My Favorite Assignment

Analyzing Tables, Graphs, and Charts: A Four-Step Approach

Teun De Rycker
Lessius Institute of Higher Education, Antwerp, Belgium

A WORKSHEET used in my class helps business communication students get the most out of a set of quantitative data. After all, "[modern] businesses not only produce goods and services but also vast amounts of data" (Buckley, Brindley, & Greenwood, 1992, p. 122). Handling this type of information both efficiently and effectively is a basic skill that requires regular practice throughout any business communication course.

The Problem: Too Little, Too Fast

Students sometimes find the analysis of tables, graphs, and charts hard to get 100 percent right. Some of them also have trouble communicating their findings accurately—an observation also made by Hayes (2000). It is not easy to determine, however, whether perceived difficulties in describing data are cognitive rather than communicative in nature. For example, a lack of clarity in formulating certain deductions is not automatically proof of poor comprehension. An added problem is that visuals can hamper comprehension through "preparer ignorance or carelessness" or "willful manipulation to deceive" (Courtis, 1997, p. 169). Students, in other words, have to learn to "see well" (Andrews & Worley, 1996, p. 87), and not to repeat other people's statistics blindly, nor to believe everything they see in print.

One of the main causes of interpretative mistakes is the tendency among "statistical consumers" (Helberg, 1995) to do too little, too fast. More particularly, in the business communication

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classroom, data analysis is often a preliminary stage in completing a bigger and perhaps more exciting assignment like a financial case study or role-playing a negotiation. In their eagerness to get the task done, some students may cherry-pick their way through the data in search of whatever may help support a claim, justify a decision, or illustrate a fact.

The Worksheet: Slowly Does It

To address this problem of "selective visual attention," I have developed a worksheet (see Appendix) to make sure that students do not go astray in presenting and interpreting visual data. The worksheet walks students through a sequence of four easy-to-remember activities: orientation, generalization, explanation, and exploration. Before discussing the benefits of using this specific approach, I'll clarify these four terms.

Orientation: Look Before You Leap

The first stage in analyzing tables, graphs, and charts is orientation. Before getting down to interpreting the quantitative information, students will first have to check off the following seven points:

1. What type of data presentation has been chosen—and why? What are some of its possibilities and limitations compared with alternative visualizations?
2. Does the data set contain a time scale? (In class we use the terms "movie" and "snapshot" for this.)
3. Does the table, graph, or chart have a title? If it does not, can you think of one? If it does, distinguish between eye-catching titles (e.g., "Look, no losses"), generic titles (e.g., "Profits 2000-2001") and what Zelazny (1996) calls "action statements" (e.g., "Profits reverse downward trend").
4. What is the source of information? What do you know about the secondary source (e.g., the business magazine where you got the graphic from) and the primary source (where the graphic got its data from, e.g., the OECD)?
5. Are there any labels, headings, or legends in the data visualiza-

tion? Do you know what the graphical entities (data points, lines, surfaces, and the like), graphical attributes (colors, size, and the like), and numerical data represent?
6. What units of measurement are used? Make sure that you know which numbers are percentages, coefficients, or indices.
7. What do the labels and other pieces of textual information used in your table, graph, or chart mean? If you are not sure, look up their definitions.

By answering these questions, students should enhance their understanding of the building blocks of the graphic that they are working with. They should also gain more insight into its strengths and weaknesses, especially with respect to bias and reliability. Finally, they should be better placed to avoid some of the interpretative pitfalls that are typical of the next stages.

Generalization: Getting the Picture

The next stage is generalization: describing the data as accurately as possible and reducing them to a small number of maximally useful generalizations. As our worksheet objectives are different from those of a class in inferential statistics, there is no call for too much sophistication. Even so, business students should be able, as Morris (2000, p. 52) puts it, to extract from a set of numerical data "the major features, without resorting to long calculations." They should be able to spot patterns, identify trends, and discover similarities and differences. In addition, students should be able to report their interpretations in an informative way, using an appropriate range of linguistic choices and combinations.

To enhance the quality of the analysis, I ask worksheet users to divide their descriptive generalizations and observations into what I refer to as "extremes" and "in-betweens." For "movies" (see Question 2 above), the "extremes" are (1) the starting and ending points of the time period covered, (2) the highest and lowest data points during this period, and (3) the largest and smallest changes—including significant tipping points. The "in-betweens" refer to anything else like minor fluctuations, overall speed of change, or comparisons across consecutive years within the

period. For "snapshots," the "extremes" refer to the largest and smallest data categories (e.g., wedges of a pie chart), and the "in-betweens" to anything that lies in between. Moreover, I have also found it pedagogically helpful to make students number their generalizations. A numbered list of descriptive statements—in either the "extreme" or "in-between" category—forms a far better basis for the next stages in the analysis than a running text.

Explanation: Correlation is not Causation

The next stage is explanation, the most challenging stage in the entire analysis. As it may take a long time with lots of additional research, I do not really expect my business students to answer the "Why?" question in detail. The level of completeness required in this part of the worksheet will depend on what goal the numerical data will have to accomplish, the type of business communication in which the findings and/or data will be placed (e.g., a PowerPoint presentation or a staff newsletter), the intended audience, and other variables in the writing situation.

When explaining what they see in a table, graph, or chart, students do not always report their findings equally systematically nor do they all apply the same range of causal possibilities. To help them introduce more consistency, balance, and structure into what they write and how they organize it, I have developed two tactics.

First, as I observed above, all generalizations and other descriptive statements have to be numbered. When students explain the data, I make them copy the number of the observation that they explain. In this way, it will become immediately apparent which statements have been explained and which ones have not—something that is much harder to ascertain when both activities are combined in running text. This approach helps students work more systematically.

Second, I also make students misspell "explanation" as "ECSPlanation," in which the four capitalized letters stand for "economy," "culture," "society," and "politics." That reinforces the need to explore each of the four elements for each statement and thus treat every statistical finding in the same way.

Exploration: Opinions are Free

Finally, the worksheet offers students an opportunity to do what often comes most naturally, namely, to respond to the numerical information. To quote Lewis (1997, p. 139), we normally do not read texts to answer detailed comprehension questions; in real life "we either read to find a particular piece of information or more frequently, we respond to what we read." Arguably, the same also holds true for data.

Some students—perhaps inadvertently—express their own views and opinions through evaluative statements like "The unemployment rate is too high" instead of its more descriptive counterpart "The unemployment rate is 12 percent." If they are going to evaluate anyway, we might as well make them do so, but then, in a place where it will not interfere with the more non-judgmental part of the data analysis. Thus the last box of the worksheet invites students to

- offer evaluation
- indulge in speculation
- discuss possible implications
- bring in other facts and figures
- tell us what they found surprising or interesting
- examine the way the data affect them as human beings or business majors

In short, they can explore the table, graph, or chart from their own subjective perspective.

Benefits

The four-stage data analysis worksheet is not meant to have any "fidelity" as a business communication simulation in approximating either reality or the work environment (Hildebrand, 1997, p. 97). Still, I have found that it can play a critical role in the prewriting process and that worksheet-based assignments enable students to hone their data-handling skills. In this respect, the worksheet may turn out to be similar to Winter's (1996) "prewriting problem-solving plan" in that it reduces stress, promotes learn-

ing, and helps students organize their ideas. Of course, these claims will have to be backed up by future empirical research. Pending that, my own experience and the informal feedback received from students allow me to report the following benefits.

Students

Apparently, the worksheet strikes the right balance between the two interrelated skills of "studying the data" and "communicating the data" (Cleveland, 1993). It enhances students' ability to look before they leap, to see the forest for the trees, to differentiate between describing and explaining, to steer clear of certain logical fallacies, and to keep facts and opinions separate. Its structured approach ensures that students do not skip any important steps in the analysis and that they will be less easily tricked by sloppy or outright misleading graphics.

The worksheet is not only an effective analytical tool or useful prewriting checklist. It also makes for enjoyable communication practice. Students are especially excited about the fourth stage. Being asked to explore the data from their own individual perspectives promotes motivation, increases personal involvement, and stimulates peer interaction.

Finally, the worksheet also offers something for everyone. Generalization and descriptive observation, for example, cater to the more number-minded students, perhaps drawing on their wider experience in statistical analysis. By contrast, the more linguistic learners tend to prefer the narrative possibilities of the explanation stage. At the same time, the worksheet invites either group of students to bridge the gap between the numbers and the words and to appreciate the need to develop both skills.

Instructors

The benefits that flow to instructors include at least the following two. First, instructors can easily use the worksheet format to design a wide range of high-quality assignments that meet their own local needs. The simplest approach is to bring your own table, graph, or chart into the classroom and have students ana-

lyze it individually. (Completing the worksheet takes a class period of 50 minutes—at least, if you do not expect a full-blown explanation in the third box.) At a more complex level, the worksheet can provide a springboard for student empowerment, collaborative learning, and group writing. In addition, because of its "one-size-fits-all" approach, the worksheet is equally suitable for experienced and inexperienced students in both business and nonbusiness departments.

A second benefit of the worksheet is that it allows instructors to adopt an interdisciplinary approach. Because of its potential for low-level statistical analysis, its requirement to explain the main trends, and its interest in the affective domain of education, the worksheet may reinforce what students have learned in other classes. Making sense of figures—and using figures adequately in a business environment—not only requires excellent communication skills but also an ability to think critically and a strong ethical awareness. In this respect, the worksheet provides opportunities to revisit, for example, the different types of logical fallacies (e.g., hasty generalizations, *post hoc*, joint effect, and subverted support) or discuss the ethics of data visualization (e.g. Jackman, 1996).

Concluding Remark

The significance of handling data as a receptive skill—as opposed to collecting, visualizing, and reporting your own data—can scarcely be overstated. If numbers fail to communicate, decision-makers may draw faulty deductions and map out plans that jeopardize their company's chances for success. The data analysis worksheet described in this article makes students take a longer than usual look at other people's tables, graphs, and charts. As such, it is not a realistic communicative genre in its own right, but more of a preparatory document, a prewriting tool that generates both critical insight and potentially useful information (i.e., trends, reasons for those trends, and personal reactions). How this information—and how much of it—will be used depends on what specific goal the numerical data are intended to accomplish and

on the type of business communication in which they will be placed.

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Address correspondence to the author, Department of Economics and Business Administration, Lessius Institute of Higher Education, Korte Nieuwstraat 33, B–2000 Antwerp, Belgium (e-mail: teun.derycker@lessius-ho.be).

Appendix
Example of a Completed Data Analysis Worksheet

ORIENTATION

type	line chart *Snapshot—movie*
title	eye-catcher: "Look, no losses" ordinary title: "IATA airlines' operating revenues"
source	primary source: IATA secondary source: *The Economist*, 10 March 2001
labels	there are no labels; the black solid line represents operating revenues; the data for 2000 are estimates (see the note at the bottom of the chart)
units of measurement	years on the X axis (from 1990 to 2000) $bn on the Y axis (from –$6bn to +$6bn)
definitions	• IATA: International Air Transport Association (I found lots of useful information at www.iata.org) • IATA airlines: IATA members (e.g., Air Canada, Lufthansa, Olympic Airways, TWA, and Cathay Pacific) • operating revenues: income received less costs, expenses and "interest charges" (see the * footnote), this can result in either an (operating) profit or loss

GENERALIZATION

Extremes

1. Between 1990 and 2000 IATA's member airlines moved from a loss position of approximately $3bn to profits of just over $2bn.
2. Operating revenues hit their lowest level in 1992. In that year operating losses stood at $4.3bn.
3. Apparently, in the past decade airline companies obtained their best results in 1995 and 1997. In both years profits peaked at $5bn.
4. When you look at the period between 1992/1993 and 1995 you'll notice a really sharp increase in revenues of some $10bn.
5. Towards the end of 1993 operating revenues of the IATA airlines cross the zero line, i.e., the companies become profitable again.