

Technical Writing for Engineering Professionals

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The Models

Here's the short form: Engineers who need to explain a concept often use analogies to similar concepts by way of illustration. This book uses three increasingly complex model projects to illustrate possible ways to handle report writing.

This chapter outlines these model projects for illustrations of ways to handle writing strategies and problems. None of these models is a true representation of any known project, although all of them have been derived from real projects.

Archimedes's Law

Long before entering engineering programs, engineers may have become familiar with Archimedes's law that an object displaces its own weight. Some have heard the story about the law that has grown up through science folklore: The king of Syracuse at the time of Archimedes (probably Hiero II in the middle of the third century BCE) provided gold to a court jeweler to make into a crown. When the crown came back, Hiero suspected that the jeweler had not used the full measure of gold provided to him. He called Archimedes (who, for our purposes, was equivalent to the director of the Syracuse Research Center) and charged him with determining whether the crown contained the correct amount of gold. If it did not, the king would assume the jeweler was guilty of theft and sentence him to death.

Of course, science wasn't nearly as advanced in 250 BCE as it is today, so this problem would have been much more challenging for Archimedes to solve than it would be for a modern engineer—or even for students in modern primary schools. As the story goes, the biggest problem facing

Abstracts

Here's the short form: Readers of technical reports generally read to solve business problems or to improve efficiency, not to entertain themselves. The abstract is your chance to show your reader why your paper is worth their time.

The abstract is likely to be the second thing in your report your readers read—if they bother to go beyond the title. Because readers want to solve problems, your abstract should focus on solutions that can help make their operations better. Therefore, your abstract should highlight the *accomplishment* that makes your paper worth writing, the *situation* that made your project worth pursuing, and the *value* your work will bring to your company, your clients, or the industry.

Optimally, you will do all of this in a paragraph of about 90 to 125 words. Some abstracts are much longer, but the additional length may be counterproductive: if your readers are in a hurry, the longer abstract may seem too time consuming, and if it does not quickly and clearly deliver business reasons for reading, it may never be finished.

The main objective of your abstract is to engage the readers in your project, answering two critical questions: *What did you accomplish?* and *So what?*

Elevator Talk

Think of the abstract as the elevator talk. If you got in an elevator with your reader and you had just a few seconds to tell them what your project accomplished, what would you say? You probably would tell them your most recent finding—and why it matters to them.

detailed review, and you might put that in a separate subsection following the introduction. (For more information, see chapter 7, Literature Review.)

- **Closure.** What did you accomplish? Closure provides a restatement of the conclusions. If the project was complex enough to have multiple conclusions, each conclusion should have a closure statement.

Keep in mind that the amount of detail and the length of the introduction depend on the audience, purpose, and context of the report. For a short report, the complete introduction, containing all these parts, may fill only a short paragraph or two. In a long report, it may require several pages and may be divided into subsections that provide specific local and global situations and closure for each part of the project.

The amount of material in each of these subsections also depends on the audience, purpose, and context of your report: you want to give readers as much material as you can, but you don't want to overwhelm them. For the company report, you'll include details on potential future projects, but for the meeting paper, you won't include so much detail as to discourage readers or give away propriety knowledge.

Drafting the Introduction

In any case, be sure the introduction includes the information that will help your readers understand the reasons your project was necessary or helpful and how it will serve their needs in doing their jobs.

Establish the local situation.

The logical place to begin the introduction is usually with the local situation, framing the project in terms of the immediate problem that brought it to your attention and that your readers will understand because of their own experience. That situation can arise from any number of observations, complications, or opportunities:

- A customer or client identified a need for information.
- In the course of normal operations, something went wrong and you needed to find a way to fix it.

collection for them to see that you gathered the data responsibly and that they are the right data to achieve the conclusions you drew from them.

In our displacement experiment, for example, we assumed that Archimedes did 20 tests, with 5 different sizes each of objects of 4 different shapes (cube, sphere, cylinder, cone) that he measured directly and calculated volume. He would have collected data by showing the measurements of each object and their calculated volumes.

Next, he would have placed small objects in a graduated cylinder or measuring cup (if he had those 2,265 years ago), where the data would have been the initial volumes of water in the cylinder and the volume after submerging the objects. He put larger objects in a tub with an overflow system that allowed him to measure the runoff after he submerged the objects. In writing the report, he'd describe those cylinders (especially if he had to develop them for this test) and those tubs, and he'd write about how he got the objects in and the water out without distorting the measurements.

Since today's engineers understand the concept of displacement, those 20 tests may seem like far more data than we need to collect, but when it was a brand new concept, multiple tests would have been useful to provide assurance that it worked. By the same token, engineers today do not need to conduct multiple iterations of standard tests because they have been tested enough to give us great confidence in a single test run; but engineers who are developing new procedures may find that multiple iterations of the test are important to assure readers that the approach or tool is reliable.

For example, in our case with the flowmeter, a single test at our target rate of 5 ft/min might have run successfully, but that might have reflected an error somewhere in the test. Multiple successful tests at that rate would increase our readers' confidence in the reliability of the tool, and tests at higher and lower flow rates would have framed the lowest rate more accurately. Multiple tests also would have shown whether the tool functioned consistently through a range of flow rates. While that much detail may seem extraneous, it is important for demonstrating the claim that this tool is accurate and reliable at low flow rates.

Data acquisition becomes a good deal more complex for our mooring system report because the project itself is so much more complex, which

you can divide it differently. Your objective here is to keep the number of levels low, which helps the reader focus on the work.

One advantage to using the styles function to set up your headings and subheadings is that you can switch to outline view and see only the headings and subheadings, which is a good way to check to see if the paper seems logically organized.

Using the styles function also simplifies formatting the various headings; instead of applying the desired heading by hand for each heading, you simply click in the heading and then click the style you need. The word processor will format the headings correctly and consistently every time. (If you don't like the ones that come built in to the software, you can modify them, even after you have finished the paper. If you modify the style after the paper is finished, the software will adjust all of the styles with that name to look the same.)

If the report is long enough to need a table of contents, the styles function will format the table for you and keep track of the page numbering; if you add or subtract material or change heading levels as you work, you can update the table of contents in a few keystrokes.

Critiquing the Title

The title is usually the way readers are made aware of papers, so it should be designed to capture their interest in the paper. Be sure yours meets the following criteria:

- Includes the accomplishment of the project in clear and simple terms
- Includes sufficient keywords to make it searchable in databases, optimally with a moderate or low number of hits in the search engine
- Is limited to 7 to 15 words, or no more than 120 characters
- Includes a verb form (optimally as part of a complete sentence) to give it energy

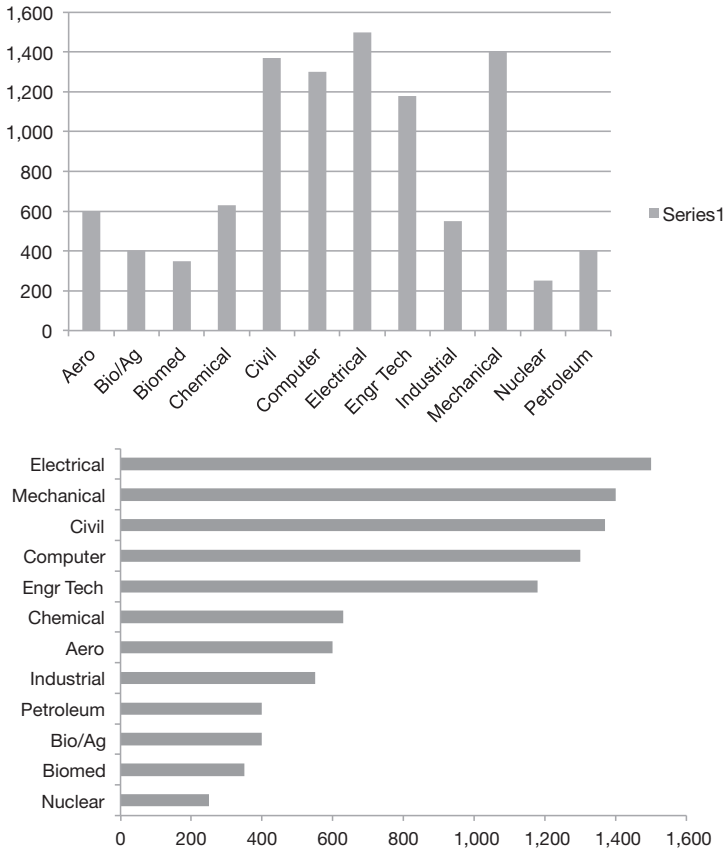


Fig. 10-11. Rotate bar charts to make the type horizontal.

Also be sure the axis divisions are consistent. Even though you collected data at irregular intervals, the time axis of your graphic should show the consistent intervals to keep the curves or trends aligned properly.

Photographs

The combination of easy, inexpensive electronic photographs (including snapshots taken with cell phones) with easy-to-use, efficient software means photography is much more widely used in technical reports today than even a few years ago. Here are some thoughts to consider if you think photographs may be a good solution for your work: