Playing with Data

A workshop on experimenting with visual form

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BU Guest Lecture

3.9.2021

Data visualization is the practice

of giving form

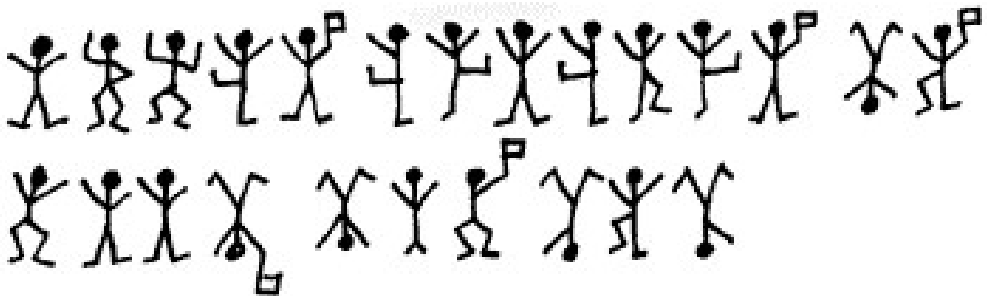
to the abstract and unseen.

Part I: Encoding Data

1. What are encodings?
2. Creating encodings to represent data

What are encodings?

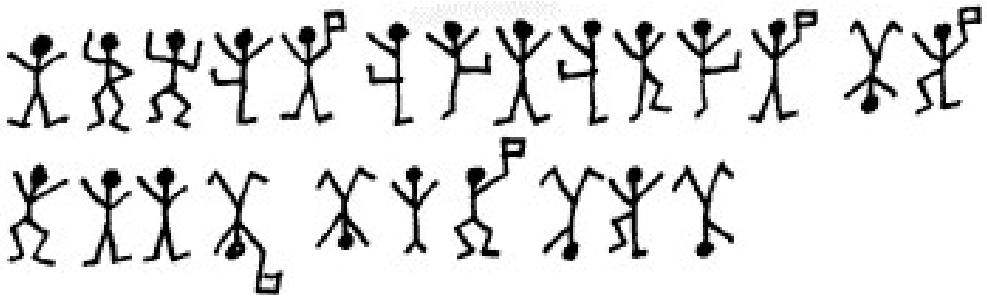
Visual marks can represent information



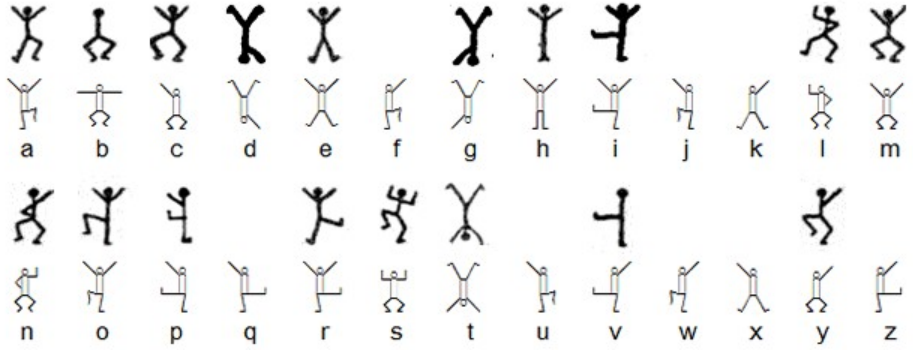
Breaking the code

An encoding connects a visual mark with meaning

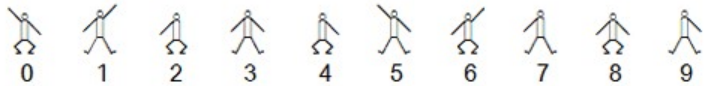
Marks



Encoding (cipher)



Numerals

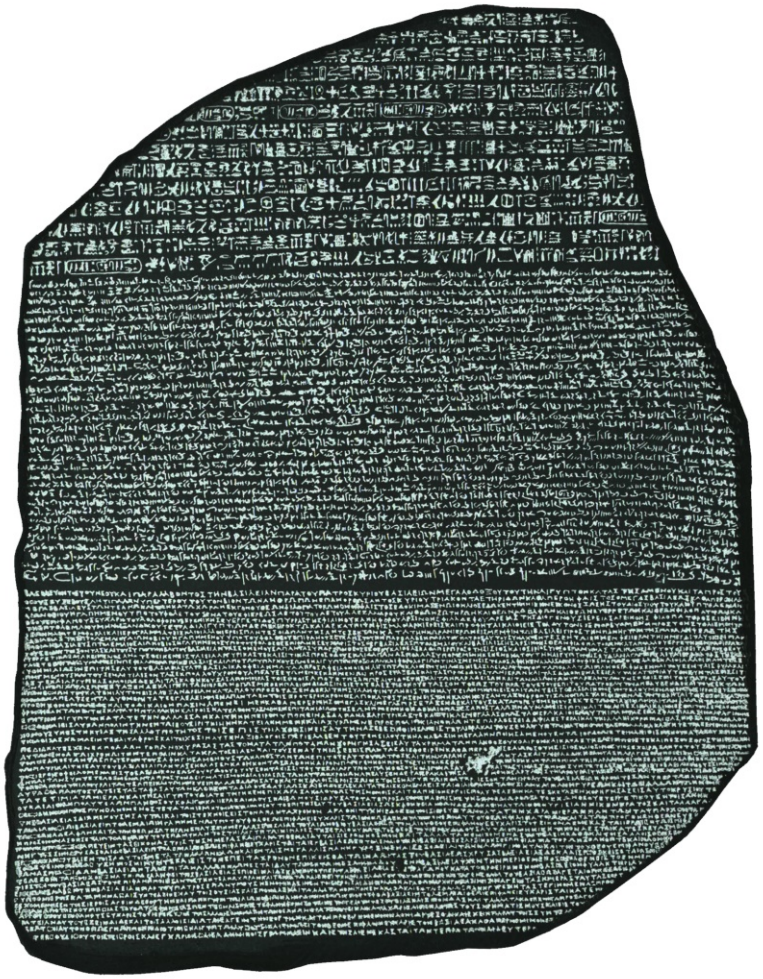


Symbolic encoding

Sometimes, the mark represents a concept or idea

Marks

Encoding (symbolic)



A recent example

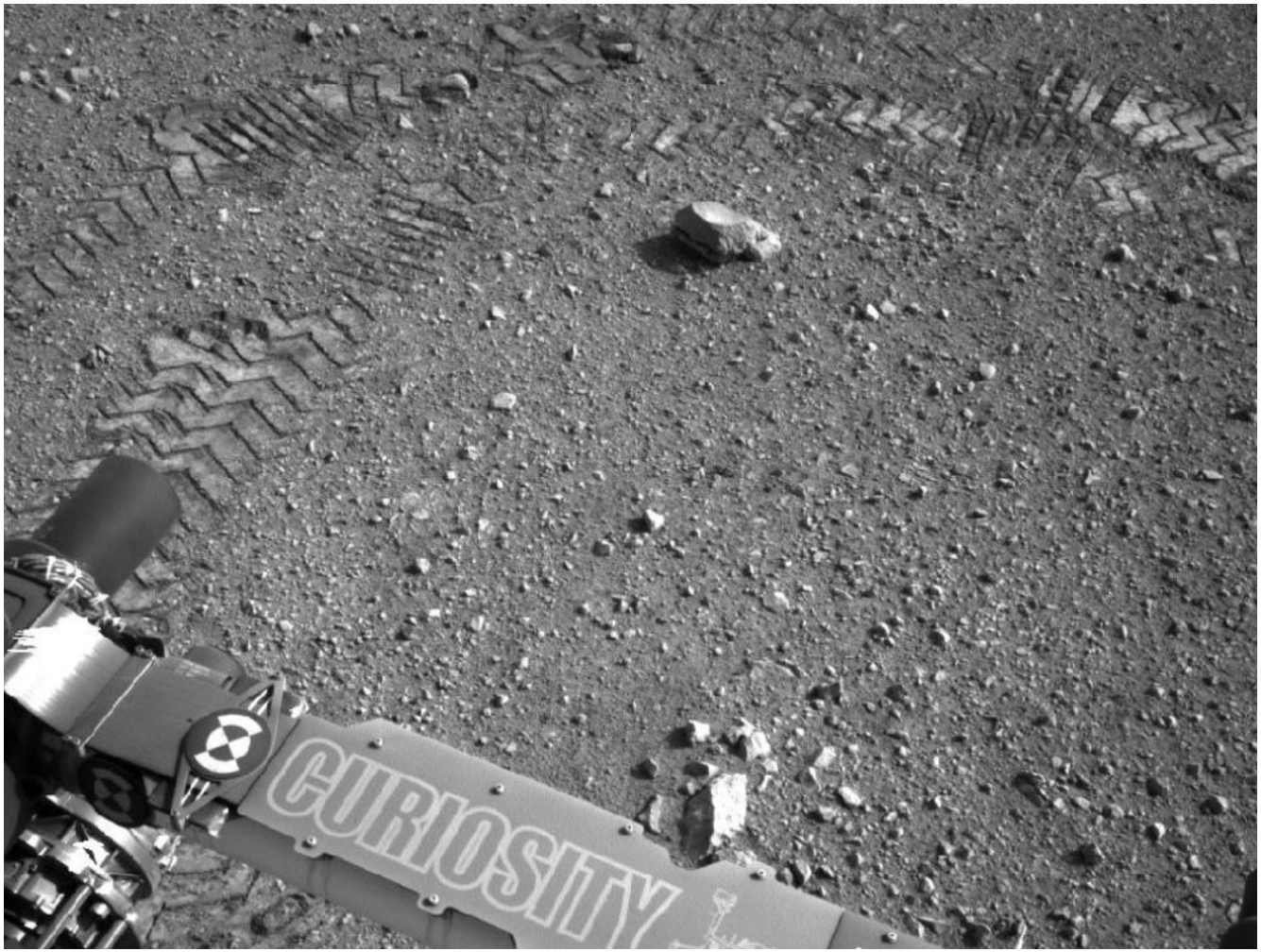
NASA engineers encoded a hidden message in a parachute

A code in a code

The visual encoding was based on Morse code

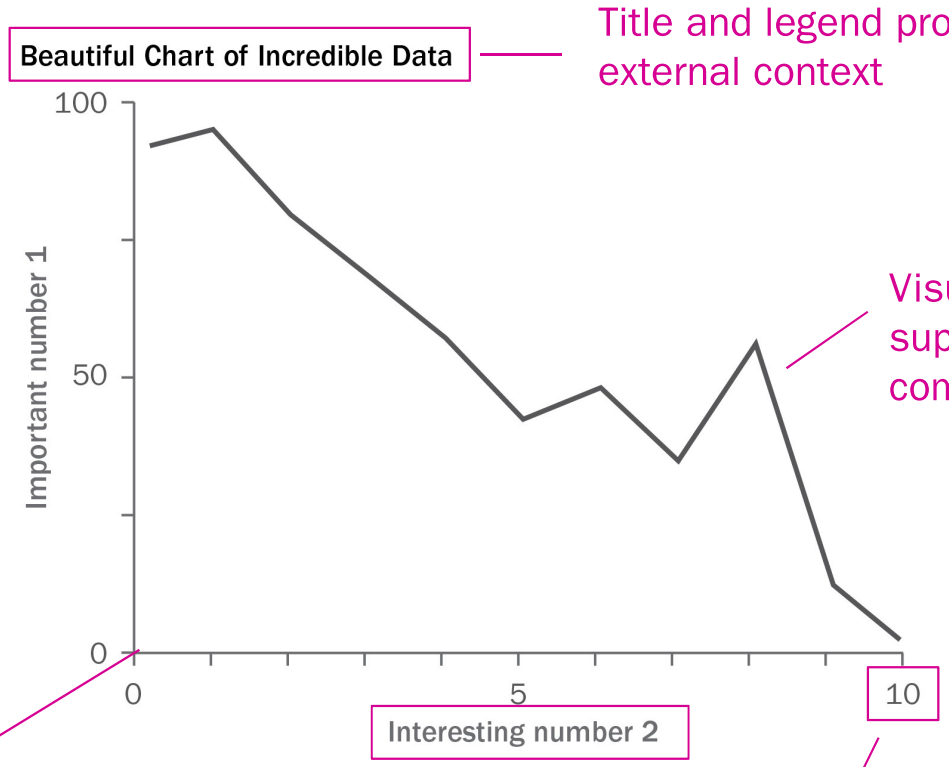
Audience matters

A Martian would not be able to decipher this code



Anatomy of a Chart

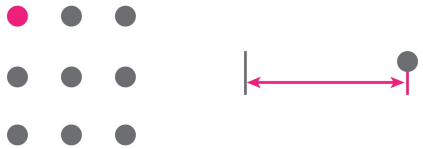
Common structures help us understand meaning



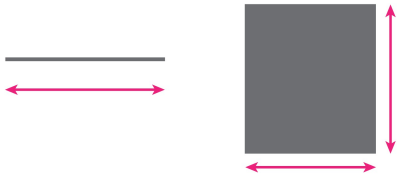
Types of encodings

There are lots of ways to encode information

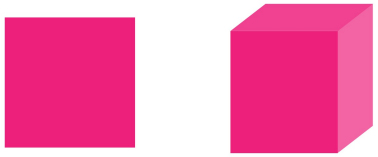
Position



Length/Height/Width

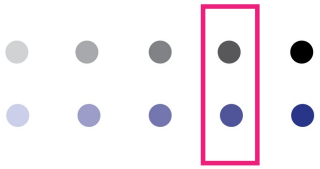


Area/Volume

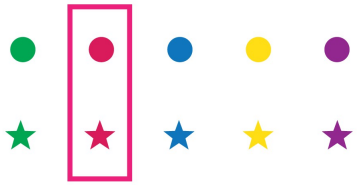


Shape/Symbol

Value/Saturation/Intensity

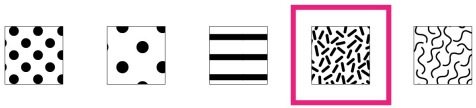


Color (hue)

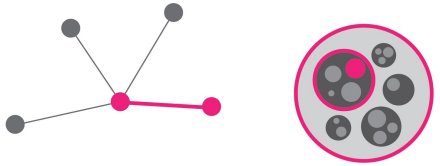


Rotation/Angle

Texture



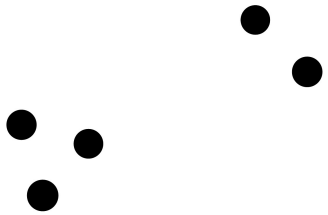
Relationship/Connectivity



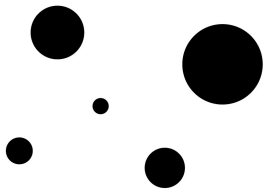
Visual Variables

Different visual properties can be used as the basis for an encoding

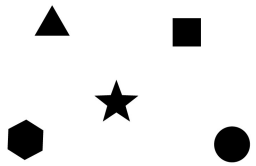
Position



Size

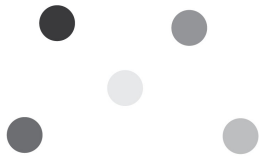


Shape

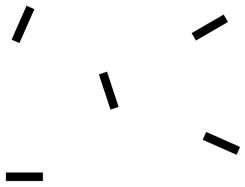


Color (hue)

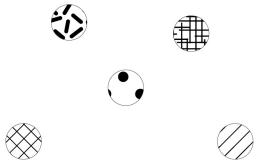
Color (value)



Orientation



Texture

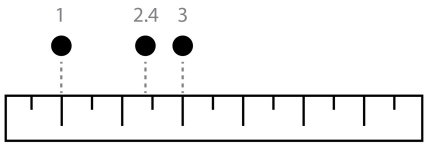


Jacques Bertin

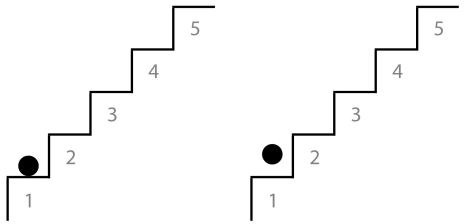
Kinds of data

Every part of a chart has a job to do

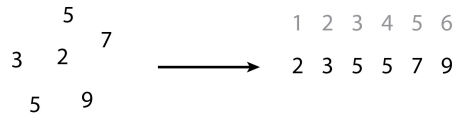
Value (continuous)



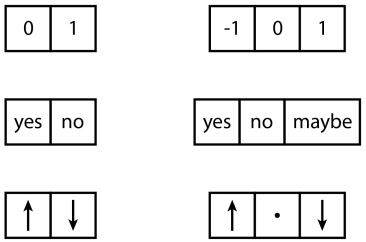
Value (discrete)



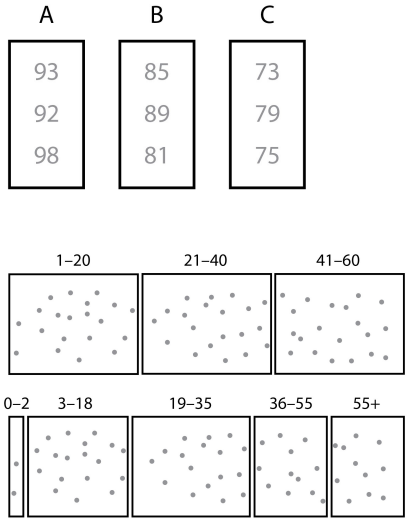
Ordinal



Binary/Ternary

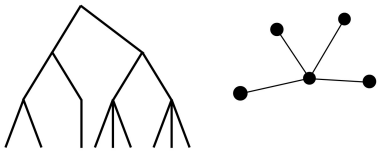


Binned



Categories/Hierarchies

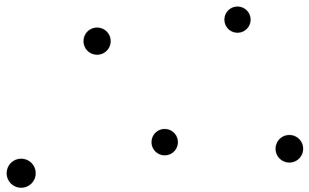
apple orange banana



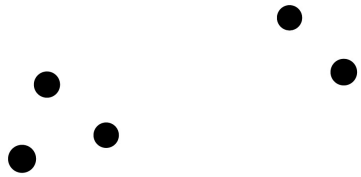
What can we do with marks?

Visual encodings support a variety of tasks

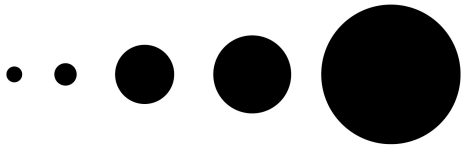
Count



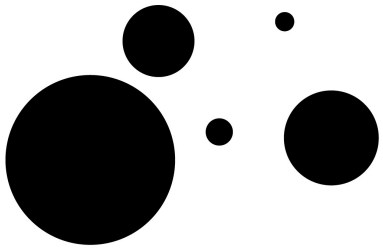
Group



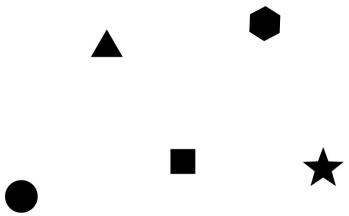
Sort/Order



Different attributes



Different kinds

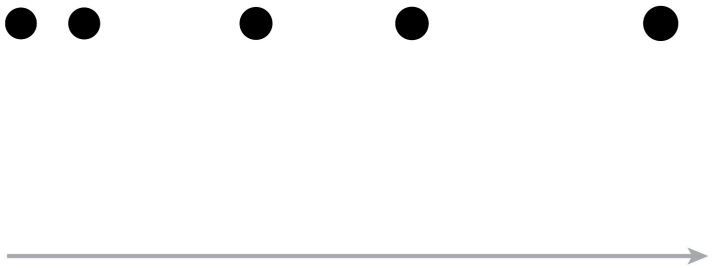


Situational attributes

Some attributes don’t change the mark

Sequence

Position



Identity attributes

Some attributes affect how we perceive identity

Circle

Star

Combining attributes

We can apply multiple attributes to the same mark

Size

Shape

Size & Shape
(& Position)

Compound marks

Glyphs are marks made up of other marks

http://www.oecdbetterlifeindex.org/

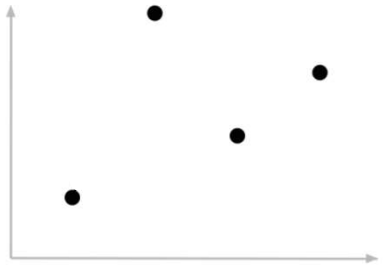
Traditional encodings

Standard charts represent a formal language of encodings

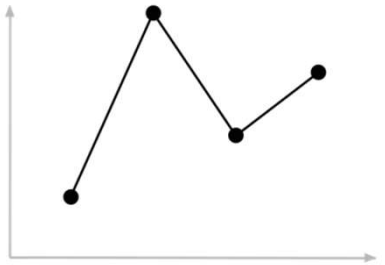
Area

Area, Position

Position (×2)



Position (×2)

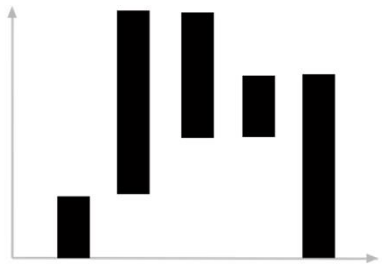


Position (×2)

Position (×2)

Length, Position

Length, Position (×2)

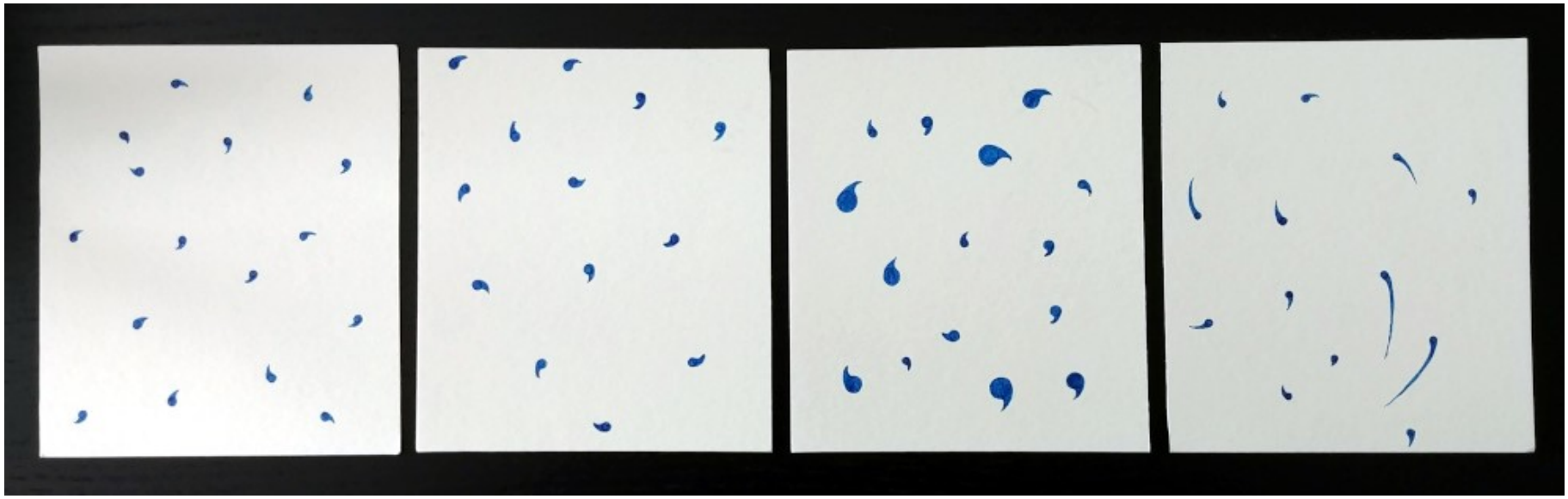


Non-traditional encodings

There is also room to draw outside the lines

Playing with form

Changing different attributes can emphasize different things



Your turn

10 minutes, work with your data. Create as many encodings as you can.

Part II: Purpose and Task

1. What's the visualization for?
2. Supporting a user task

Know your purpose.

Audience: Who am I talking to?

Context: What kind of information do they want/expect to see?

Content: Am I communicating a quantitative insight,
or a subjective truth?

Things to ask yourself:

- What's your purpose?
- Who is it for?
- What are you trying to show?
- What do people need to see to understand?
- What makes sense for your data?
- Which chart supports the user task?
- How can you use design principles to clarify your representation?

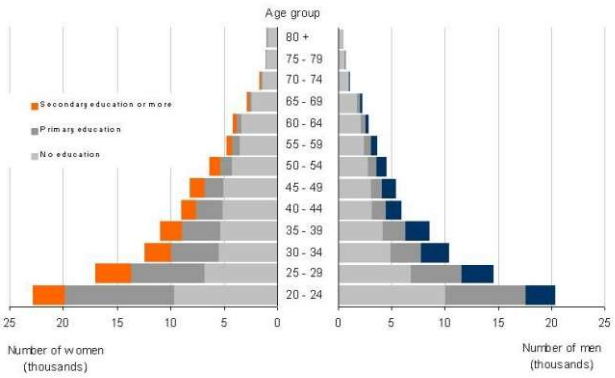
Data visualization as task

- Compare objects side by side
- Group things together
- Understand a sequence of events
- Identify membership
- Explain how things change
- See how individuals are connected

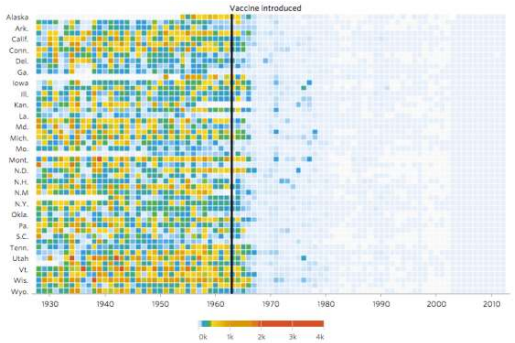
Different Charts for Different Tasks

Charts can support different tasks

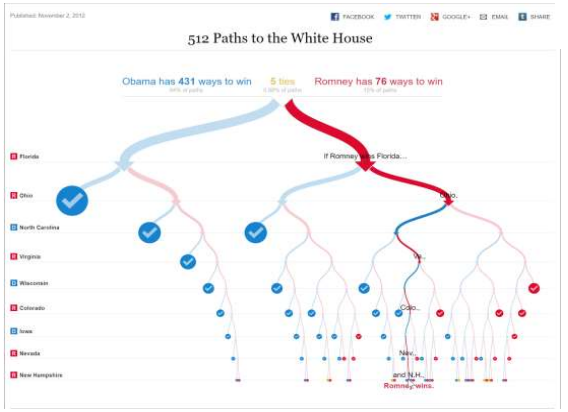
Compare objects side by side



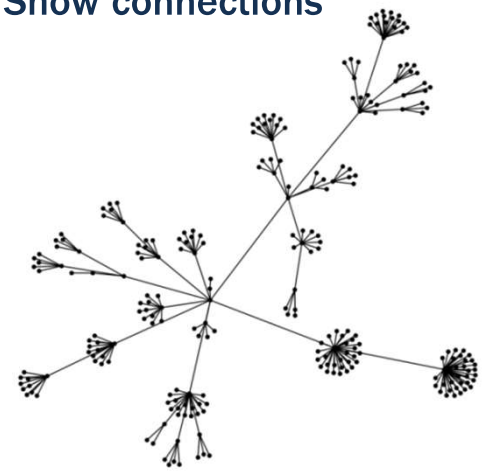
Group things together



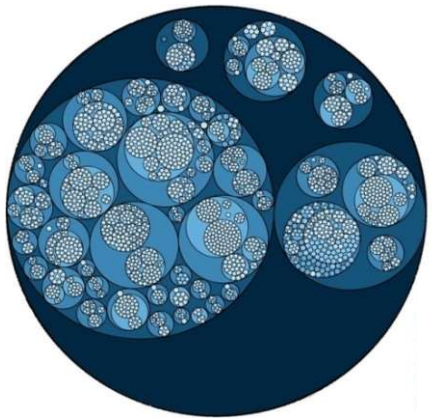
Narrate a sequence of events



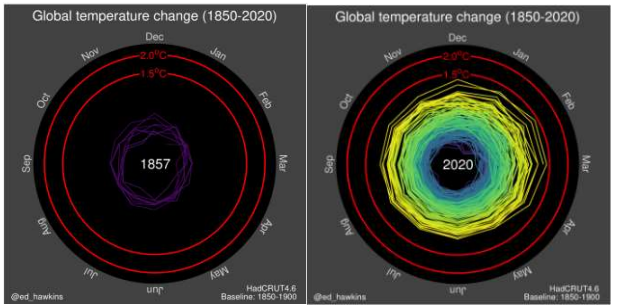
Show connections



Show membership



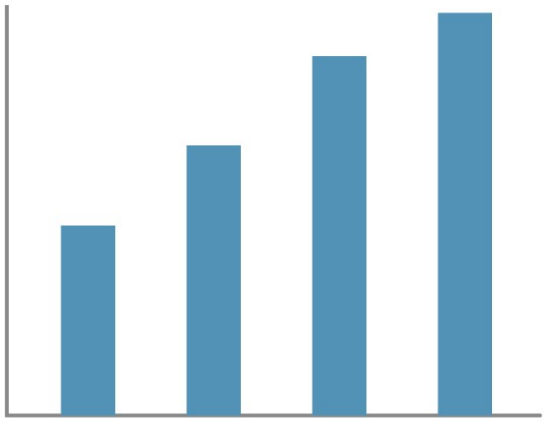
Explain how things change



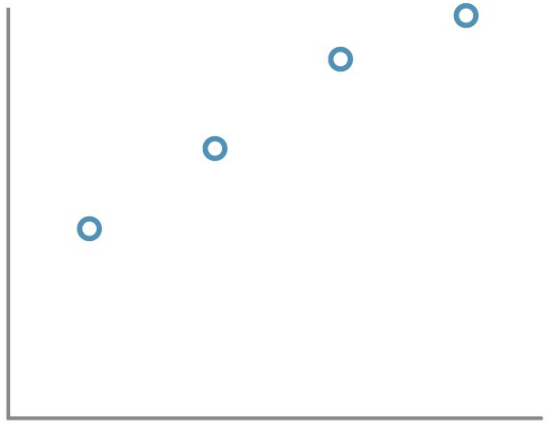
Marks Matter

How you draw the data affects what you see

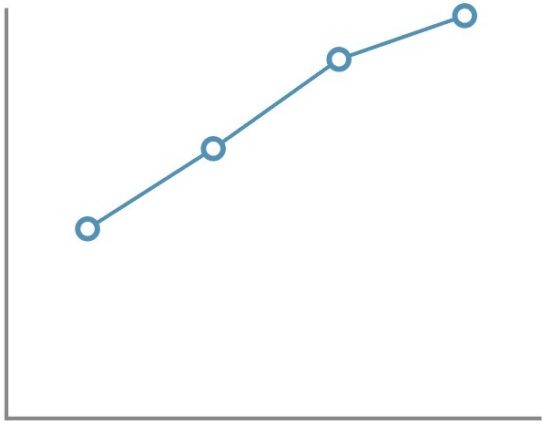
Compare bar height



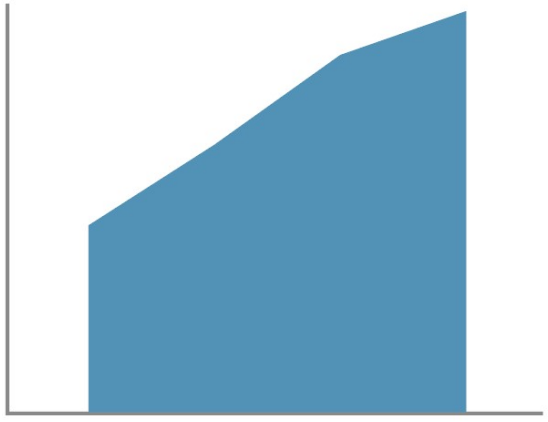
Read dot values



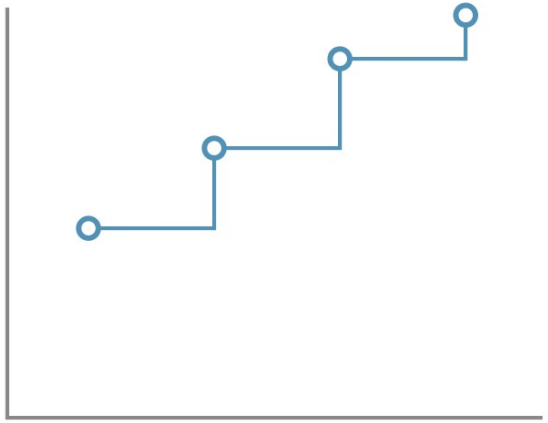
See change btwn points



Focus on area under curve



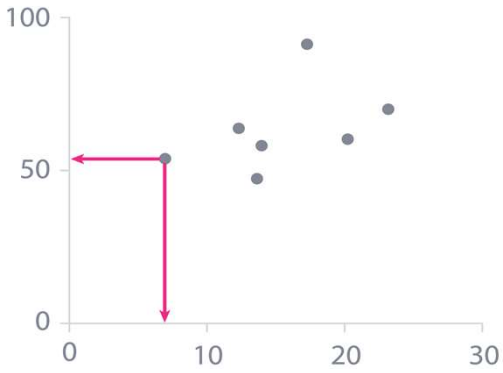
See size of change



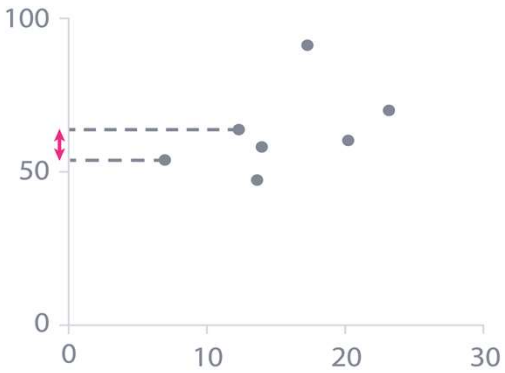
One chart, many tasks

A user can complete many tasks from a single encoding

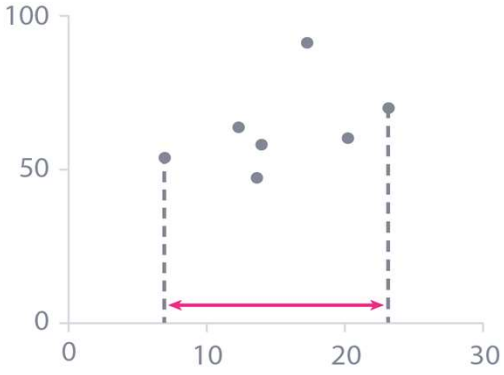
Read value of a point



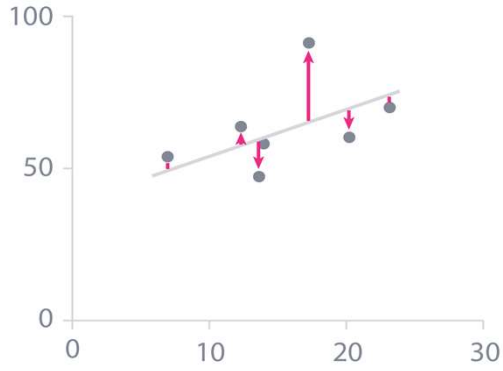
Compare two points



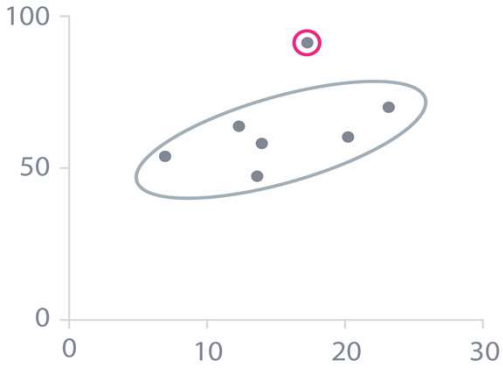
Max and min value



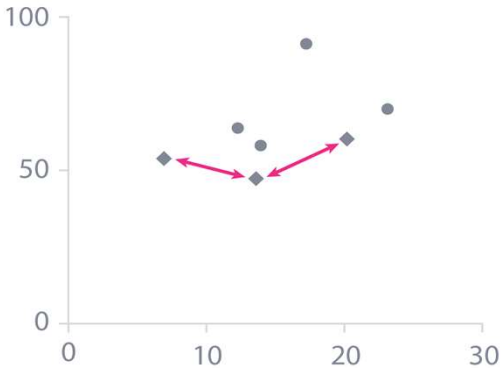
Compare to trendline



Look for outliers



Compare series values



Your turn

5 minutes. On a separate sheet of paper:

Identify a purpose for your encodings from part I, and pick the two that you think support that purpose best.

Write down tasks that you think someone can do with these two encodings.

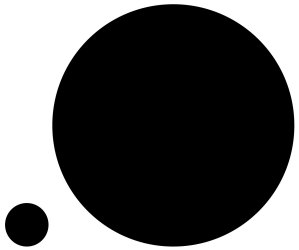
Part III: Optimizing a Visualization

1. Visual principles
2. Analyzing your vis

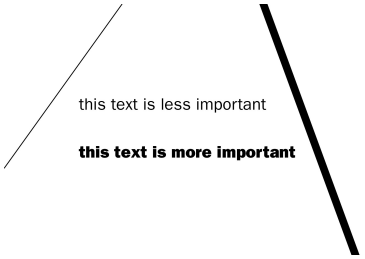
Visual salience

Use visual attributes for emphasis, and to direct attention

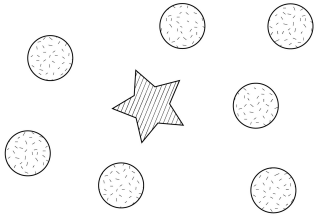
Big



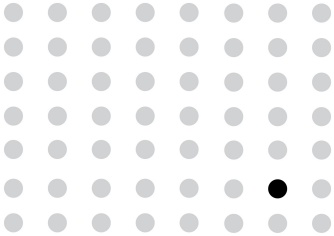
Bold



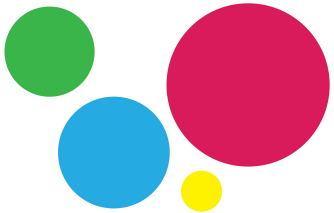
Different



Dark

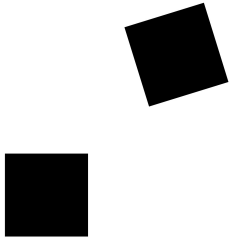


Bright

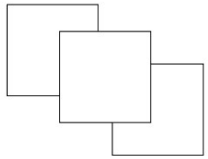


Different color group

Visual Instability



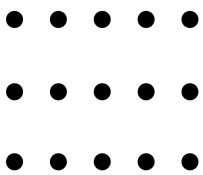
Layer order



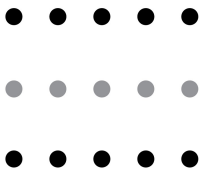
Create relationships

Use Gestalt principles to support meaning

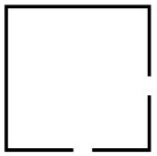
Proximity



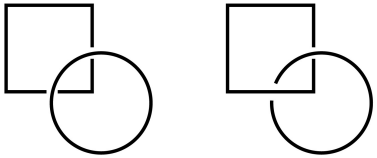
Similarity



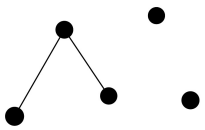
Closure



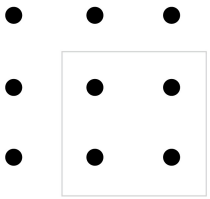
Continuity



Connectedness



Enclosure



Symmetry

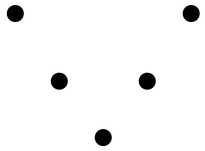
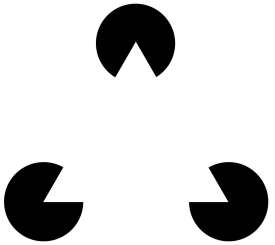
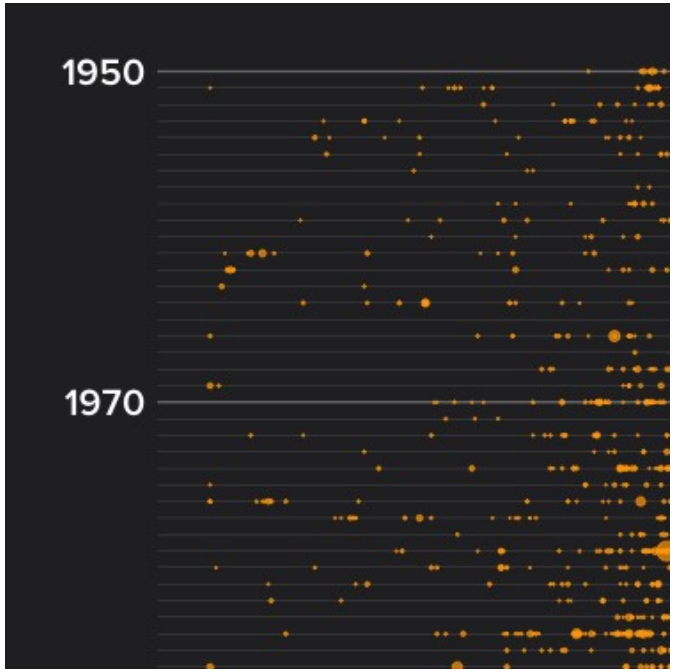
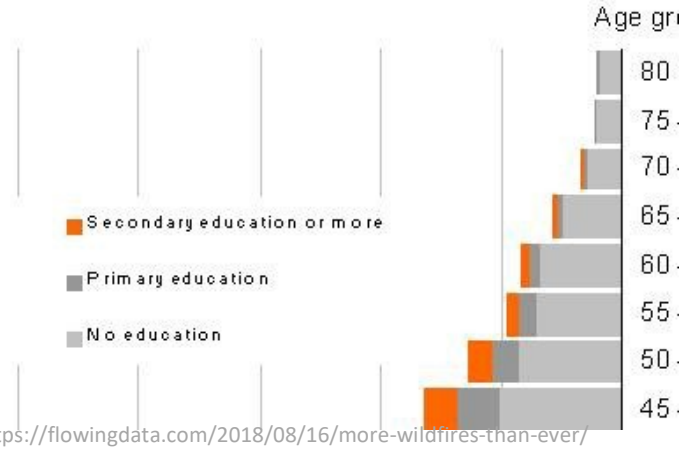


Figure & Ground



Gestalt principles in action

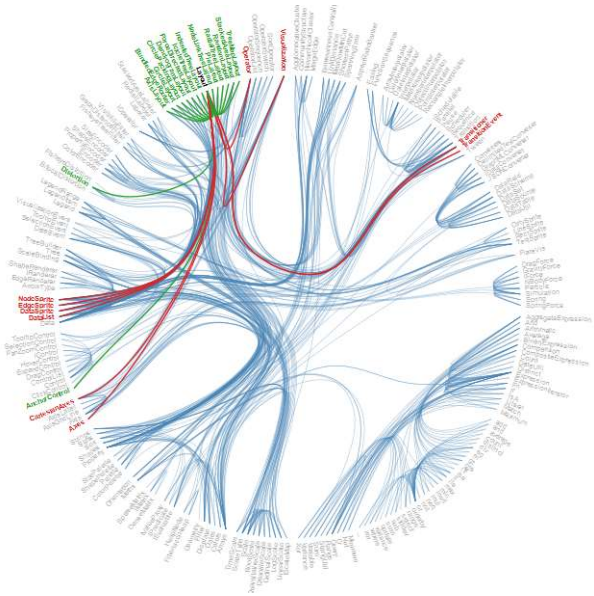


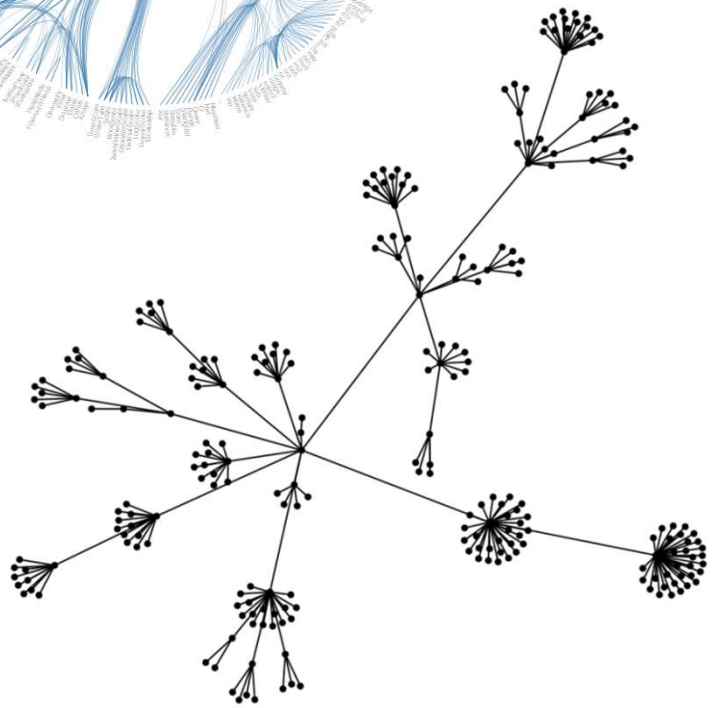


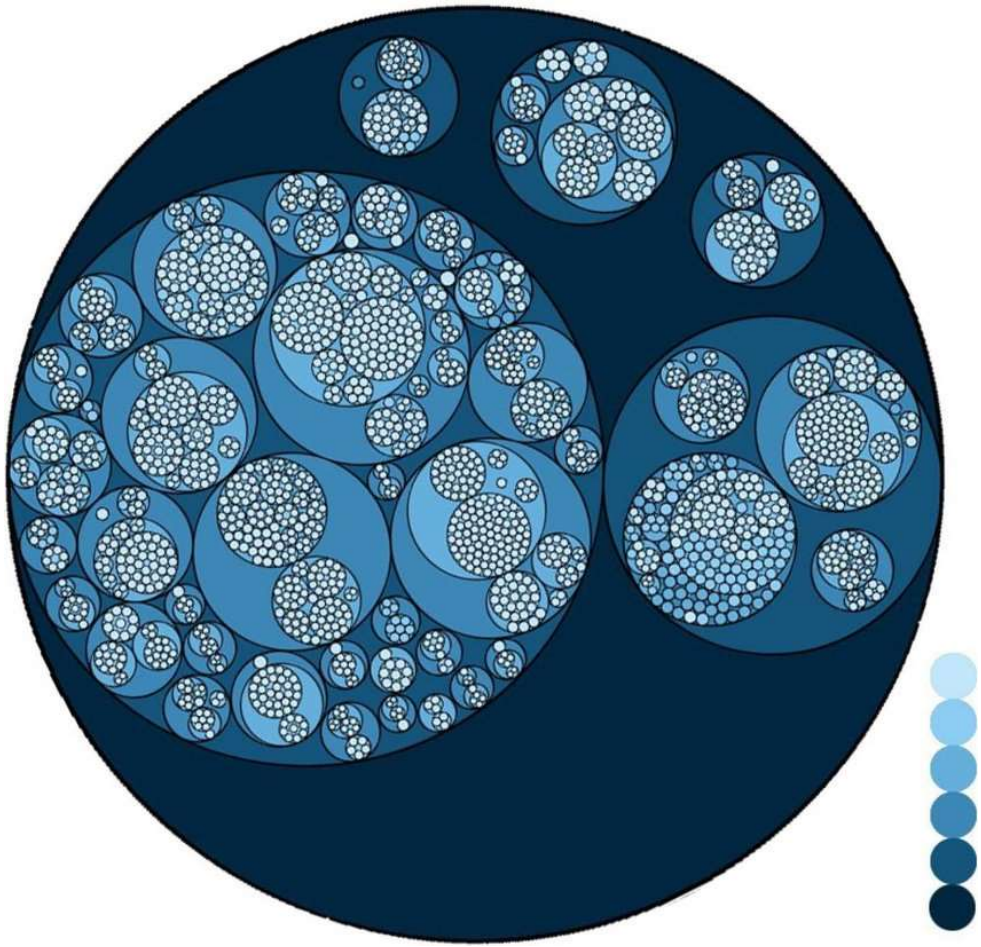
https://flowingdata.com/2018/08/16/more-wildfires-than-ever/
https://medium.com/data-and-society/data-visualization-4286f78af898

https://www.fastcompany.com/3054064/feast-your-eyes-on-the-most-beautiful-data-visualizations-of-2015

Gestalt principles in action







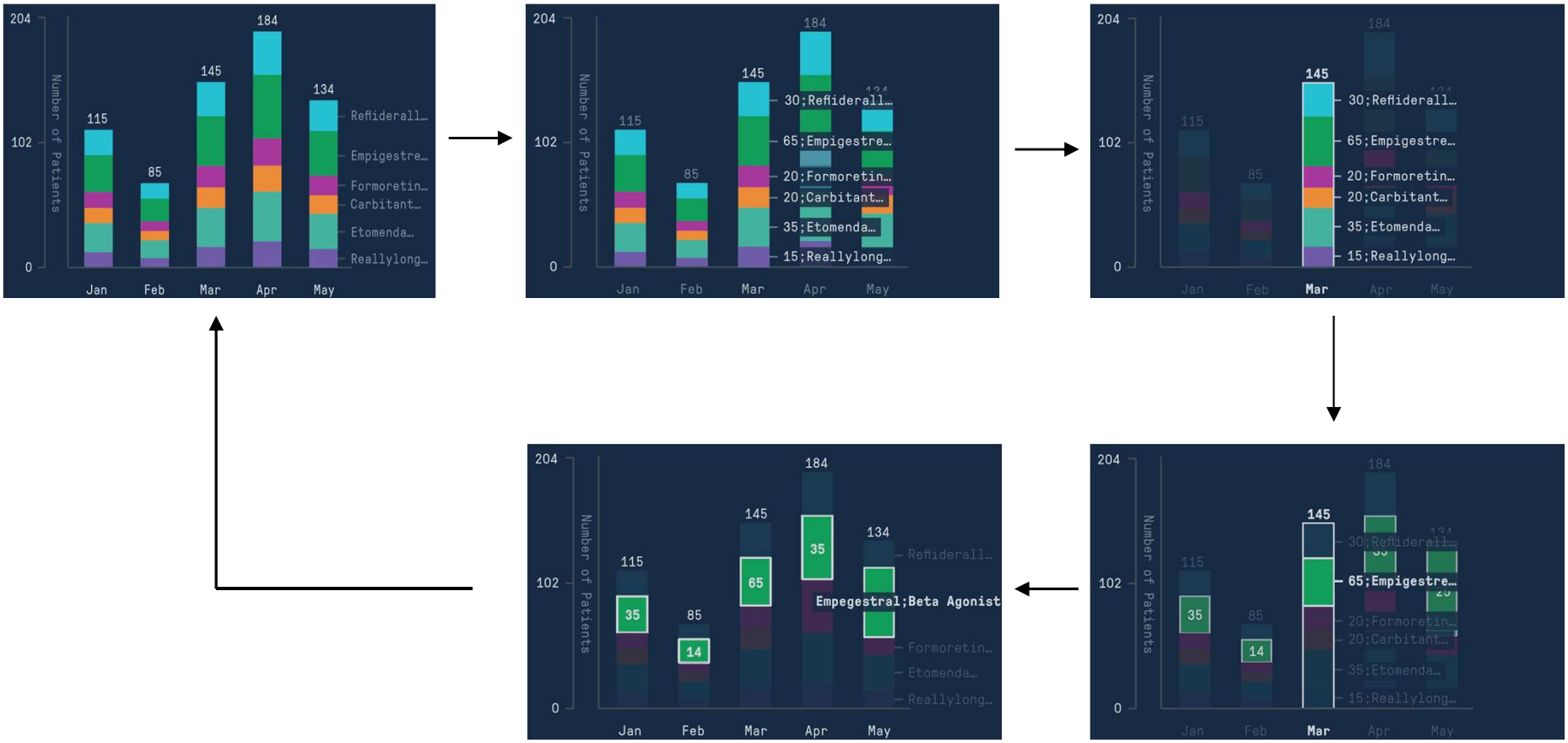
https://wwwf.imperial.ac.uk/blog/charityinsights/2015/08/10/cdp-blog-3-chord-diagrams/

https://www.r-graph-gallery.com/313-basic-circle-packing-with-several-levels.html

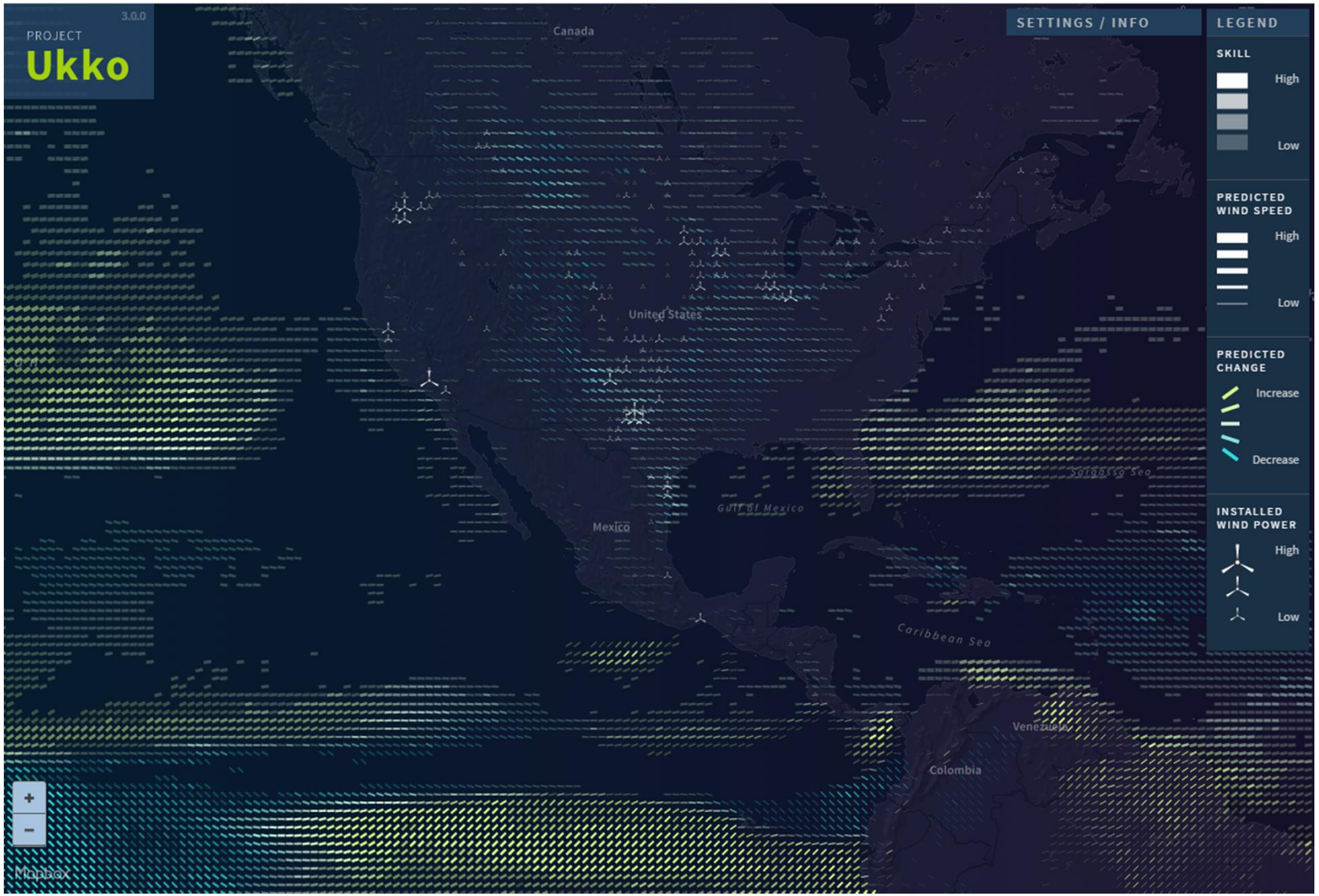
https://www.researchgate.net/figure/Circular-treemaps-automatically-generated-by-our-variational-algorithm-for-the_fig1_283095369

Visual hierarchy

Creating visual hierarchy can support a user task



Adding layers of data



Things to ask yourself:

- Did my visualization serve its purpose?
- Did people understand the encoding?
- Does the visualization really represent the data?
- Does it support a user task?
- Are you using design principles to focus, optimize and clarify your representation?

Your turn

15 minutes.

Get into groups with a partner.

Share your visuals, and see if your partner can:

a) Understand the encoding
b) Find what's most important
c) Guess your purpose for the vis

Explain your encoding, and brainstorm about how you can use visual principles to make it clearer/better/stronger/easier to read and understand.

Iterate

10 minutes.

Pick one vis from your first set (or start a new one!). Think about:

a) Your purpose
b) The tasks you want the user to complete
c) How/where you want to direct attention

Sketch out a new vis focusing on these items.

Share

Talk as a group about the different sketches