JI: Methods Review

The methods section allows readers to assess and replicate your work

Use subheadings to separate different methodologies

Describe what you did in the past tense

Describe new methods in enough detail that another researcher can reproduce your experiment

Describe established methods briefly, and simply cite a reference where readers can find more detail

State all statistical tests and parameters

Source: J. Montgomery (2-6)

Start your methods section with an overview

In a few sentences, what did you do?

Before your reader can make sense of your materials and procedures, they need an overview of the experiment.

Organize your methods

What information does your audience need first? What information does your audience need next? …

not

What is the first thing you did? What is the second thing you did? …

Chronological order may not be the most logical way to organize methods—these aren’t instructions

Use figures, when useful!

You don’t need to illustrate everything in your methods, but figures can help your reader to understand certain concepts more easily

Well labelled diagrams are generally better than photographs

Tables can be better than paragraphs for presenting lists of numerical data (e.g., parameters/dimensions of equipment/material)

Format equations

Write equations directly in whatever word processor you’re using. If you write equations elsewhere and insert them as images, they will look blurry and inconsistent.

Remember to number each equation and define the terms in the paragraph text beneath it.

Writing about your Approach

Design	Theoretical	Experiments (including numerical)

• What were your specifications? What was your design rationale/concept?
• Did you do any modeling? Introduce key calculations
• Did you do a prototype? How was it manufactured?
• Validation: What was your experimental procedure to see that specifications were met?
	• What is your problem statement? (analysis problem to solve)
	• What are your assumptions?
	• How did you derive your results?
	• Together, should be enough information for another person to derive the same results.
		• What was your hypothesis?
		• Experimental setup: What were your test materials/tools?
		• Experimental procedure: How were your tests run?
		• Are calculations required to relate your measurements to end results?
		  • May precede or follow experimental information
		  • Ideally, another party should be able to replicate your tests.

Slide taken from Dr. Eric Johnson, W2022 RISE Author Workshop

Example that requires revision

To vary the conditions of the controller, **we** used the LabVIEW program previously mentioned, along with the equipment setup shown in Figure 1 below, to perform these experiments. **We** began by testing the motor, loaded and unloaded, in an open circuit. **We** varied the voltage applied to the circuit from 6V to 20V in 2V increments. Next, **we** used a closed loop with a proportional controller in both loaded and unloaded circuits. **We** ran two experiments with this controller at 1400 rpm and 1800 rpm, respectively. For each speed, **we** varied *Kp* from 0.02 to 0.18 in increments of 0.04. Finally, **we** used a closed loop driven by a PID in both loaded and unloaded circuits. Once **we** found the ideal proportional gain, *Kp*, integral gain, *Ki*, and derivative gain, *Kd* values to fulfill your requests, **we** ran the controller once at both 1400 rpm and 1800 rpm. [148 words]

Source: S. Burcon

Revised, passive voice: more concise/less repetition

To vary the conditions of the controller during the experiments, LabVIEW 2014 was used along with the equipment setup shown in Fig. 1 below. First, the motor was tested in loaded and unloaded conditions in an open circuit, with the voltage varied from 6 V to 20 V in 2V increments. Then, the motor was tested in loaded and unloaded conditions in a closed-loop circuit driven by a proportional controller set at 1400 and 1800 rpms, with the ideal proportional gain, *Kp,* varied from 0.02 to 0.18 in 0.04 increments. Finally, the motor was tested in loaded and unloaded conditions in a closed-loop circuit driven by a PID set at 1400 and 1800 rpms, after the *Kp*, integral gain, *Ki*, and derivative gain, *Kd*, values required to fulfill testing requirements had been determined. [132 words]

Supporting an Argument with Convincing Evidence includes the use of Effective Visuals

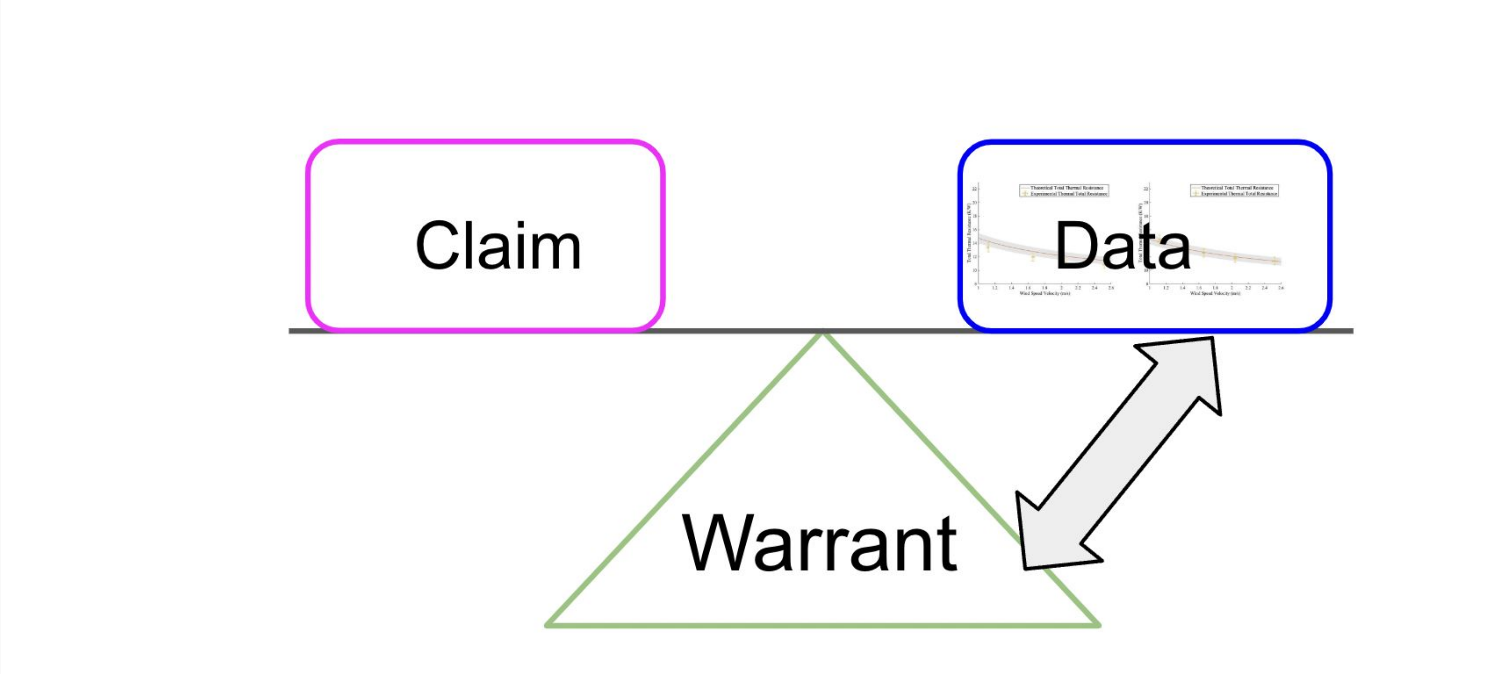
Why do we use data visualizations at all?

Visuals can be more specific than text

Well designed visuals can be processed more easily than text

Visuals help readers learn

Conducting a time study is of primary importance, as shown by the figures above, with only 26% of consultants reporting mastery of that method.



Captions are an important space to reaffirm your argument

Label each caption (Figure 1:)

Labels occur above tables and below figures

Left align, do not use italics

The caption should be the length of the figure and in 10pt font

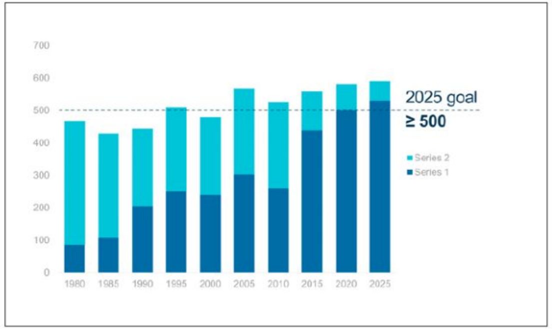
- Keep the caption within the implied margins of the figure
- The caption is always -2pt of the body text

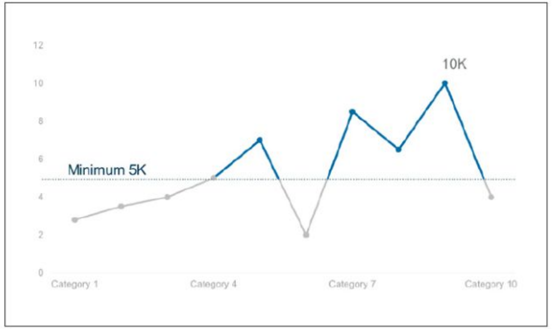
Tells us not only WHAT the figure is, but HOW we should read it

- State the significance of the figure
- Why does this figure help you argument? Tell us!

DELINEATING DATA SHOWS SHORTFALLS AND SURPLUSES

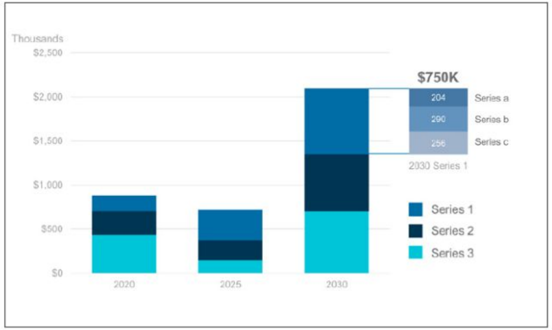
Adding a simple horizontal line to indicate a baseline turns a simple chart into a clear visualization of where benchmarks are being met and where they are not.

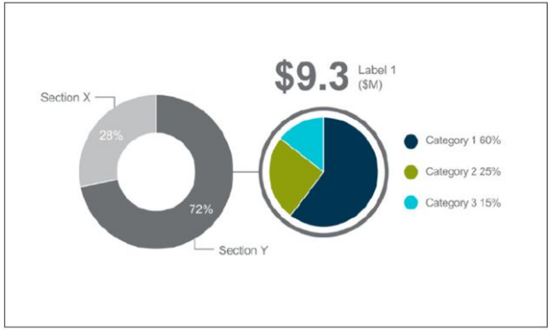




DISSECT DATA BY EXPLODING IT OUT

To provide additional information on one data set, create a secondary element on the chart where you highlight subcategories with colors and graphics.





Tables: unclutter them!

Remove gridlines, if possible (white space margins can help)

Consider order (highest to lowest)

Considering highlighting the important part

Numbers are right aligned, text is left aligned (generally)

Tables are labeled and captioned ABOVE

Remove any box around the table

Table 1. Consultants lack strong experience in vital IOE areas required for process improvement

Type	Question	None (%)	Limited (%)	Moderate (%)	Extensive (%)
Data Collection Methods	Time study	13.64	54.55	25.00	6.82
	Work measurement systems	22.73	50.00	22.73	4.55
	Historical data records	13.64	47.73	34.09	4.55
	Surveys	0.00	27.27	54.55	18.18
	Interviews	0.00	36.36	47.73	15.91
	Observations and physical space measurements	6.82	15.91	52.27	25.00
	Literature research and review	4.55	34.09	45.45	15.91
Data Analysis Methods and Tools	Six Sigma Statistical Analysis (DMAIC)	70.45	13.64	11.36	4.55
	Current State Mapping/Value Stream Mapping	50.00	22.73	18.18	9.09
	5S Methods (Sort, Set in order, Shine, Standardize, Sustain)	54.55	18.18	15.91	11.36
	Simulation	40.91	34.09	20.45	4.55
	Flow diagrams (Spaghetti, Swim Lane)	45.45	40.91	9.09	4.55
Additional IOE Principles and Concpets	Materials handling principles	38.64	38.64	20.45	2.27
	Inventory management	18.18	38.64	34.09	9.09
	Linear programming	2.27	38.64	43.18	15.91
	Ergonomics for worker safety	6.82	47.73	27.27	18.18
	Ergonomics for website usability	31.82	43.18	22.73	2.27
	One or more of the 14 principles from the Toyota Production	27.27	34.09	31.82	6.82

Figures: unclutter them!

Remove the redundant title above the figure

Large axes

Choose color carefully

Remove any box around the figure

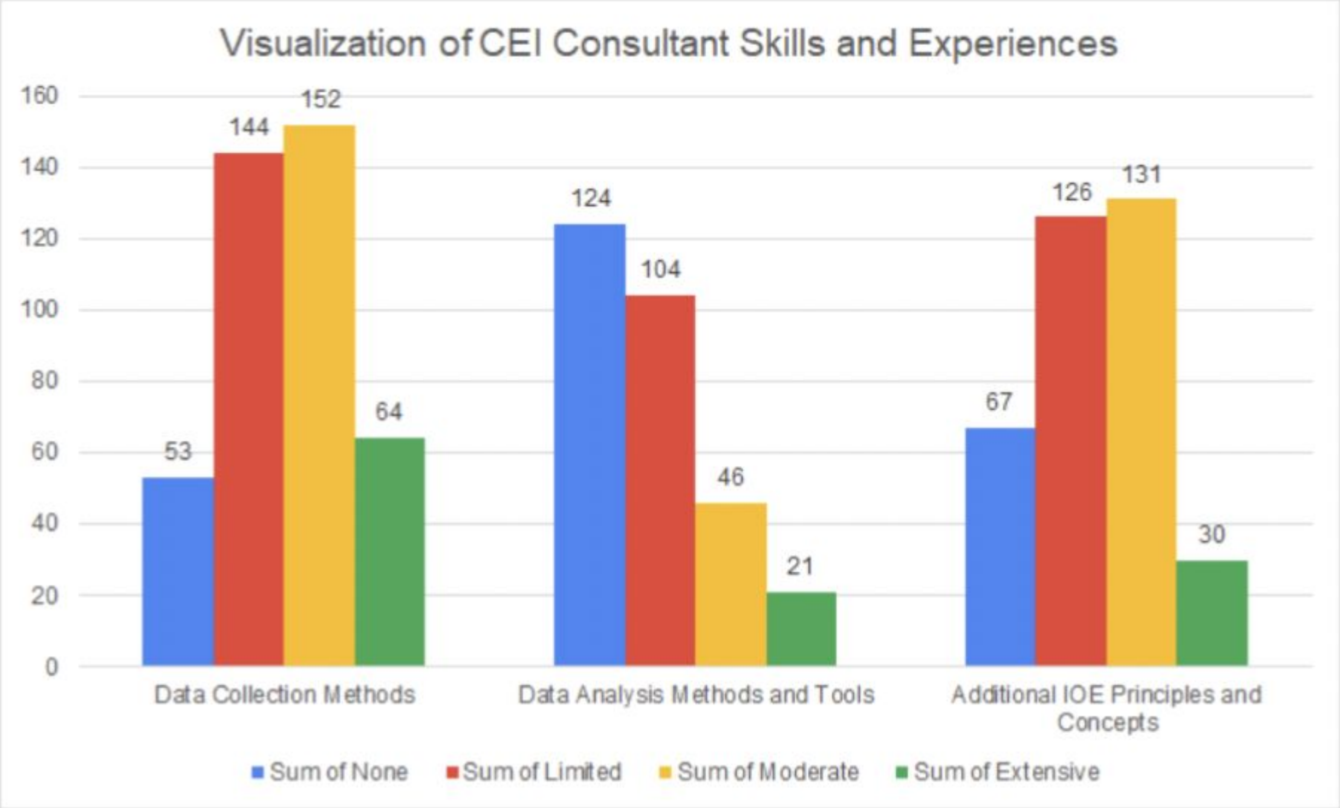
Place bars in order (if using a bar chart)

Avoid legends; use direct labels

Use visuals annotations when possible

Linear programming	1	15	32	11
Materials handling principles	18	27	12	2
One or more of the 14 principles from the Toyota Production System	19	23	14	3

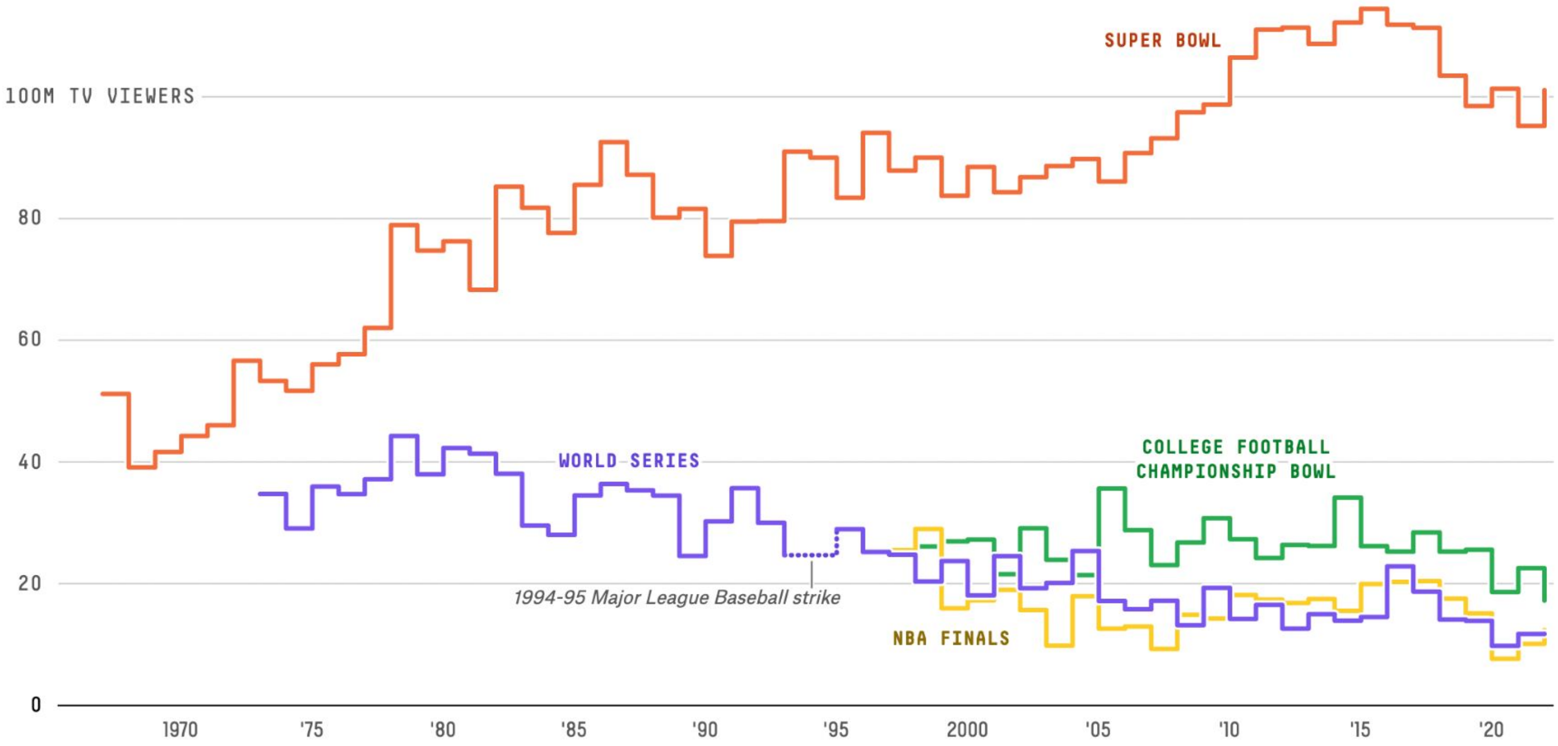
Figure 1: Visualization of CEI Consultant skills and experiences



In Summary: Make simple, easy to read visuals and be intentional with your design

Nothing grabs America's attention quite like the Super Bowl

Average viewership for men's sports championships in the United States, 1967-2022



Viewership is defined as the average number of persons watching an event on television. Totals for the World Series and NBA Finals are averages of the viewership of each game of that year's series. Viewership numbers were first made available in 1973 for MLB and in 1997 for the NBA. College football championship viewer ratings span back to the creation of the Bowl Championship Series in 1998.