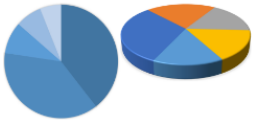
Creating more effective charts

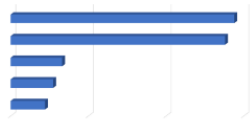
Perception, reasoning, and credibility

2022 MIDFIELD Institute

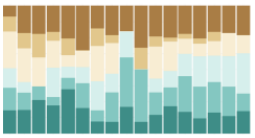
Creating More Effective Graphs by Naomi Robbins (2013) inspired the session title and Chapter 2, "Limitations of some common graphs," inspired our exercises.



Effective alternatives to pie charts



Effective alternatives to bar charts

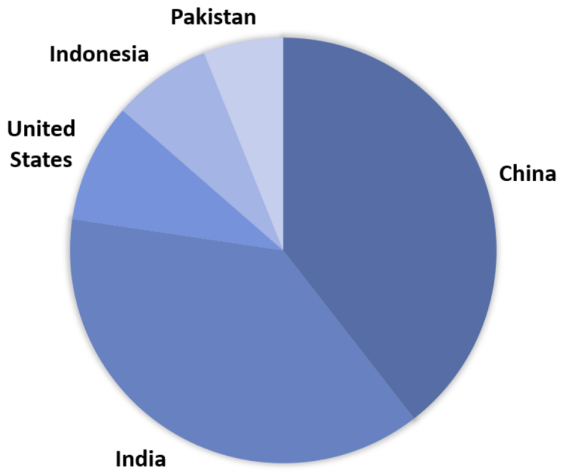


Aligning the design to the story

Advice from experts

§ *Effective alternatives to pie charts*

Judging pie slices is a low-accuracy task



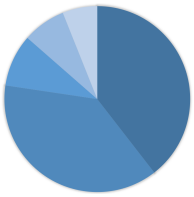
- *Visually estimate* each country's percentage
- Fill-in the blanks in the table
- Total should be 100%

Country	Percentage
China	
India	
United States	
Indonesia	
Pakistan	

Data source: World Bank (2022)

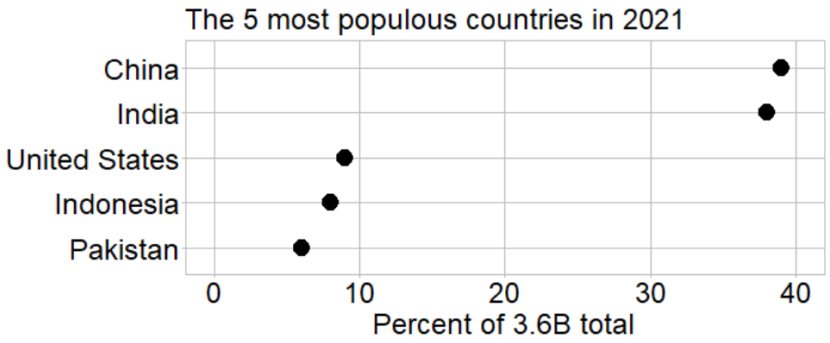
Judging values along a common axis is a high-accuracy task

- The new chart displays the same data
- *Visually estimate* the percentages using the new chart
- Fill-in the blanks in the table

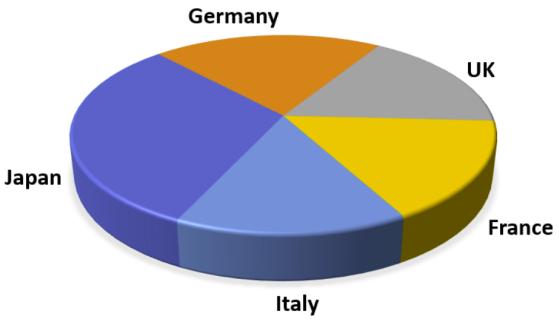


The data from the pie chart is shown below as dots along a common scale.

Country	Percentage
China	
India	
United States	
Indonesia	
Pakistan	



3D effects distort our judgment even further



- *Visually estimate* each country's percentage
- Fill-in the blanks in the table
- Total should be 100%

Country	Percentage
Japan	
Germany	
UK	
France	
Italy	

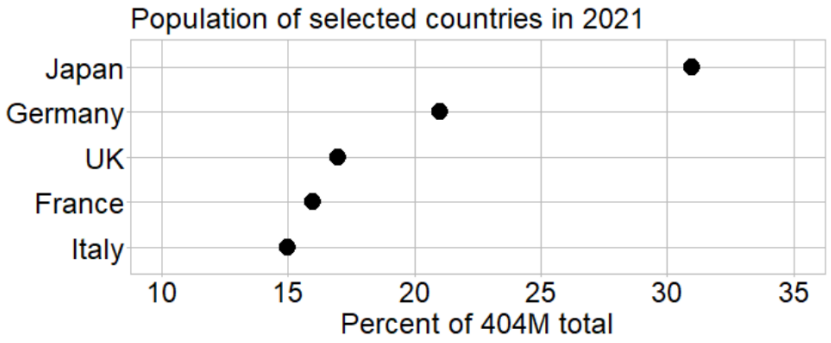
Data source: World Bank (2022)

Again, a common scale improves our visual judgments

- The new chart displays the same data
- *Visually estimate* the percentages using the new chart
- Fill-in the blanks in the table

The data from the pie chart is shown below as dots along a common scale.

Country	Percentage
Japan	
Germany	
UK	
France	
Italy	

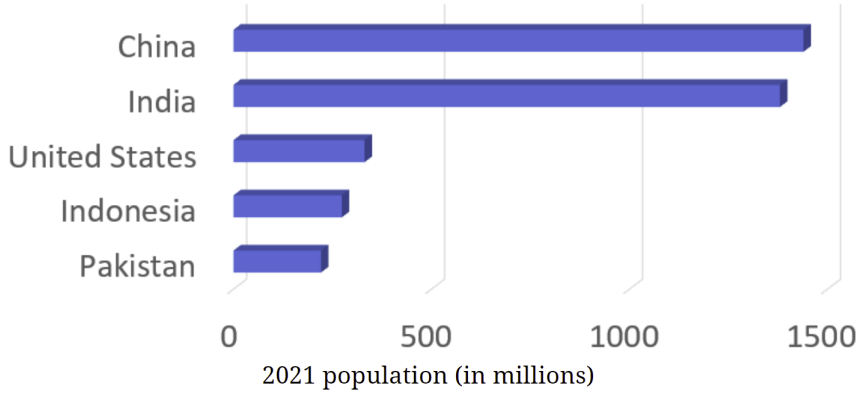


§ *Effective alternatives to bar charts*

3D effects always distort our judgment

- *Visually estimate* each country's population in millions
- Fill-in the blanks in the table

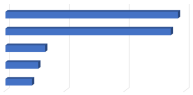
Country	Millions
China	
India	
United States	
Indonesia	
Pakistan	



Data source: World Bank (2022)

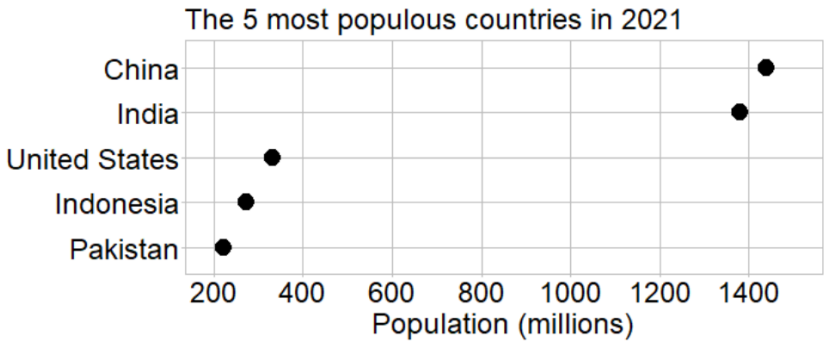
Same data—without 3D effects—along a common scale

- The new chart displays the same data
- Visually estimate the percentages using the new chart
- Fill-in the blanks in the table



The data from the 3D bar chart is shown below as dots along a common scale.

Country	Millions
China	
India	
United States	
Indonesia	
Pakistan	



With a zero baseline and no 3D effects, bars are OK

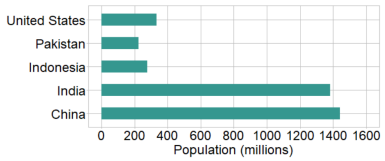
- Zero baseline avoids deception
- Ordered by data values
- Only the endpoint encodes information

Consider dot charts for

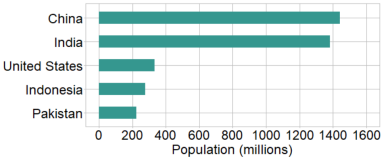
- Visually comparing quantities
- Replacing most pie and bar charts

Notes

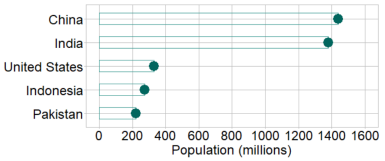
Default bar chart:



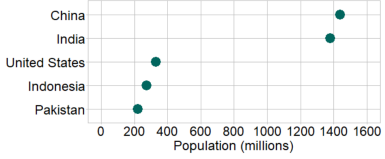
Ordered by magnitude:



Omitting the fill color:



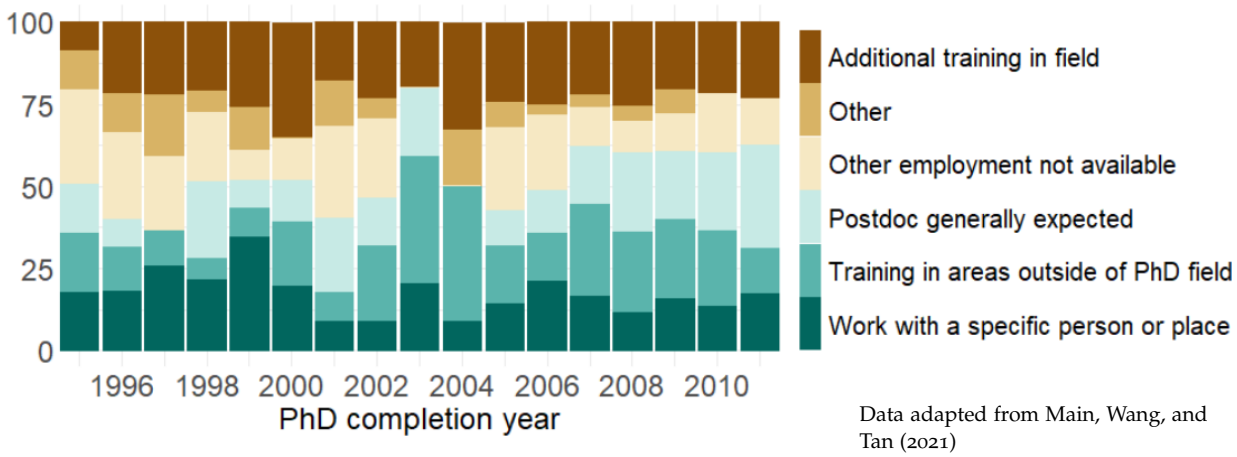
Produces a dot chart:



§ *Aligning the design to the story*

Visual grammar: charts encode information

Survey: "What was your reason for taking this postdoc?"



Data adapted from Main, Wang, and Tan (2021)

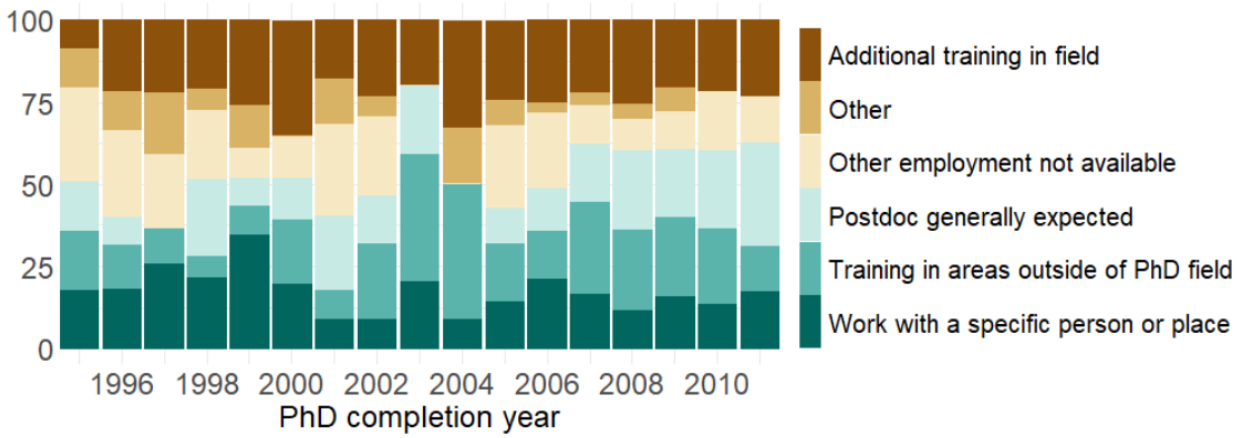
What information is encoded?

Before discussing what the chart *means*, we first have to agree on what the information *is*.

- Select one color.
- What *information* does the color encode?
- Write your thoughts below.

Visual rhetoric: charts convey meaning

Survey: "What was your reason for taking this postdoc?"

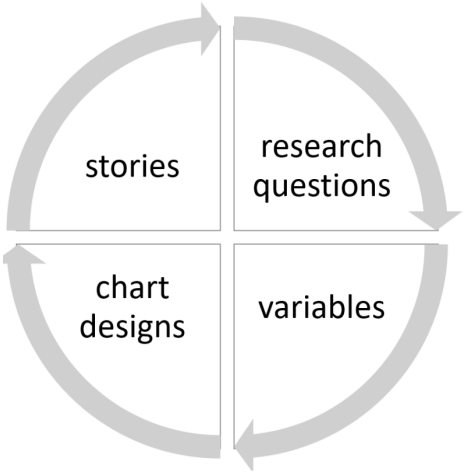


What story do these data tell?

We agree on what the information *is;* now we consider what it *means.*

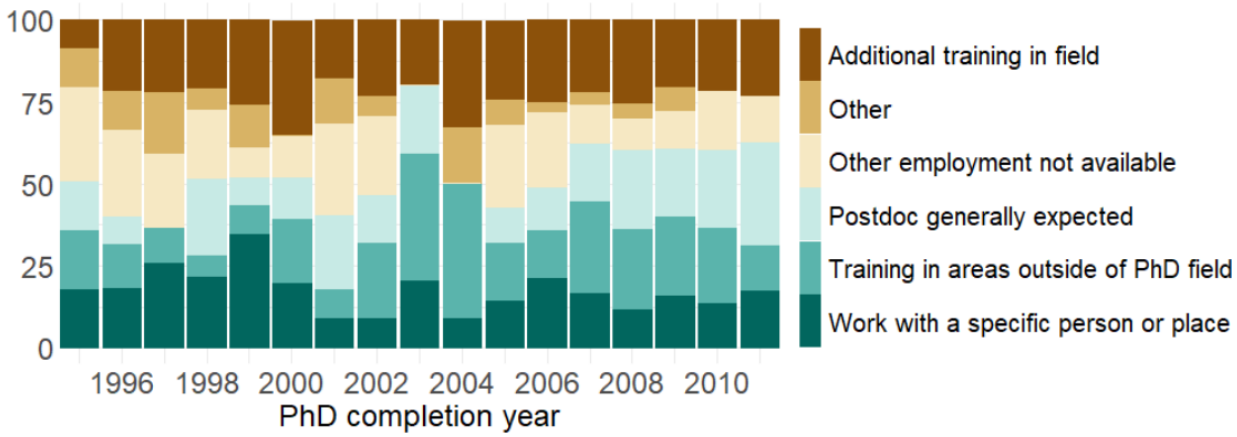
- *Meaning.* Describe a story (if any) this chart conveys *to you*.
- Write your thoughts below.

Visual grammar and rhetoric depend on the variables



- What is your question?
- What variables are measured?
- How are the variables classified?
- What chart designs suit these variables?
- What stories do the charts convey?
- How do the stories refine your questions?
- What new variables are needed?
- Repeat

What can we say about these variables?



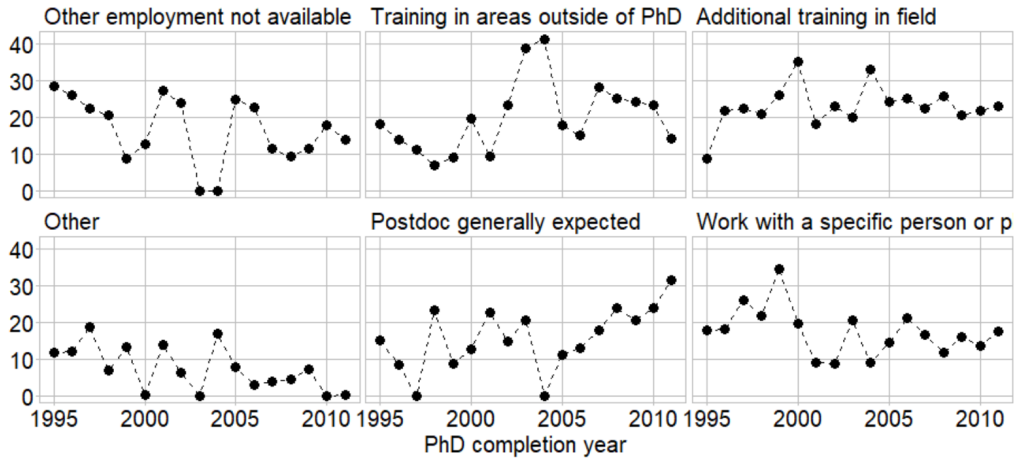
FILL IN THE BLANKS to begin summarizing the data structure.

1. _____PhD completion year_____ is a *categorical* variable.
2. _____ is a *categorical* variable
3. _____ is the *quantitative* variable
4. _____ is the *independent* variable

Note that discrete time units are not 'continuous', so the time units here are an ordered, categorical (not quantitative) variable.

Time series? Use a line chart.

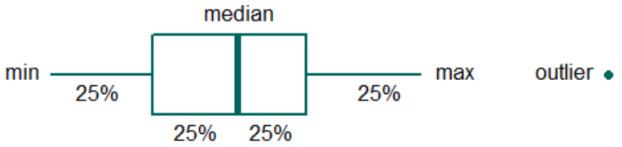
Un-clutter the display using one panel per reason.



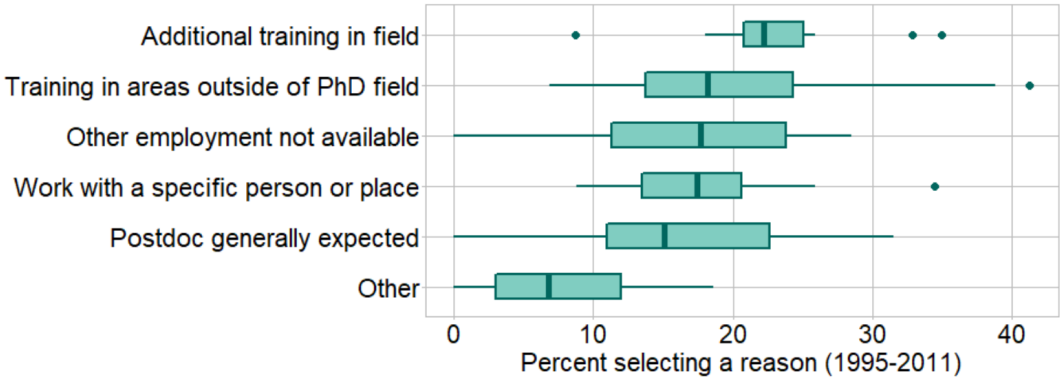
- *Meaning.* Describe a story (if any) this chart conveys *to you*.
- Write your thoughts below.

An unstated assumption underlies the visual muddle

- Emphasizing the trivial
- A distributed quantity is displayed in a box-and-whisker plot.

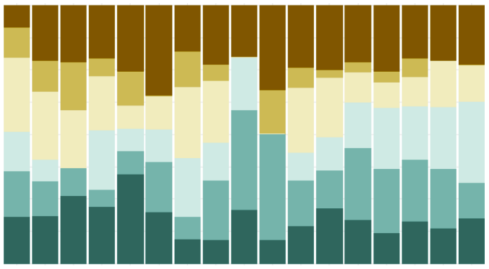


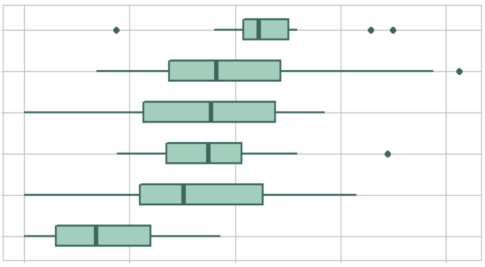
Distributions? Use a box-and-whisker plot.



- *Meaning.* Describe a story (if any) this chart conveys *to you*.
- Write your thoughts below.

Reflect on perception, reasoning, and credibility





Select any prompt. Compare the stacked bar design to the box-and-whisker chart. Outline your response:

- Compare designs: Quantitative data are *perceived* accurately.

- Compare designs: *Reasoning* about the data is supported effectively.

- Compare designs: An argument is given *credible* visual support.

§ *Advice from experts*

Match the expert to the advice.

FILL IN THE BLANKS with letters A–D.

Expert	Letter	Emphasizes the importance of
A. Alberto Cairo	_____	message
B. Jean-luc Doumont	_____	variables
C. Stephanie Evergreen	_____	revealing the complex
D. Edward Tufte	_____	knowing your main point
	_____	not lying to yourself

Ideas to consider

- Characterize the data structure and content

- Explore a story's context, causality, and complexity

- Align visual and verbal logic by revising iteratively

- Edit to suit the rhetorical goals for each audience

- Control every pixel—avoid thoughtless conformity

- Question are you seeing only what you want to believe?

References

Cairo, Alberto. 2019. *How Charts Lie*. New York: W.W. Norton.

Doumont, Jean-luc. 2009. *Trees, Maps, and Theorems*. Belgium: Principiae.

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Tufte, Edward. 1983. *The Visual Display of Quantitative Information*. Cheshire, CT: Graphics Press.

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