Visualization

MEILI VANEGAS HERNÁNDEZ
WEB DEVELOPMENT
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Based on slides from John Alexis Guerra Gómez

WHY?

Convey a story, **idea** or **insight** as **efficiently** as possible

Help people carry out **tasks** more **effectively**

WHEN?

exploratory analysis

translate to end-user's language

refining models

explore and understand data,

exploratory/explanatory

detect patterns

- Needing of human capabilities in problems that can’t be entirely done by machines

- Human visual system: high speed processor

- Handle large amount of data

- Offers interactivity

1 DATA WRANGLING

{ acquire
parse

2 EXPLORATORY ANALYSIS

{ statistics
data mining

3 DATA VISUALIZATION

{ represent
refine

{ infovis
HCI

DATA WRANGLING

E XTRACT

T RANSFORM

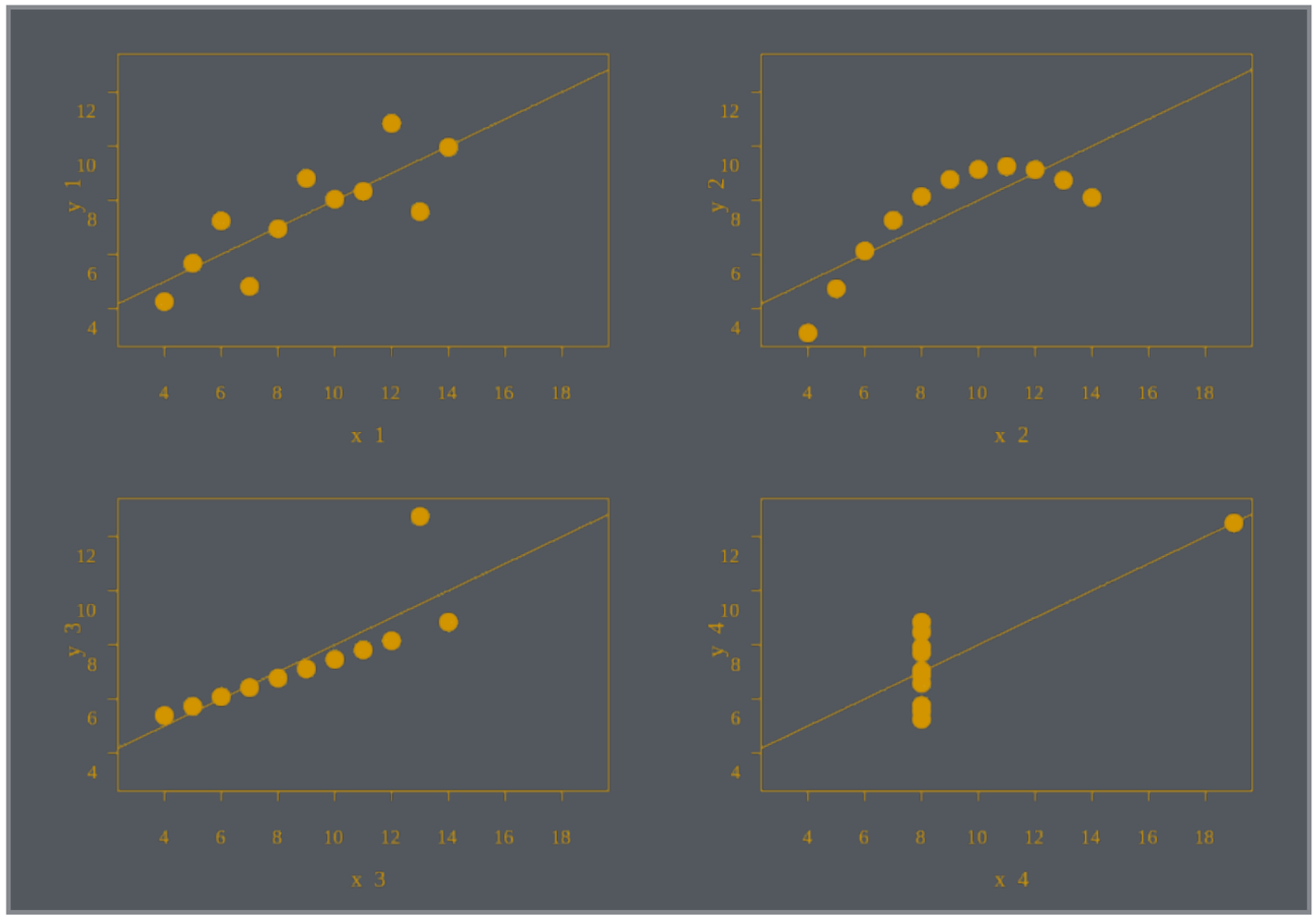
L OAD

Los datos ocultos de la registraduría

EXPLORATORY ANALYSIS

ANSCOMBE'S QUARTET

Mean of x	9
Sample variance of x	11
Mean of y	7.50
Sample variance of y	4.125
Correlation between x and y	0.816
Linear regression line	y = 3.00 + 0.500x



DATA VISUALIZATION

WHAT WHY HOW

Visualization Analysis and Design

Tamara Munzner

WHAT

Data and Dataset Types

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

Data Types

→ Items → Attributes → Links → Positions → Grids

Dataset Availability

→ Static → Dynamic

WHAT

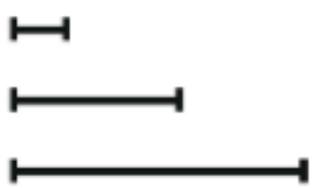
Attribute Types

→ Categorical

→ Ordered

→ *Ordinal*

→ *Quantitative*



Ordering Direction

→ Sequential

→ Diverging

→ Cyclic

WHY

- consume
  - discover vs present
    - classic split
    - aka explore vs explain
  - enjoy
    - newcomer
    - aka casual, social
- produce
  - annotate, record
  - derive
    - crucial design choice

➔ **Analyze**

➔ Consume

➔ *Discover*

➔ *Present*

➔ *Enjoy*

➔ Produce

➔ *Annotate*

➔ *Record*

➔ *Derive*

WHY

- what does user know?
  - target, location
- how much of the data matters?
  - one, some, all

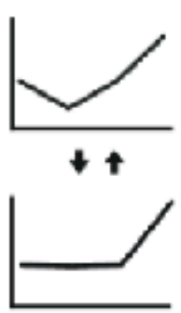
Search

	Target known	Target unknown
Location known	*Lookup*	*Browse*
Location unknown	*Locate*	*Explore*

Query

→ Identify

→ Compare

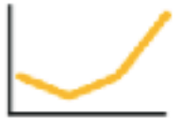


→ Summarize

WHY

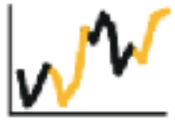
ALL DATA

→ Trends



→ Outliers

→ Features



ATTRIBUTES

→ One

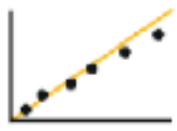
→ *Distribution*

→ *Extremes*

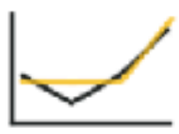
→ Many

→ *Dependency*

→ *Correlation*



→ *Similarity*



NETWORK DATA

→ Topology

→ *Paths*

SPATIAL DATA

→ Shape

HOW

Encode

Arrange

→ Express

→ Separate

→ Order

→ Align

→ Use

Map

from categorical and ordered attributes

→ Color

→ *Hue*

→ *Saturation*

→ *Luminance*

→ Size, Angle, Curvature, ...

→ Shape

→ Motion

Direction, Rate, Frequency, ...

HOW

Manipulate

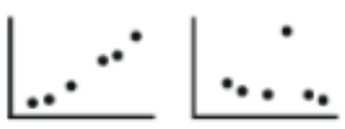
Change

Select

Navigate

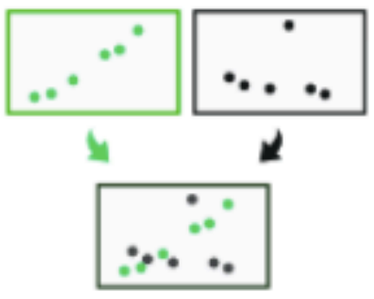
Facet

Juxtapose



Partition

Superimpose



Reduce

Filter

Aggregate

Embed

VISUAL ENCODING

Effectiveness

- Encode most important attributes with highest ranked channels

Expressiveness

- Visual encoding should express all of, and only, the information in the dataset
- Ordered data should be shown in a way we perceive as ordered

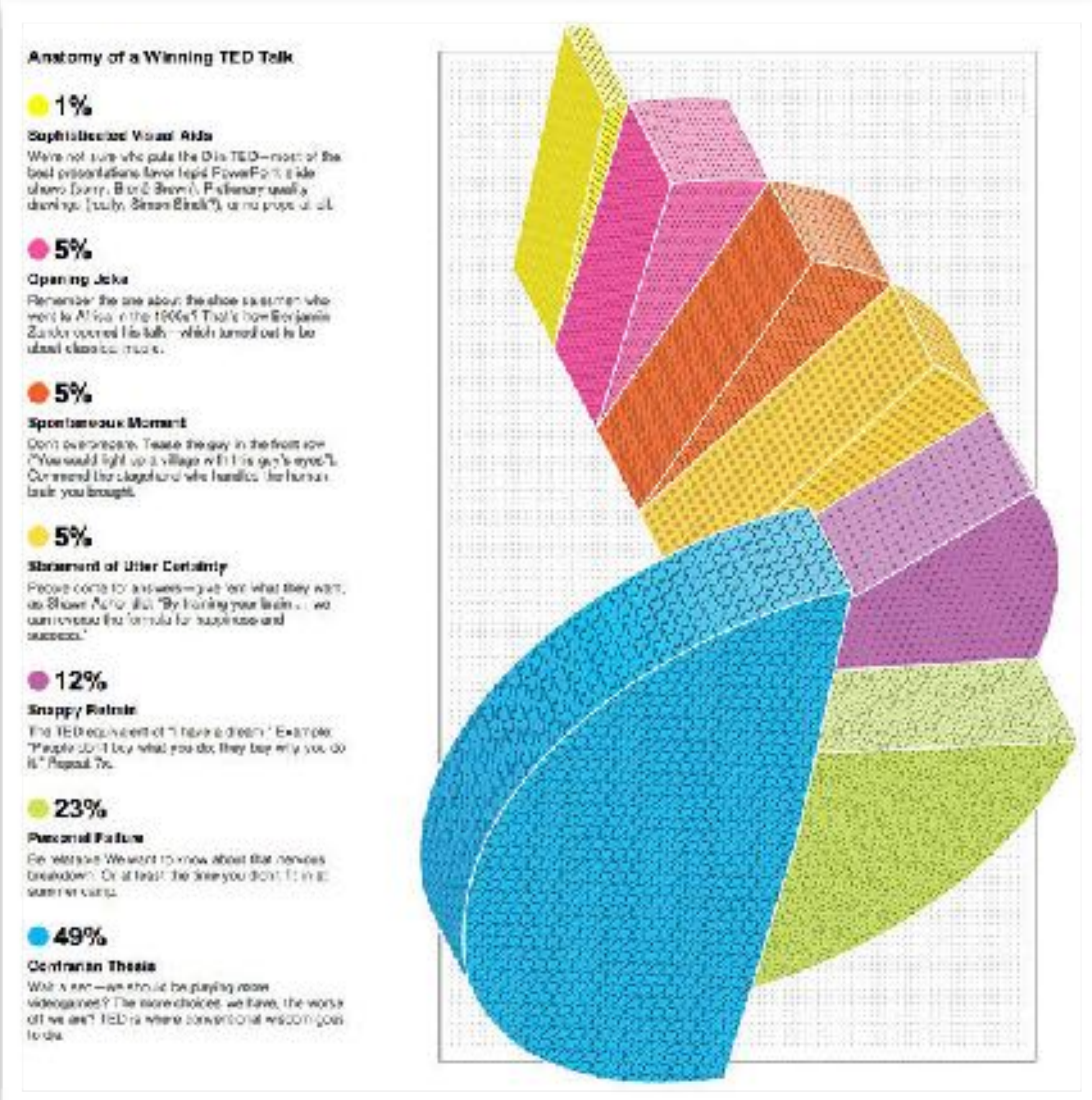
VISUAL ENCODING

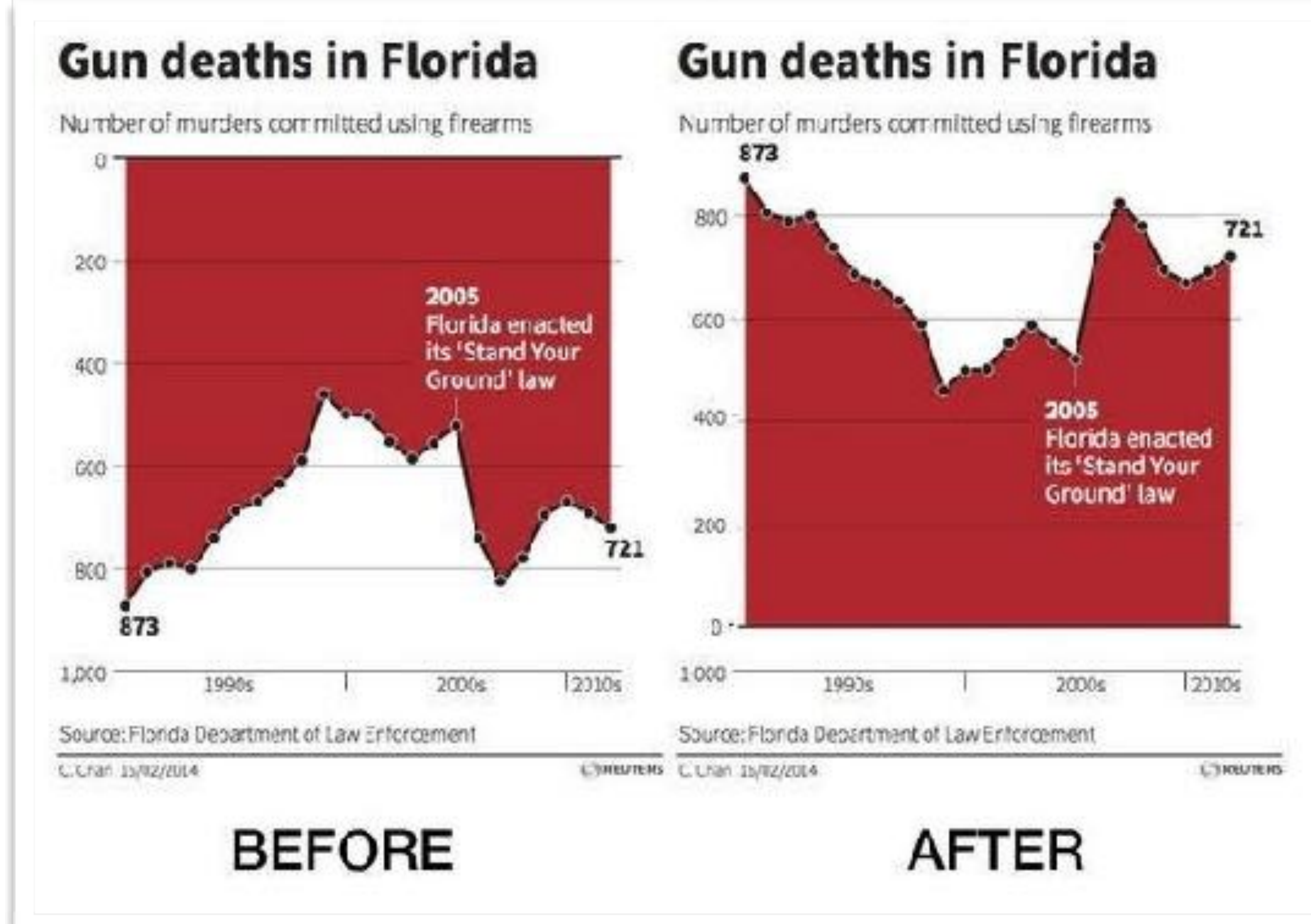
Magnitude Channels: Ordered Attributes

- Position on common scale
- Position on unaligned scale
- Length (1D size)
- Tilt/angle
- Area (2D size)
- Depth (3D position)
- Color luminance
- Color saturation
- Curvature
- Volume (3D size)

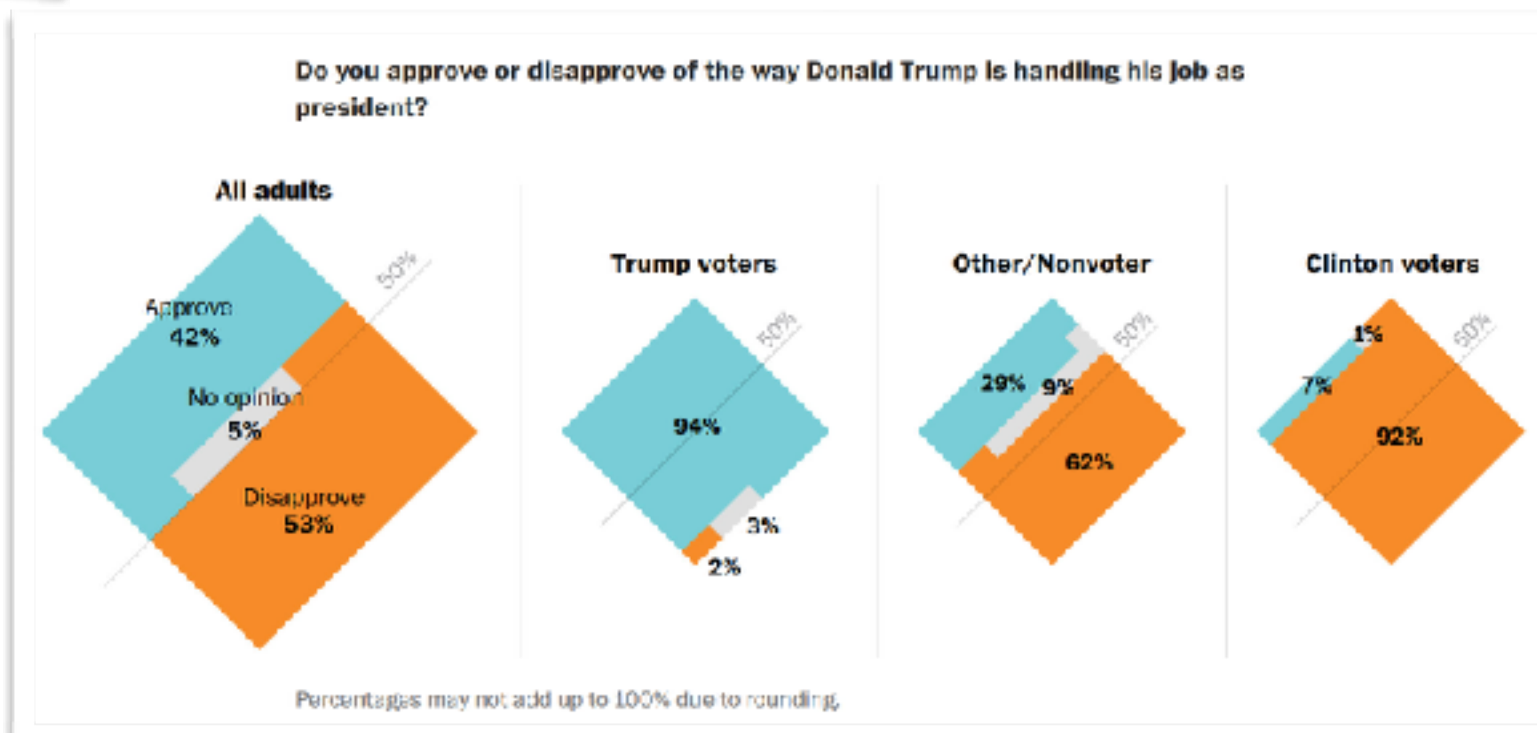
Identity Channels: Categorical Attributes

- Spatial region
- Color hue
- Motion
- Shape


Anatomy of a Winning TED Talk
1%
Sophisticated Visual Aids
5%
Opening Joke
5%
Spontaneous Moment
5%
Statement of Utter Certainty
12%
Snappy Refrain
23%
Personal Failure
49%
Contrarian Thesis


Gun deaths in Florida
Number of murders committed using firearms
0
200
400
600
800
1,000
873
2005
Florida enacted
its 'Stand Your
Ground' law
721
1990s
2000s
2010s
Source: Florida Department of Law Enforcement
BEFORE
Gun deaths in Florida
Number of murders committed using firearms
873
800
600
400
200
0
721
2005
Florida enacted
its 'Stand Your
Ground' law
1990s
2000s
2010s
Source: Florida Department of Law Enforcement
AFTER


High-Income Americans Pay the Majority of Federal Taxes
The Top 25%
Pays 15.9% of Taxes
The Top 5%
Pays 20.5% of Taxes
The Top 1%
Pays 39.5% of Taxes
Each income group excludes the previous one
howmuch


Do you approve or disapprove of the way Donald Trump is handling his job as president?
All adults
Approve
42%
No opinion
5%
Disapprove
53%
50%
Trump voters
94%
3%
2%
Other/Nonvoter
29%
9%
62%
Clinton voters
1%
7%
92%
Percentages may not add up to 100% due to rounding.

WEB TECHNOLOGIES

higher level of abstraction

higher flexibility

Raw, ChartIO

NVD3, DimpleJS, Rickshaw

D3.JS

Web GL, Canvas, SVG

Visualization Tools Taxonomy

WEB TECHNOLOGIES

higher level of abstraction

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Raw, ChartIO

NVD3, DimpleJS, Rickshaw

D3.JS

Web GL, Canvas, SVG

Visualization Tools Taxonomy

WHY D3

1. DATA
2. DRIVEN
3. DOCUMENT

- Source documents
- DOM

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2. DRIVEN
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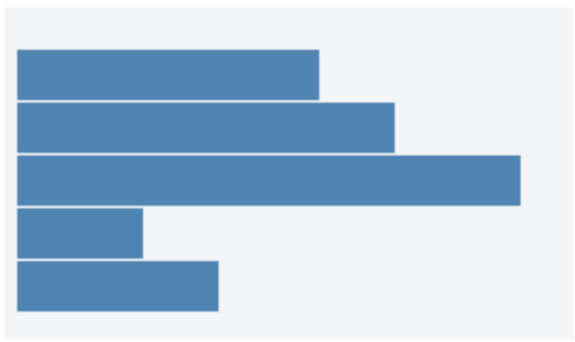
- Source documents
- DOM

D3 Tutorial



https://jsfiddle.net/mvanegas10/ozur2edj/1/

D3: SELECTIONS AND QUERIES

Id Selection

```
document.getElementById(‘chart’);
document.querySelector(‘#chart’);
```

Id Selection

```
d3.select(‘#chart’);
```

Class Selection

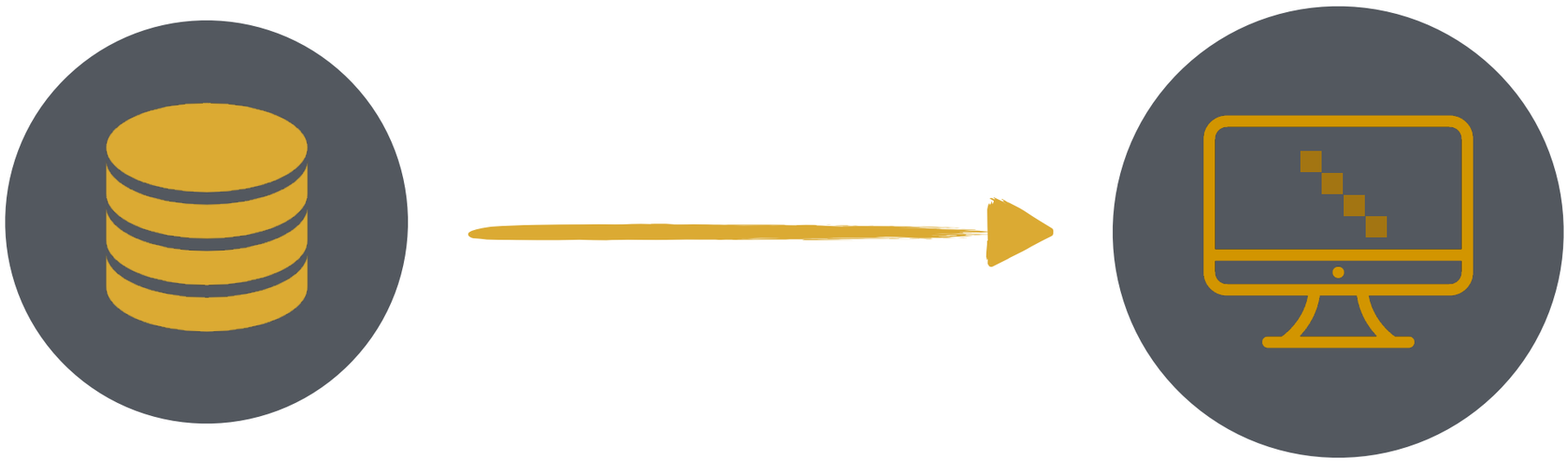
```
document.querySelector(‘.div’);
```

Class Selection

```
d3.select(‘.div’);

d3.selectAll(‘.div’);
```

D3: SCALES



DATA

PIXELS

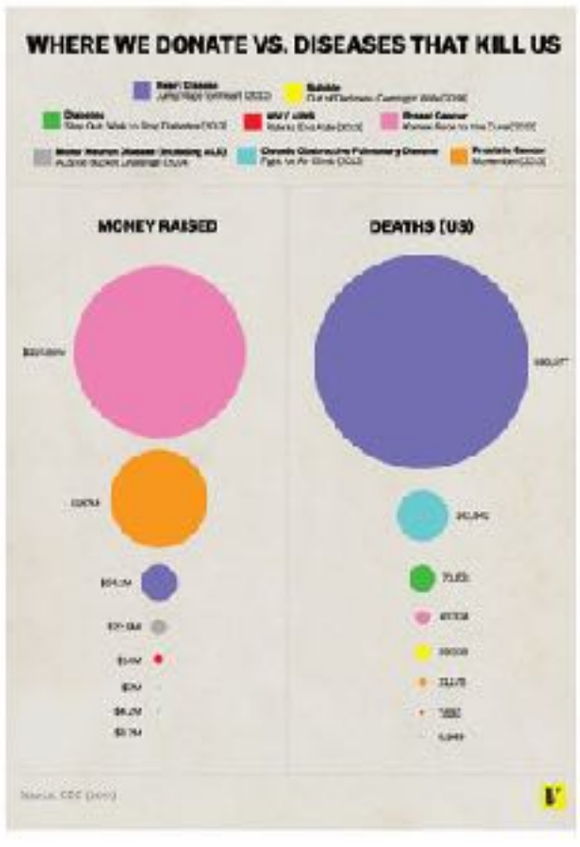
```
d3.scaleLinear();

d3.scalePow();

d3.scaleLog();

d3.scaleSqrt();
```

Original Design



Corrected Design