JI: Methods Best Practices

Methods perform three functions

1. Overview of the experimental design and setup including equipment

2. Tasks performed

3. Analysis of the process (use figures, tables as needed)

Methods: What did you do?

Use past tense

Include enough detail that another researcher could replicate your process (within reason)

1. Provide an overview and experimental setup
2. Then, explain your process and any special considerations
    a. Variables
    b. Standards
    c. Special notes/potential issues

Quantify where possible

Methods: Provide an overview before the procedure

Methods

Hybrid Dynamics & Control requested Bode plots at multiple rotation rates and the determination of the viability of a faster testing method. To generate the requisite data, experiments were performed to determine model parameters at static conditions and then compared this static model to Bode plots generated at higher speeds as well as Bode plots generated via the faster method.

Equipment and Materials

The equipment used in this experiment includes: LabView, a digital oscilloscope, a function generator, a

So methods are just like instructions?

…not exactly

Methods: a procedure–a specified way to carry out an activity (a process)

Instructions: Detailed directions on how to perform a task (step-by-step)

Be specific with your procedure (example):

“We increased the heat in increments”

You increased it to what limit? What increment?

The voltage of the fan was varied.

By what? When? How often?

The tall heat sink kept the device under 350 k.

Which one is “tall”? Under by how much?

Use figures and tables to support your claim

Source: S. Burcon
7-8

Reference to visual

Tensile Test. The number of pixels *npixels* across the width of each specimen was 330. A summary the measurements taken for gauge width (*W gauge*), cross-sectional area (*A*), and calculated pixel size (*dpixel*) for each tensile test can be seen in Table 1 below. In addition, the nominal stress-strain curve obtained from the tensile test can be seen in Fig. 2.A in the Elastic Modulus section.

Table 1. Summary of naval brass dogbone specimen measurements and resulting pixel size prior to tensile test.

Specimen #	W_{gauge} [m] ÷ 10^2	A [m²] ÷ 10^4	d_{pixel} [m] ÷ 10^5
5	1.64 ± 0.00	1.05 ± 0.00	4.98
6	1.64 ± 0.00	1.05 ± 0.01	4.98
8	1.63 ± 0.02	1.03 ± 0.03	4.95

Elastic Modulus. The elastic portion of the true stress-strain curve used to obtain Young's modulus can be seen in Fig. 2.B below.

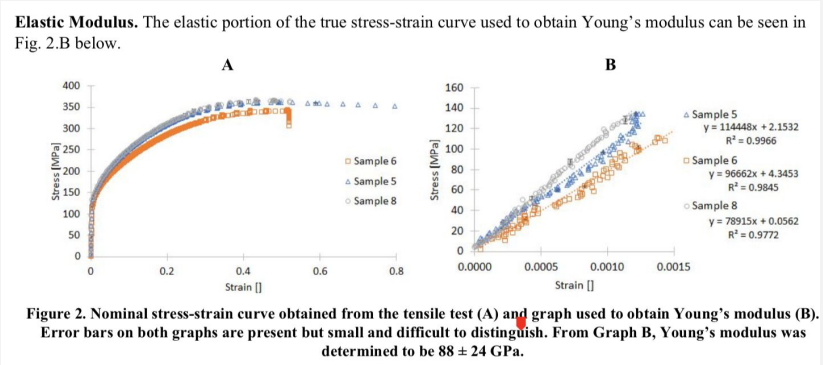


Figure 2. Nominal stress-strain curve obtained from the tensile test (A) and graph used to obtain Young's modulus (B). Error bars on both graphs are present but small and difficult to distinguish. From Graph B, Young's modulus was determined to be 88 ± 24 GPa.

Note: keep captions within the implied margins of the figure, left aligned

Caption with conclusion →

Explanatory text would follow.

General Guidelines for Figures

Introduce figures and tables in text prior to their appearance

Use the same language across sections

Make sure variables, titles, labels are consistent and clear

Refer back to equations, figures, sections by name or number

Use connecting language to ensure that ties between activities/sections can be understood

What is the *first* thing you want your reader to know?

- Figure 1 shows that temperature increases proportionally to increases in pressure.
- Temperature increases proportionally to increases in pressure (Figure 1).

One more thing…Active or Passive Voice?

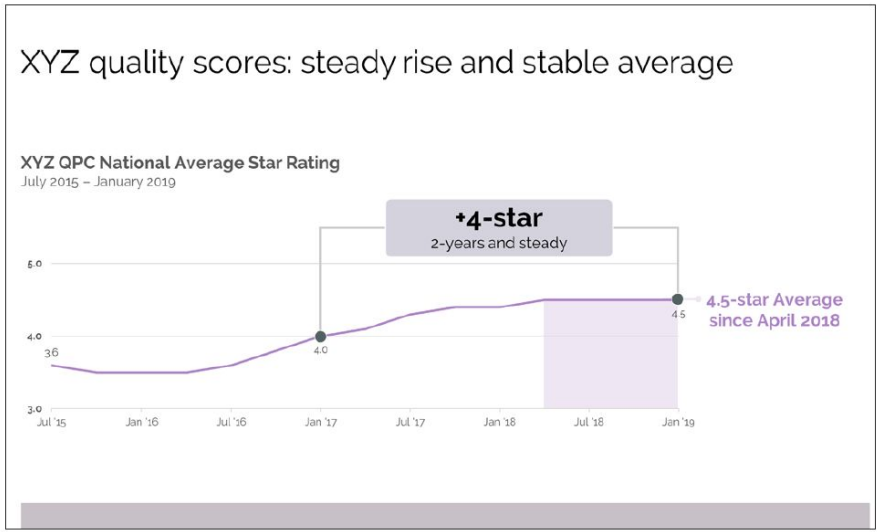
Active voice is dominant: it's grammatically clear and easy to read

Passive voice can sometimes feel natural in the "methods" section by focusing on the action vs. an individual (if the document serves that purpose!)

Conversely, it can be helpful to identify the actor in other cases by using active voice! (persuasion)

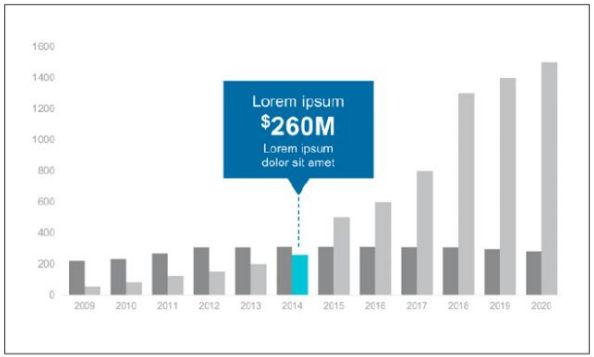
Methods should be in past tense

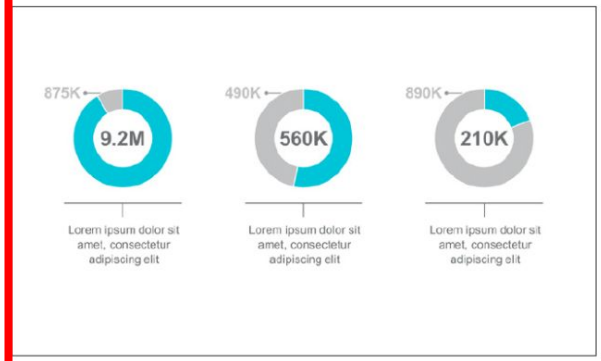
Visual Annotations are Effective



ADD LABELSTO CHARTSTO COMMUNICATE WHAT'S IMPORTANT

Charts often include a lot of numbers and data, and it can be hard for a viewer to know where to look. To draw attention to the most important points, call out statistics with labels or large type in addition to using a contrasting color.





Variable	Value
Bottle height (h_{bottle})	8.50 in
Bottle cross-sectional area (A_1)	4.34 in
Nozzle cross-sectional area (A_2)	0.54 in
Bottle mass (m)	6.92 millislugs
Water density (ρ_{water})	1.12 millislugs/in^3
Air density (ρ_{air})	1.34 microslugs/in^3
Atmospheric pressure (P_{atm})	14.7 psi
Gravity Constant (g)	386.22 in/s^2
Air Constant Ratio (k)	1.4
Drag Coefficient (C_D)	0.7

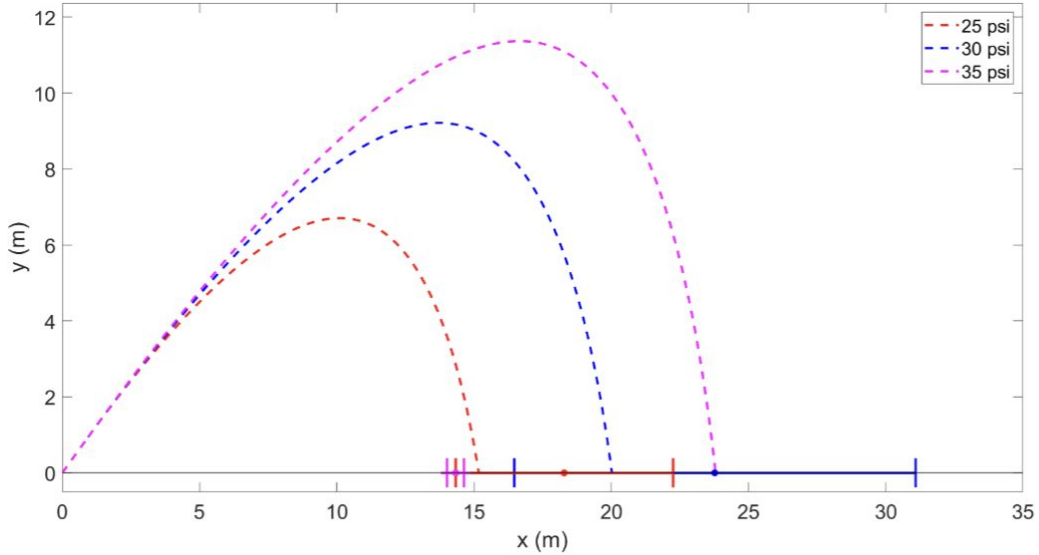


Figure 6. Experimental data of flight distance when pressure is varied from 25 to 35 psi compared to the model's prediction of flight. The model predicts that as pressure increases, the distance travelled (both vertically and horizontally) increases. The experimental data, however, predicts that the highest pressure, 35 psi, will yield the lowest horizontal distance 14 ± 1m. As shown, the error for the experimental data is quite large and of the order of magnitude of 10^0 at maximum, likely due to inconsistency between manually launching the rocket and launching it with the launch mechanism. Experimental error was also contributed to by the inaccuracy of measuring large distances over unflat ground with a short measuring tape.