking (if axis ordered)
- Emphasises individual values



Bar chart idiom

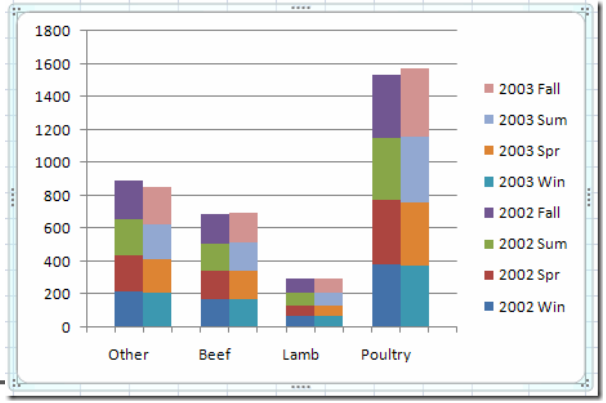


- Categorical attributes match well with spatial **regions**
- **Separate, order, align**
- Can be hard to find patterns in the data “shape”

Idiom	Bar Charts
What: Data	Table: one quantitative value attribute, one categorical key attribute.
How: Encode	Line marks, express value attribute with aligned vertical position, separate key attribute with horizontal position.
Why: Task	Lookup and compare values.
Scale	Key attribute: dozens to hundreds of levels.

Credit: T. Munzner, 2014

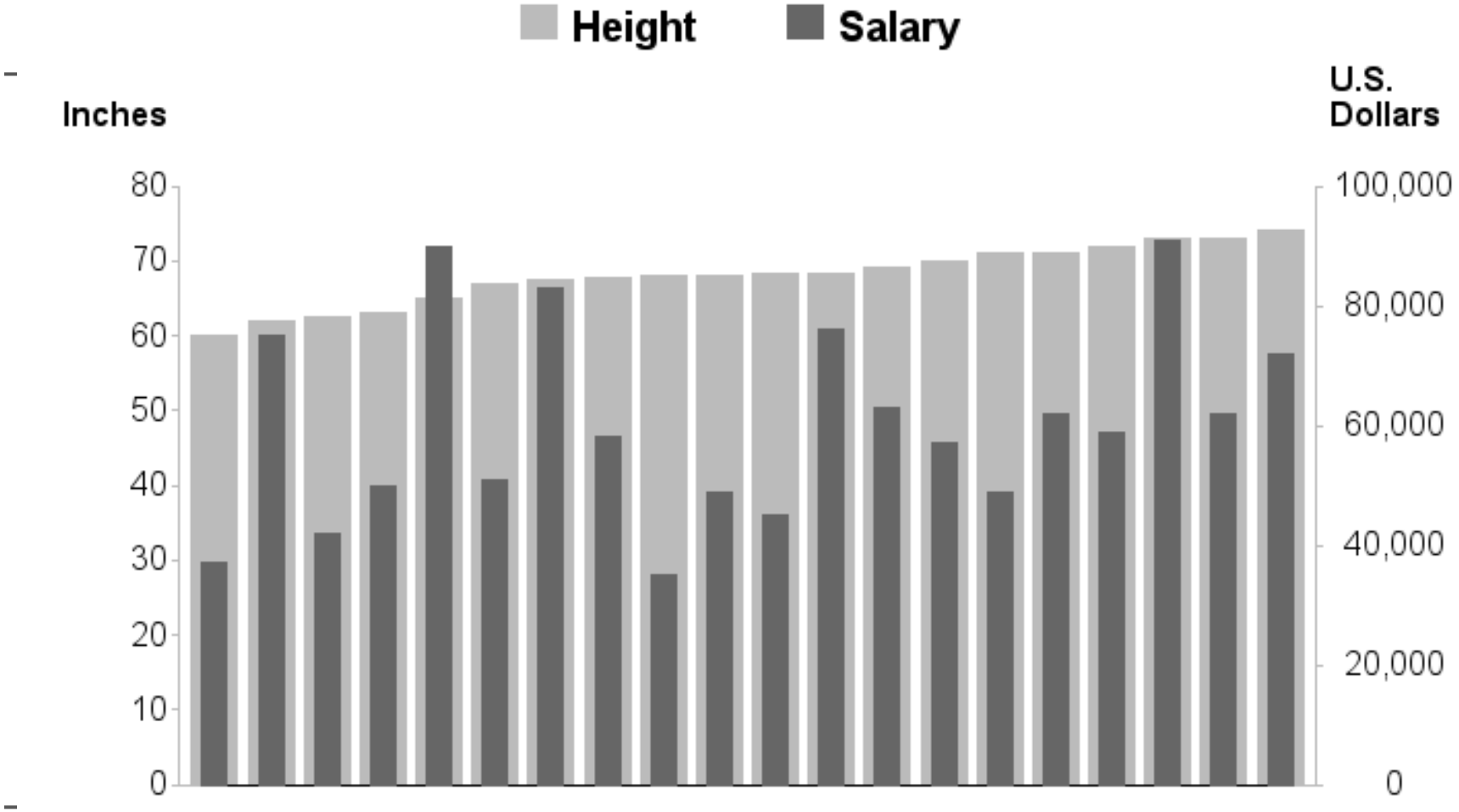
Stacked bars



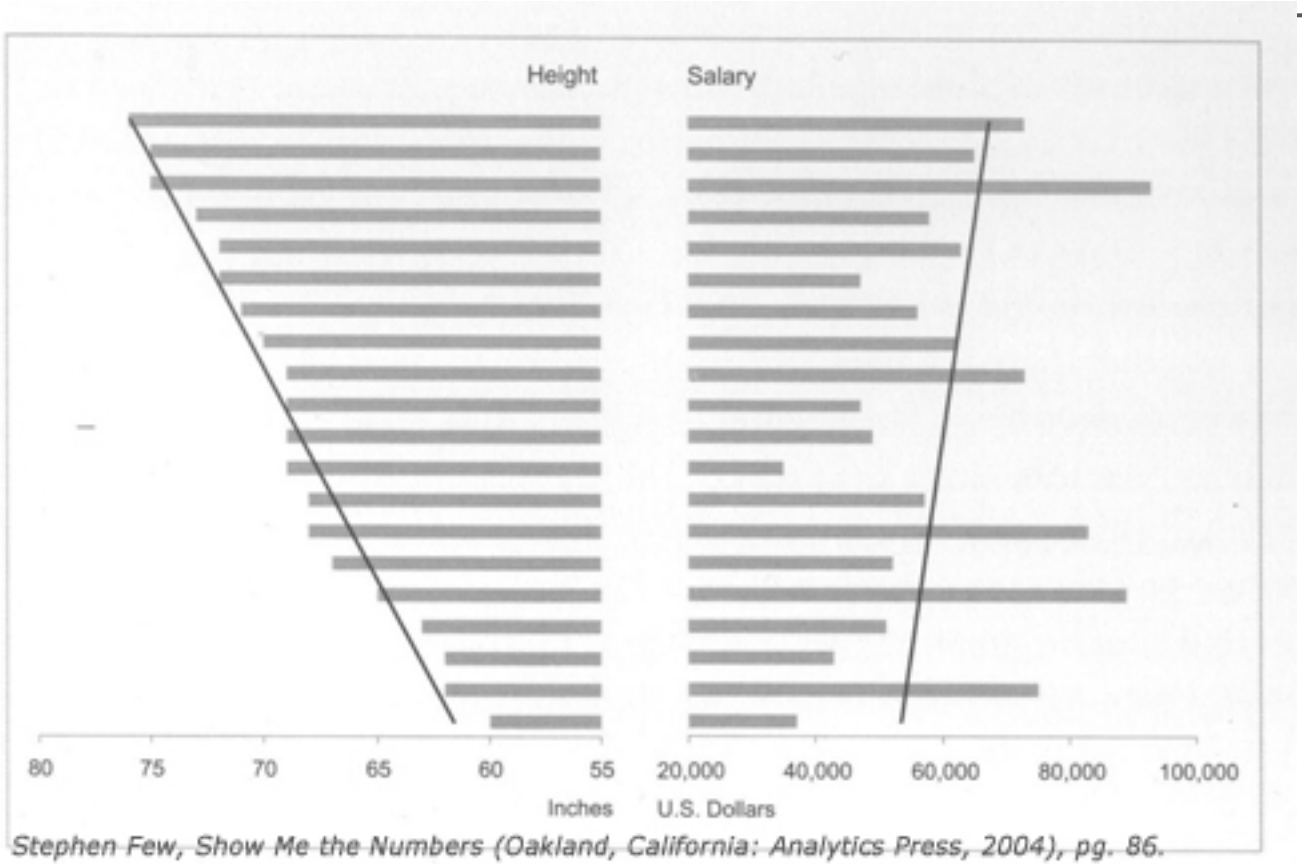
- Multidimensional tables with 2 keys/attributes
- Typically use colour or texture for 2nd

Idiom	Stacked Bar Charts
What: Data	Multidimensional table: one quantitative value attribute, two categorical key attributes.
How: Encode	Bar glyph with length-coded subcomponents of value attribute for each category of secondary key attribute. Separate bars by category of primary key attribute.
Why: Task	Part-to-whole relationship, lookup values, find trends.
Scale	Key attribute (main axis): dozens to hundreds of levels. Key attribute (stacked glyph axis): several to one dozen

Few's correlation bar graph



Paired Bar graph with trend lines (Few)



Stephen Few, Show Me the Numbers (Oakland, California: Analytics Press, 2004), pg. 86.

Streamgraphs

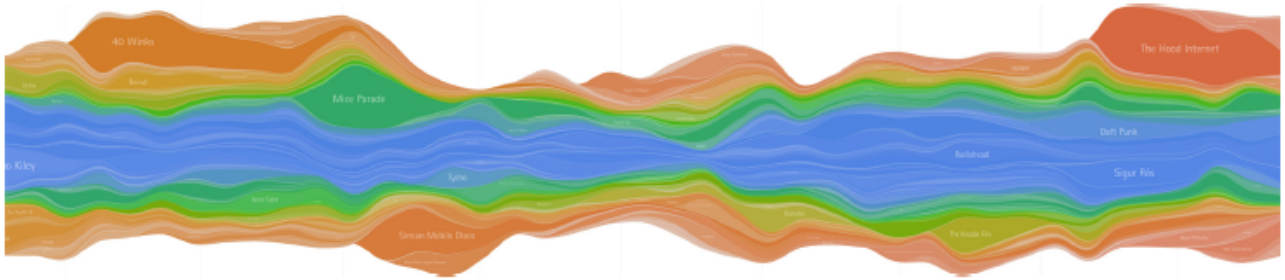


Figure 7.6. Streamgraph of music listening history. From [Byron and Wattenberg 08, Figure 0].

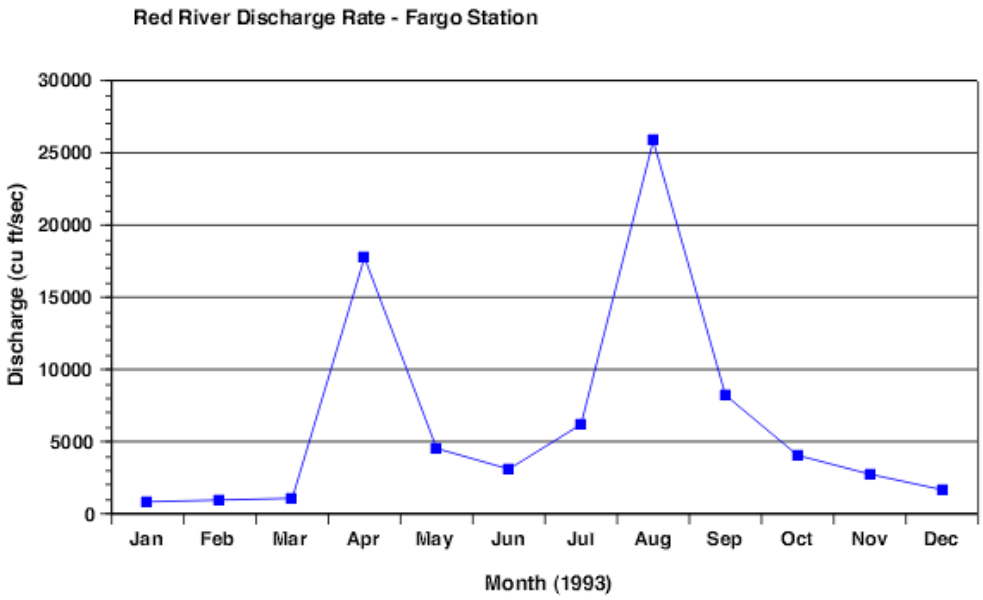
- Stacked time series

Idiom	Stacked Bar Charts
What: Data	Multidimensional table: one quantitative value attribute, two categorical key attributes.
How: Encode	Bar glyph with length-coded subcomponents of value attribute for each category of secondary key attribute. Separate bars by category of primary key attribute.
Why: Task	Part-to-whole relationship, lookup values, find trends.
Scale	Key attribute (main axis): dozens to hundreds of levels. Key attribute (stacked glyph axis): several to one dozen

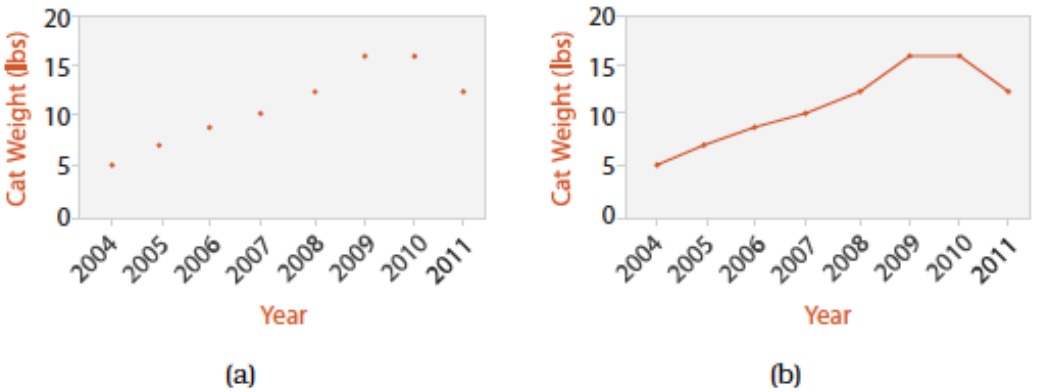
- Show shape of the data and part-whole relationships
- De-emphasise individual values

Line charts and dotplots

- Position to express value according to key
- Line charts use angle/shape to show trends
- Frequently time



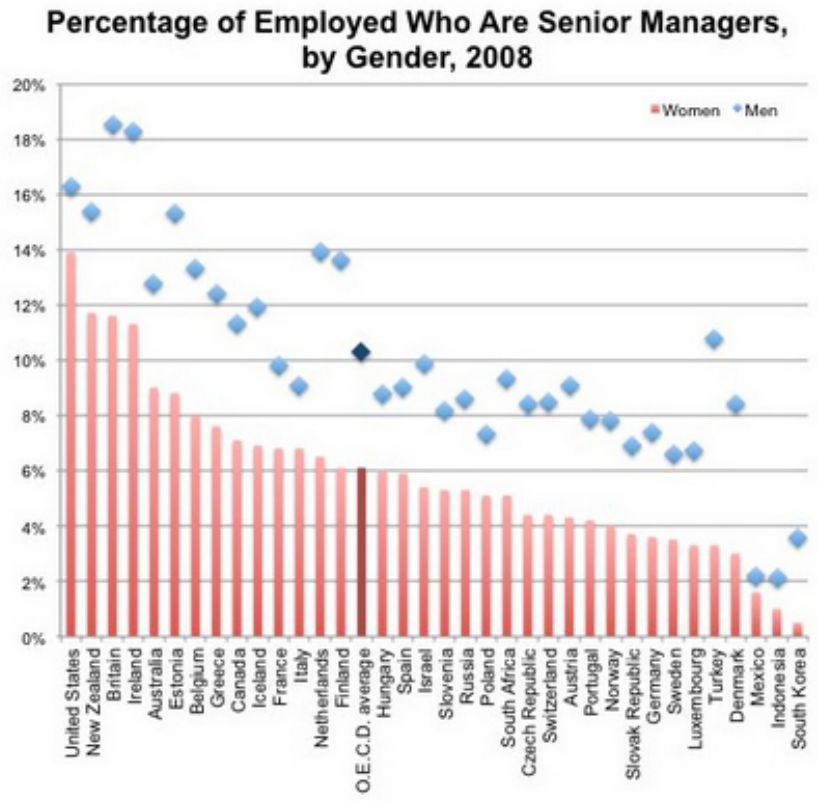
Line Chart idiom

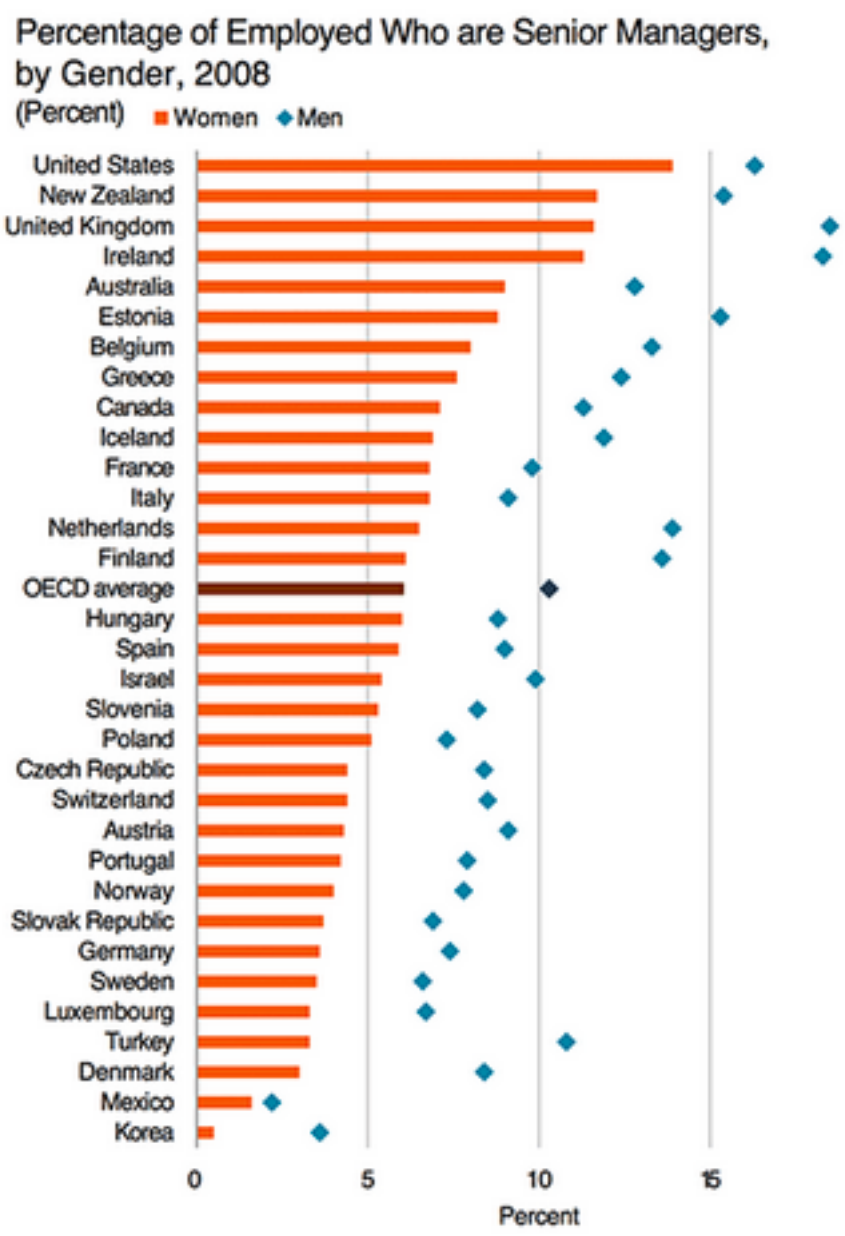


- Line charts, dotplots
- Good for ordered data

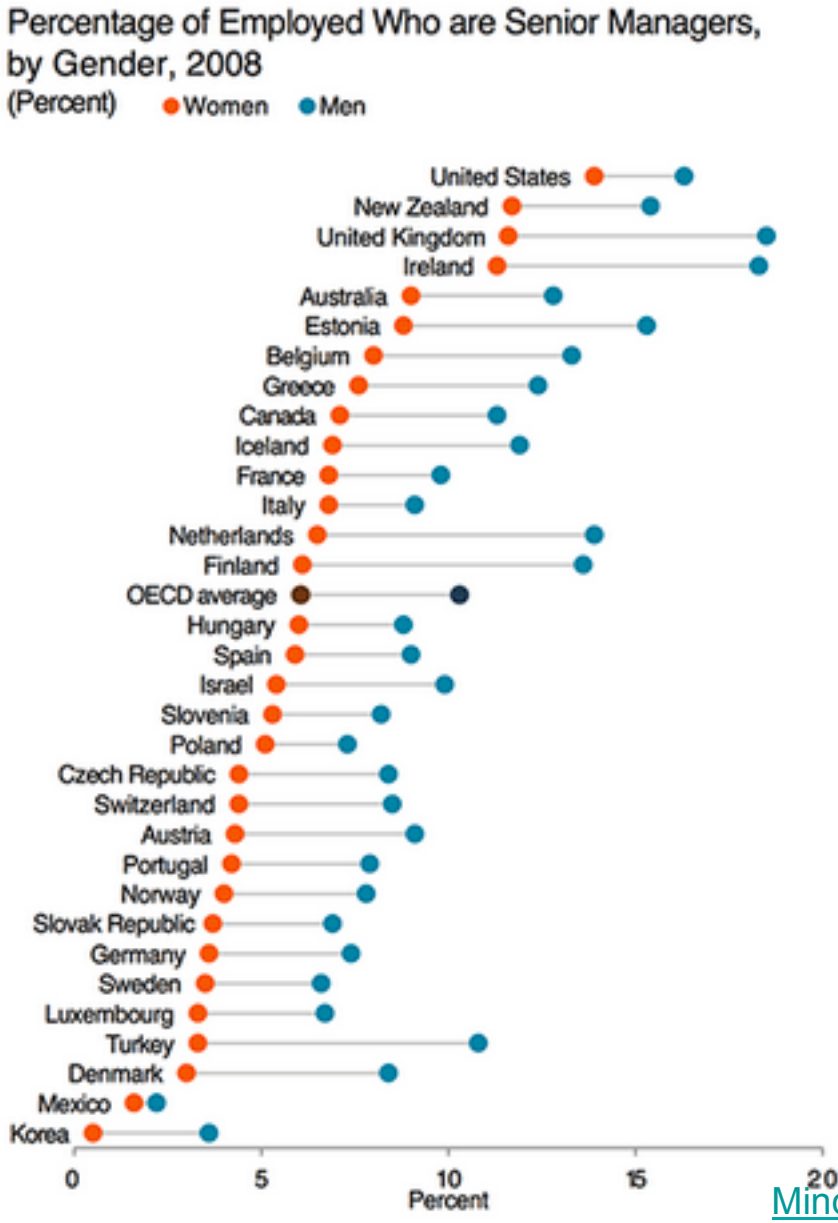
Idiom	**Dotplot**
What: Data	table: 1 quant value attrib, 1 ordered key attrib
How: Encode	point marks aligned vertical position to express value attrib, separate/order by key attrib into horiz regions
Idiom	**line chart**
What: Data	table: 1 quant value attrib, 1 ordered key attrib
How: Encode	point marks, connection marks, aligned vert position to express value attrib, separate/order by key attrib into horiz regions

Mind the Gap - An Economic Chart Remake



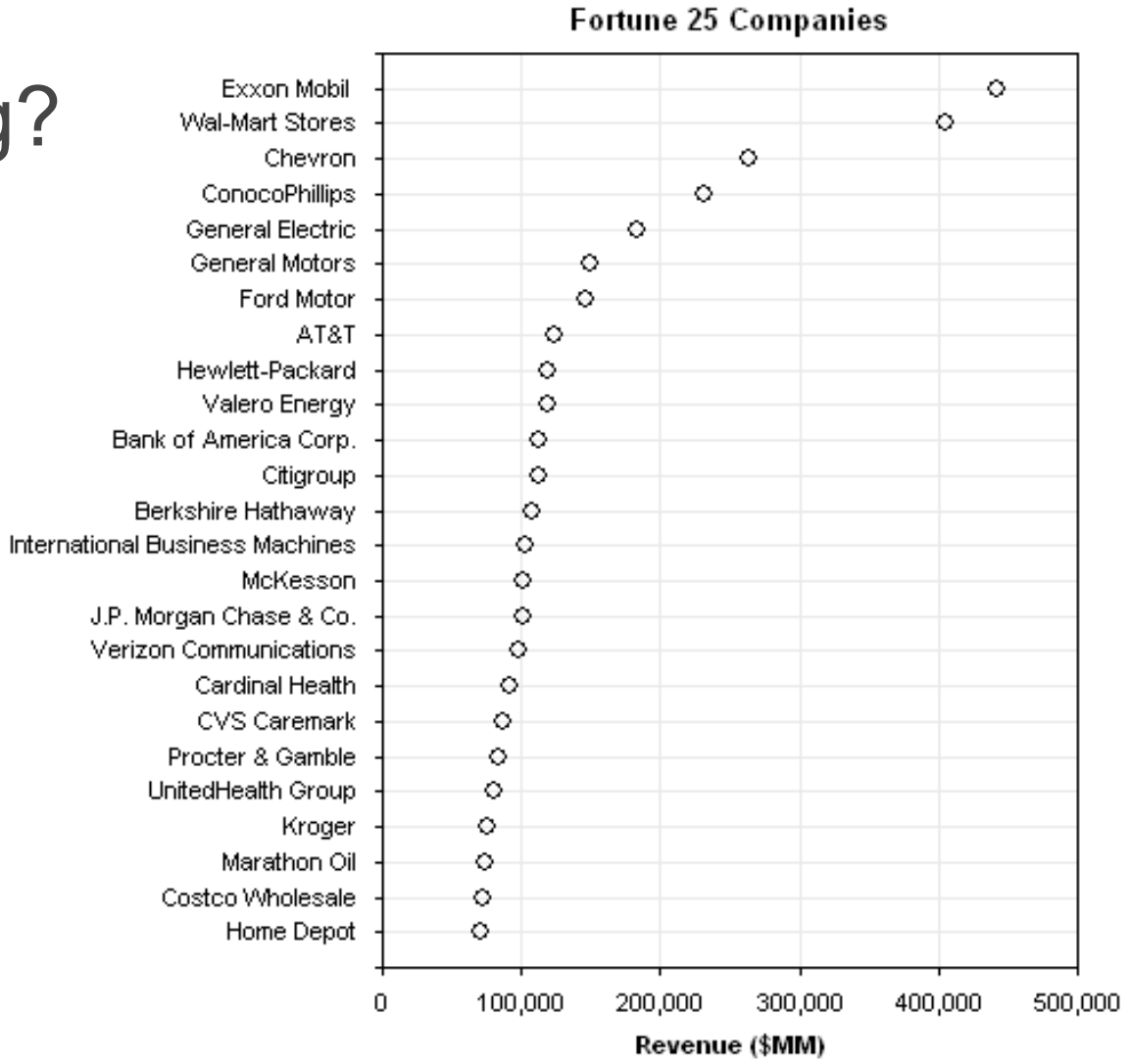

Percentage of Employed Who are Senior Managers, by Gender, 2008
(Percent)
Women
Men
United States
New Zealand
United Kingdom
Ireland
Australia
Estonia
Belgium
Greece
Canada
Iceland
France
Italy
Netherlands
Finland
OECD average
Hungary
Spain
Israel
Slovenia
Poland
Czech Republic
Switzerland
Austria
Portugal
Norway
Slovak Republic
Germany
Sweden
Luxembourg
Turkey
Denmark
Mexico
Korea
0
5
10
15
Percent


Percentage of Employed Who are Senior Managers, by Gender, 2008
(Percent)
Women
Men
United States
New Zealand
United Kingdom
Ireland
Australia
Estonia
Belgium
Greece
Canada
Iceland
France
Italy
Netherlands
Finland
OECD average
Hungary
Spain
Israel
Slovenia
Poland
Czech Republic
Switzerland
Austria
Portugal
Norway
Slovak Republic
Germany
Sweden
Luxembourg
Turkey
Denmark
Mexico
Korea
0
10
0
10
Percent



[Mind the Gap - An Economic Chart Remake]

What's wrong?


Fortune 25 Companies
Exxon Mobil
Wal-Mart Stores
Chevron
ConocoPhillips
General Electric
General Motors
Ford Motor
AT&T
Hewlett-Packard
Valero Energy
Bank of America Corp.
Citigroup
Berkshire Hathaway
International Business Machines
McKesson
J.P. Morgan Chase & Co.
Verizon Communications
Cardinal Health
CVS Caremark
Procter & Gamble
UnitedHealth Group
Kroger
Marathon Oil
Costco Wholesale
Home Depot
0
100,000
200,000
300,000
400,000
500,000
Revenue ($MM)

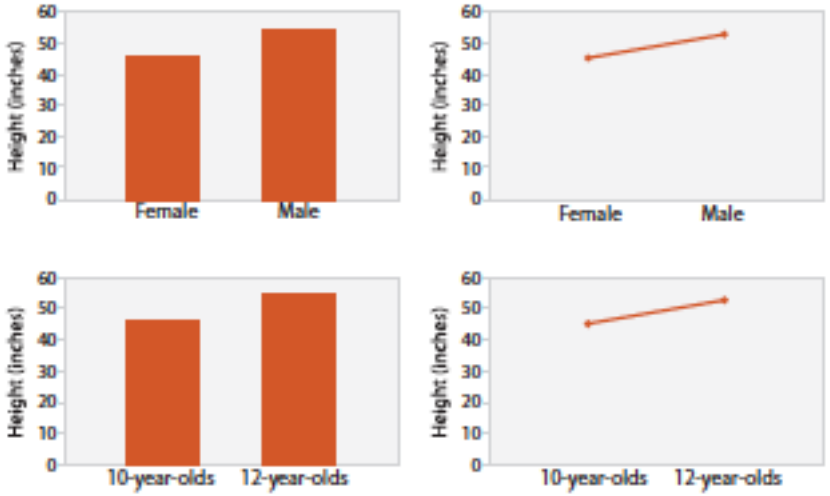
The semantics of mark types

- Bar charts, line charts and dotplots all encode a quantitative value against a key attribute in a rectilinear layout.
- Often use additional encoding for other categories
- Lines also use connection marks to show inter-item relations
  - Only use for ordered data!

Which to use when

- Bars and bubbles emphasise comparison and association of individual values

- Lines (explicit and implied) emphasise trends



Lines and bars

Lines imply connections

- "the more male some
  the taller he is"

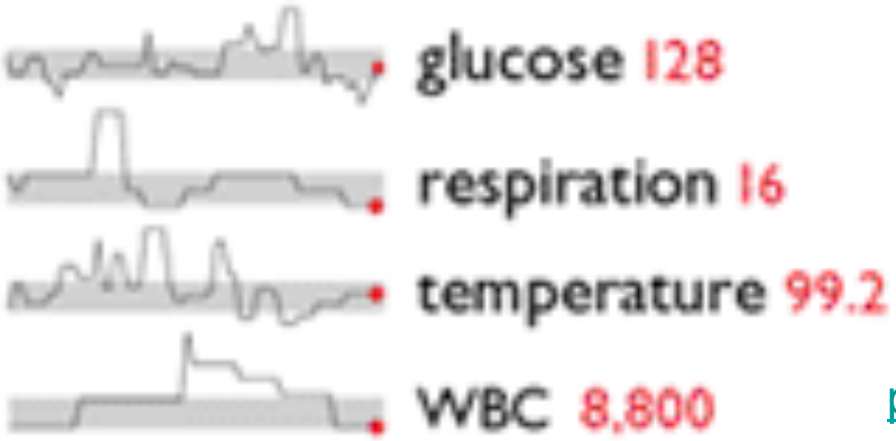
Use when there is some
progression between the
on the x-axis

- "12 year olds are talle
  10 year olds"

Je Zacks and Barbara Tversky. Bars and Lines:
A Study of Graphic Communication." Memory and Cognition 27:6(1999), 1073{1079

Tufte's Sparklines

- Give a hint of the trend, but don't show the actual axes and scales.

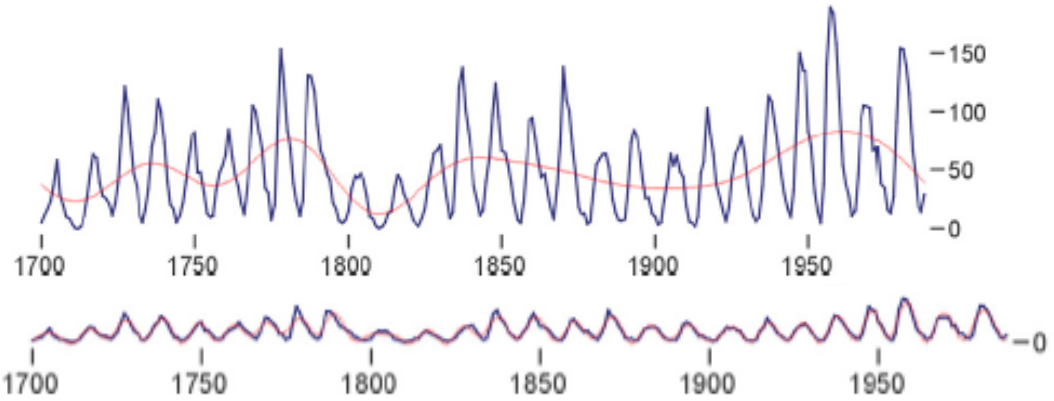


peer2patent.org

- Good for dashboards and small spaces

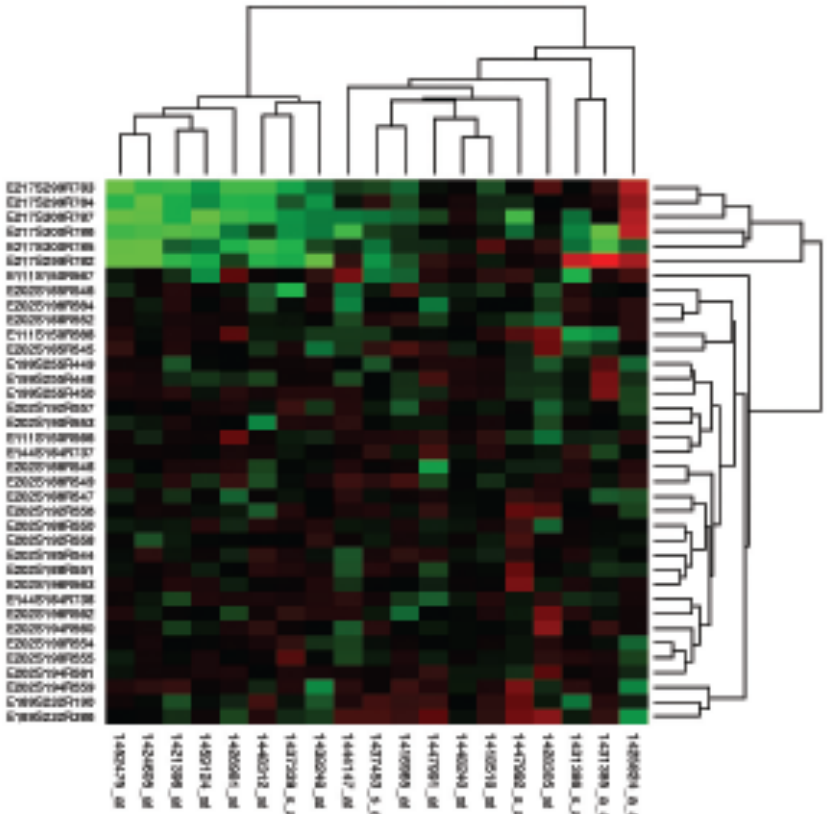
Lines: Aspect ratio matters!

- our ability to judge angles is more accurate at exact diagonals than at arbitrary direction
  - We can judge distances “off” 45 or 90 degrees (43) but cannot see the difference between 20 and 22 degrees
- Multiscale banking to 45 degrees – algorithm to compute informative aspect ratios to maximise line segments close to the diagonal



Matrix alignment

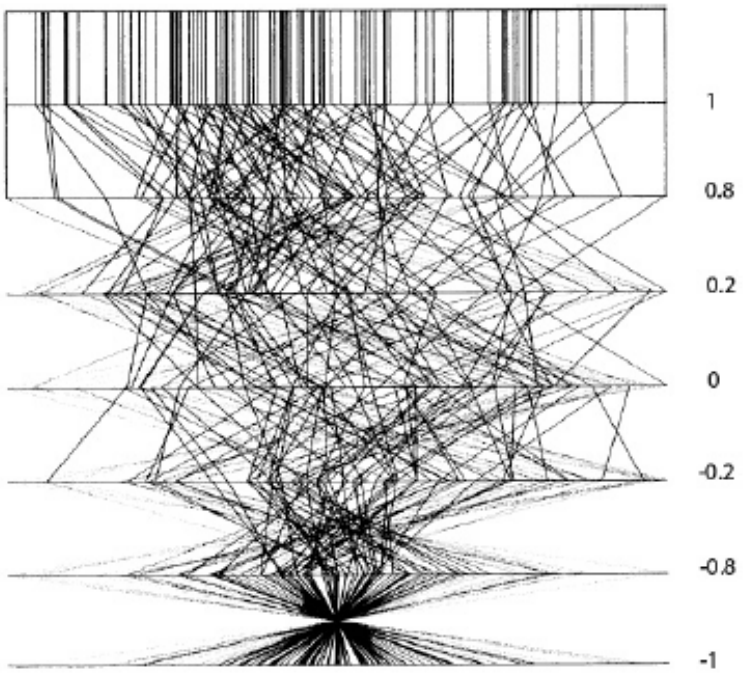
- Heatmap
- 2 keys, 1 value
- Good for dense encoding
- Re-ordering for clusters



Idiom	Heatmaps
What: Data	Table: two categorical key attributes (genes, conditions), one quantitative value attribute (activity level for gene in condition).
How: Encode	2D matrix alignment of area marks, diverging colormap.
Why: Task	Find clusters, outliers; summarize.
Scale	Items: one million. Categorical attribute levels: hundreds. Quantitative attribute levels: 3–11.

Parallel layouts

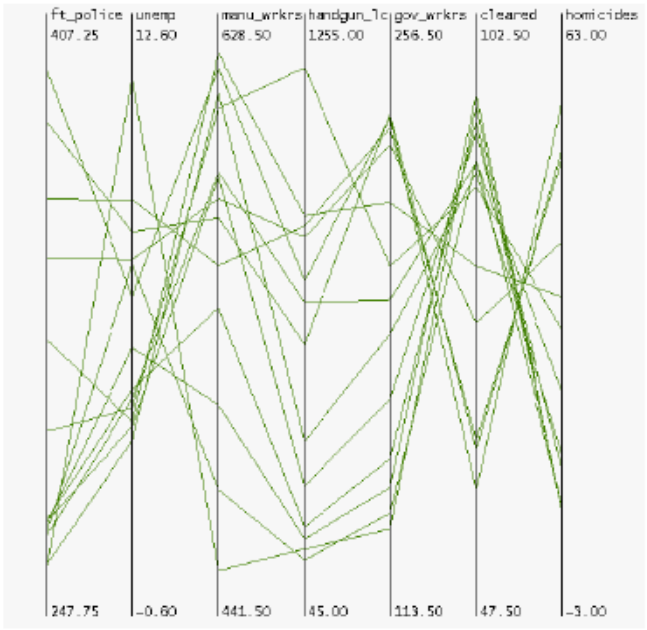
- Parallel coordinates
- Many key attributes
- Different correlations
- Value vector is a line



Parallel coordinates

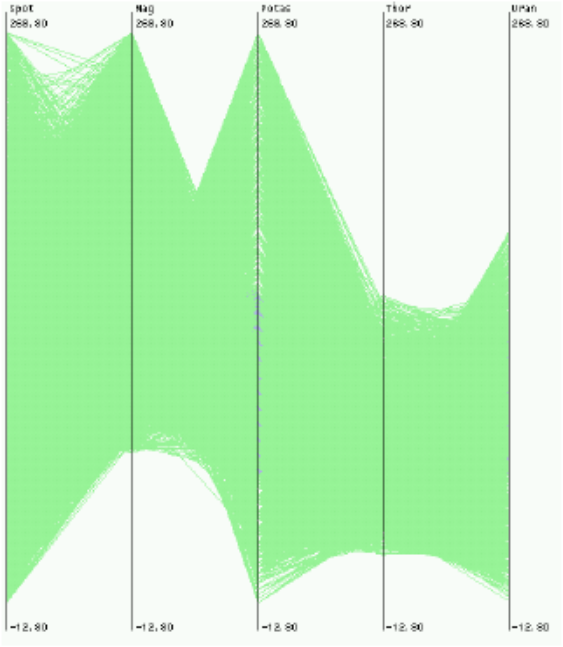
Idiom	Parallel Coordinates
What: Data	Table: many value attributes.
How: Encode	Parallel layout: horizontal spatial position used to separate axes, vertical spatial position used to express value along each aligned axis with connection line marks as segments between them.
Why: Tasks	Find trends, outliers, extremes, correlation.
Scale	Attributes: dozens along secondary axis. Items: hundreds.

13 items, 7 keys



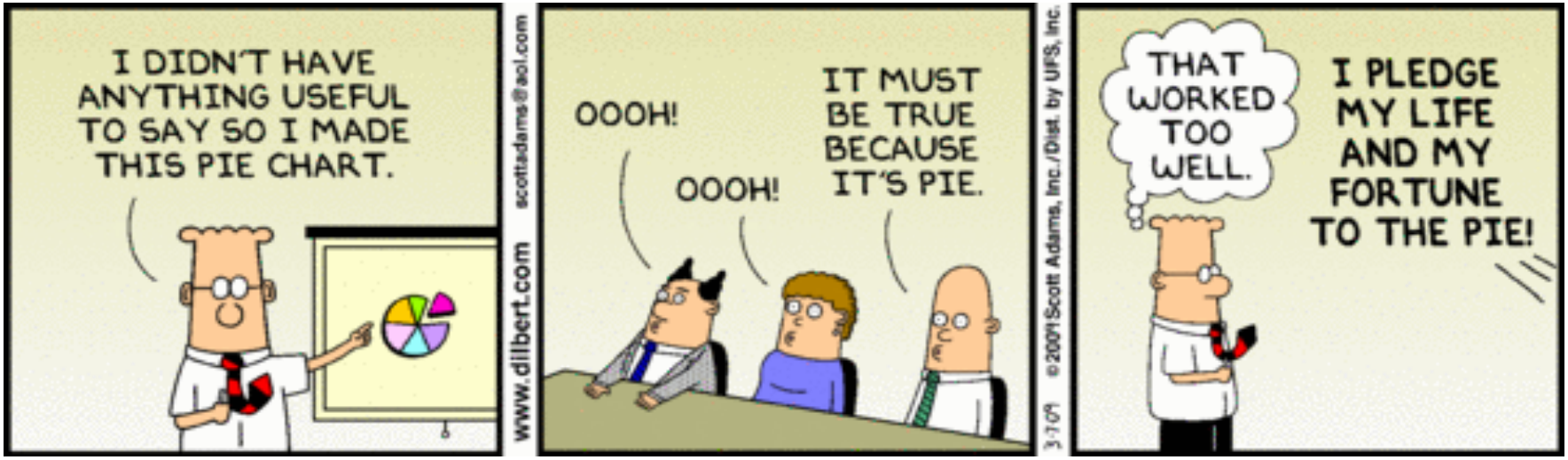
(a)

16K items, 5 keys

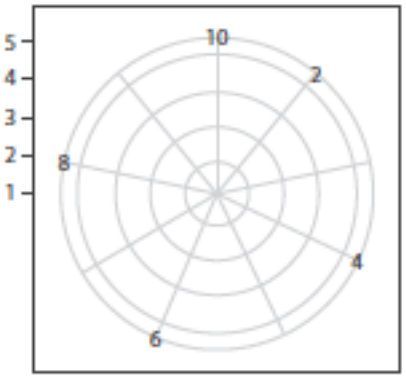


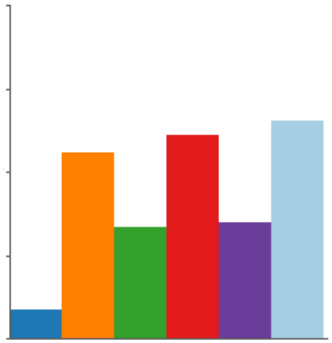
(b)

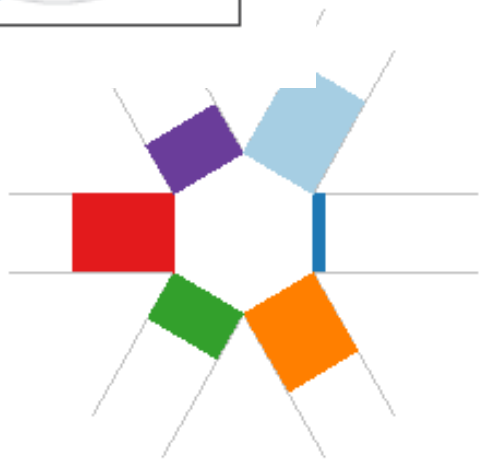
What about Pies?



Radial layouts

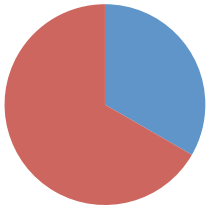






Use polar coordinates

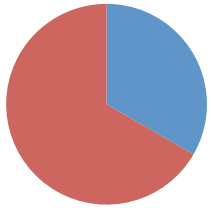
- 1 categorical key, 1 quantitative value



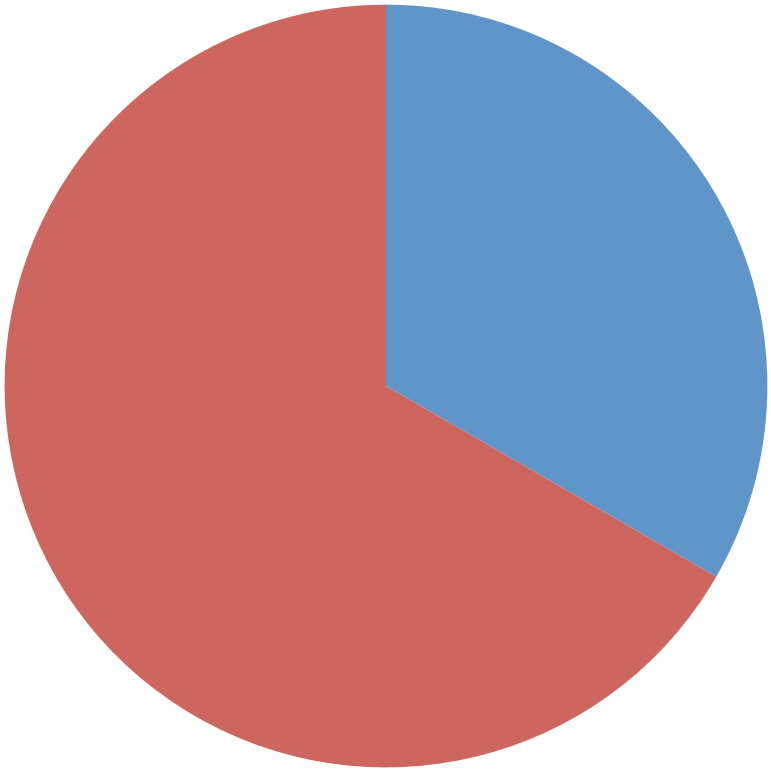
radial idioms

Idiom	**Star plot**
What:data	Table: 1 quant value, 1 categorical attribute
How: Encode	length coding along point marks at 1D spatial position along axis + 1D spatial position for aligned axes

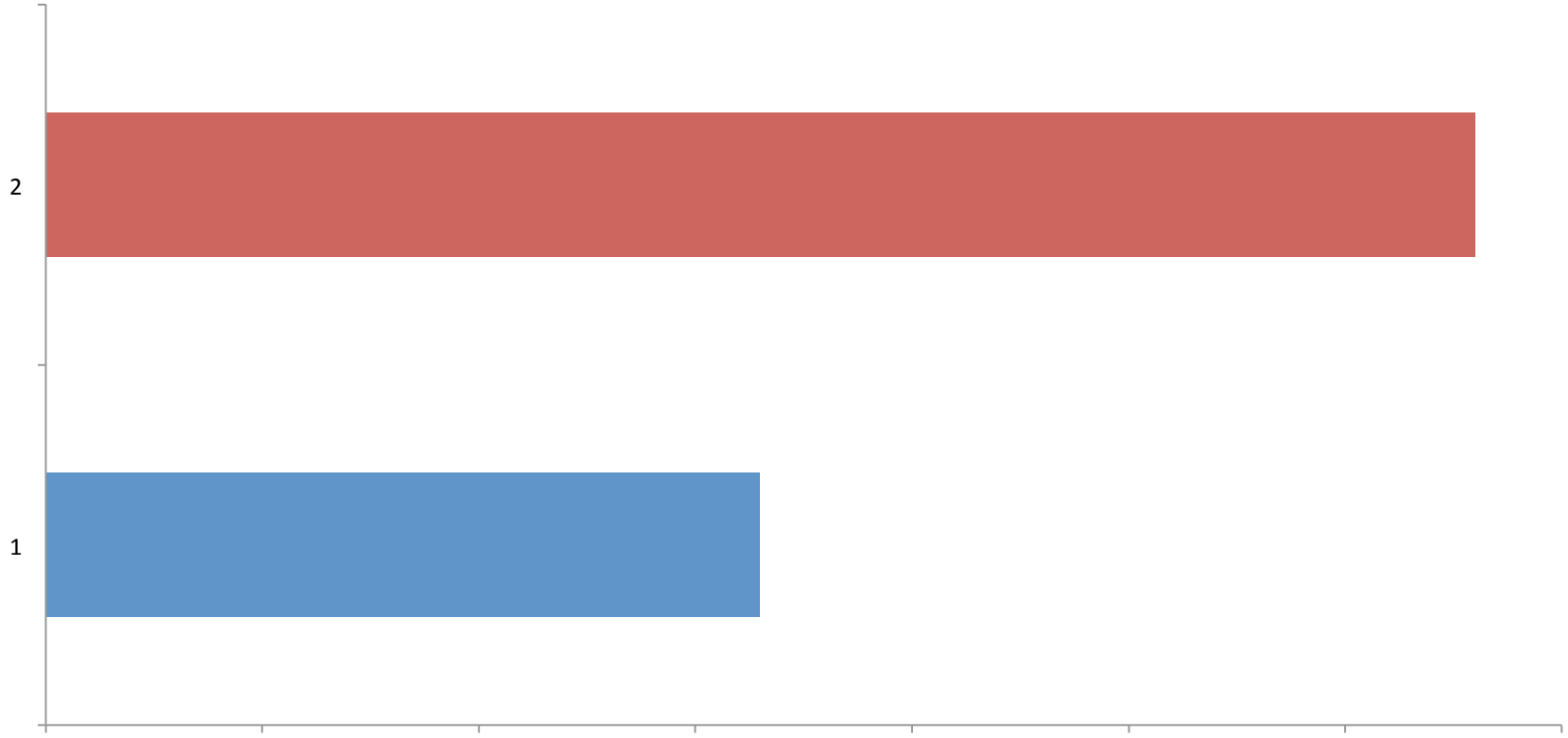
Idiom	**Pie chart**
What:data	Table: 1 quant value, 1 categorical attribute
How: Encode	area and angle



Percent Blue relative to Red?

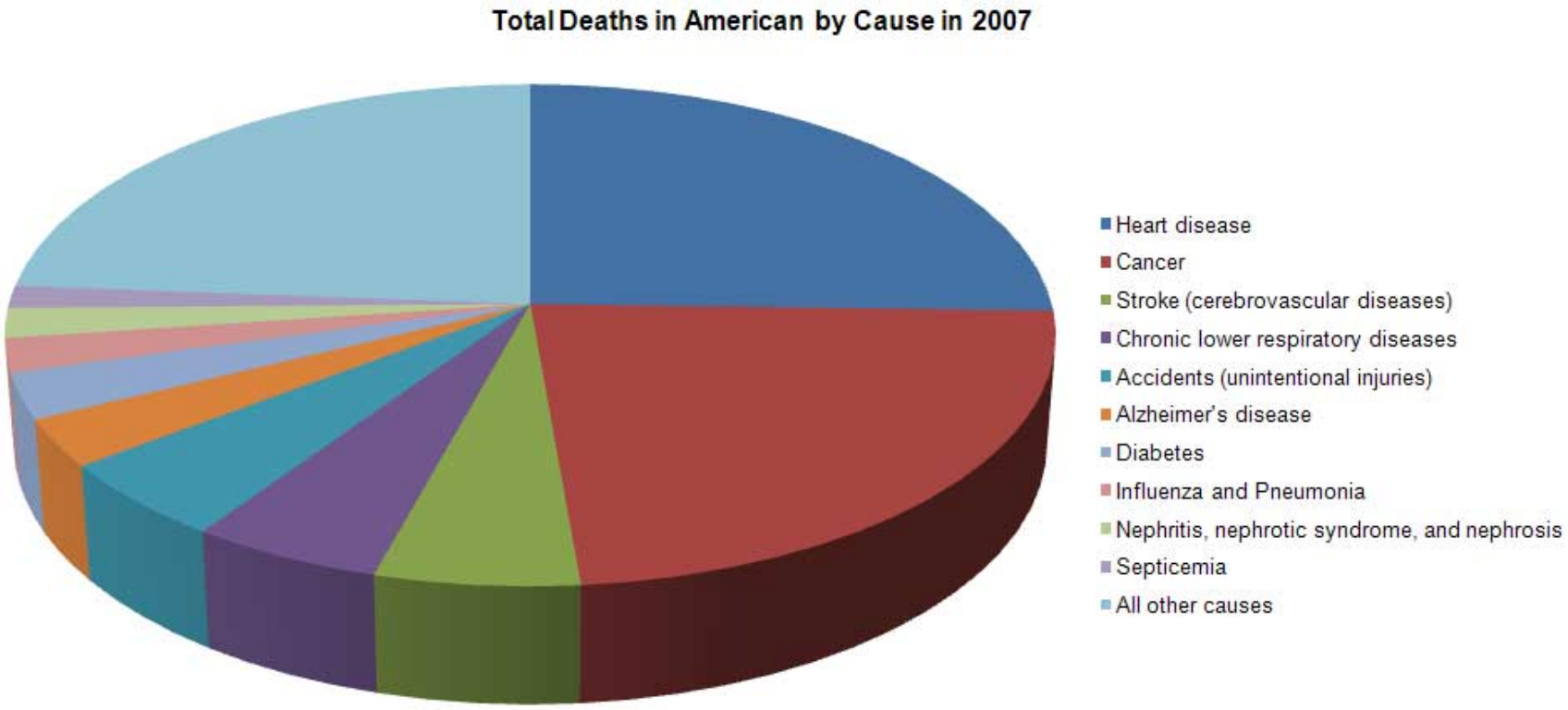


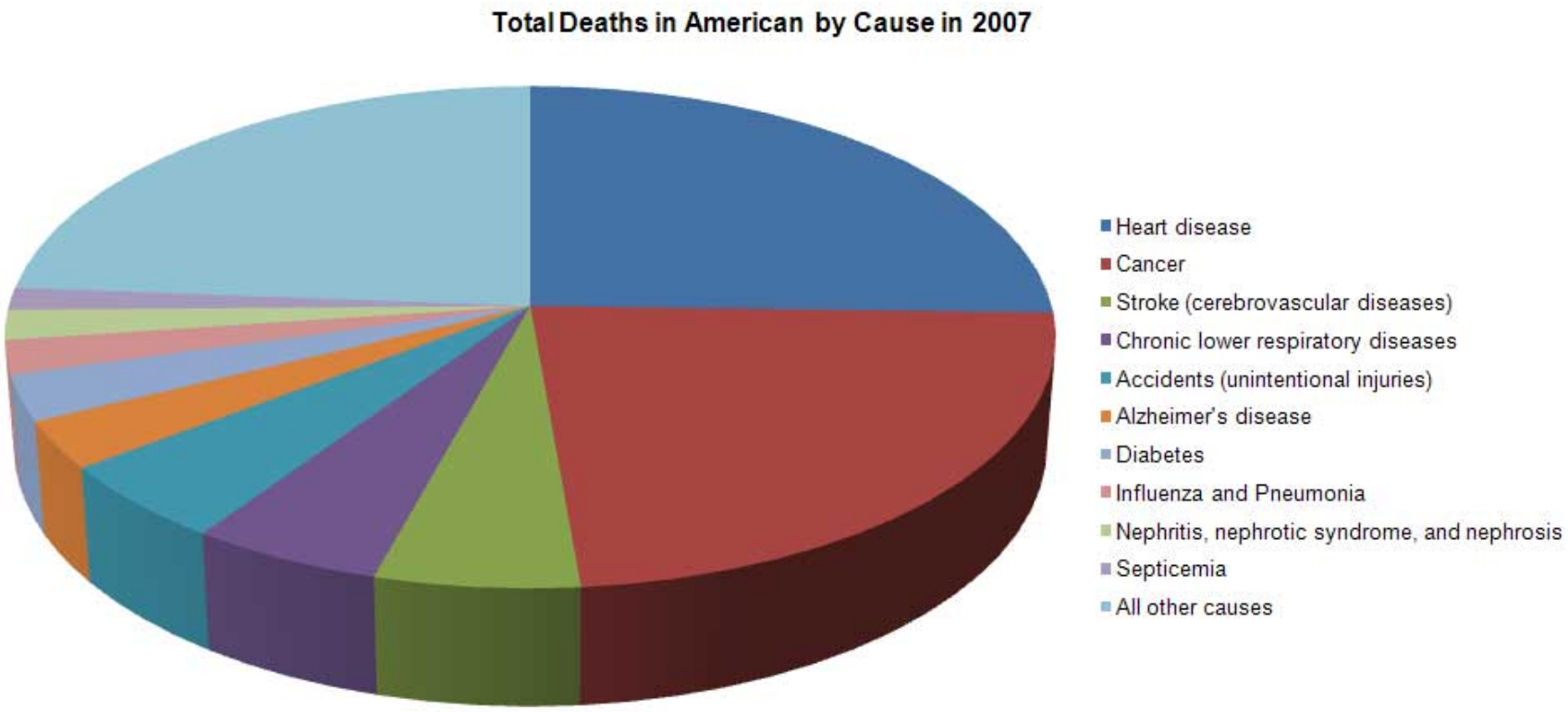
Percent Blue relative to Red?



Few's criteria for an effective visualization

- Clearly indicate the nature of the relationship
- Represent the quantities accurately
- Makes it easy to compare the quantities
- Makes it easy to see the ranked order of values
- Makes obvious how people should use the information


Total Deaths in American by Cause in 2007
Heart disease
Cancer
Stroke (cerebrovascular diseases)
Chronic lower respiratory diseases
Accidents (unintentional injuries)
Alzheimer's disease
Diabetes
Influenza and Pneumonia
Nephritis, nephrotic syndrome, and nephrosis
Septicemia
All other causes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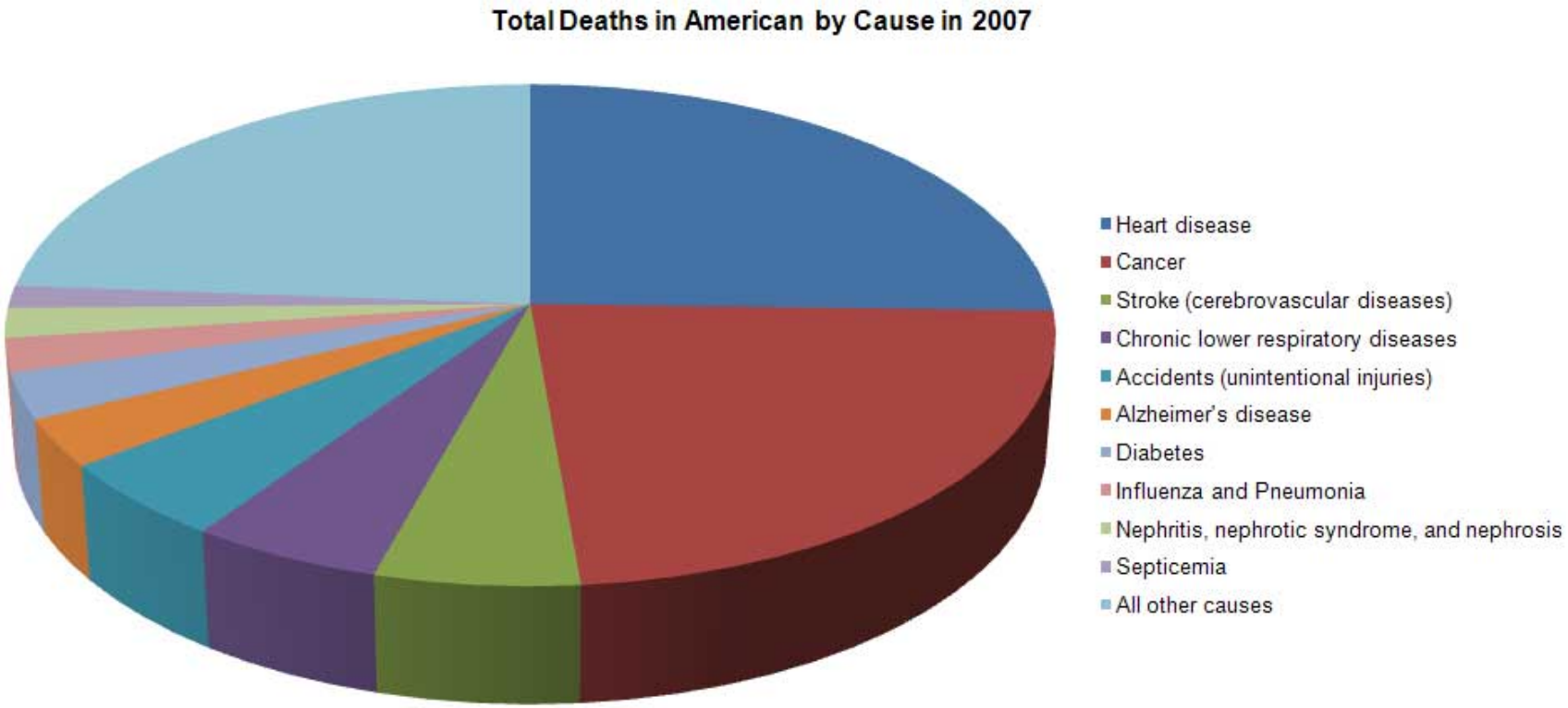
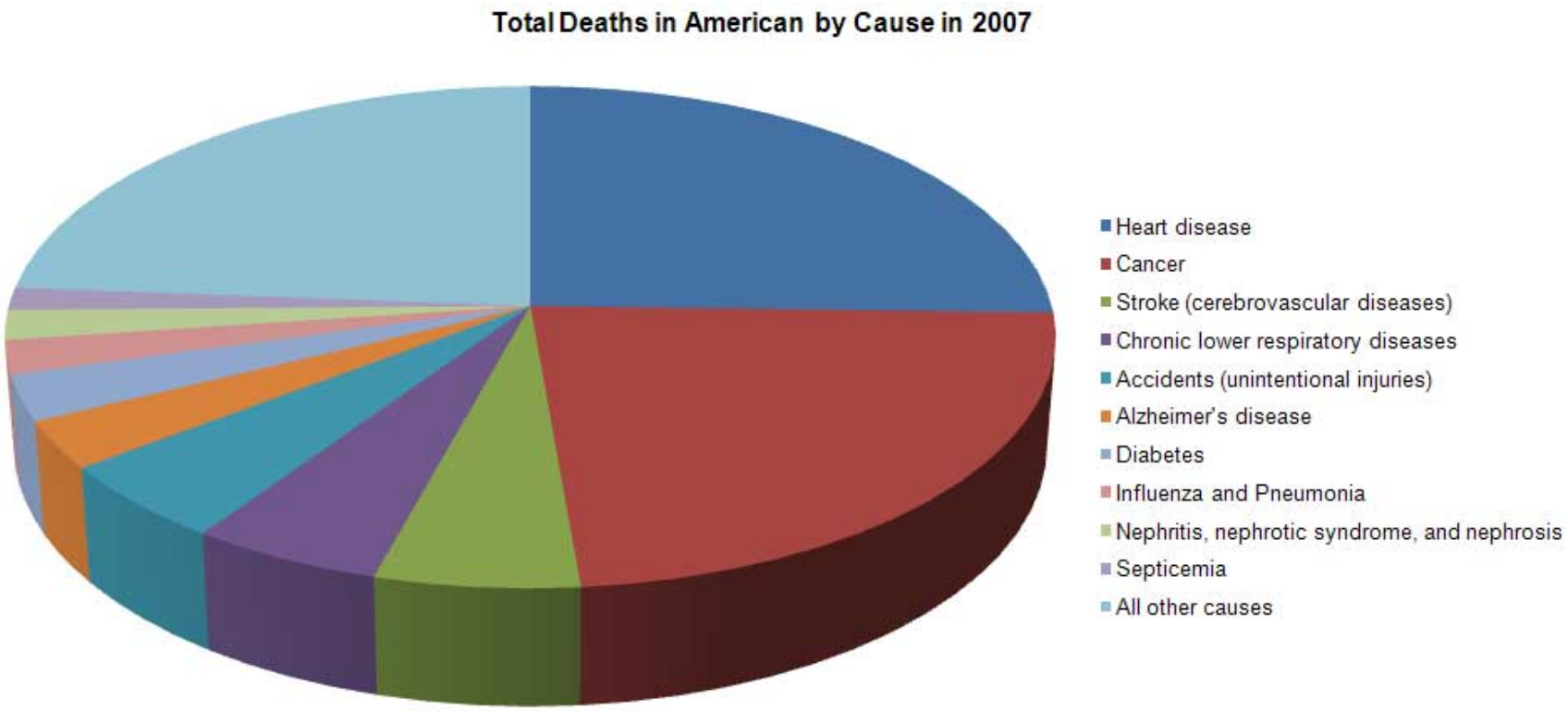
Accidents (unintentional injuries)
Alzheimer's disease
Diabetes
Influenza and Pneumonia
Nephritis, nephrotic syndrome, and nephrosis
Septicemia
All other causes

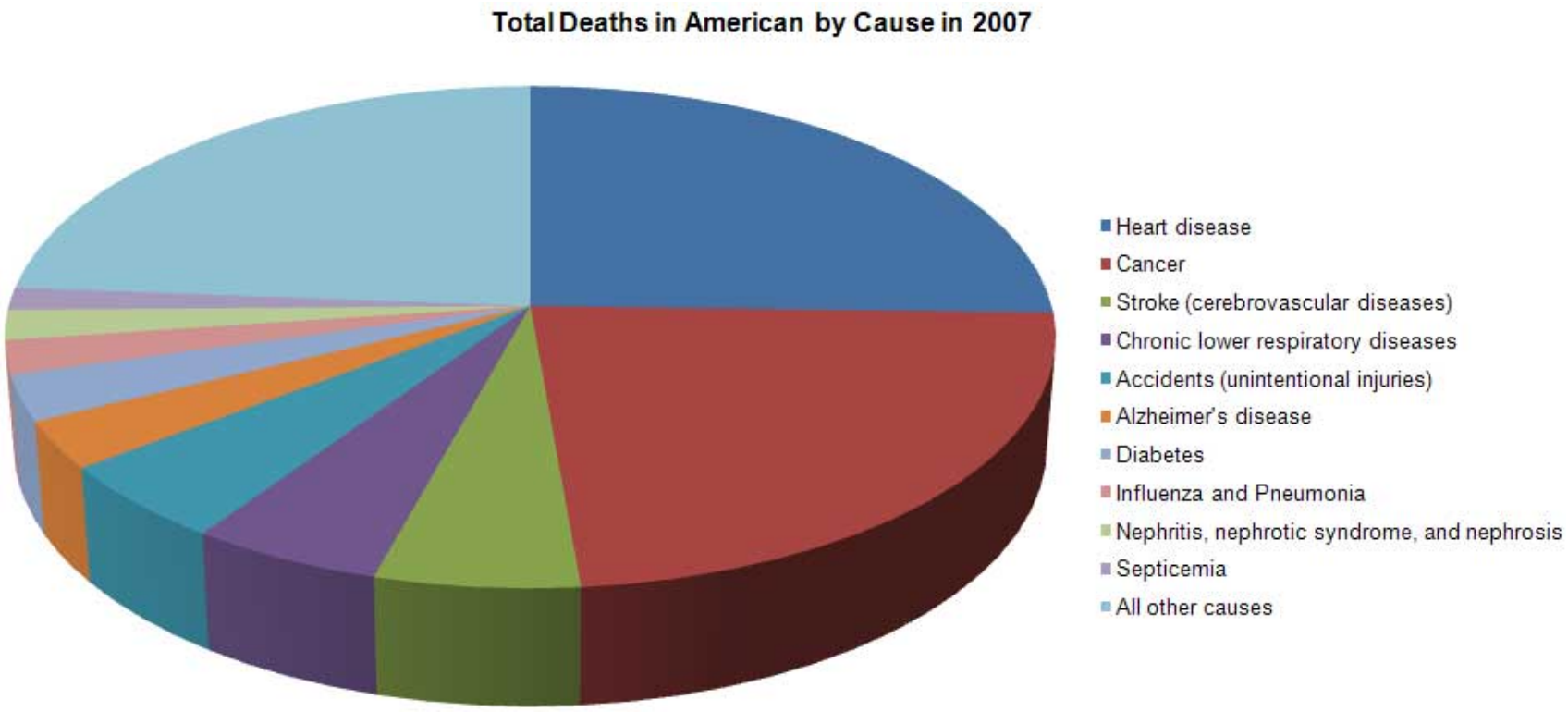
Clearly indicate the nature of the relationship?



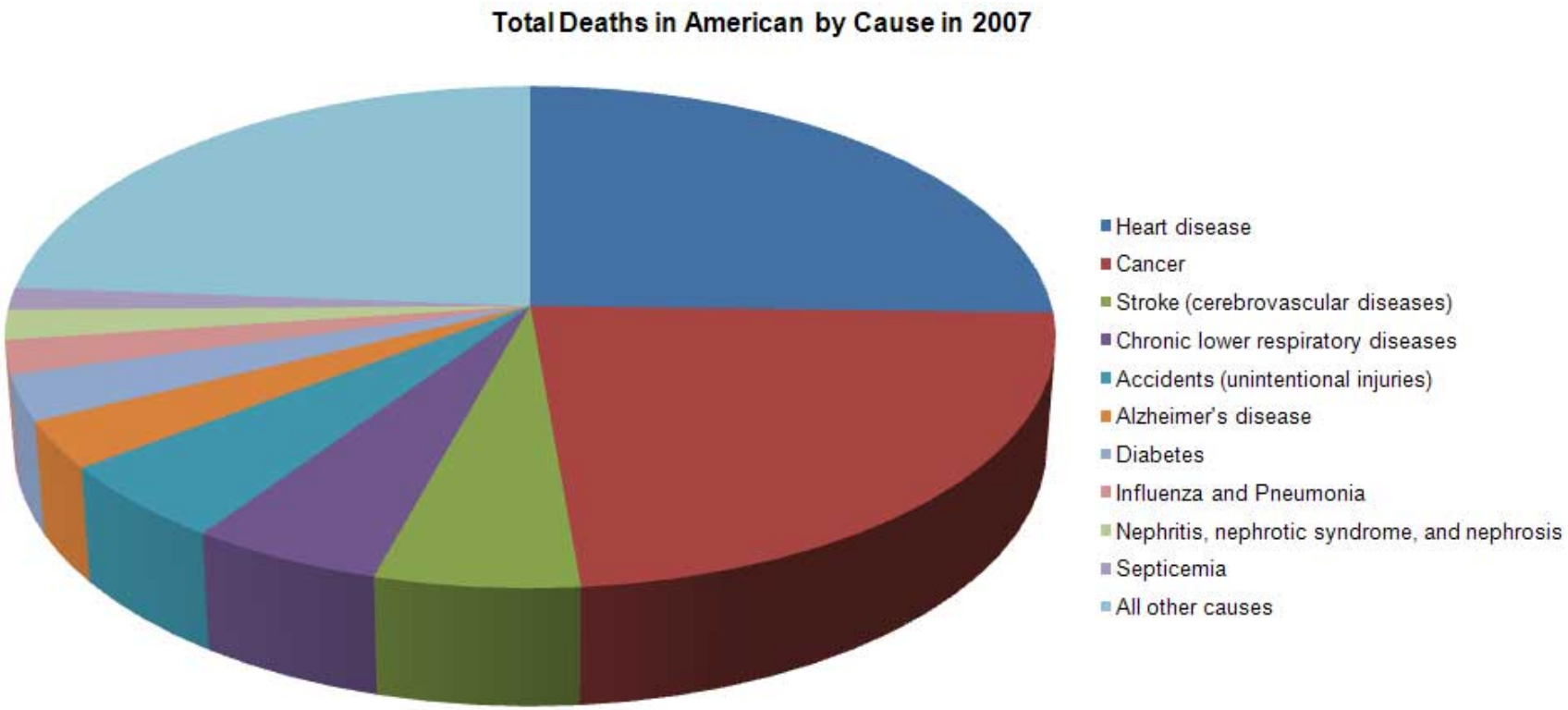
Represents quantities accurately?



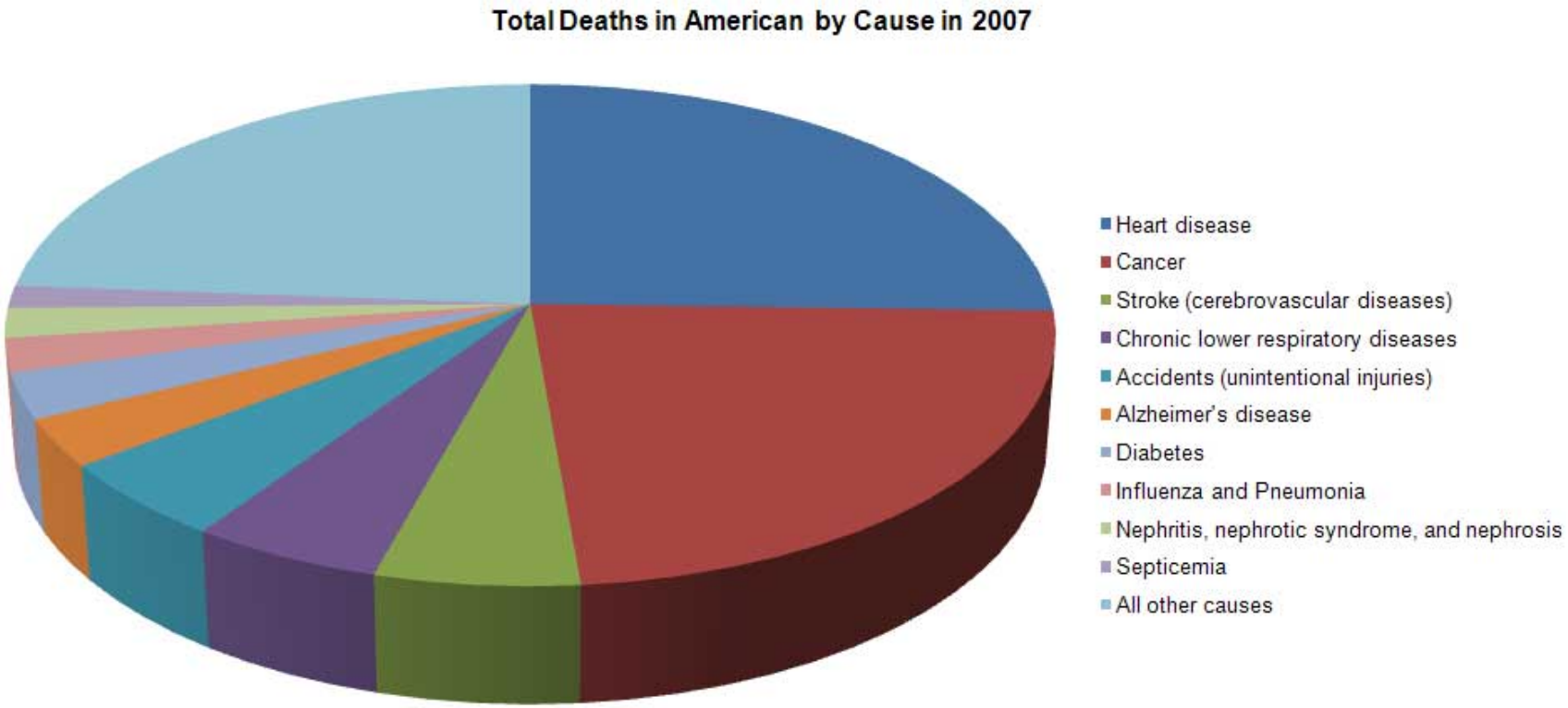
Makes it easy to compare quantities?



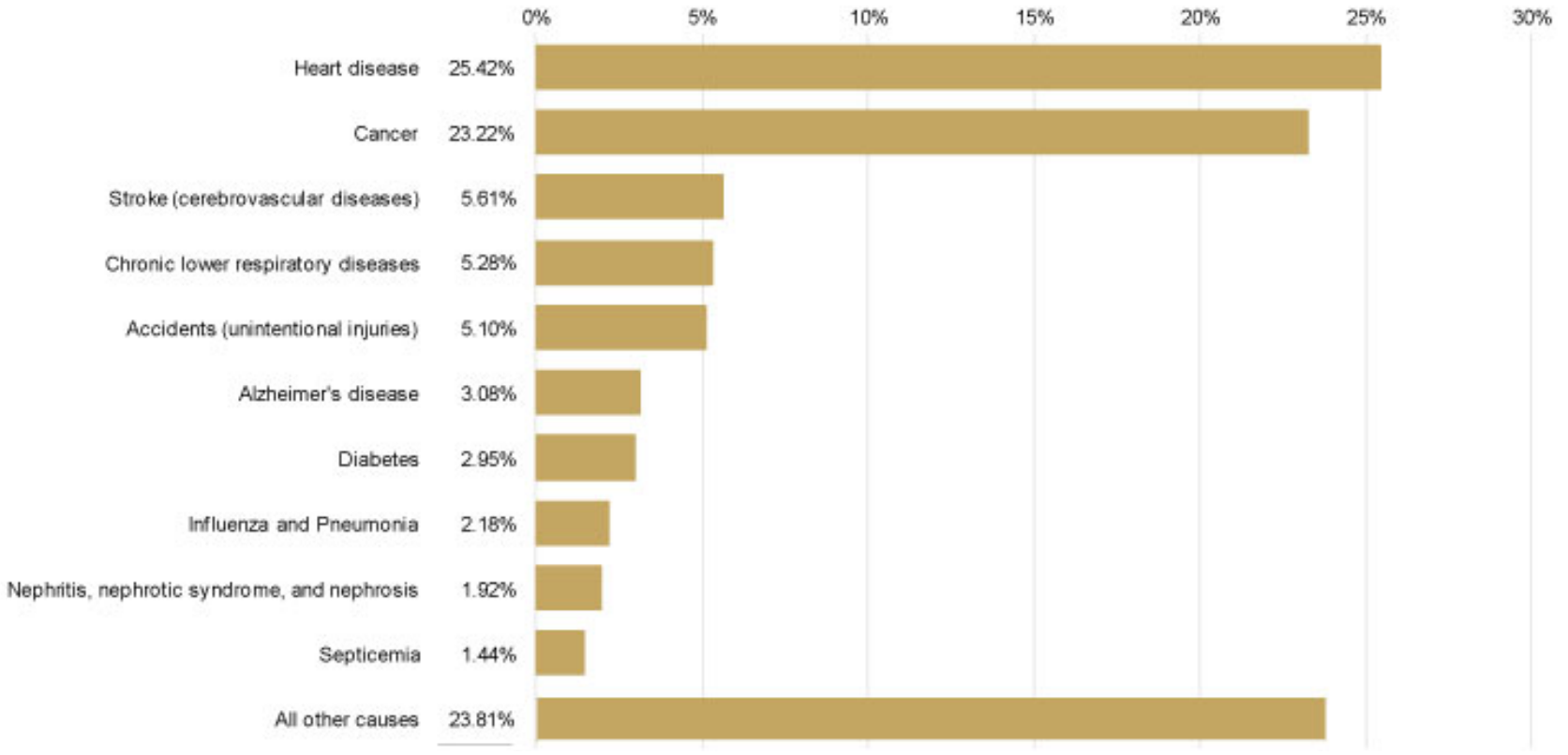
Makes it easy to see ranked values?

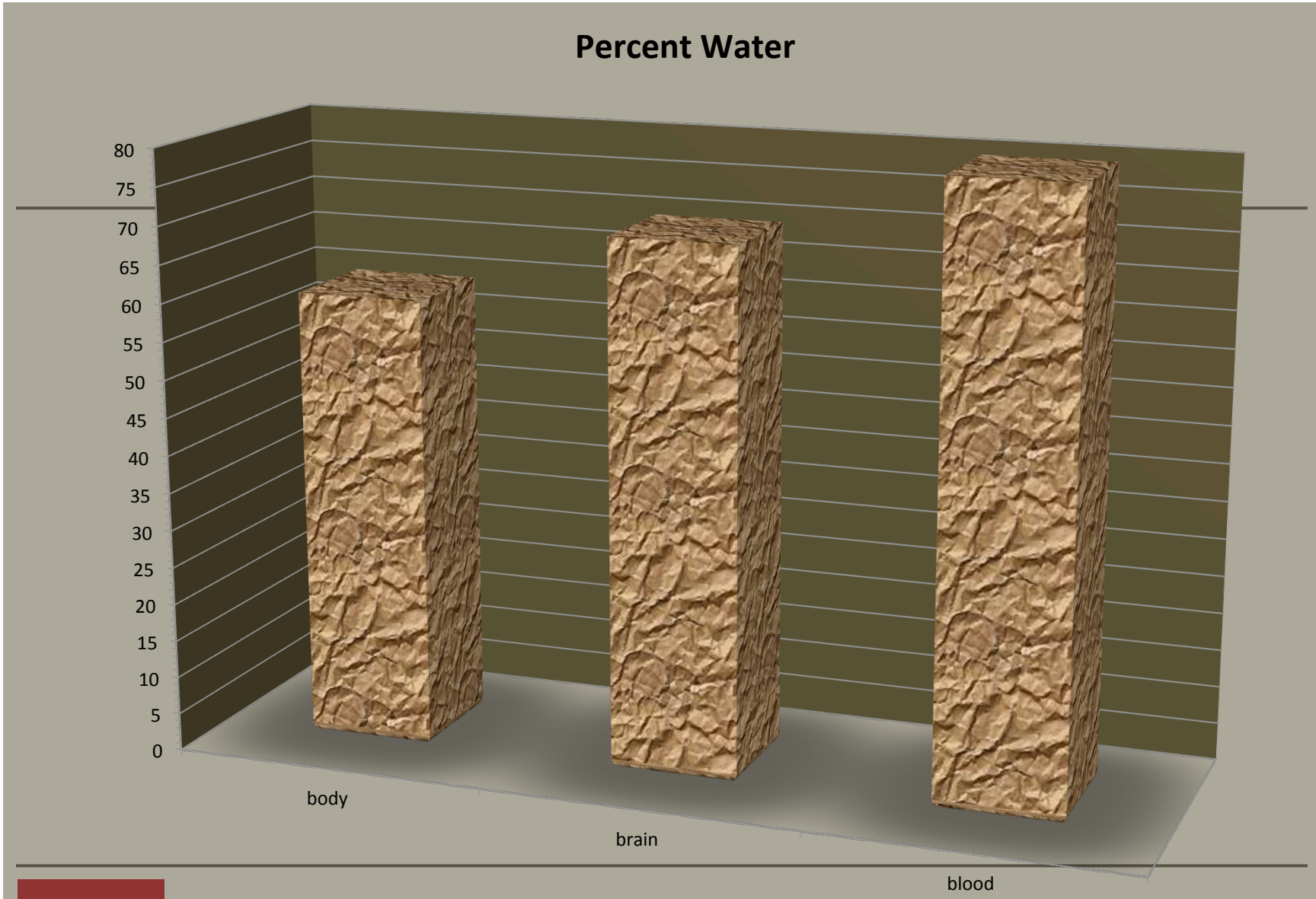


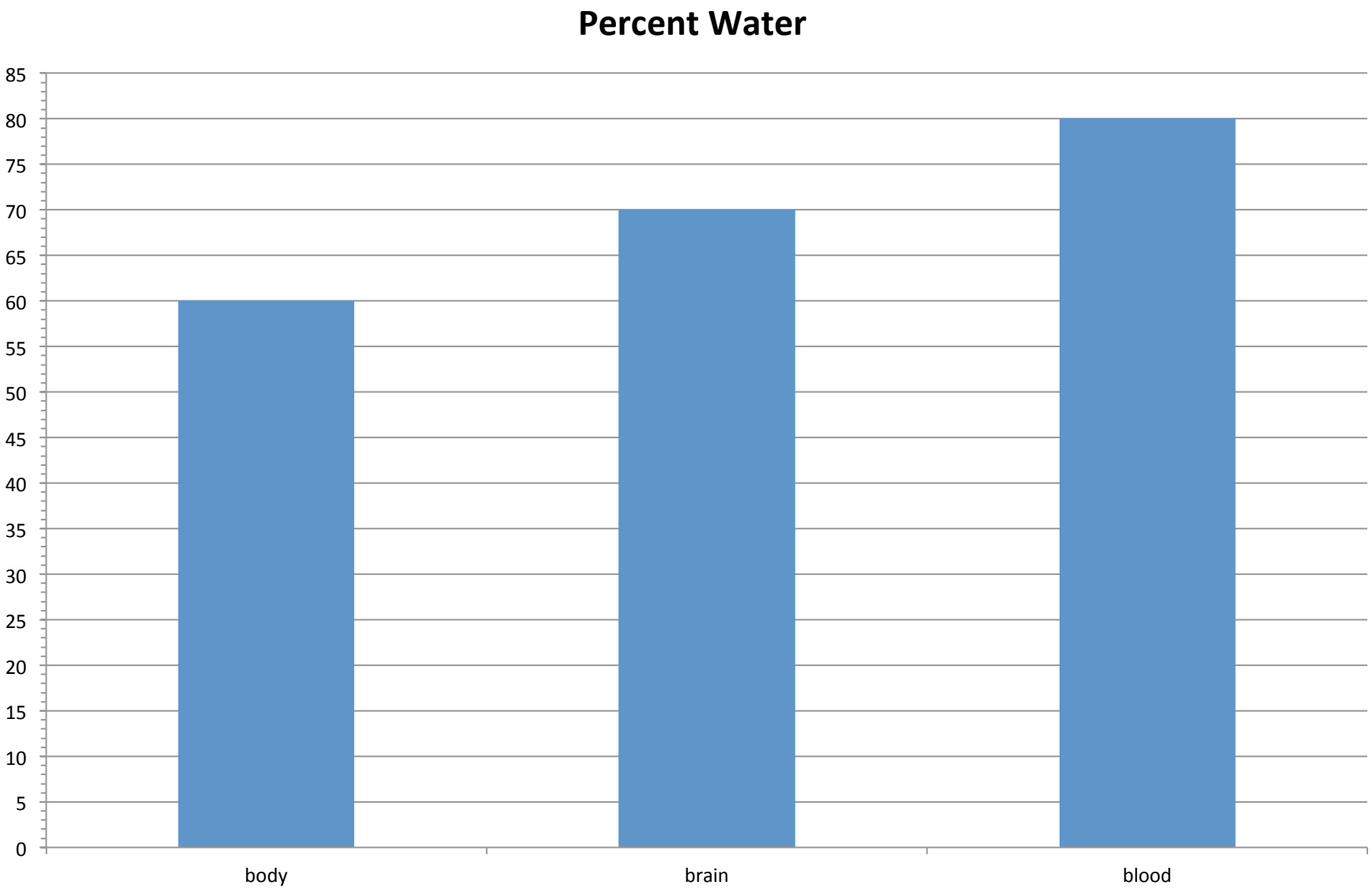
Makes it easy to see how people should use information?



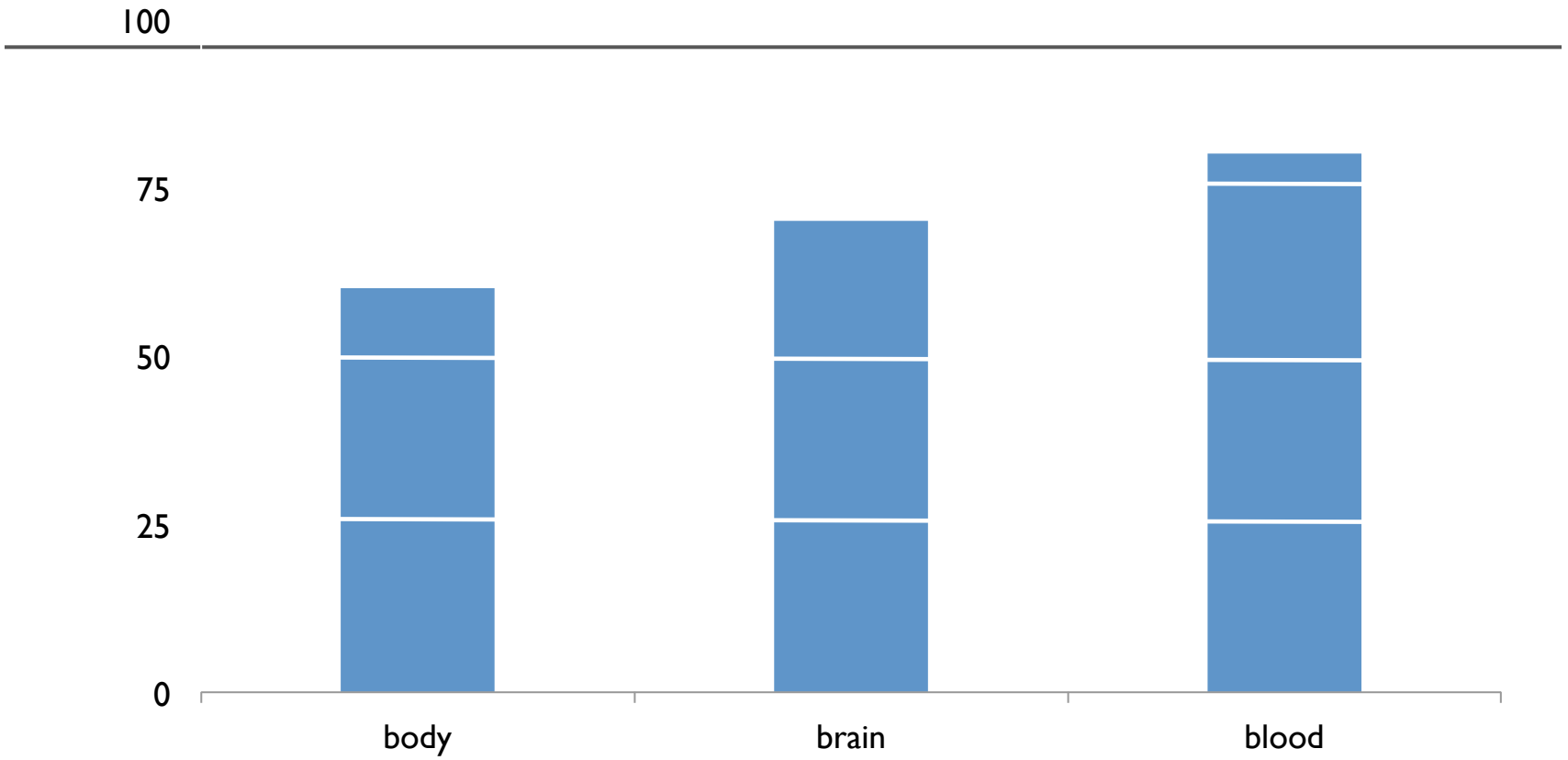
A better way


0%
5%
10%
15%
20%
25%
30%
Heart disease 25.42%
Cancer 23.22%
Stroke (cerebrovascular diseases) 5.61%
Chronic lower respiratory diseases 5.28%
Accidents (unintentional injuries) 5.10%
Alzheimer's disease 3.08%
Diabetes 2.95%
Influenza and Pneumonia 2.18%
Nephritis, nephrotic syndrome, and nephrosis 1.92%
Septicemia 1.44%
All other causes 23.81%

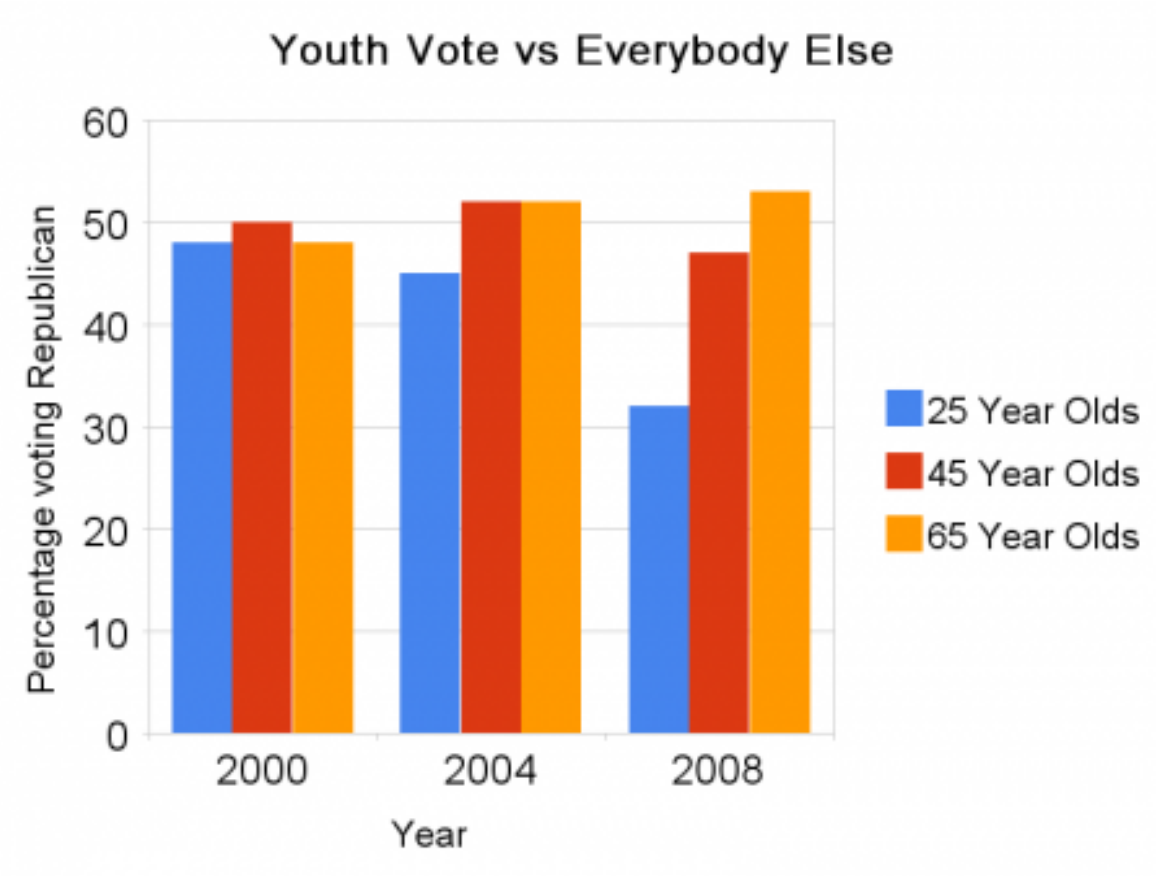

Percent Water
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
body
brain
blood


Percent Water
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
body
brain
blood

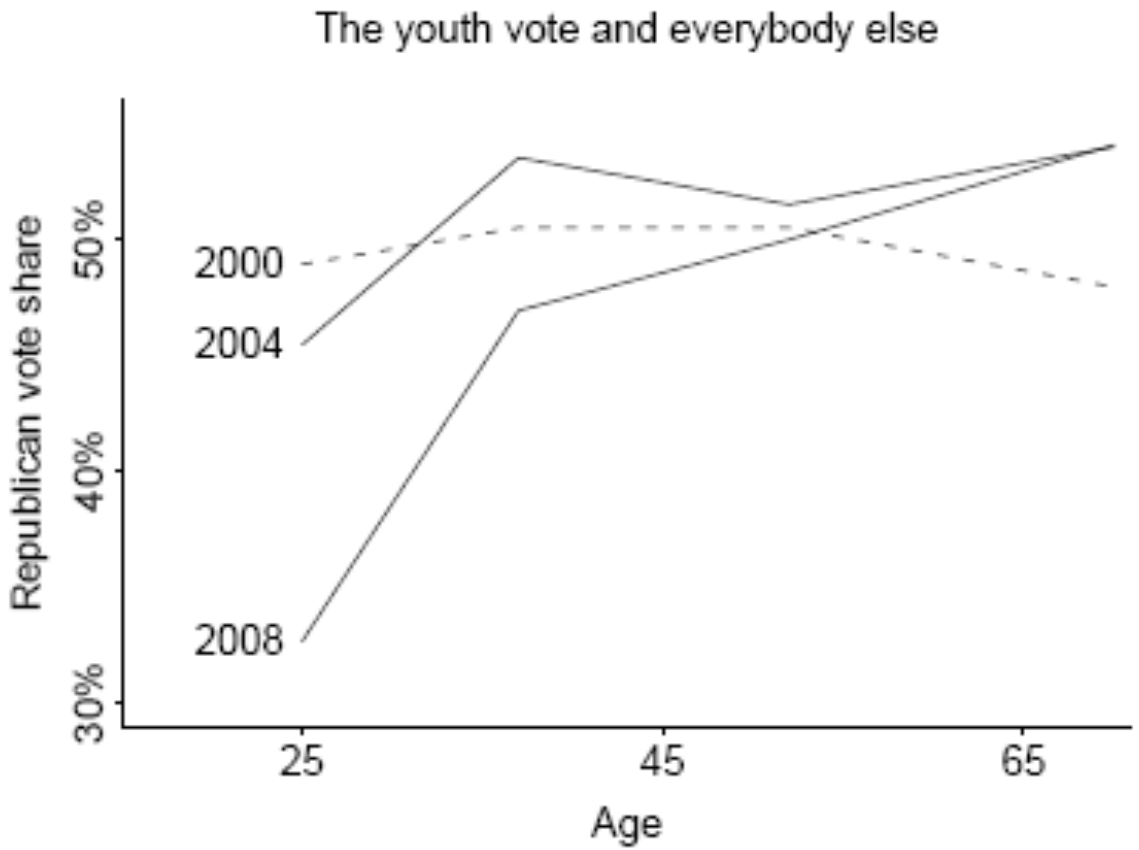
Percent Water



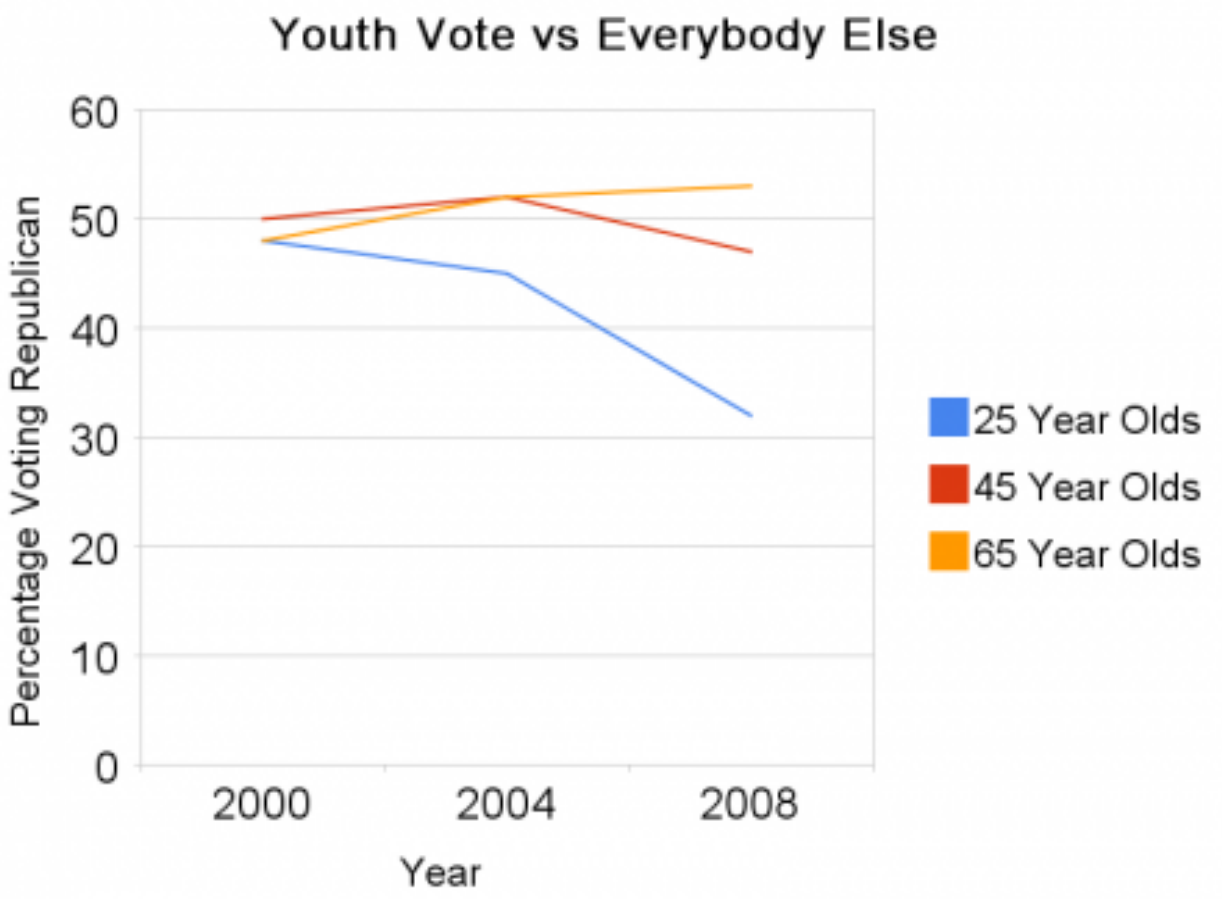
Bad

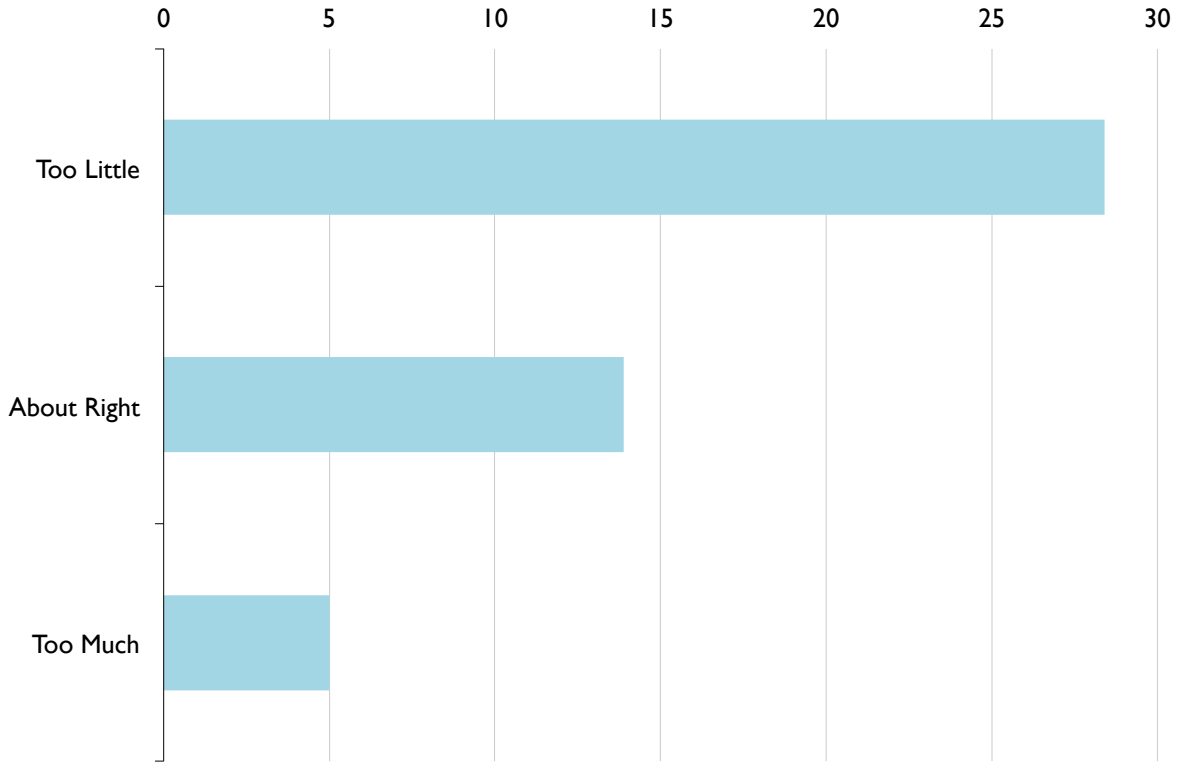

Youth Vote vs Everybody Else
Percentage voting Republican
60
50
40
30
20
10
0
2000
2004
2008
Year
25 Year Olds
45 Year Olds
65 Year Olds

Better

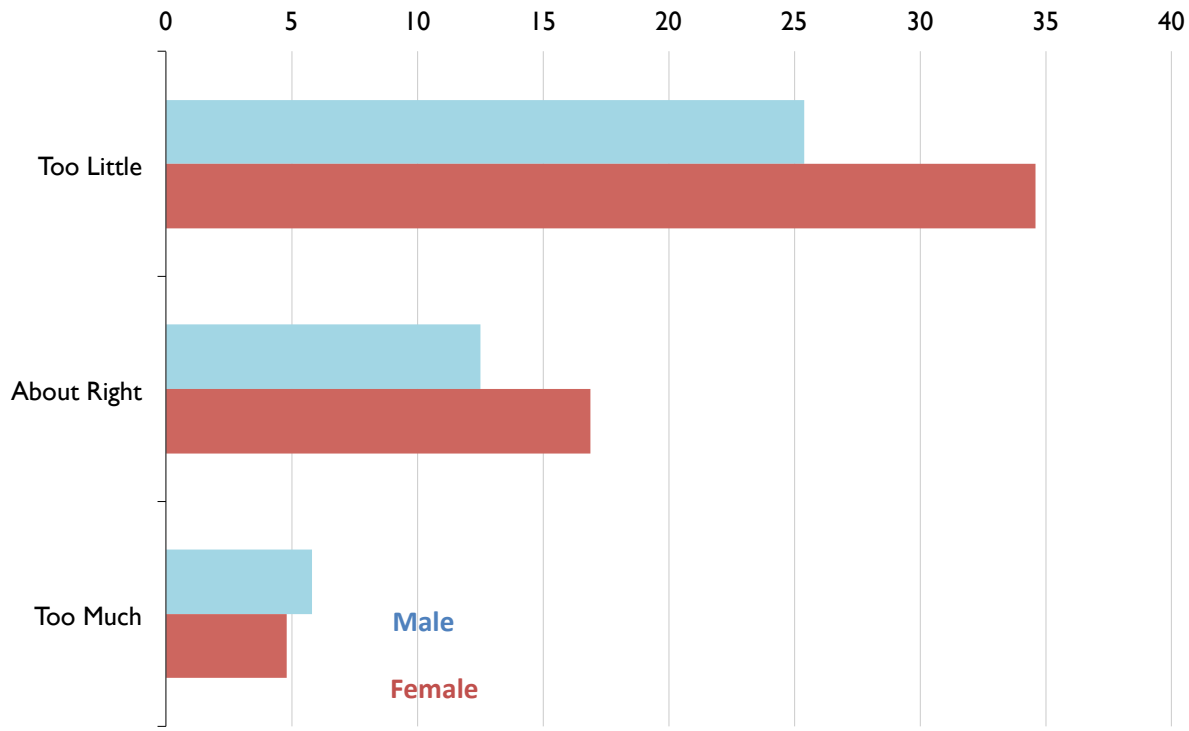

The youth vote and everybody else
Republican vote share
50%
40%
30%
2000
2004
2008
25
45
65
Age

Even Better*

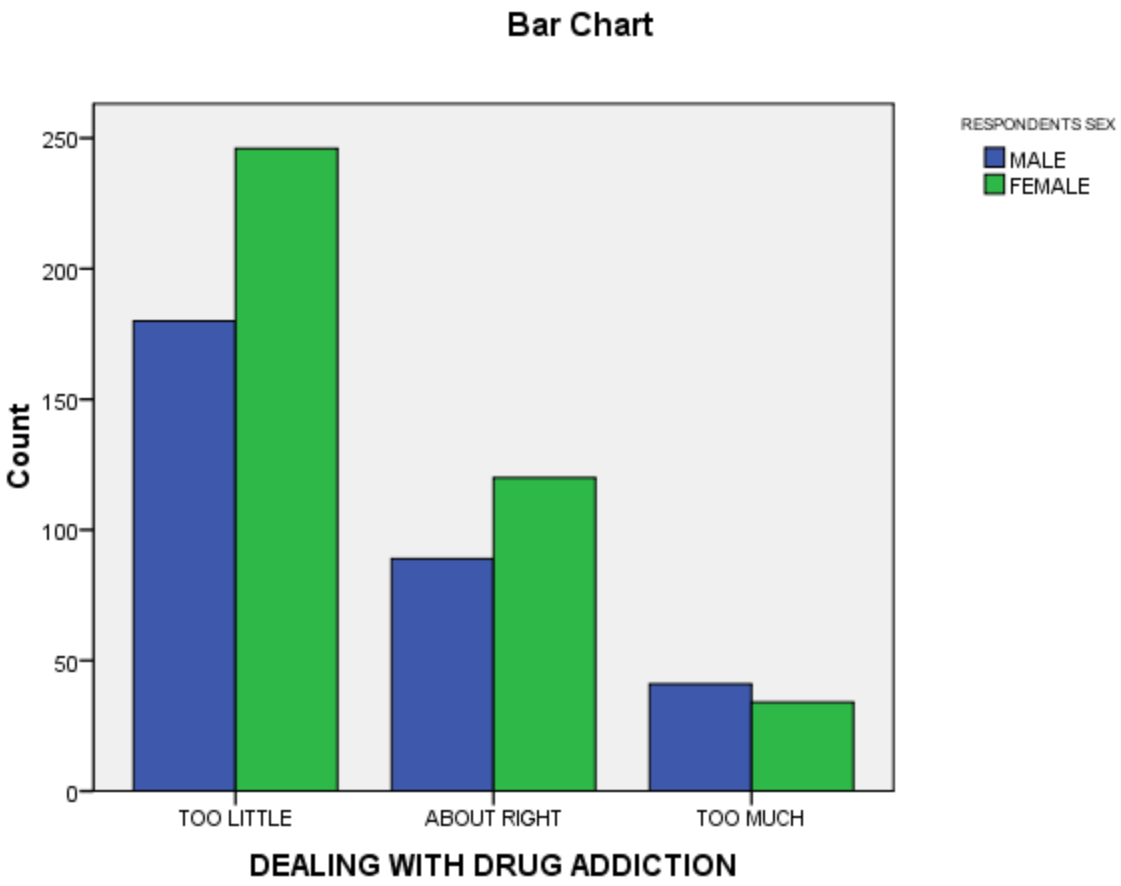

Youth Vote vs Everybody Else
Percentage Voting Republican
60
50
40
30
20
10
0
2000
2004
2008
Year
25 Year Olds
45 Year Olds
65 Year Olds

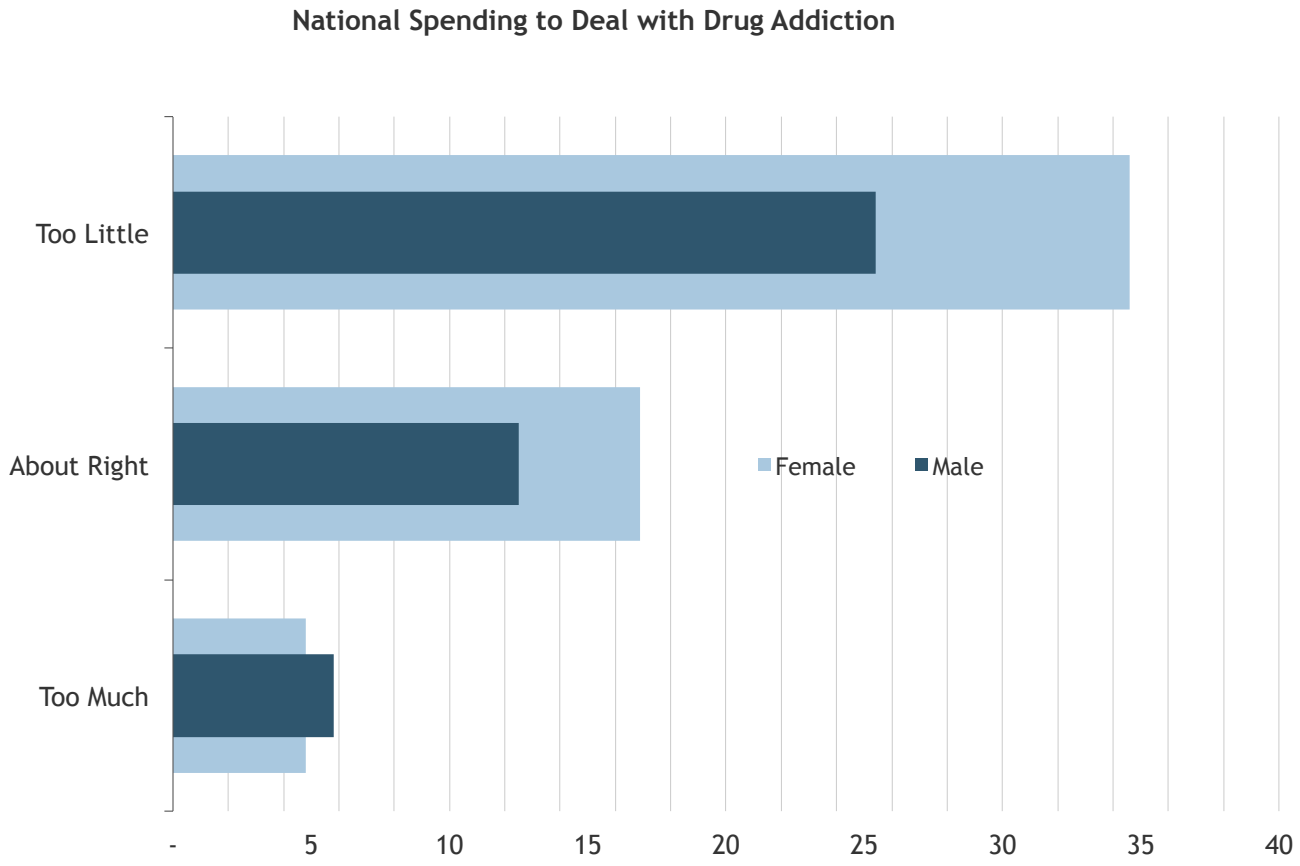


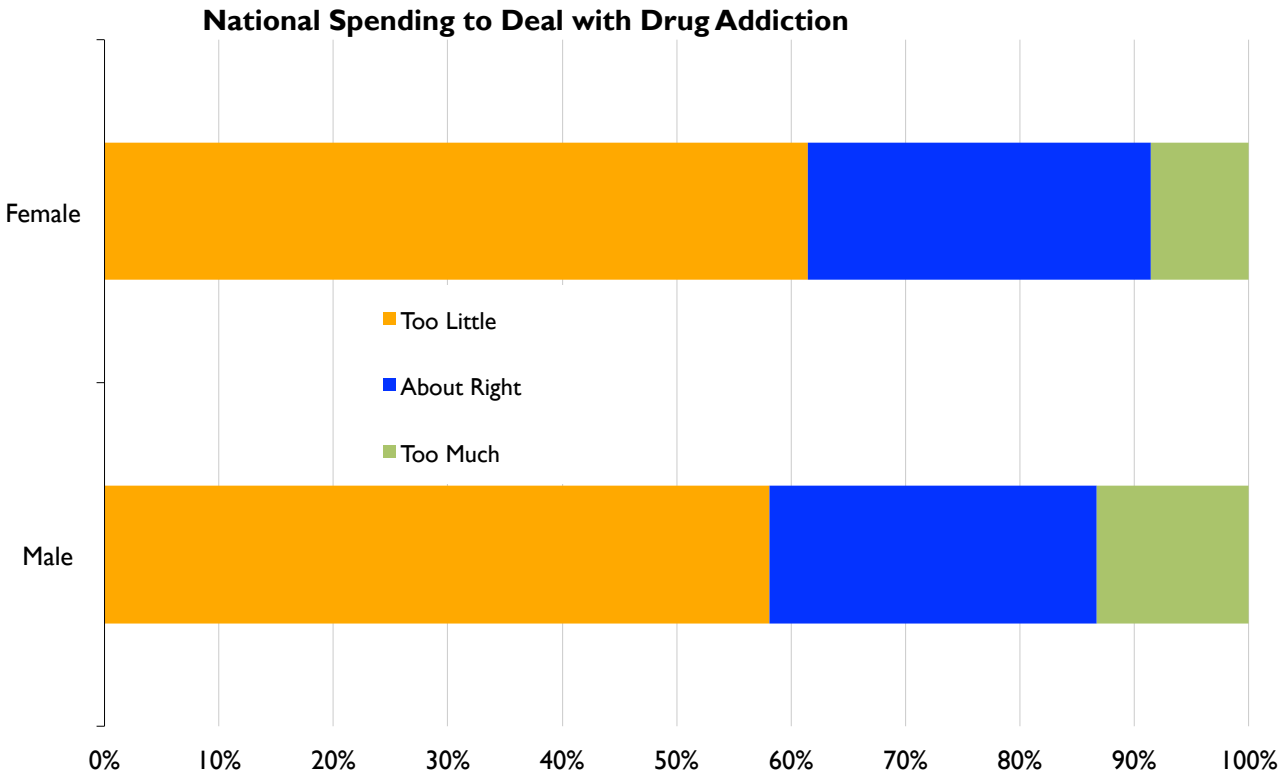
National Spending to Deal with Drug Addiction

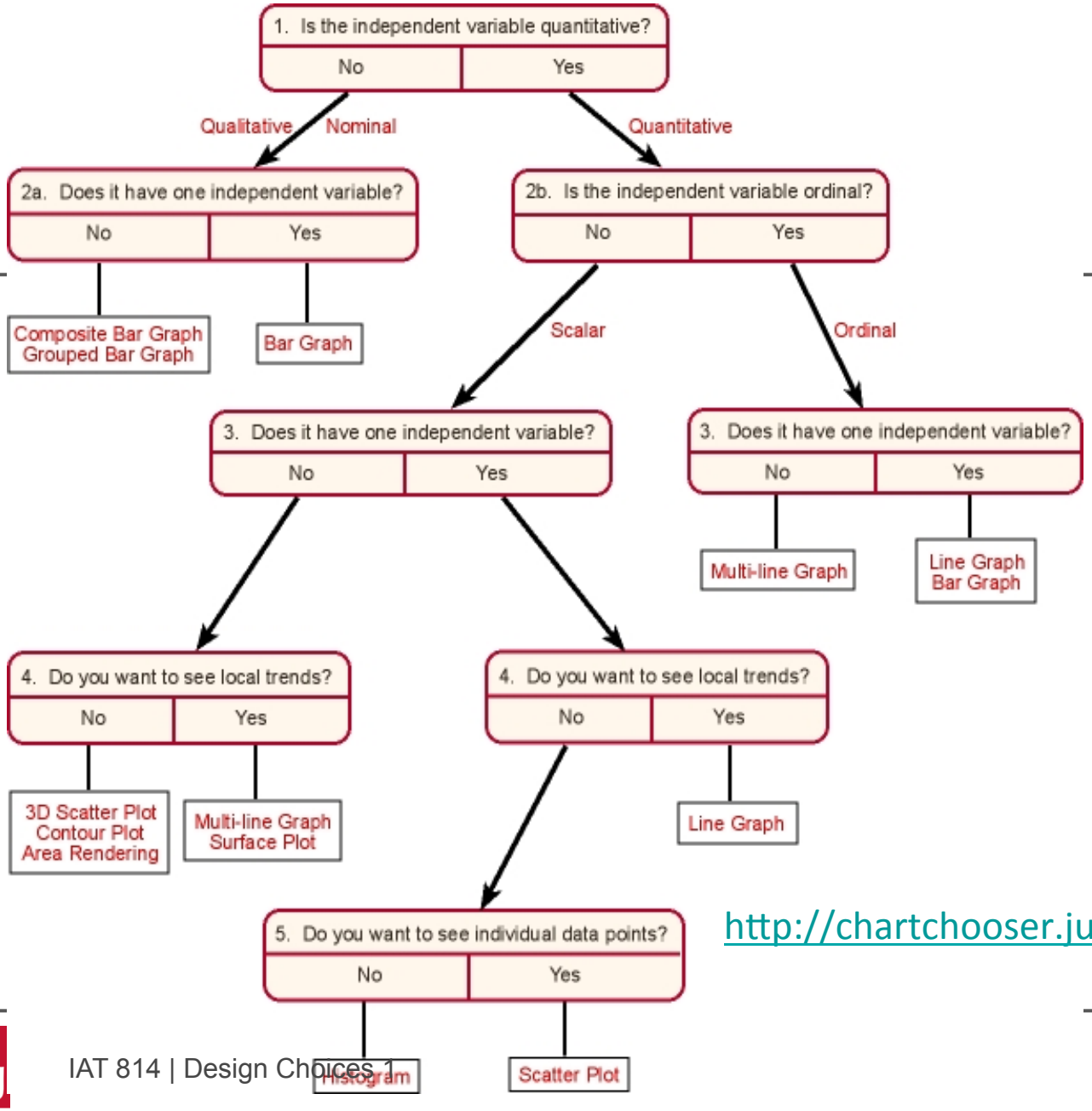


National Spending to Deal with Drug Addiction


Bar Chart
RESPONDENTS SEX
MALE
FEMALE
Count
250
200
150
100
50
0
TOO LITTLE
ABOUT RIGHT
TOO MUCH
DEALING WITH DRUG ADDICTION


National Spending to Deal with Drug Addiction
Too Little
About Right
Too Much
Female
Male
-
5
10
15
20
25
30
35
40


National Spending to Deal with Drug Addiction
Female
Male
Too Little
About Right
Too Much
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%



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