Giving Form to Data

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BU CFA AR 881

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Giving Form to Data

Data visualization is the practice

of giving **form**

to the **abstract** and **unseen.**

Data Visualizations should:

1. **Accurately represent** information, without distortion or undue emphasis.

Data Visualizations should:

2. Help people understand something about the data that they might not otherwise have seen.

Quantitative insight

Emotional or subjective truth

Data Visualizations should:

3. Have a purpose.

Audience

Context

Scientific publications

Does Crystal Density Control Fast Surface Crystal Growth in Glasses? A Study with Polymorphs

Published as part of a virtual special issue of selected papers presented at the 2010 Annual Conference of the British Association for Crystal Growth (BACG), Manchester, UK, September 5–7, 2010

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ABSTRACT: As organic liquids are cooled to become glasses, crystal growth at the free surface can be substantially faster than in the interior, a phenomenon uncommon for other materials and for which different explanations exist. We have measured the surface and bulk growth rates of three polymorphs in carbamazepine glasses. Crystal density has no controlling effect on the extent to which surface crystal growth is enhanced over bulk crystal growth, in contradiction to models that relate fast surface crystal growth to the release of crystallization-induced tension.
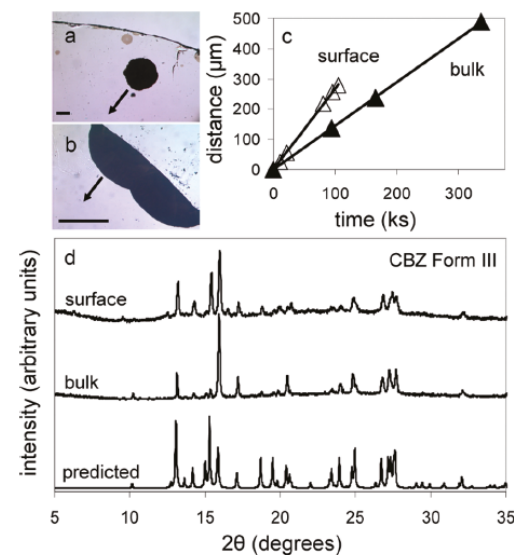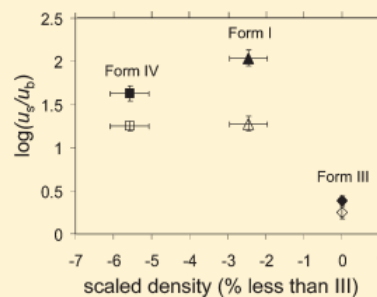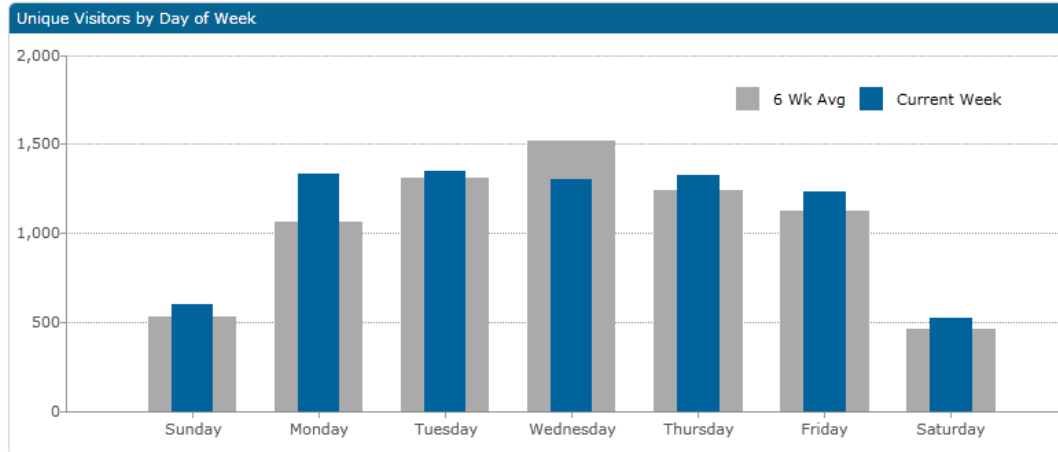

Figure 3. Form III crystals growing (a) at the surface and (b) in the bulk at 313 K. Scale bar = 200 μm. Arrows indicate growth directions. (c) Distance of growth vs time for crystals in (a) and (b). (d) Observed and predicted XRD patterns of Form III crystals.

Business reports

DMANA **Website Operational Dashboard**   June 11th, 2011

Unique Visitors by Day of Week

Legend: 6 Wk Avg | Current Week

(Bar chart: Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday — scale 0 to 2,000)

Bounce Rate	Change
Yesterday 66.90 %	
6 Wk Avg 66.63 %	0.27 %

Avg. Time On Site (Seconds)	Change
Yesterday 121	
6 Wk Avg 112	9.00

Avg. # of Pages per Visit	Change
Yesterday 2.24	
6 Wk Avg 2.27	-0.03

% of New Visitors	Change
Yesterday 77.21 %	
6 Wk Avg 78.84 %	-1.63 %

Yesterday's Activities
Article - Data Governance Primer
News Item - Next generation of data federation tools
Article - Data Integration Challenges Rises
Sent out June Newsletter - Visualizing Big Data

Unique Visitors by Day of Week Performance

Current Wk vs. 6 Wk Avg % Change | 6 Wk Rolling Trend

Sun.
Mon.
Tues.
Wed.
Thurs.
Fri.
Sat.

-10%   0   +10%

Total Rolling 6 Wk Trend (2,000 — 0)
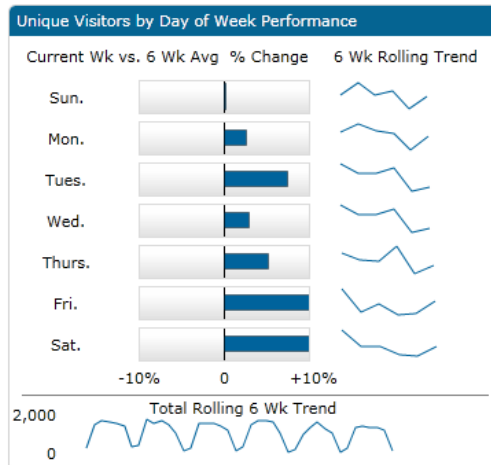
Google Keyword Search Rankings (as of Yesterday)

Keyword(s)	Current Month's Rank	Previous Month's Rank	Change
Data Management	1	2	⬆
Data Federation	2	2	
Business Intelligence	3	12	⬆
Data Warehouse	3	4	⬆
Data Governance	4	2	⬇
Data Analytics	4	1	⬇
SOX Compliance	4	9	⬆
mobile business intelligence	7	34	⬆
Big Data	9	11	⬆
analytics dashboard	10	23	⬆
data in the cloud	12	6	⬇

Planned Activities

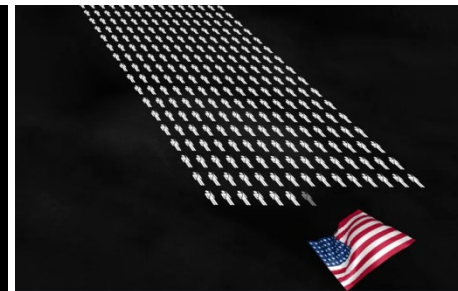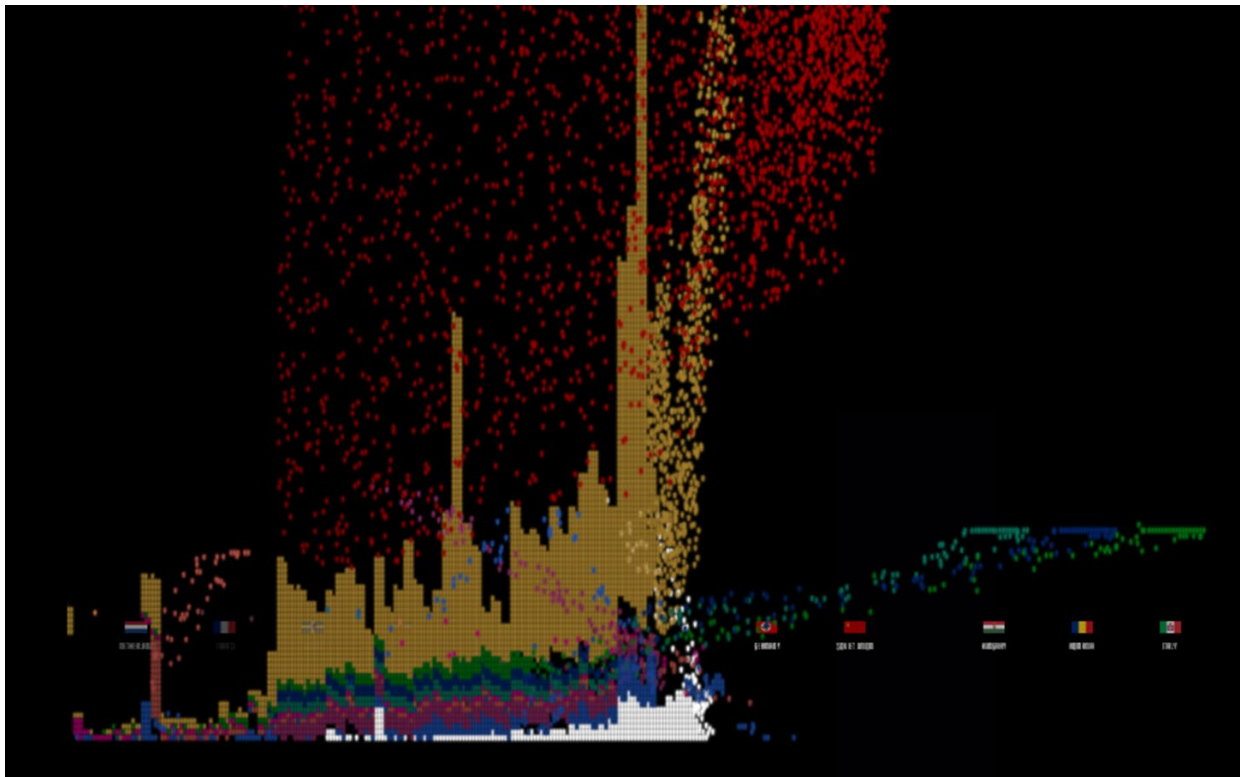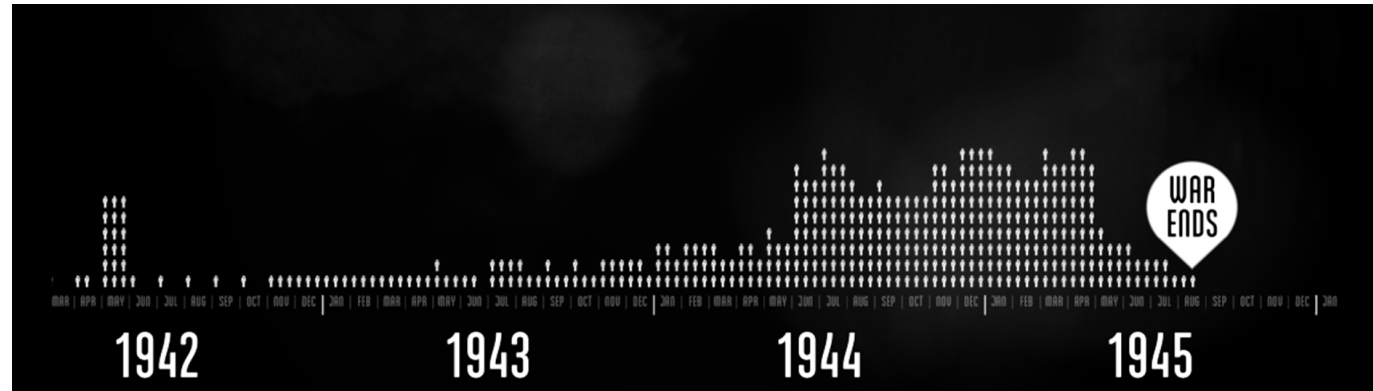| Activity Date	Description
Jun 20, 2011	New Article - Common Data Management Pitfalls
Jun 23, 2011	Interview with Larry Hinds, President, Show Me the Numbers Inc.
Jun 25, 2011	New Research Paper - Why BI projects fail
Jun 26, 2011	New Article - Looking for the one version of the truth: the never ending search

News article
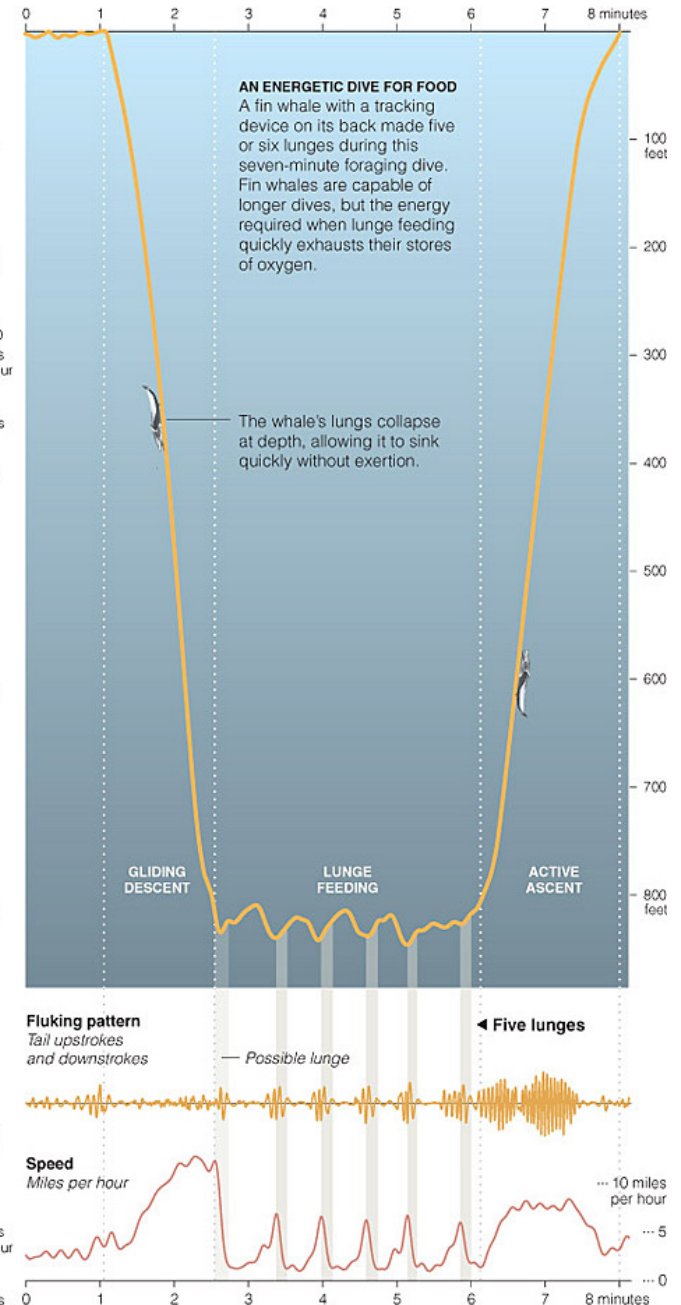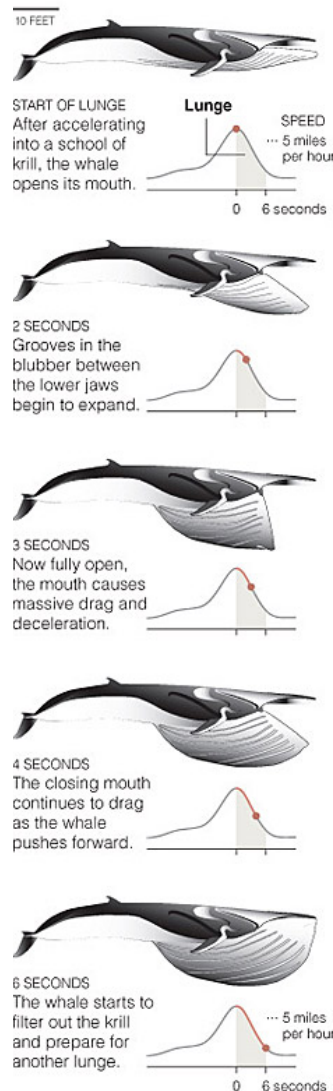
Persuasion

Neil O'Halloran: http://www.fallen.io/ww2/

Activism / Advocacy

Periscopic: https://guns.periscopic.com/?year=2013

Art

Nicholas Rougeux: https://www.c82.net/work/?id=358

Art

Jeff Hemsley. Occupy the Amendment.

Data Visualizations should:

4. Have a **perspective.**

Who is represented, how, and why?

Data humanism

What is a data visualization?

- **Encodes** information

- **Converts data channels (variables) into visual form**

- **Uses marks to represent the data values**

Methods of encoding data

Tamara Munzner. Visualization Analysis and Design.
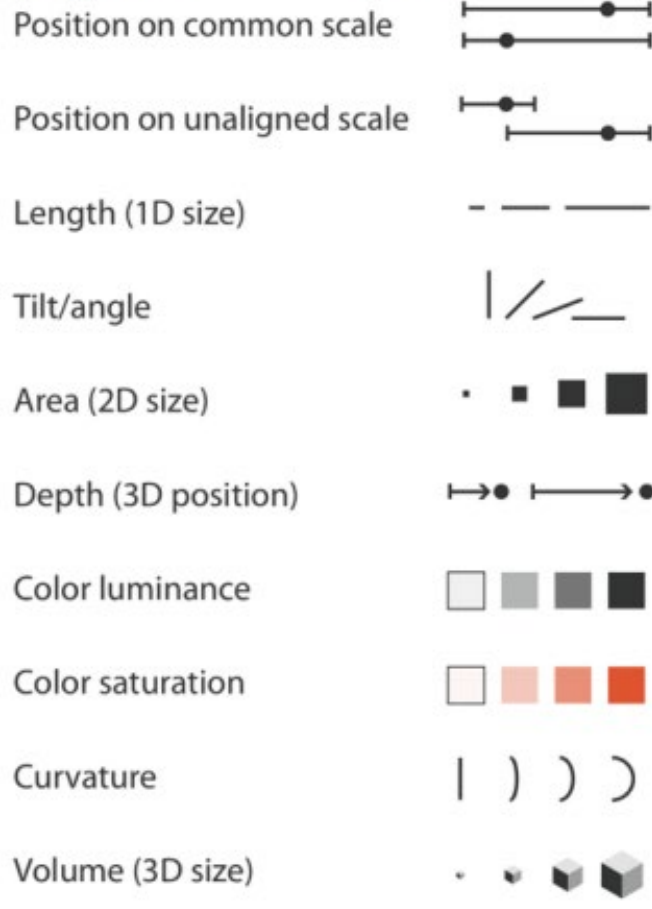
Making marks

Marks are usually drawn using some combination of visual variables.

POSITION · SIZE · SHAPE · VALUE · HUE · ORIENTATION · TEXTURE

Jacques Bertin. Semiology of Graphics. Image from AxisMaps.com
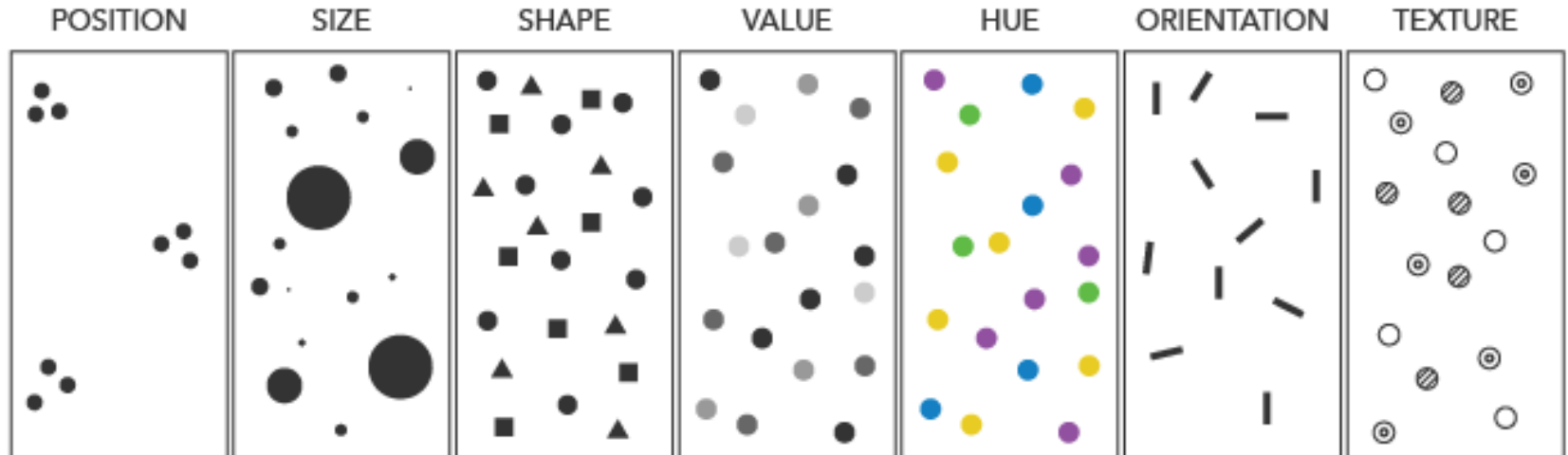
Gestalt principles of human perception

Using gestalt principles improves readability and reinforces meaning
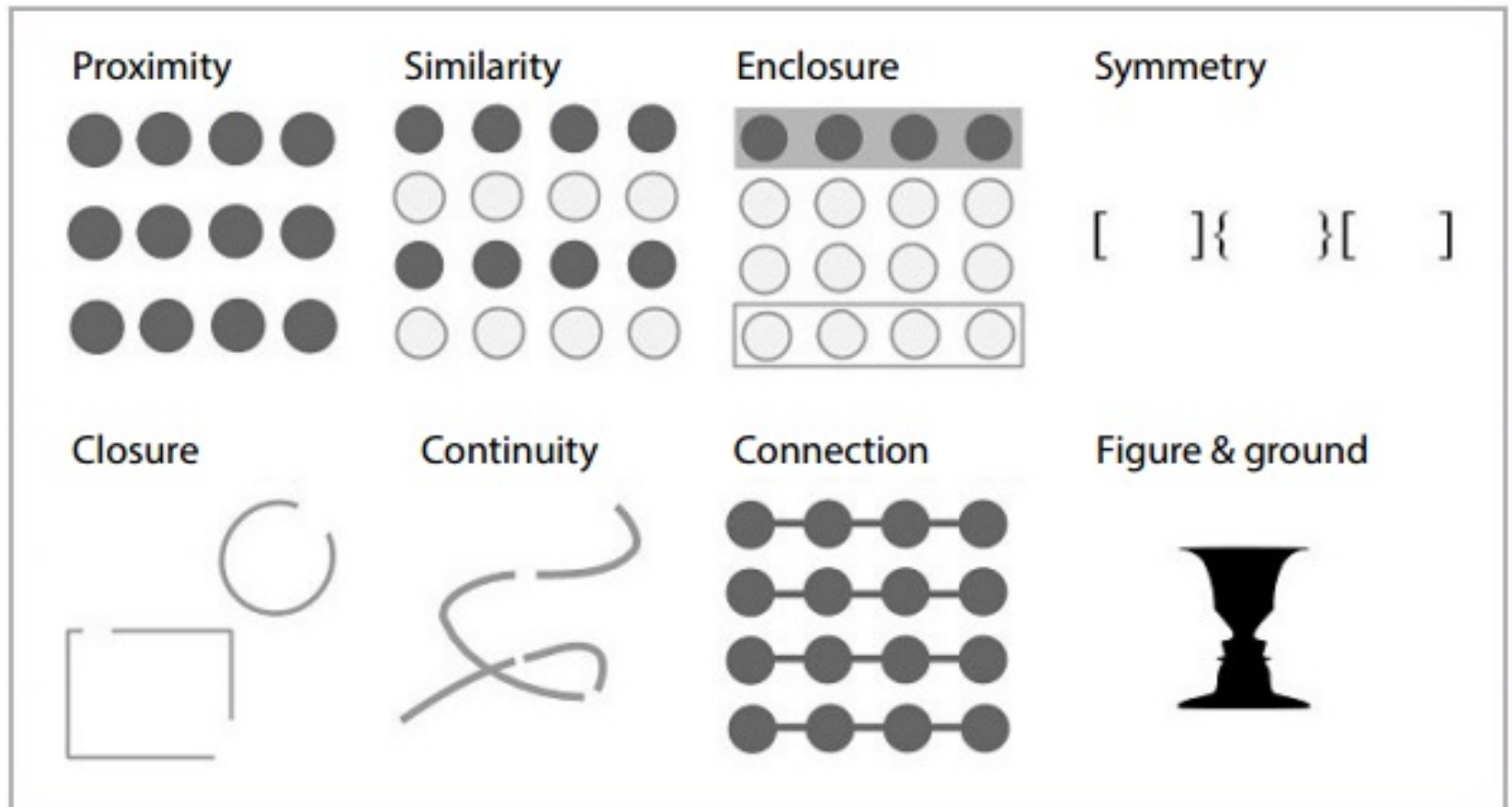
Index, Icon, Symbol

Semiotics is the formal study of symbol making. Its principles apply equally well to language, art, traditional graphic design, and to data visualizations.

Really, semiotics is a way of categorizing how we represent things.

**Index (tread marks from car)
Icon (photo of the scene)**

Index (road is slippery)

Symbol (needs cultural knowledge to understand)

Data as index, visualization as icon

- **Data is a *record* (index or icon) of a particular property or thing.**

- **It is represented by a *mark* that encodes the relevant data channels in some way.**

- **A data visualization acts as a *symbol*— a visual representation that allows us to make sense of the data, if we know how the symbol is made.**

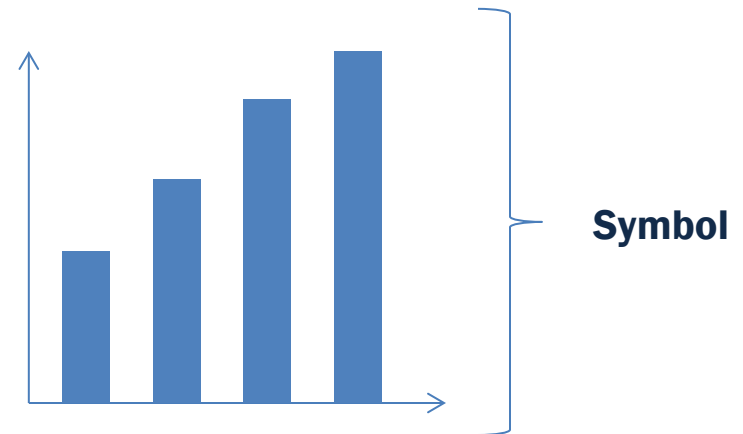# From object to visualization

Objects (people themselves)

Data (measurement/icon)

Age (y)	Height (in)
4	40
8	51
12	58
16	67.5

Channel and Encoding

Channel 1: Height
Encoding: Length

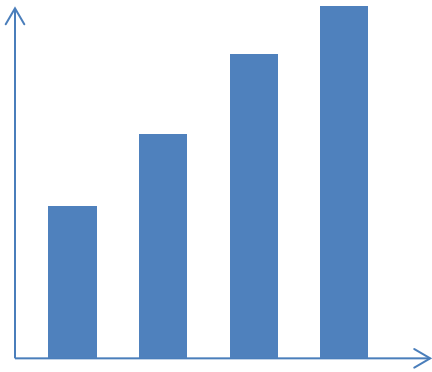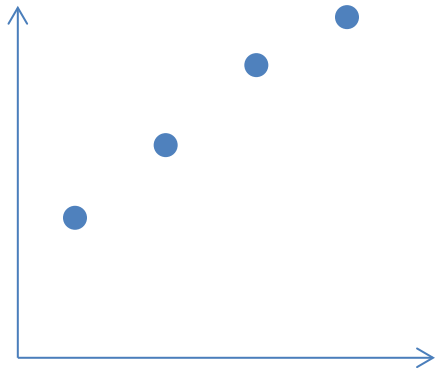Channel 2: Age
Encoding: Position

Marks

Symbol
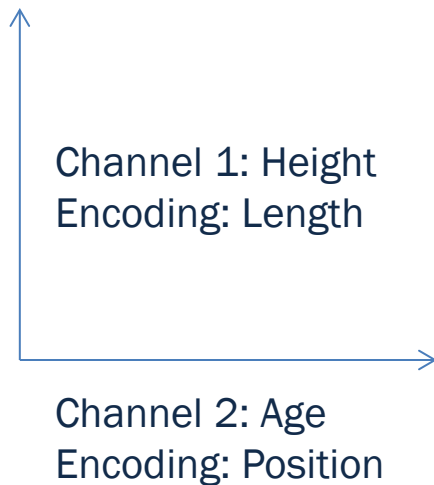
Changing the mark

The mark chosen can emphasize different aspects of the data
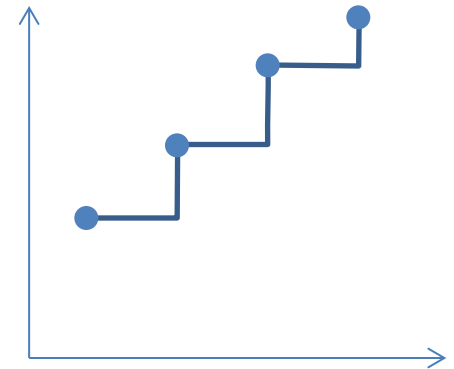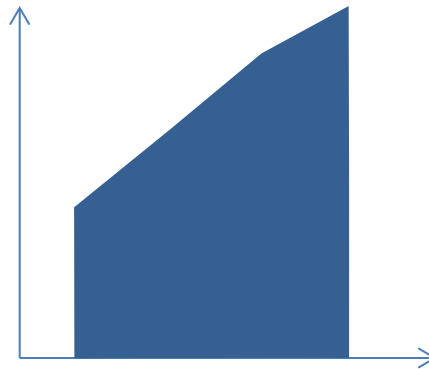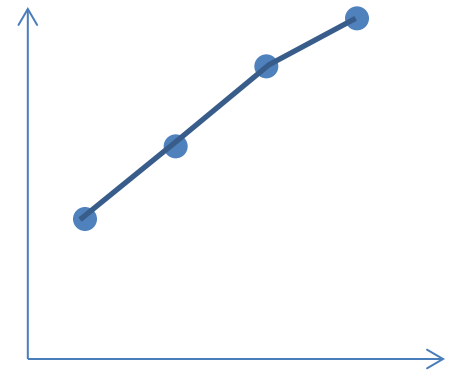
Changing the encoding

Changing the way we encode data also affects how we perceive it, and what we can actually see.
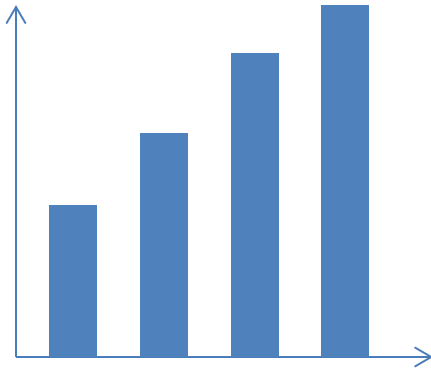
Length/Position

Area/Radius
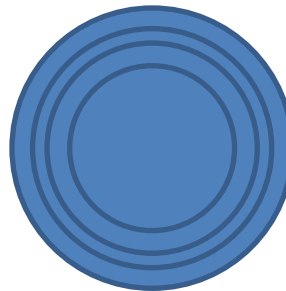
Color
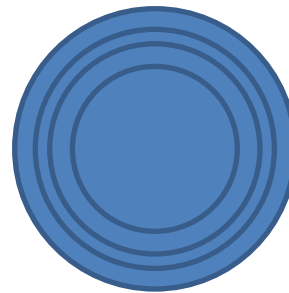
Most accurate ⟶ **Least accurate**

The importance of metaphor

Matching the encoding metaphor to your data makes a visualization more readable.
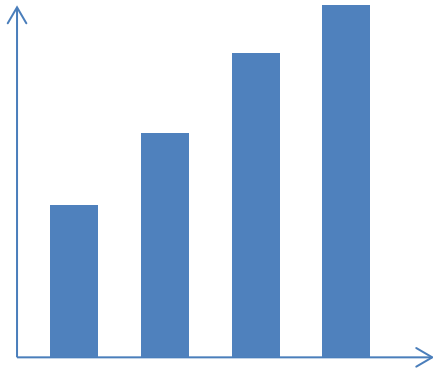

Functions more like an index

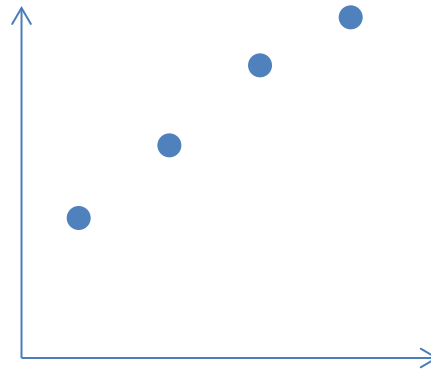**Pure symbols – no automatic meaning**

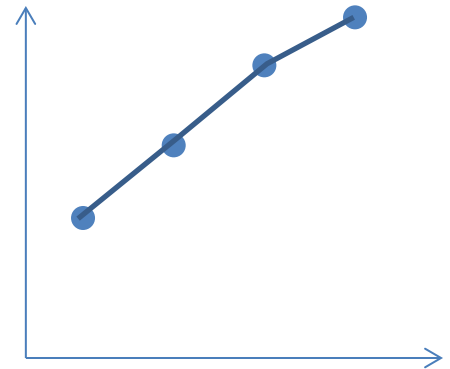**Data Visualizations should:**

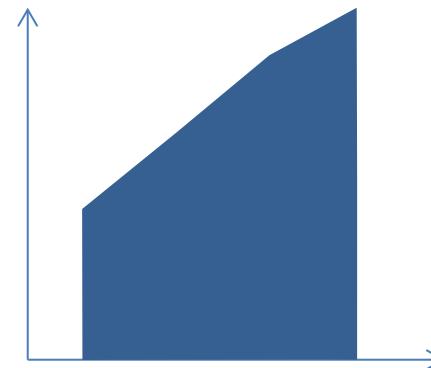# 5. Support a user task.
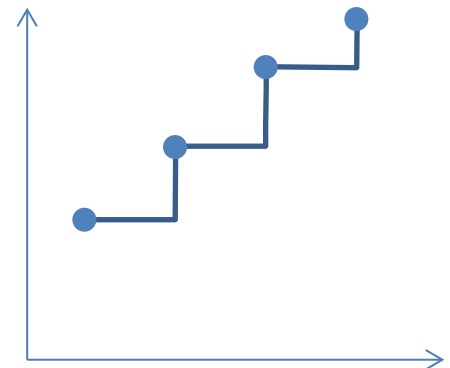
User tasks

Compare bar height

Read dot values

See change btwn points
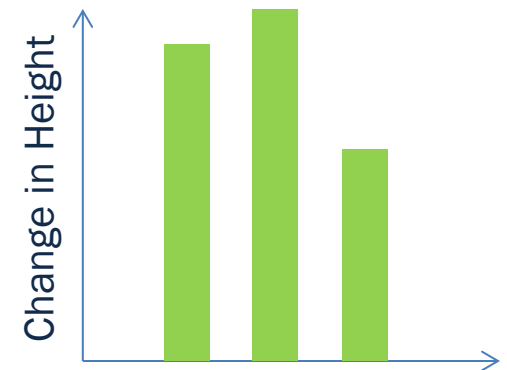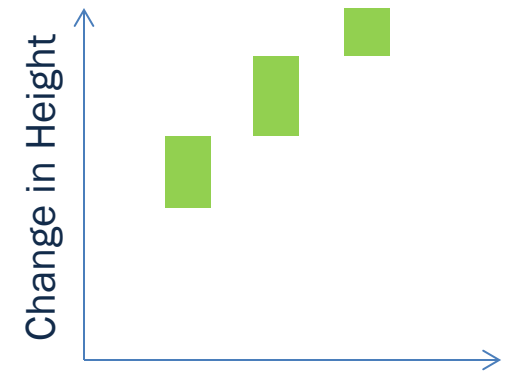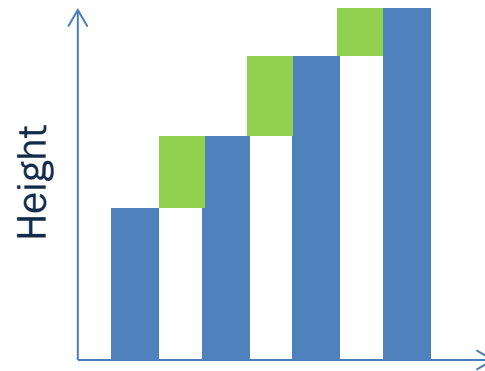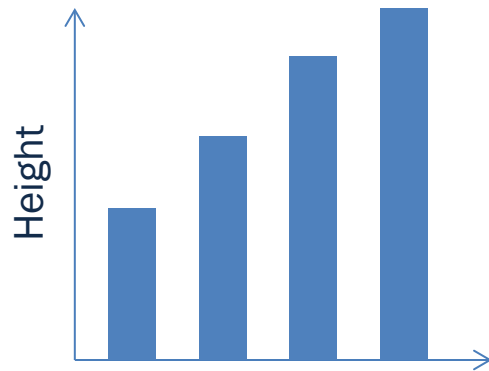

Focus on area under curve

See size of change

Changing the channel

Redefining a single channel can also shift how we read and understand data, and the insights that we are able to get from it.

Data visualization as story

What kind of story does your data tell?

- **Compare** objects side by side

- **Group** things together

- Narrate a **sequence** of events

- Show **membership**

- Explain how things **change**

- Show how individuals are **connected.**

Sankey diagram: a case study

Using different channels, encodings and marks can dramatically change the focus of a visualization.

Food flow

Representing multiple layers of data at once

Land use

Building glyphs from marks

Land use