Southern New Hampshire University

DAT 520 Module Eight Overview

What good is a perfect analysis if it is not reported well? There is no substitute for a well-written report. Writing good reports is a skill that will serve you well, not only in this class, but in any analyst profession you may find yourself in. Accurate reporting is a skill worth having. This module description is going to discuss a few general points about good scientific reporting, especially regarding effective decision analysis model reporting. We have read some articles previously—such as the von Winterfeldt paper in Module Three—which we can use as a basis for judging whether we are encountering good or not-so-good scientific reporting. We are also going to develop our own powers of good reporting by doing it in the milestones and final project.

Scientific writing is characterized mainly by a formalized structure. A number of instructors teach scientific writing as a high style where you are forbidden to use the words "I," "you," or "we" and there is a detached, passive voice narrating events as if they occurred in the distant past in a dusty, dimly lit room. Fortunately, that barrier has started to break down. Not all scientific writing has to be like that. Some of the best scientific writing tells a story very similar to a work of nonfiction. Some of the best scientific stories contain digressions, or lots of footnotes, or even parody. If you ever have a chance to pick up a copy of the journals *Nature* or *Science*, you will see that many of the articles in those journals, especially the short ones and vignettes, are written in an accessible, readable style. These articles are like a more technical version of *Scientific American*. This is perfectly acceptable science writing and reporting—with a few caveats. Scientific reporting is also characterized by its concise, dense powers of description. Since science is usually achieved as a process, the reporting has to reflect the events that actually occurred, similar to following a cookbook recipe to create a meal. So while your report may contain a good story, it also must convey the specific steps that you took in order to get the results. There are sections devoted specifically to these elements, such as "methods" or "data analysis."

These structured sections can be a godsend, since they allow you to collect the story-like parts into different locations than the dry explanation of tasks undertaken. So, the formalized nature of reporting is an asset, not a hindrance. Also, for the reader, it is easier to flip to the sections of interest, perhaps even reading the paper or skimming through it out of order. If the report is structured and titled well, it is no big deal for the reader to approach the material in a nonlinear manner. Some people like to skip right to the graphics and then jump around

to the sections that most interest them. Some readers only read the abstract, take a glance at the graphics, and then move on to the next paper. This is also perfectly acceptable. Some people always read cover-to-cover. The formal structure of a report accommodates all styles of readership.

As far as writing style for scientific reporting, the main element to remember is to spend only as much time as is necessary relating the *what* aspects of your research, and to focus on *how* and *why* your research is new, relevant, exciting, interesting, fascinating, state-of-the-art, etc. The *what* is simply relating events in the process and your results. The *how* and *why* are the *choices* you made in creating the model the way you did—explaining why you assigned the probabilities or utilities that you did; why you included some elements and excluded others; how you arrived at your conclusions rather than just noting the conclusions themselves; how you approached your thought processes rather than assuming the reader knows; among many more aspects of how and why. Constantly raising the discussion from the *what* to the *how* and *why* is a hallmark of good science reporting.

Bear in mind that reporting and article writing are not the same activity. Scientific articles usually focus on telling the interesting story that is at the heart of the research, focusing less on the process, discussion of error and bias, and the dry reporting of numerical results. A report, on the other hand, will include the interesting story as well as the other, more formalized elements. Another aspect of both article writing and reporting is that there is usually a word count or page number target, which means the story must take shape in limited space. If you are writing an article, you have the entire length of the article to spin the tale. If you are writing a scientific report, you must include methods, descriptions, and results, which will limit the remaining space available to tell your story. As such, a scientific report will generally tell the interesting story in a highly compact form, compared to the less-restrictive article.

One consideration that often arises is what to do about graphics or pictures in a scientific report. A picture is worth 1,000 words, but when it is part of an article, it needs at least a short caption to describe it and explain why it has been included in the report. The graphic or picture has to relate to the matter at hand and enhance what is being told. There are number of ways to do this: include just a caption with the picture; refer to the picture at length within the text of the narrative; or refer to the picture briefly in the narrative with further detail in a caption, among other options. For example, a graph can convey hundreds or even thousands of numbers simultaneously. But if the graph were omitted and for some reason you needed to convey all those numbers, that Sisyphean task would take up a large amount of text to convey all those numbers. Worse yet, it would be difficult to relate them to one another in your mind like a picture does. But if you include the graph and an explanation of the key takeaways, then you have saved many pages of text in the space of one well-

explained graphic.

On the opposite extreme, too many pictures can also be a detriment. The story could get lost if the reader is trying to keep track of how each graphic relates to the others. If you have to include many graphs of a similar look, then you might want to find a way to condense them all into one graph or very few graphs, or come up with a new graph style that no one else has employed. These types of fusion graphs can sometimes be confusing if they have many extraneous elements, but typically a good fusion graph will have multiple lines or stacked bars or some other graphing meme that people are already familiar with and can easily adapt to when they look at your new style of graph. This may be difficult to do with decision trees, and in this class we will typically only be appreciating one decision tree at a time. Keep in mind that there are advanced decision modeling techniques that produce hundreds or thousands of decision trees and so there are ways to represent all of them simultaneously and to highlight the most important or relevant ones.

The last aspect of good science reporting that we will discuss is improving your powers of skepticism. A data skeptic is someone who can cast a keen eye toward data quality and content, and, at a glance, make a fair assessment of that information. Exceptional data skeptics are pretty amazing. In two seconds of looking at a table, they are able to tell you all the key pieces of information: how the various groups relate to one another; whether the reported results are to be considered significant or not; and how sources of bias or confounding might be clouding the results.

True experts in their field have an internal compass that instantly tells them which numbers are in a plausible range, and which to pay attention to or ignore. Good data skeptics will take a few minutes to appreciate a table of information, digest it, think about it and answer questions solidly about it. Fair data skeptics may miss some important concepts, but can guess which results mean something and which probably do not hold much value. Poor data skeptics simply need to spend more time learning the arts.

Your job as research reporter is less to be the true expert and more to give readers as much information as they need so they can exercise their own powers of skepticism. Imagine a poorly written report that contains not only numerical errors, but that leaves out key elements of the researcher’s thought processes, or perhaps is written in a misleading way. Or, the story might be told so poorly that even the best skeptic would have no idea how to critique the results and conclusions. Now, imagine a well-written report: it contains just the right amount of well-annotated graphics; a clear abstract so that the reader knows what is coming; compact and neatly reported numerical results; an introduction that sets the scene for what the research means in its own context; a story worth reading about; enough description of the steps taken to get the results; as well as a logical flow of discussion about

those results leading to the logical conclusions that were made. A good report will also discuss its own limitations and how the research could be improved in future research. When all of those elements are present, a good data skeptic will be able to look past the structure of the report and into the content to draw their own conclusions about whether the research is valid or not, and that reader may more easily offer useful critique, thus advancing the science.