Previously in MIS473

- Identify and create various types of visualizations in Tableau
- The role ethics play in visualizations
- Improve ineffective visuals

Coming up...

Cognitive Load and Clutter

Principles of Visual Perception

Strategic Use of Contrast and Pre-attentive Attribute

Data Visualization

Essential Design Principles for Visualization

Cognitive Load and Clutter

- Cognitive load is the amount of mental effort required to interpret information

- The goal in data visualization is to minimize cognitive load yet accurately communicate your message

Intrinsic

Extraneous

Germane

Amount of memory we need to understand an idea

Different tasks require different amounts of thought and attention

Extraneous cognitive load relates to how information is presented

Poor design requires more effort to identify problems and create a mental image

- Germane cognitive load pertains to how we mentally organize into patterns and contextualize information for later reference

You know it when you see it

Clutter is all the things you remove while still preserving key ideas

Reduce clutter to minimize user's cognitive load

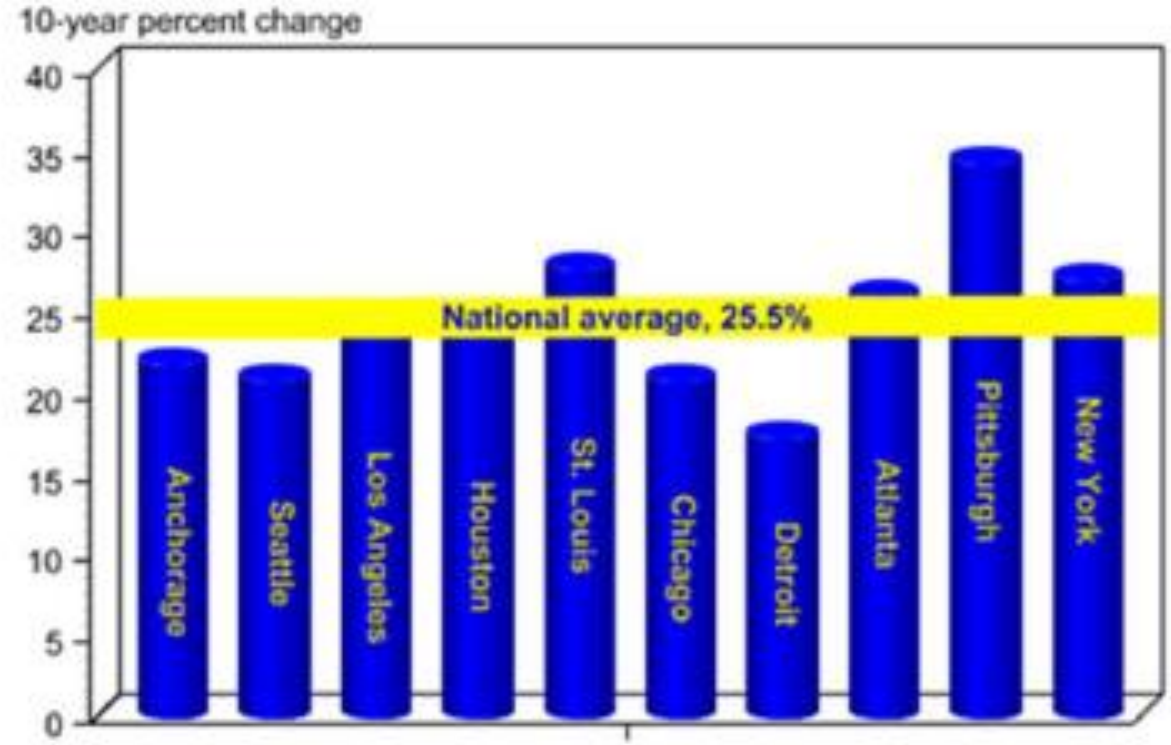
Less clutter = more effective visulizations

How would you remove the clutter?

What could have been done differently?

Retail food price inflation by Metropolitan Statistical Area (MSA), 2006-15

Retail food price inflation varies across selected Metropolitan Statistical Areas

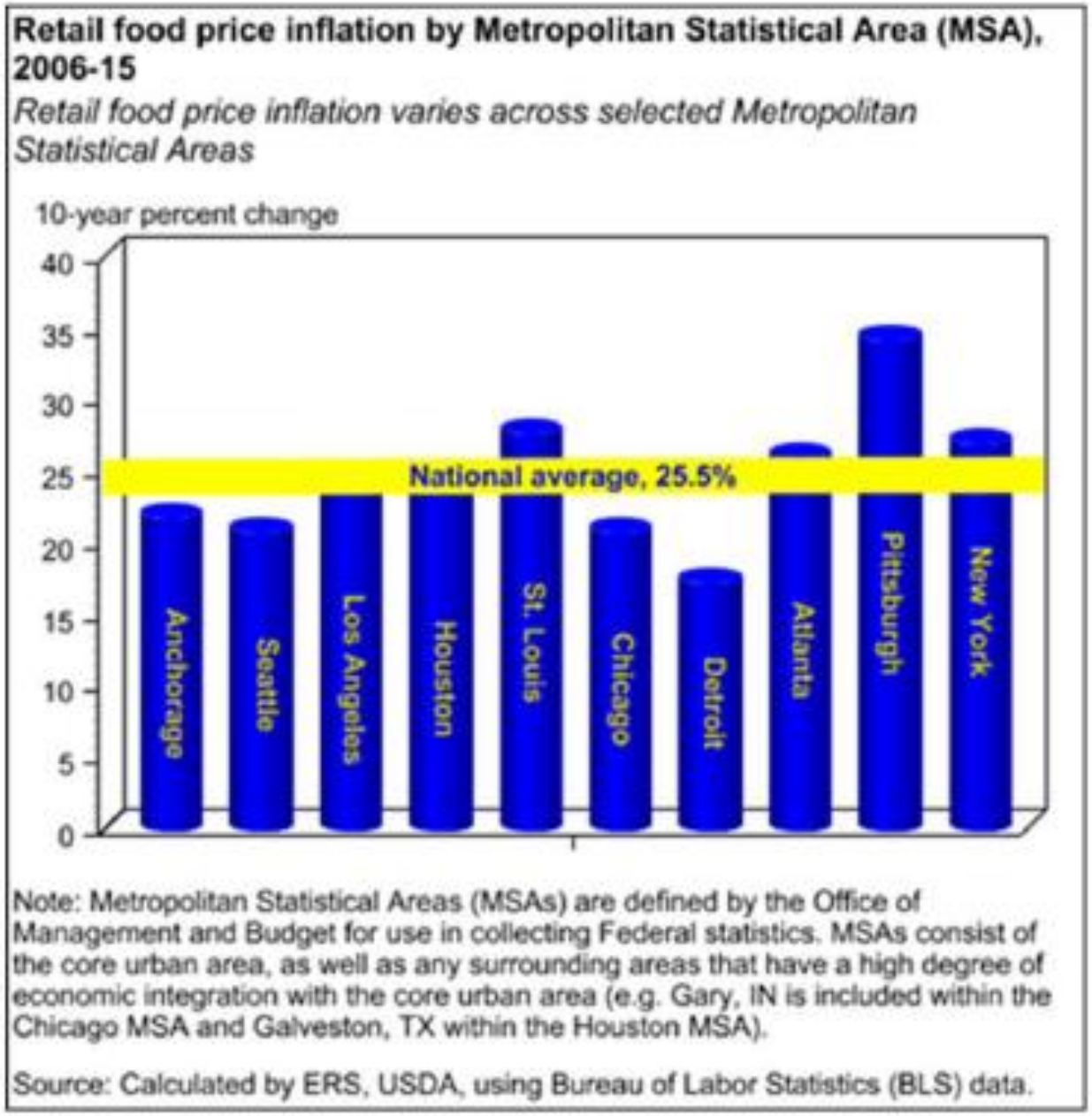


Note: Metropolitan Statistical Areas (MSAs) are defined by the Office of Management and Budget for use in collecting Federal statistics. MSAs consist of the core urban area, as well as any surrounding areas that have a high degree of economic integration with the core urban area (e.g. Gary, IN is included within the Chicago MSA and Galveston, TX within the Houston MSA).

Source: Calculated by ERS, USDA, using Bureau of Labor Statistics (BLS) data.

Things to remove:

1. 3D effect
2. Dark grid lines
3. Overuse of bright colors
4. There is no apparent sorting of the data being shown
5. An unhelpful axis



Too much detail

Taxes Collected ($ Millions) During 1st Month of Legalized Sales

State	Date of Legalization	Consumer Tax Rate	Tax Revenue $ Millions
Colorado	January 2014	12.9%	2.9
Washington	July 2014	37% excise	1
Oregon	July 2015	17%	3.48

Consumer tax rate is based on a web search of state tax authorities and are solely for illustrative purposes.

Only the critical information

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- Not all data are equally important
- Remove non-critical information

Too much detail

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Important information Summarized

- Summarize the details

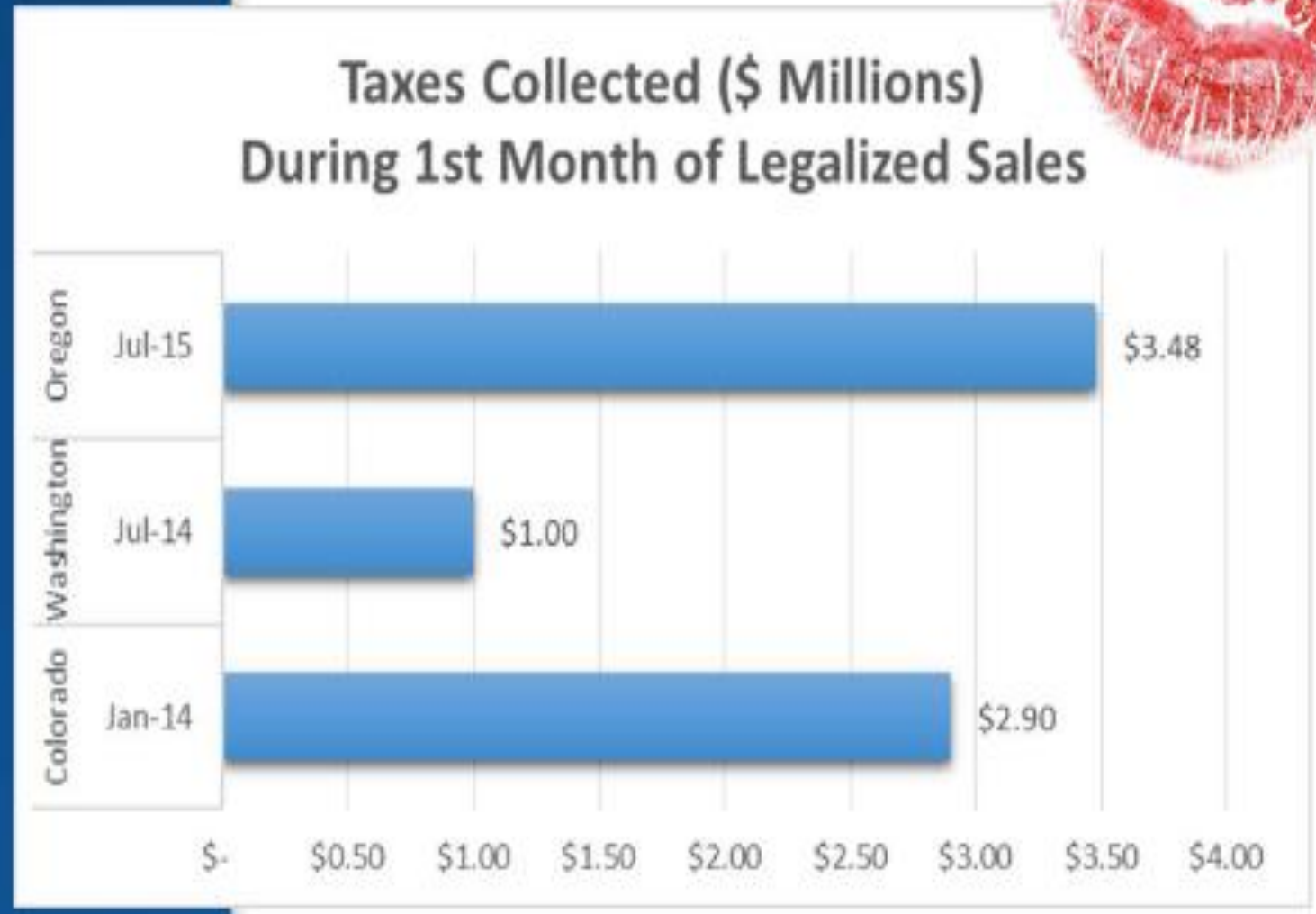
Original

Something's missing

Something's changed

- Determine if you eliminate information will it change the meaning

Keep
It
Simple
Silly



The legalization date is not the main idea of this graph, but it adds context

- It’s okay to keep non-critical information but put it in the background

3D doesn’t improve a visualization

Skews information

Adds confusion

- Redundancy (clutter) can help users manage cognitive load

Currency symbols

Percent signs

Commas within numbers

Scientific notation

Some details add clarity

Clarity reduces the effort required to comprehend complex data

Coming up: Principles of visual perception

Data Visualization

Essential Design Principles for Visualization

Aesthetics

Fundamental components of aesthetic visualizations:

Color
Alignment
Leveraging the white space

Use color strategically

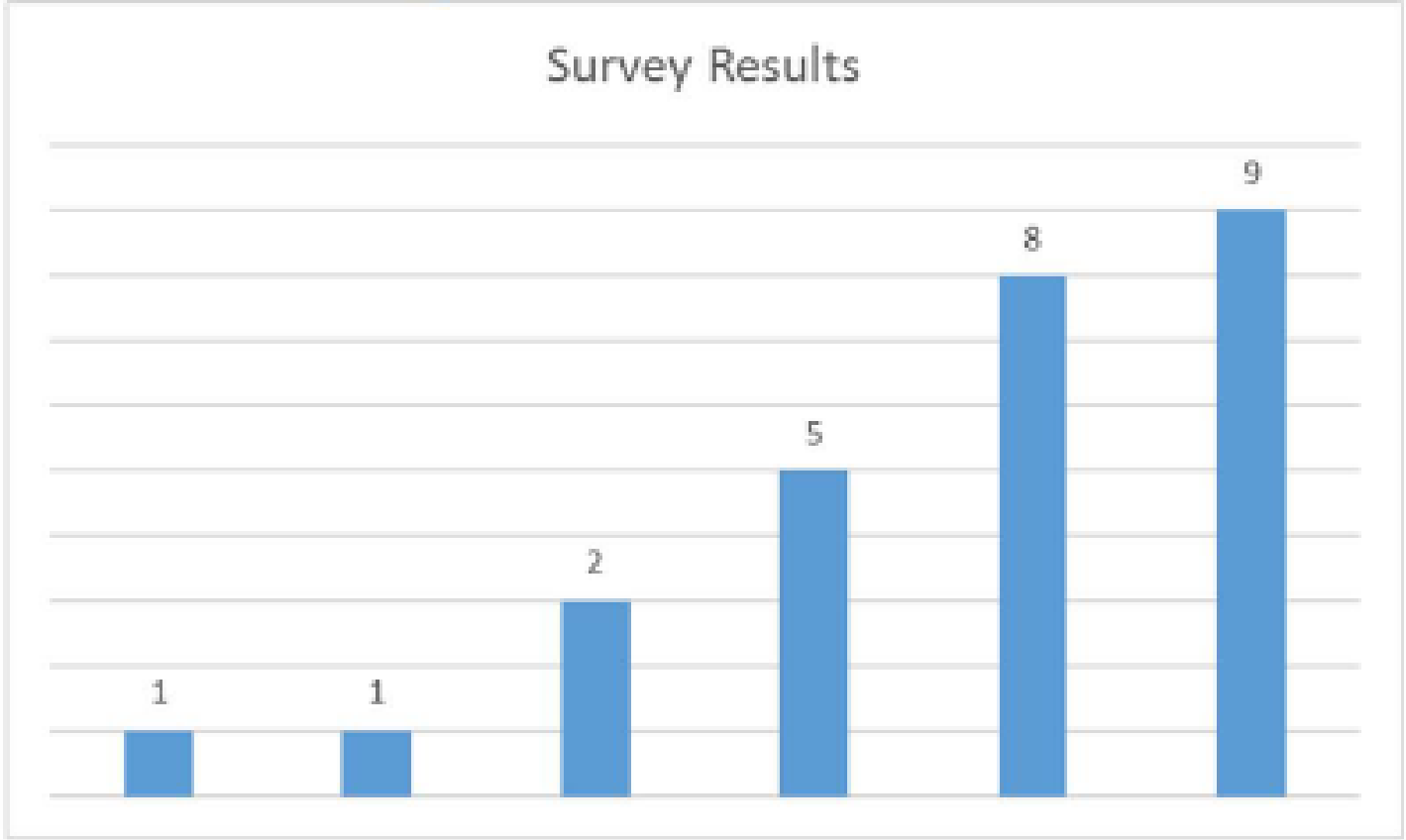
Highlight what you want the audience to see

Alignment ensures clean vertical and horizontal lines

Eliminates visual clutter

Reduce cognitive load

Correct Alignment



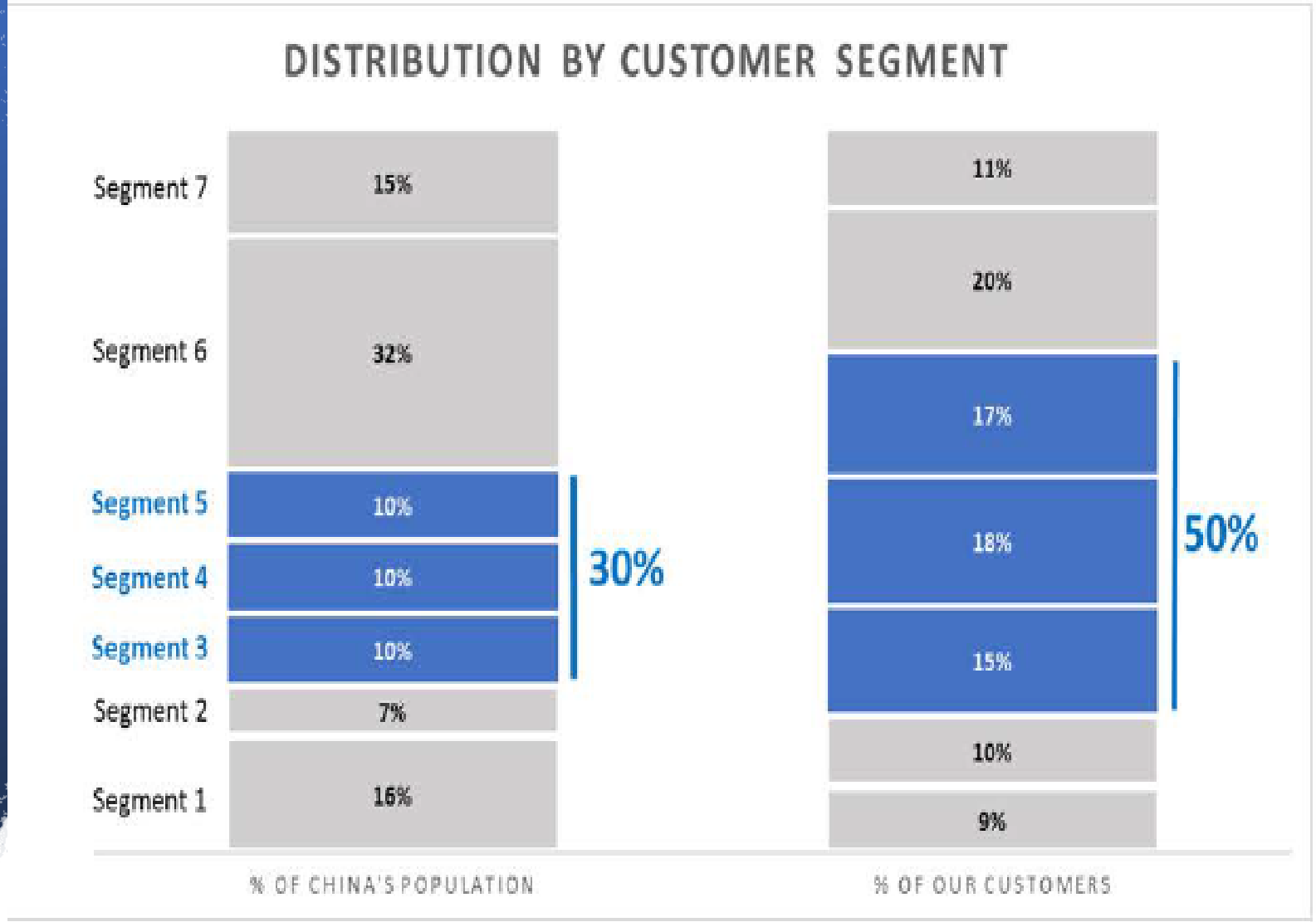
Good use of white space

Use white space strategically

Differentiate aspects of visuals

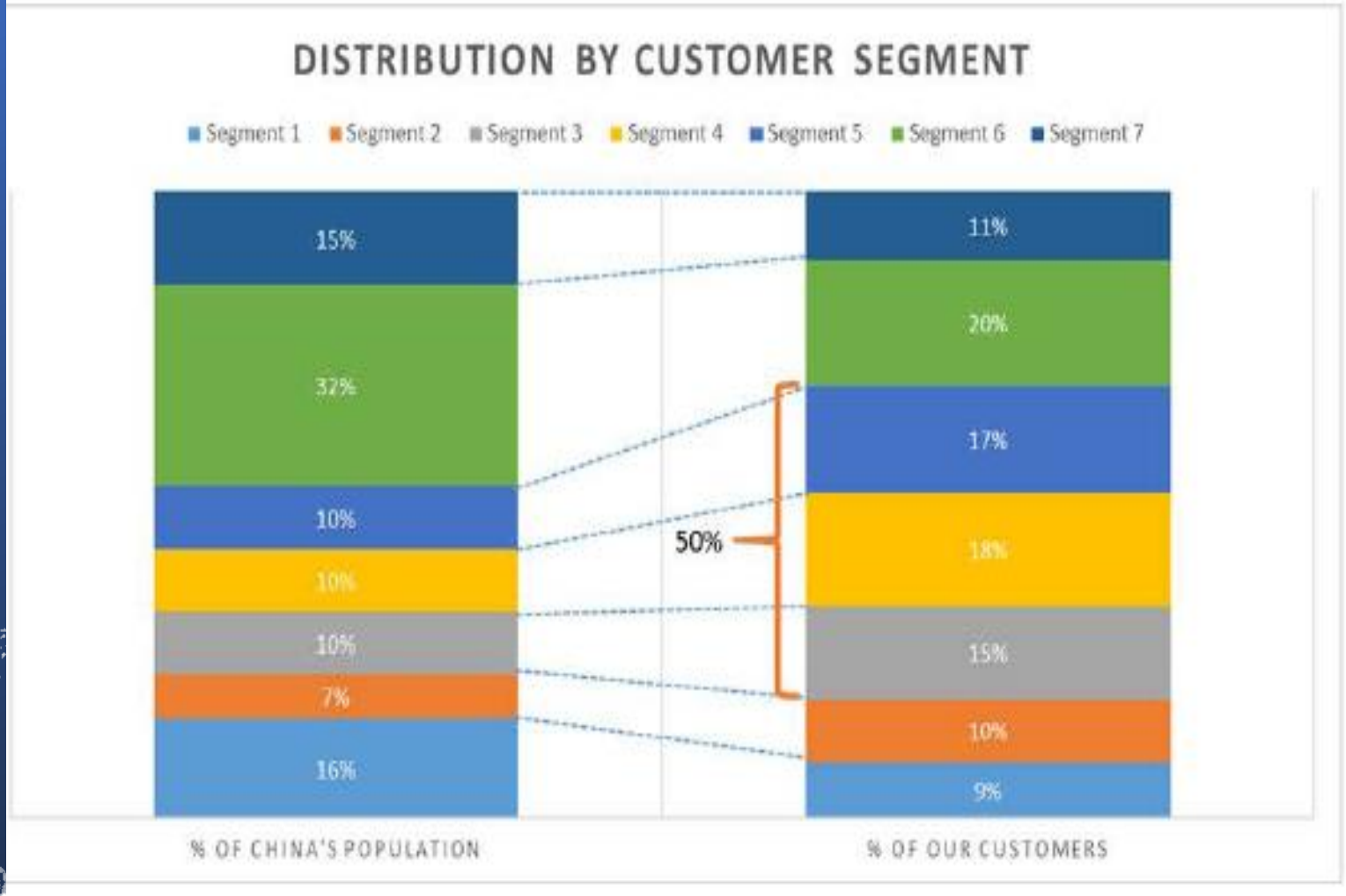
Focus user's attention

Reduce clutter



Bad use of white space

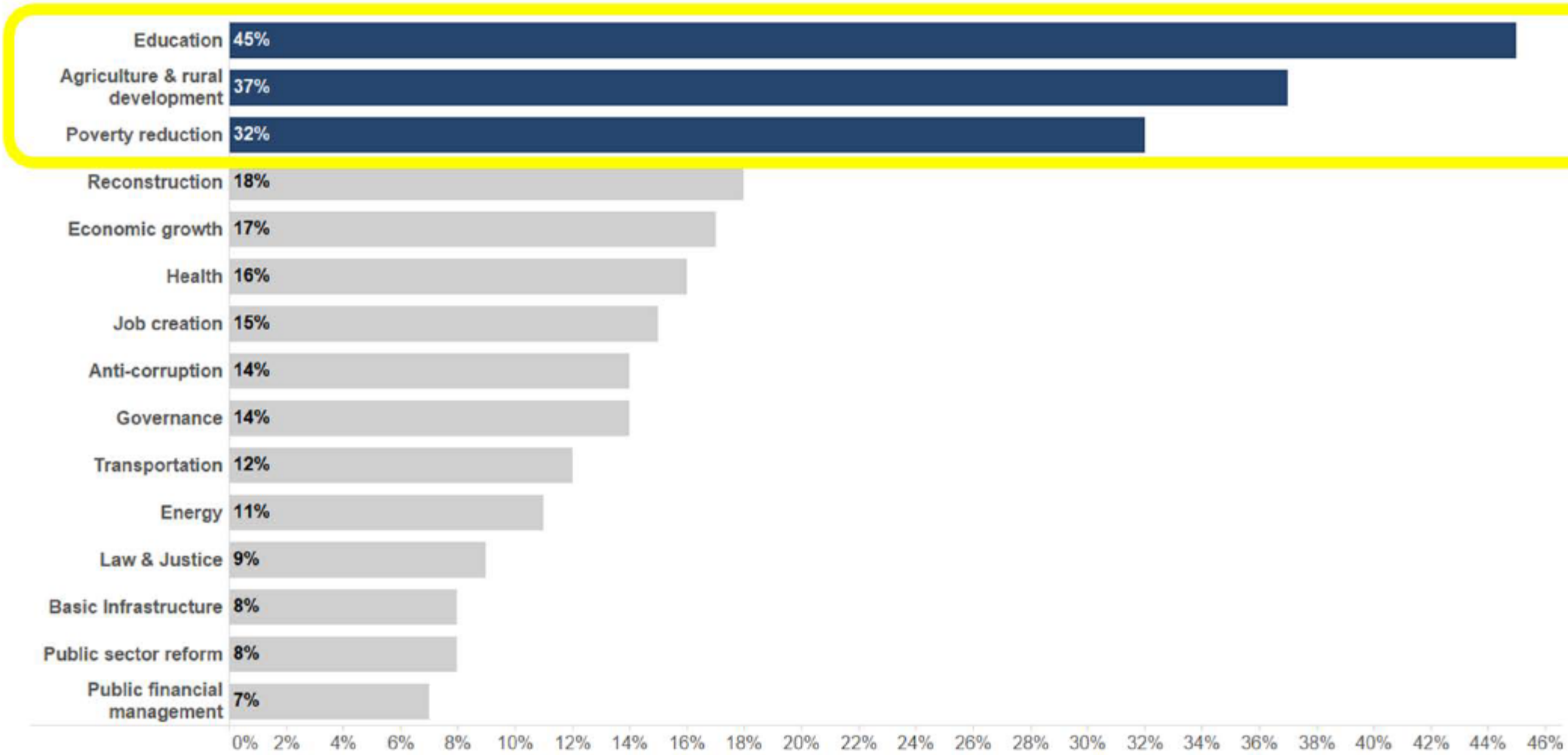
Too much or too little white space makes it hard to focus on key ideas



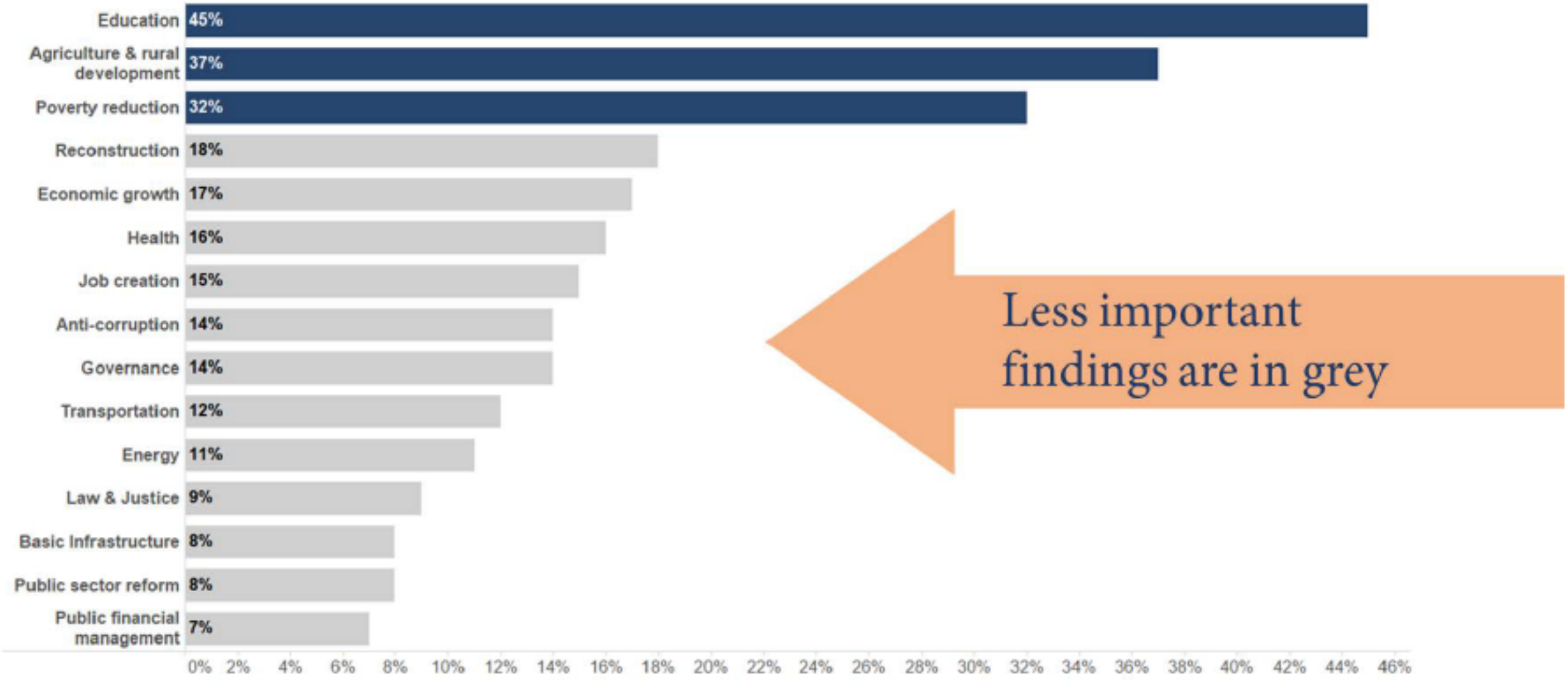
It will take some tinkering to get the right balance

Aesthetics are subjective

Think about what makes a good visual as you explore examples



Use color to show what matters



Color emphasizes the relative importance of survey findings

Data Visualization

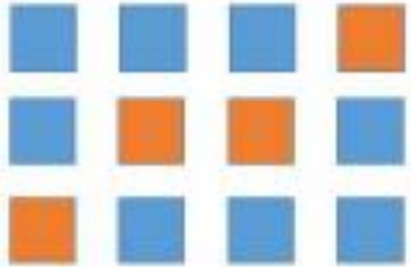
Essential Design Principles for Visualization

Principles of Visual perception

- Evaluate how we perceive our world

1. Proximity
2. Similarity
3. Enclosure
4. Closure
5. Continuity
6. Connection

Proximity



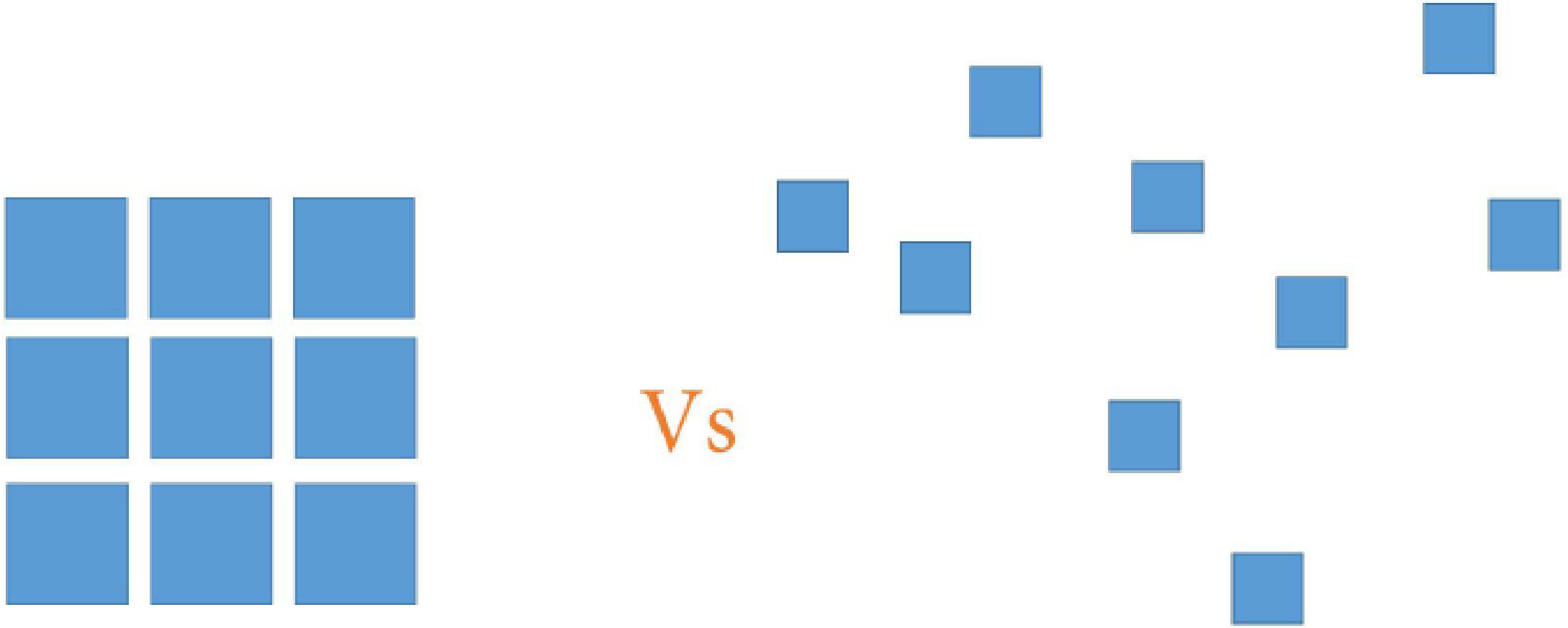
Similarity

Enclosure

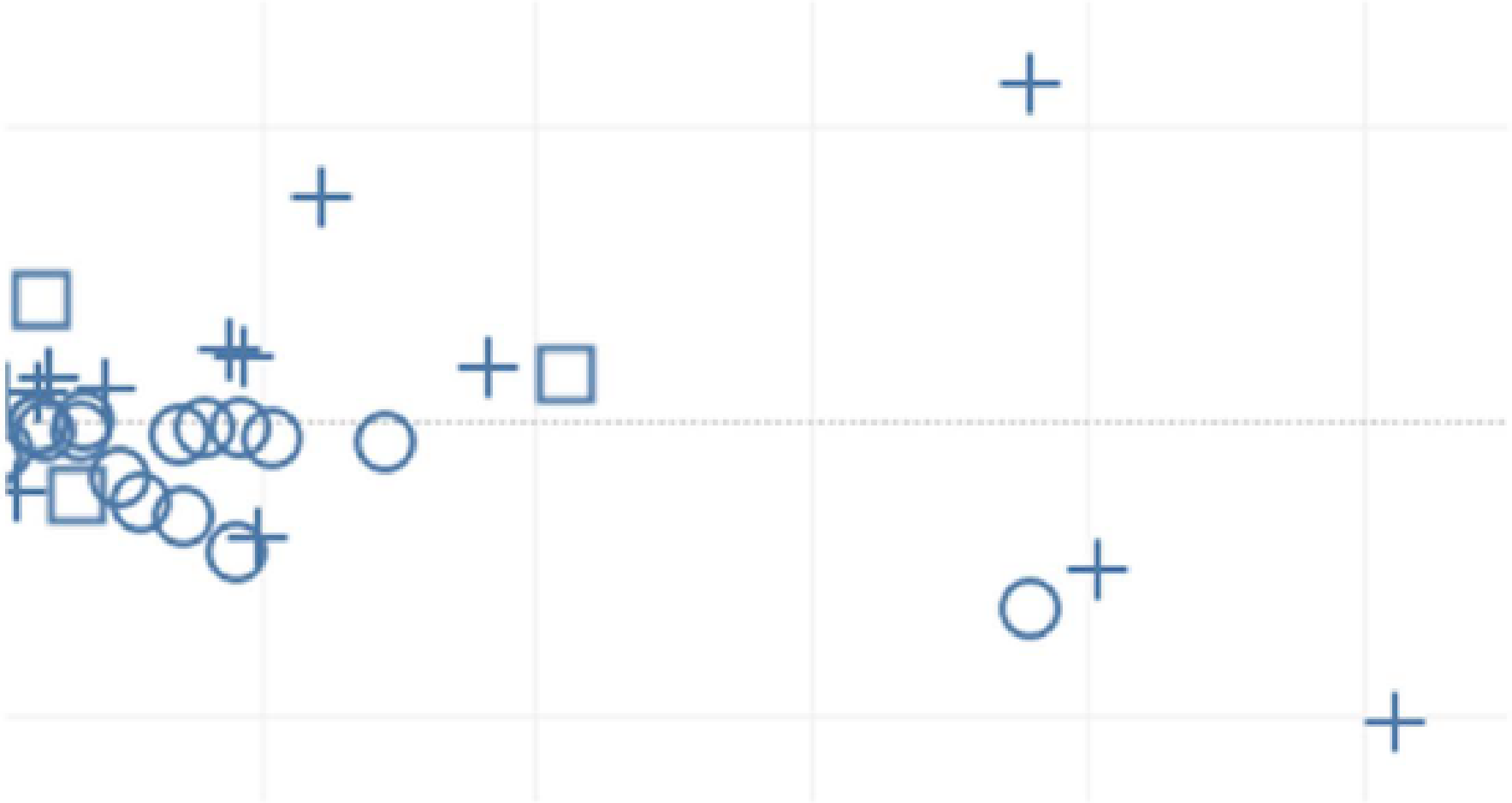
Closure

Continuity

Connection



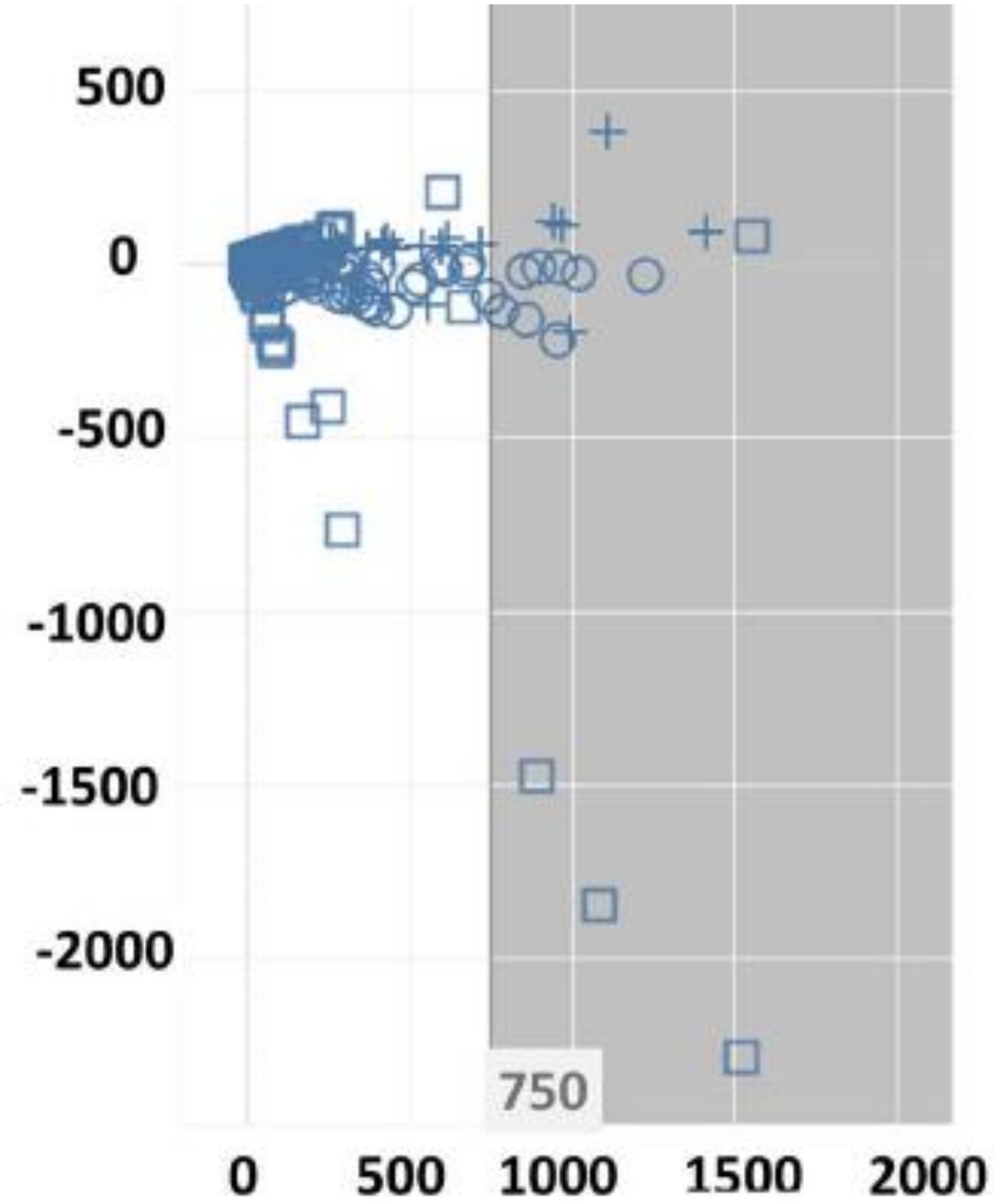
- Proximity is when we perceive objects as a group when they are close together



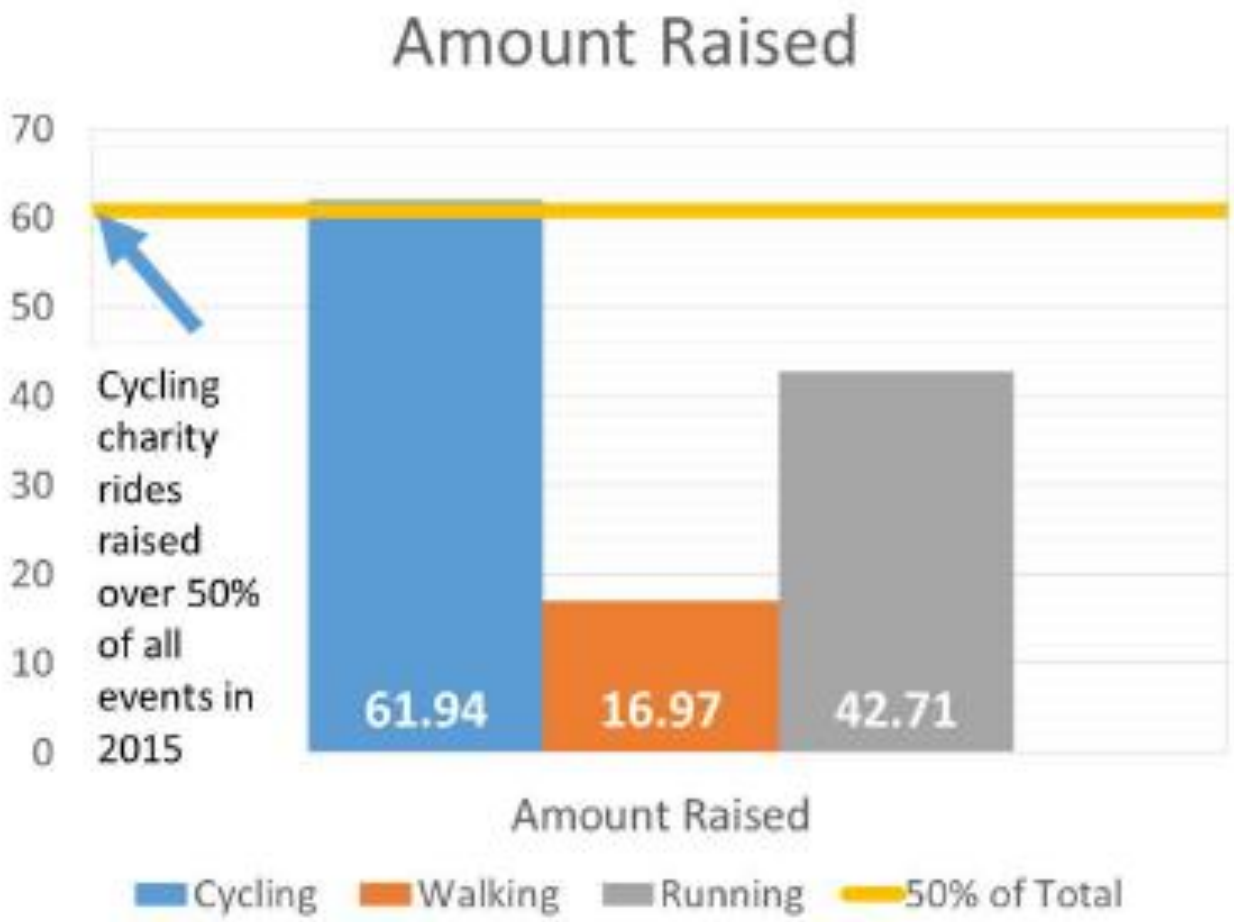
- We naturally group similar looking items

Enclosure uses color or boundaries to highlight or contrast information

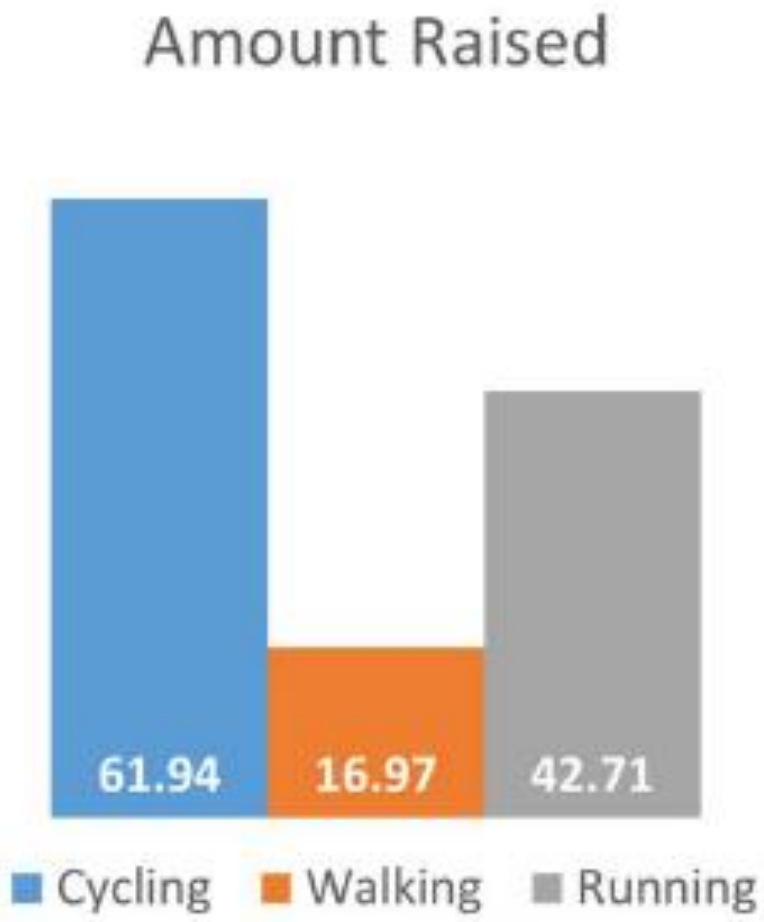
It is another way to depict groups



Not simple



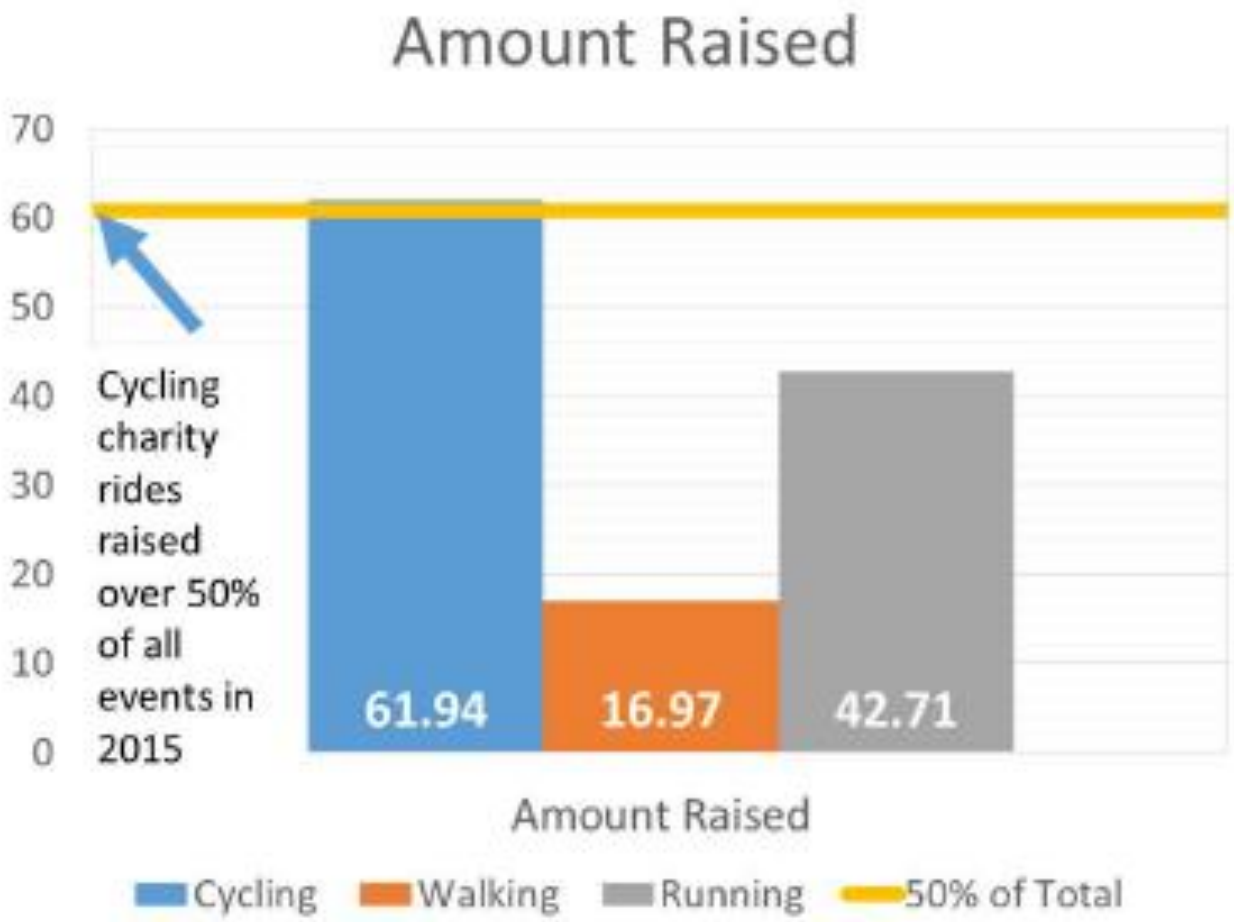
Simple but still closed



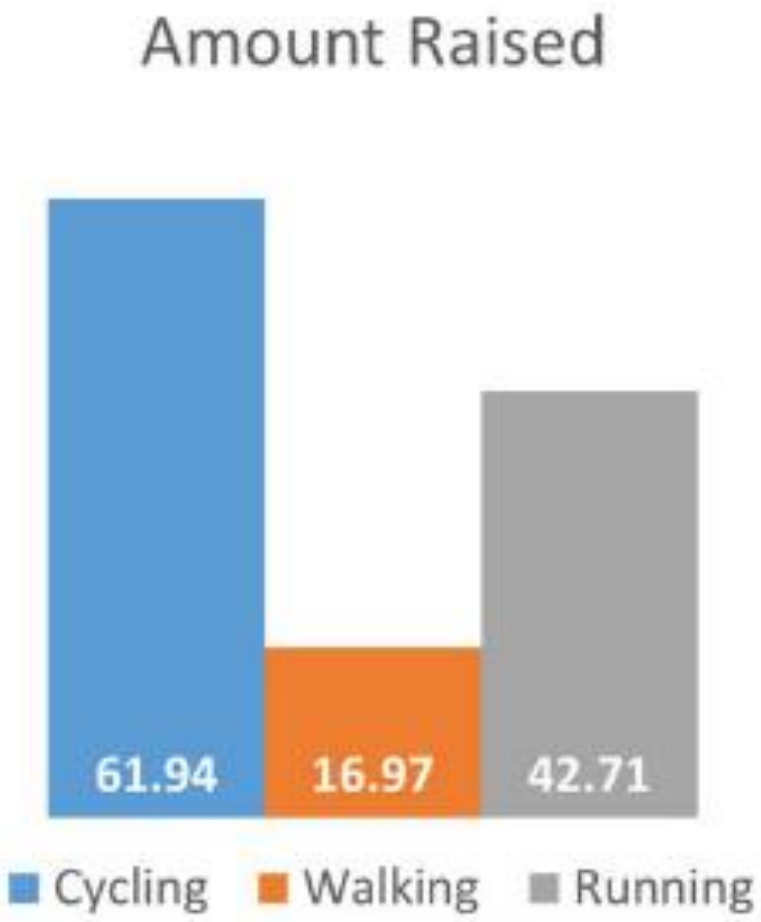
- Closure is the mind's ability to fill in gaps

User must have enough essential information to be able to fill the gaps

Not simple



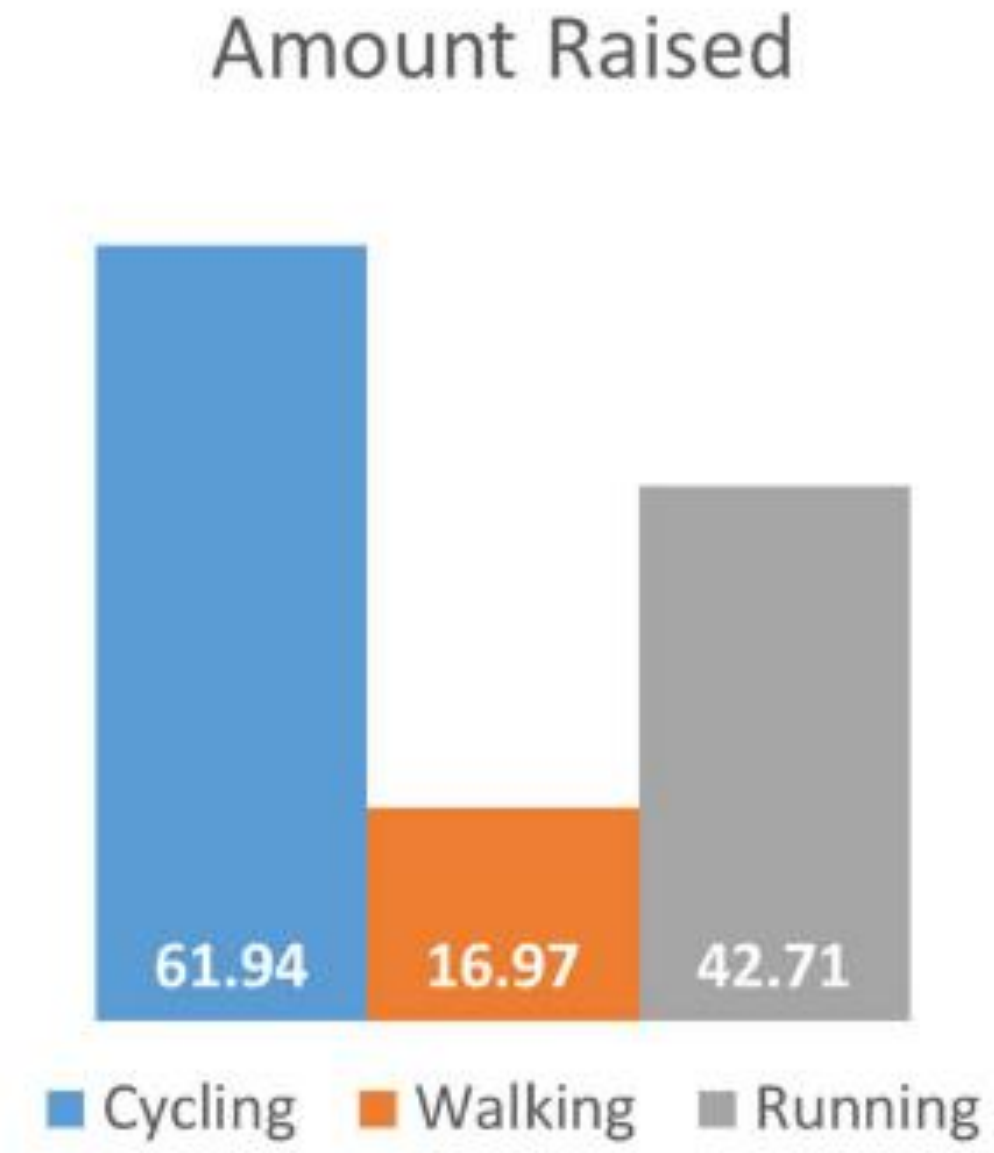
Simple but still closed

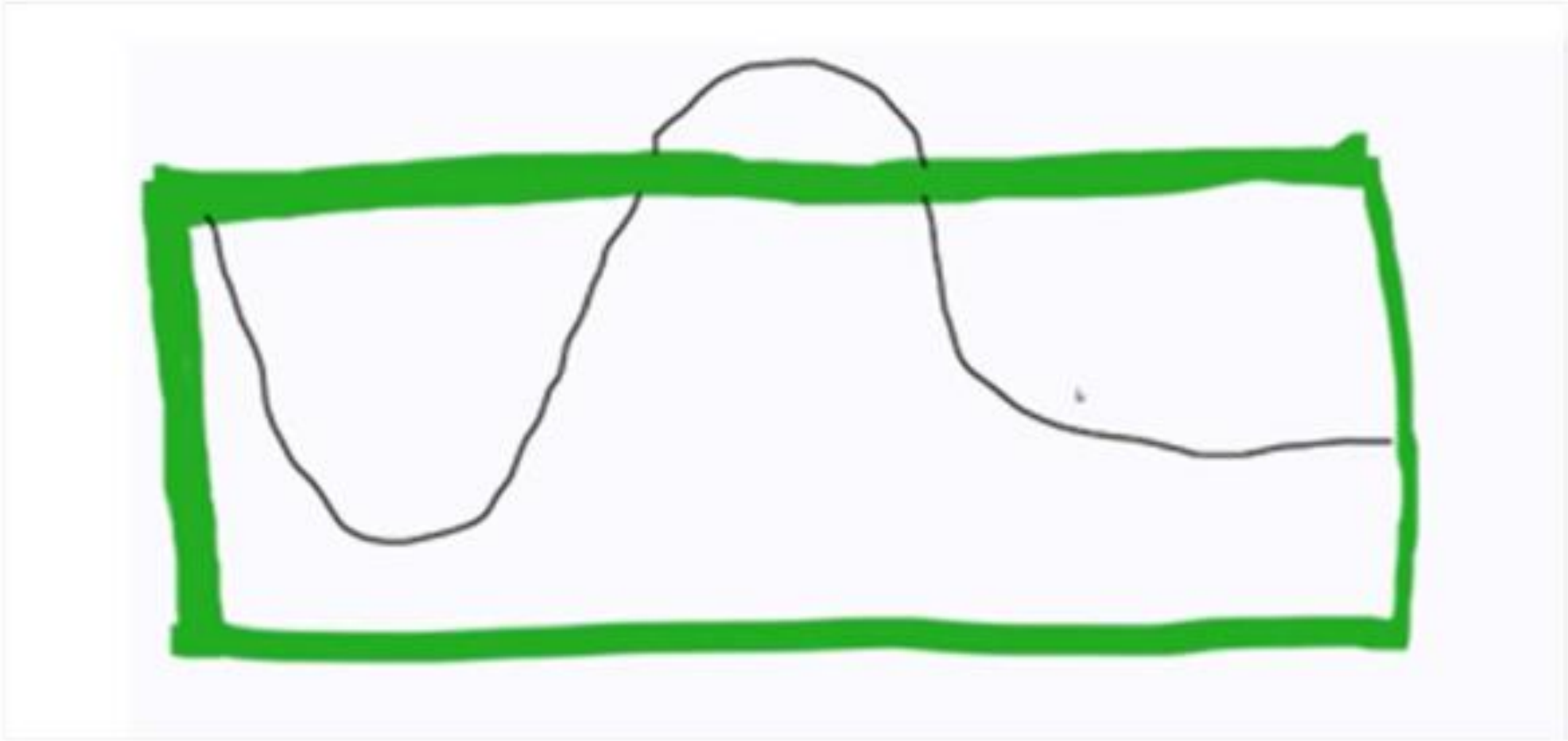


- The bar graph works without any axis because the bars are aligned on the bottom

This chart shows continuity

No need for an axis because the bars are lined up on the bottom





- Continuity is when we perceive something to be part of a whole, even if the parts are actually disconnected

Grouping the divisions and departments simplifies the data displayed

Division	Department	Headcount
Letters and Science	Chemistry	241
	Economics	112
	English	99
Engineering	Mechanical	198
	Electrical	156
Health Sciences	Neurology	139
	Psychiatry	127

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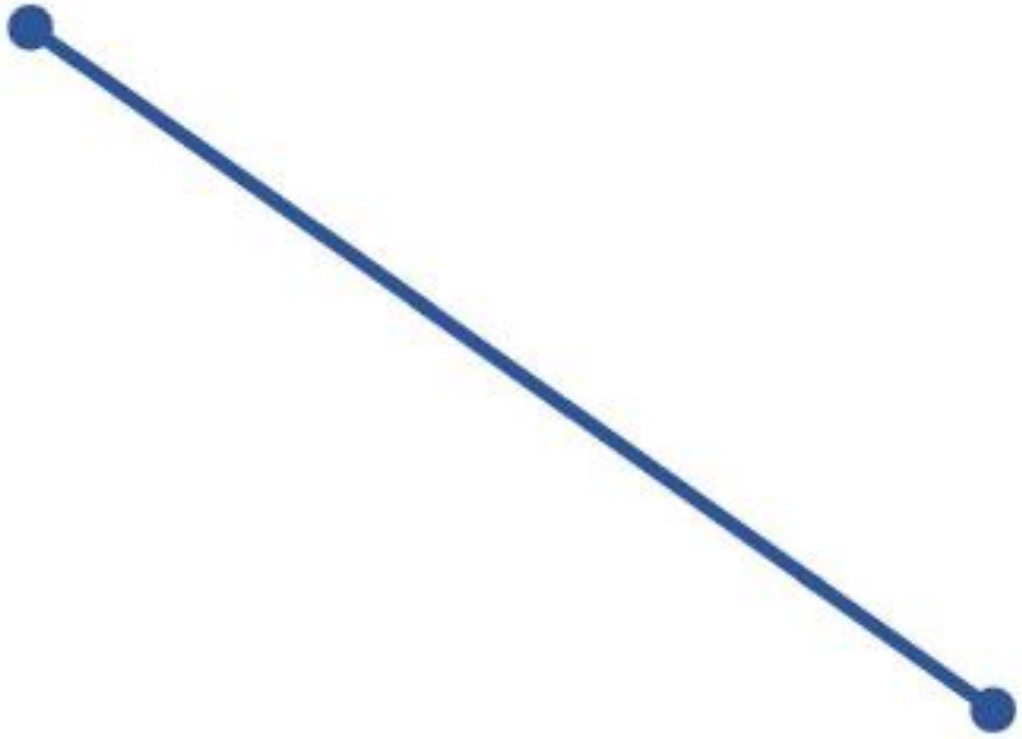
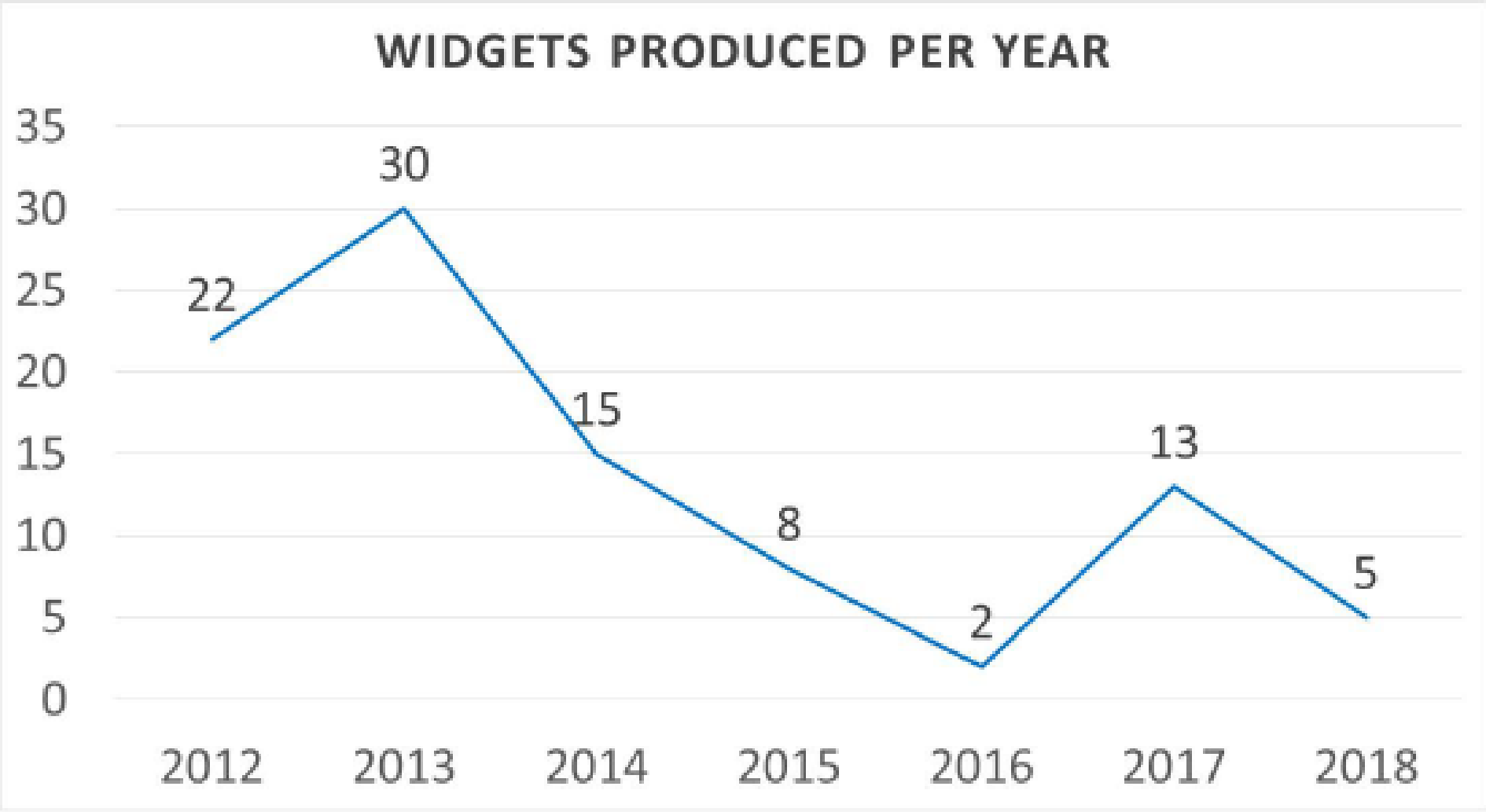
Connection

A line connects two grouped items





- Things connected by a line are related to one-another

Guidelines help designers create clear, easily understood visualizations

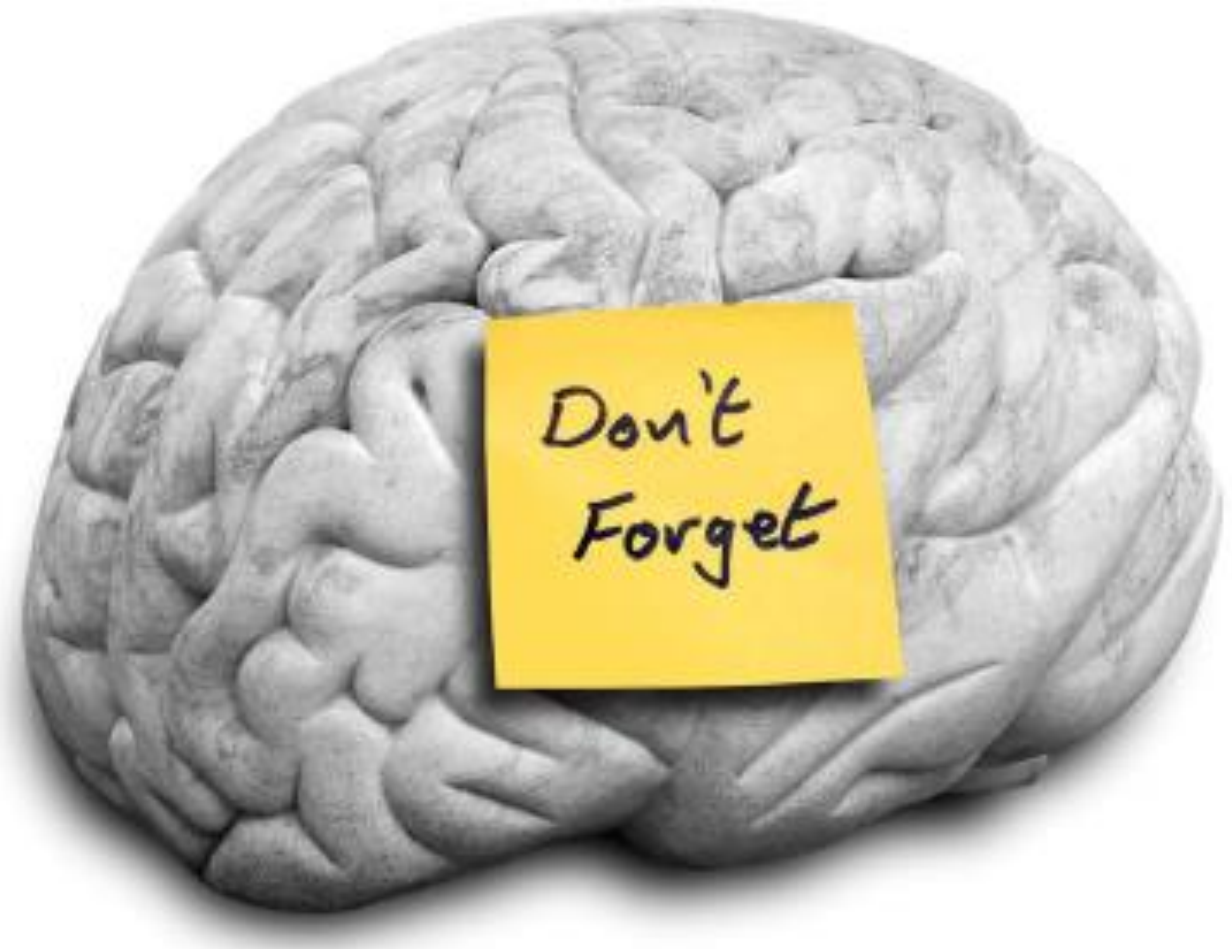
Clarity reduces user’s cognitive load

Data Visualization

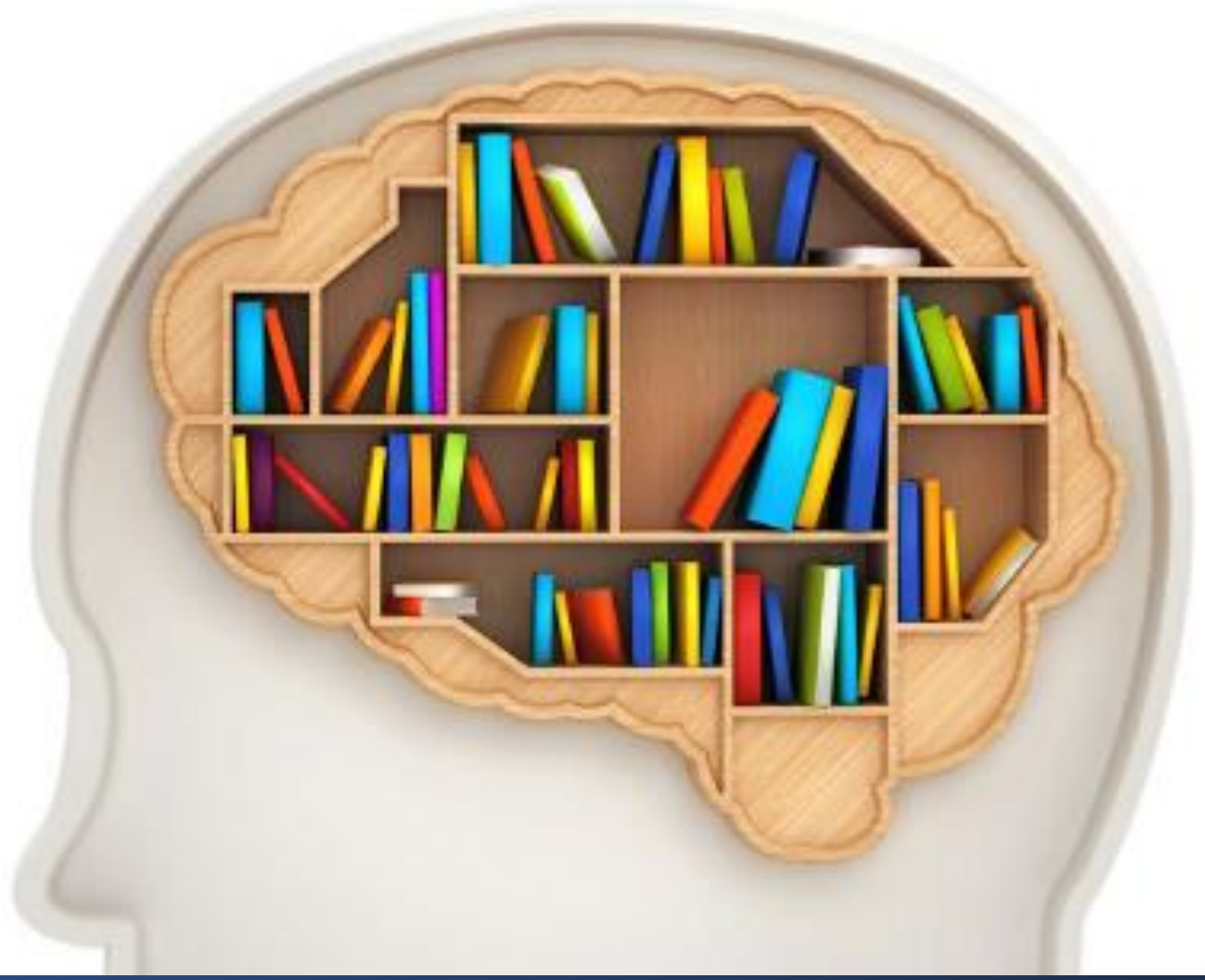
Essential Design Principles for Visualization

Pre-attentive Attributes of Visulizations

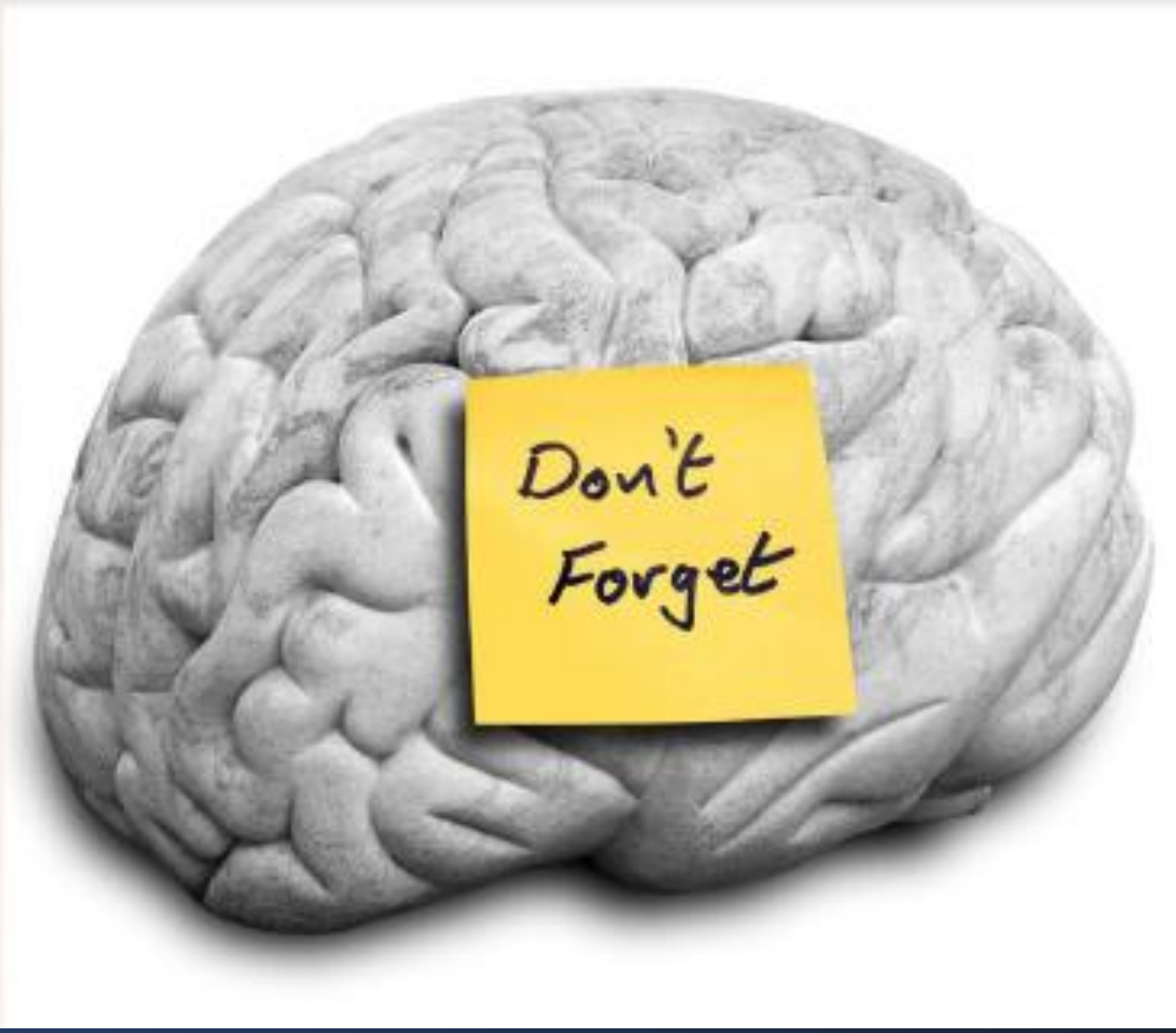
- Iconic memory is the sense memory of visual images after the images are gone



Short-term memory is the ability to hold information in active memory



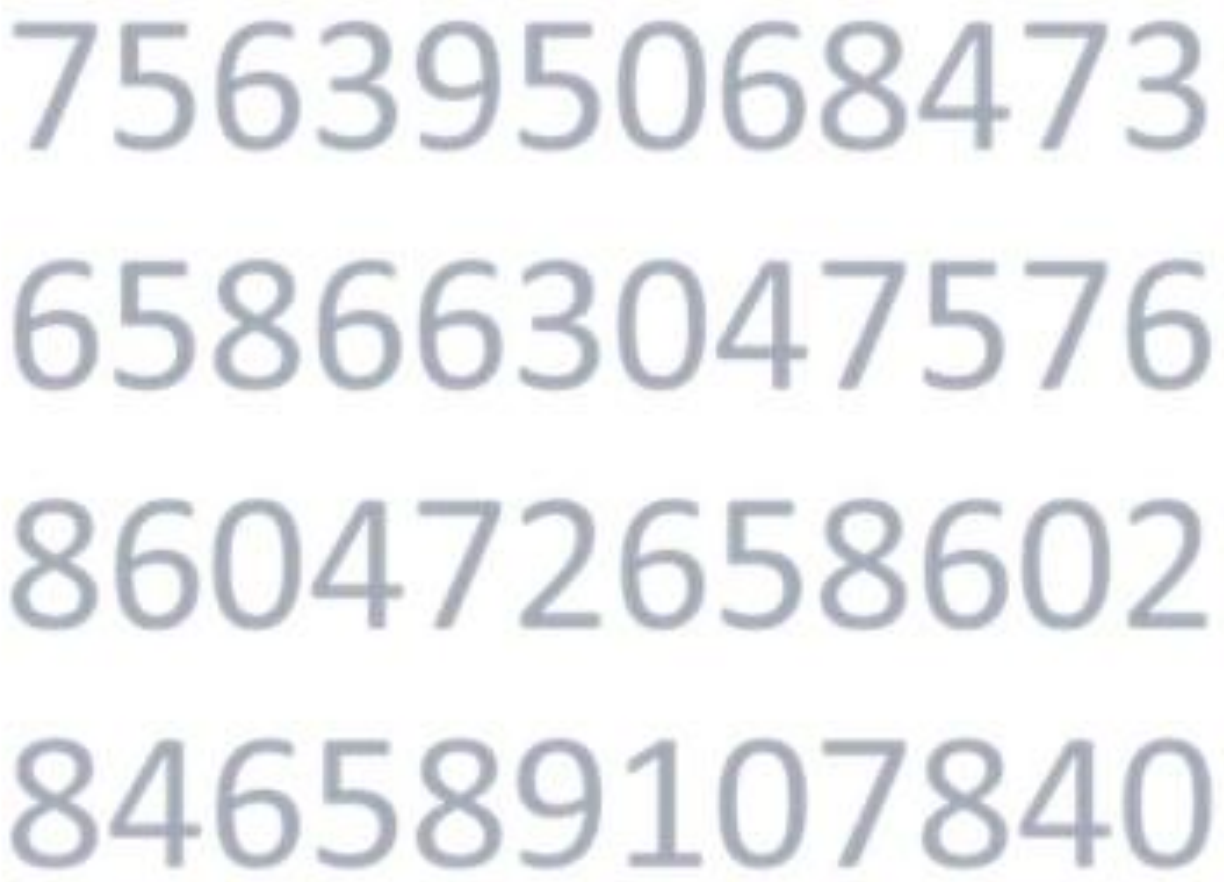
Long term memory is information and memories we retain indefinitely



- Data visualization works with both sensory and active memory

Count the 4s

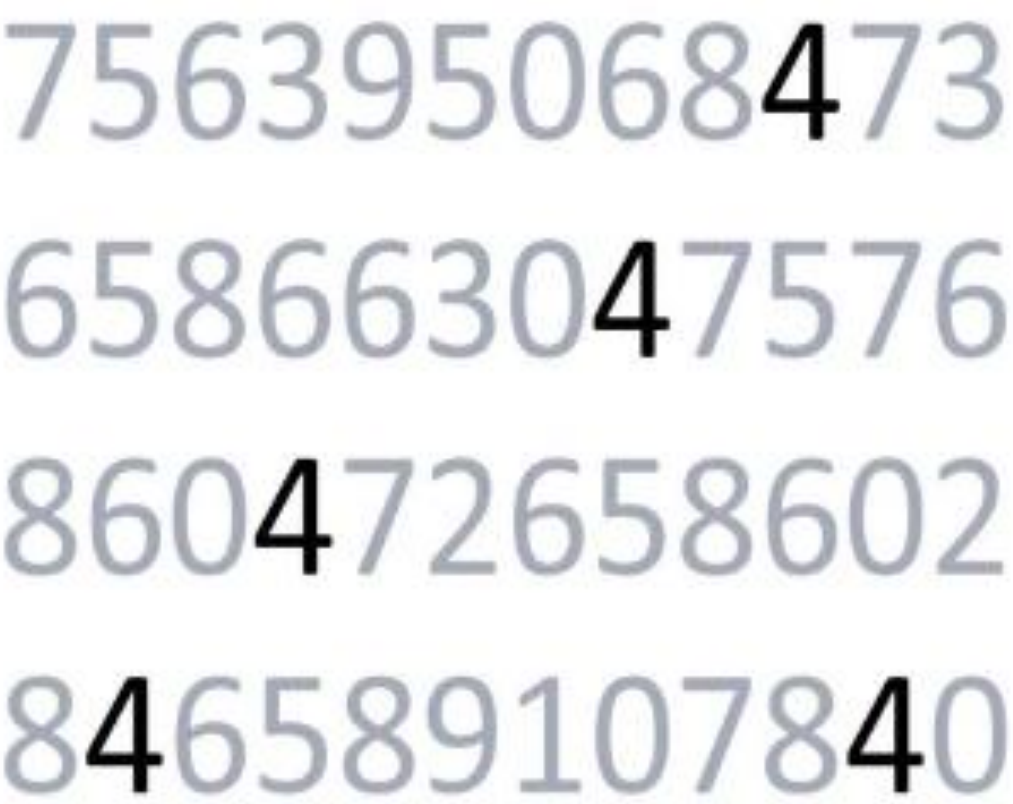
How many do you see?



Count the 4s again

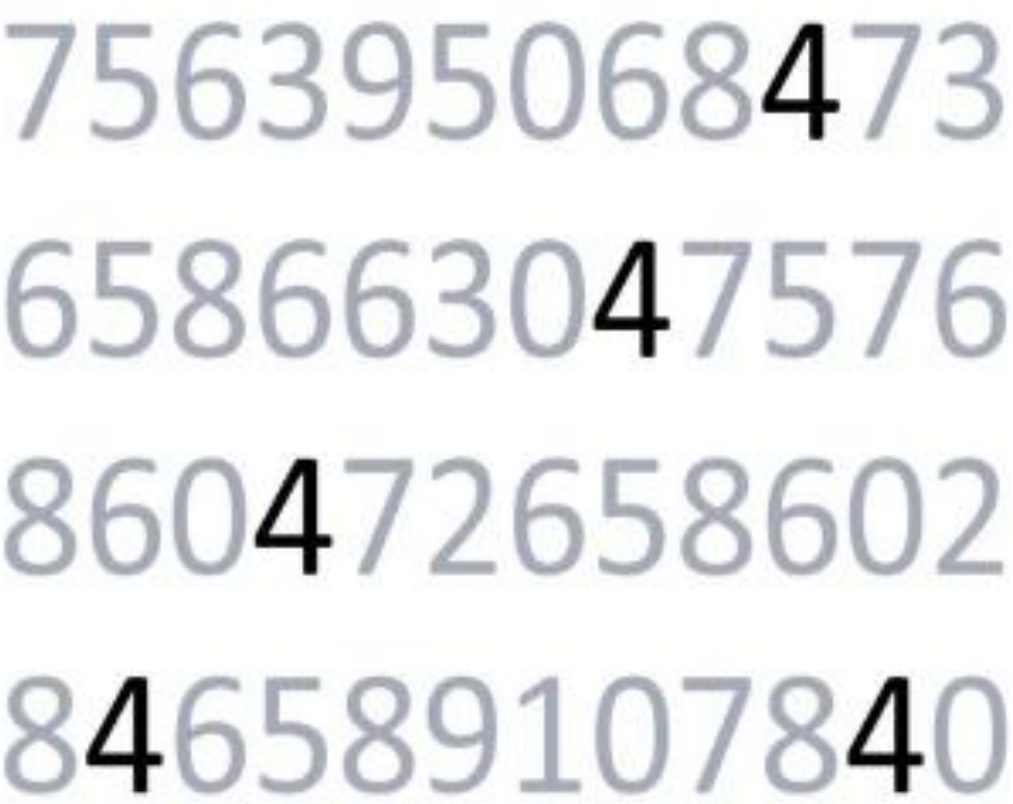
How many do you see?

Was it easier?



Did you notice how quickly you recognized the 4s?

Use pre-attentive attributes like size and color eliminates distractions



Good visualizations allow users to see what we want them to see before they know that they have seen it

Change one of thes to focus the user's attention:

Size
Color
Orientation
Shape
Line composition
Enclosure
Intensity
Position

Each tool has specific uses:

Quantification

Categorization

Be strategic

Shift user’s attention to what you want them to see

Don’t forget:
Most commonly used pre-attentive attributes