perceptual edge

Beautiful Evidence: A Journey through the Mind of Edward Tufte

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I owe a great deal to the work of Edward Tufte. Attending his one-day seminar many years ago inspired me to shift my focus in the field of business intelligence to the visual display of information. In July, 2006, his long awaited fourth book, *Beautiful Evidence*, finally became available, which I recently received and eagerly devoured. It contains much wisdom and flashes of brilliance, as expected, but it also seems to stray from the principles Tufte advocates so forcefully in this book and his earlier work. I revere Tufte as a mentor, as do so many others, so it is with some trepidation that I review *Beautiful Evidence*. However, I believe to do so honors the spirit of his work and teaching.

In the introduction, Tufte states: *"Beautiful Evidence* is about *how seeing turns into showing*, how empirical observations turn into explanations and evidence. The book identifies excellent and effective methods for showing evidence, suggests new designs, and provides analytical tools for assessing the credibility of evidence presentations" (Edward Rolf Tufte, Beautiful Evidence, 2006, Graphics Press LLC, Cheshire, Connecticut, page 9). While holding the book in my hands for the first time, even before opening it, I experienced a foreshadowing of what I would find within. The dust cover is graced with four photographs taken by Tufte of a dog in motion (one of his beloved dogs, I assume) leaping above and eventually splashing into a body of water. The images are beautiful, befitting the first word of the book's title, but I failed to see how they related to displays of evidence.

I found the contents of *Beautiful Evidence* beautiful throughout, but was frequently distracted by a sense that Tufte focused more on the beauty of its contents than on relevance to the topic or a clear presentation of his case. Reading it felt like spending an evening with Tufte, sipping brandy in his library and conversing while he wandered among the bookshelves pulling and showing examples here and there as they caught his attention. As such, I enjoyed it thoroughly, but as a treatise on the beauty of finely crafted presentations of evidence, it lacked the logical unfolding of argument and validation through carefully chosen examples that I expected. Rather than a book that was designed to examine a specific topic and present a compelling argument to meet the real needs of a particular audience, it seemed more like a series of essays ranging across a variety of topics that were selected mostly because they have occupied his attention in recent years. One striking example was the inclusion of the last two chapters of the nine, "Sculptural Pedestals: Meaning, Practice, Depedestalization" and "Landscape Sculptures," which featured his work as a sculptor—beautiful, but not on topic without stretching the imagination.

At the beginning of the first chapter, "Mapped Pictures: Images as Evidence and Explanation", I already found myself struggling to understand the significance of the photographic image of Dorothy and her companions from "The Wizard of Oz." The green grid lines that appear on the claw-like hands of the wicked witch and the upper body of Dorothy lend it a cartographic quality, but it doesn't illustrate the topic in any meaningful way. Though

more beautiful than most of the clip-art that typically populates PowerPoint slides (which Tufte scathingly dispatches in a later chapter), this image seems gratuitous—a close cousin to the *chartjunk* that Tufte and I both deplore.

Early in the book, Tufte asserts:

> *Making an evidence presentation is a moral act as well as an intellectual activity. To maintain standards of quality, relevance, and integrity for evidence, consumers of presentations should insist that presenters be held intellectually and ethically responsible for what they show and tell. Thus consuming a presentation is also an intellectual and a moral activity.* (Ibid)

This is classic Tufte; the great teacher at his best. These words inspire me, but they also encourage me to assume ethical responsibility as a presentation consumer by putting *Beautiful Evidence* to the test and questioning what strikes me as suspect.

A troubling pattern begins in the first chapter and prevails throughout the book: visual examples that demonstrate Tufte's expert knowledge of art and the history of graphics, but fail to adequately clarify and complement his point. In many cases, these are examples from his earlier books (such as Minard's graphic presentation of the French army's 1812-1813 incursion into Russia resulting in devastating losses) or examples that have historical significance, but fail to illustrate his points as well as more modern examples, or, better yet, examples that he could have created for this purpose. A section that especially exemplifies this practice appears in the chapter entitled "Words, Numbers, Images – Together." Here, Tufte uses several reproductions of the 14th century Venetian work of fiction, *Hypnerotomachia Poliphili*, to illustrate the integration of text and images. The *Hypnerotomachia Poliphili* is a milestone in the history of book design, but a single image and paragraph would have made this point sufficiently before yielding to more modern and practical examples of how we can intimately merge text and images into a unified presentation of evidence.

In this same chapter, Tufte challenges an argument made by statistician and fellow data visualization expert William Cleveland in his excellent book, *The Elements of Graphing Data*. I want to focus on this material as an example of one of the few visual design solutions of Tufte's that I have ever found lacking. Cleveland uses a graph taken from Carl Sagan's book, *The Dragons of Eden: Speculations on the Evolution of Human Intelligence*, to illustrate how the plot area can become cluttered when data objects (such as the data points in a scatterplot) are directly labeled with text. Figure 1 shows the original graph as it appears in Sagan's book, and Figure 2 shows the same graph without the text labels.

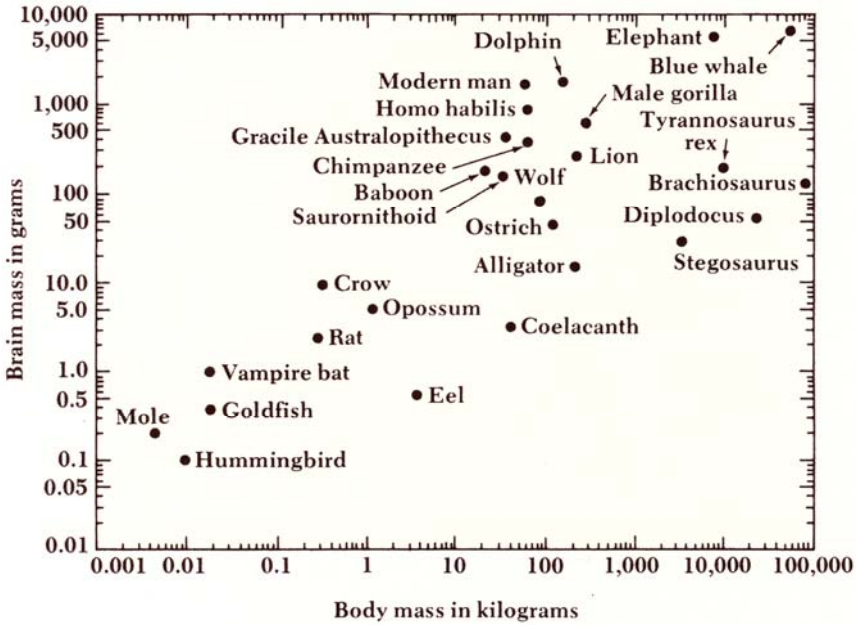

Figure 1: Graph comparing brain mass and body mass in various animals.

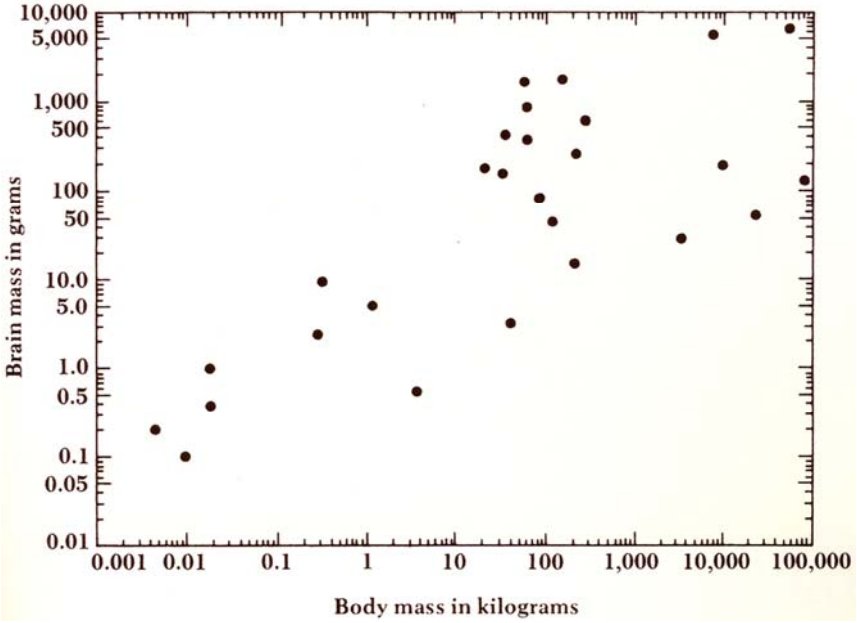

Figure 2: The graph in Figure 1 without the text labels.

I believe that Figure 2 confirms Cleveland's contention that without labels, it is much easier to see patterns formed by data, which in this case reveals a loose positive correlation between body mass and brain mass among animals. Tufte acknowledges that text labels obscure the pattern, but bemoans the loss of the labels, which are also meaningful data after all. He goes on to propose a new solution that attempts to retain the labels without obscuring the visual pattern formed by the data points. I support his intention, but don't think his design entirely succeeds (see Figure 3).

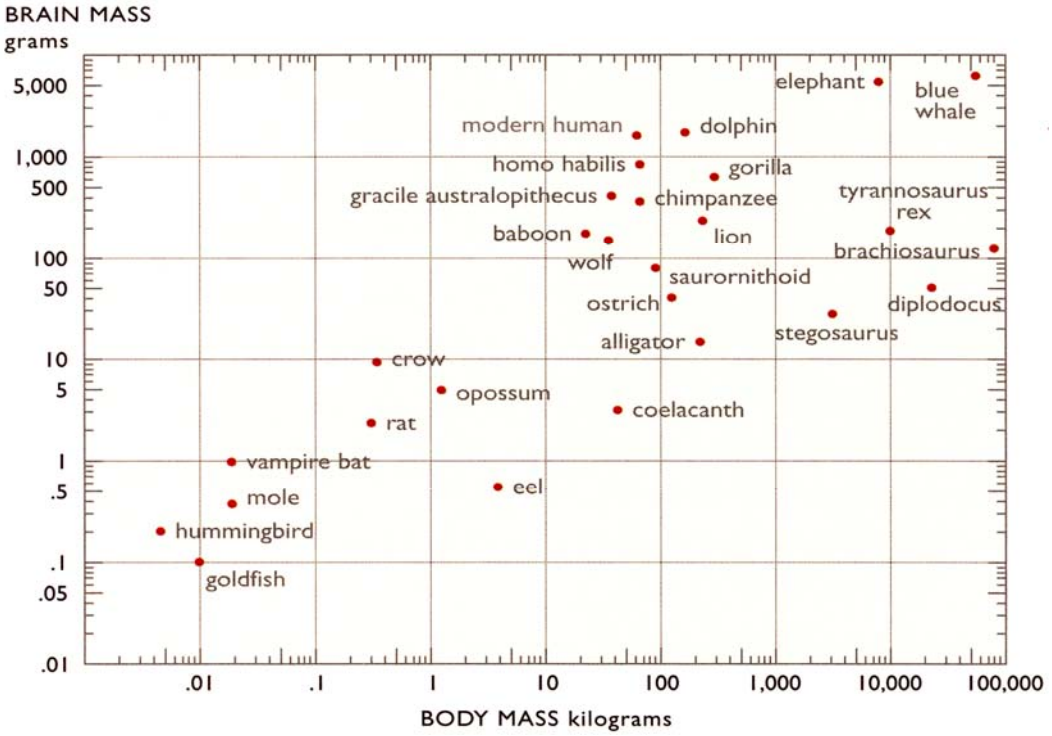

Figure 3: Edward Tufte's redesign of Cleveland's proposed graph in Figure 2.

By lightening the text and changing the color of the data points to red, the graph has been improved compared to the original, but I believe the labels still distract from the pattern formed by the data points. The text and data points have not been adequately set apart into distinct visual layers to eliminate visual competition, and the grid lines are more visible than necessary, further distracting attention from the data. I believe that Tufte's intentions would have better served with the redesign shown in Figure 4. Because text labels cannot be perceived as a whole but must be read one at a time when you wish to know the animal that is represented by an individual data point, they only need to be visible enough for individual labels to be read with ease when desired.

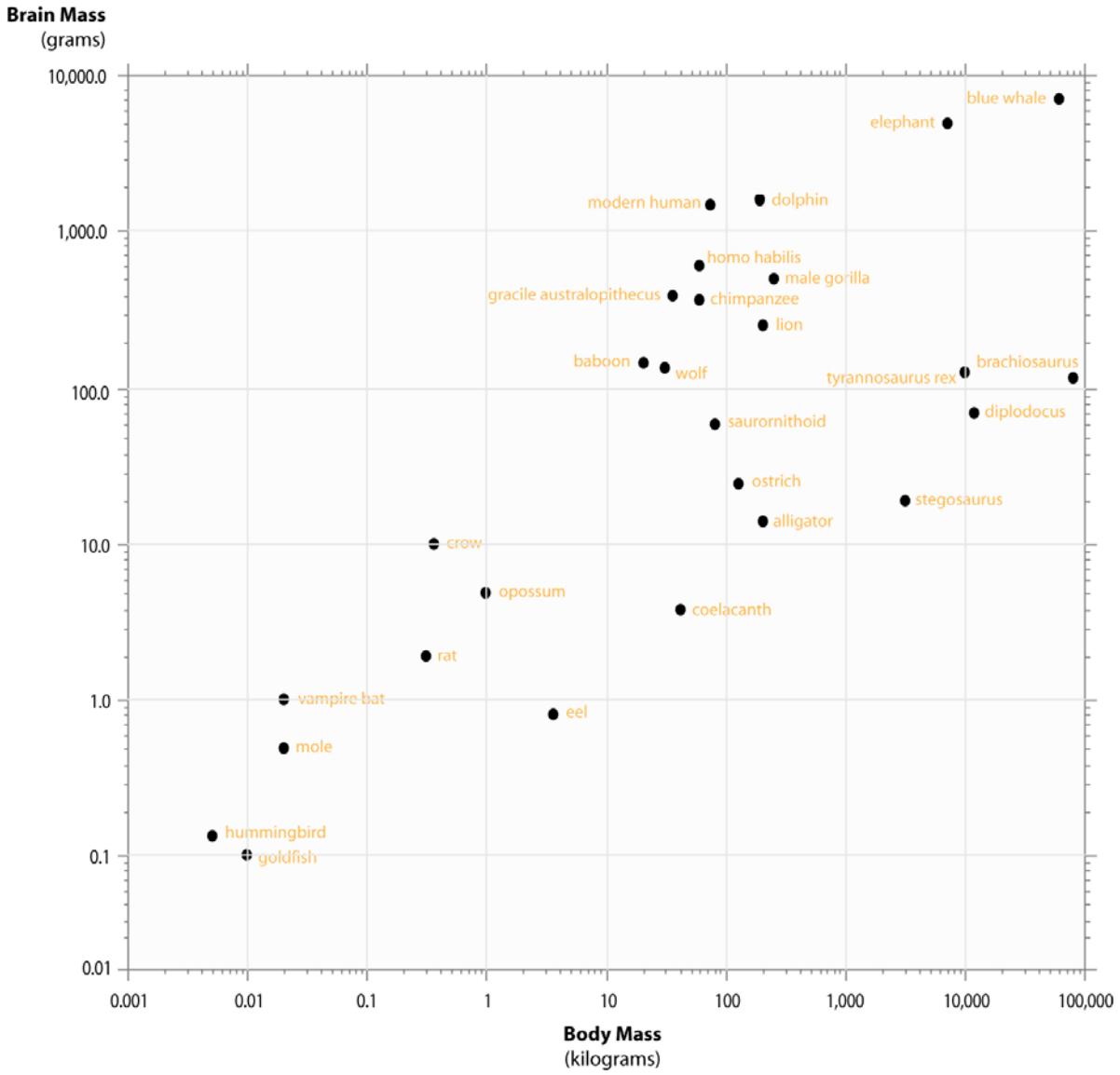

Figure 4: My redesign of Tufte's graph in Figure 3.

This works well as a static presentation, but I believe that the best solution is one that involves an interactive display, which can only be shown on a computer screen. Tufte has low regard for screen-based displays. He correctly points out that screens don't come close to the high resolution of printed displays on paper. In his seminars, he prefers to hold up a copy of one of his books and point to an illustration on one of its pages, directing his audience turn to that page in their own copy to follow along, rather than use a projected image. Not all displays require the high resolution of the printed page, however. Computers can enable valuable interaction with the data, which is critical to data exploration and analysis. Tufte's disdain for screen-based displays sometimes prevents him from acknowledging valuable solutions. He asserts that text and images are both data and therefore ought to be integrated without distinction in evidence displays. Although true and important, this position goes too far, minimizing the differences in how we perceive text and images. While both are data, we perceive text using the verbal channels of the brain, which involves relatively slow serial processing (that is, it must be read sequentially), but images, on the other hand (such as the pictures formed in the plot area of graphs) are perceived using visual channels, which are processed in a much faster parallel manner. Each of these media for encoding data (text and

image) has its own strength and is best used for somewhat different purposes. When we design displays of evidence, we cannot ignore these differences, even as we closely integrate them to avoid the dysfunctional separations between them that Tufte strives to prevent.

The information visualization research community has long advocated the power of interactive computer-based visual displays of information for exploration and analysis. The principle of "details-on-demand," which allows analysts to focus on the visual display, examining trends, patterns, and exceptions in the data, and to easily access text-based details (such as the labels in Sagan's scatterplot) only when needed is a powerful alternative to having text always cluttering the display. A good software solution would allow us to focus on the pattern of correlation in the data without distraction, but also to hover over individual data points to read text labels as needed, to select a group of data points to see all of their labels together (perhaps in a simple table, sorted from the highest values to the lowest), and also to turn the labels on and off for the entire data set right in the plot area (similar to Figure 4). To me, this is a better approach.

My favorite chapter is the one entitled "Sparklines: Intense, Simple, Word-Sized Graphics." For two years now I have advocated the use of sparklines (miniature time-series displays) when a sense of history must be presented in a small amount of space, such as on a dashboard. Everyone should read this chapter and marvel at the wealth of information that can be displayed within eyespan when properly designed. This material is brilliant, practical, and necessary.

In the chapter entitled "Corruption in Evidence Presentations…," while exposing the evils of chartjunk—gratuitous decoration of graphs—Tufte reacts to Microsoft Excel with a bold assertion that I dispute: "For preparing data presentations other than ads in tabloid newspapers, a professional statistical graphics program is essential" (Ibid, page 153). I'm not a fan of Excel's charting functionality, but it isn't all that difficult to bypass the chartjunk in Excel to produce effective graphs. You can find many examples throughout my book, *Show Me the Numbers*. Statistical software products are needed for sophisticated data analysis, but even statisticians often use Excel for the simple stuff.

In the chapter entitled "The Cognitive Style of PowerPoint: Pitching Out Corrupts Within," Tufte takes on the most popular presentation software on the market and finds it not only wanting, but irredeemably corrupt. For the most part, I agree. Most PowerPoint presentations communicate poorly, and corrupting influences are built right into the product, especially in the form of ridiculous templates. Nevertheless, PowerPoint can be used effectively if you are a skilled communicator and know to avoid the fluff. My biggest problem with this chapter isn't its excessive rhetoric and somewhat contrived examples, but its failure to present evidence in the way that Tufte himself advocates elsewhere in the book. He states, "This chapter provides evidence that compares PowerPoint with alternative methods for presenting information: 10 case studies, an unbiased collection of 2,000 PP slides, and 32 control samples from non-PP presentations," but he only presents summaries of these findings sprinkled throughout the chapter without telling us enough about the source data or describing the methodology of analysis. He argues elsewhere in the book that presentations of evidence must be accompanied by this information. He identifies one major set of source material as "28 books on PP templates," but doesn't give us their titles. Are the 2,000 PowerPoint slides that were examined representative of those that are typically used in business, science, and elsewhere? Is it meaningful to compare the number of data entries

that appear in graphs found in scientific periodicals and major newspapers to those that appear in books about PowerPoint presentations? These books, after all, are not presenting evidence but illustrating techniques. Is a comparison of the number of text characters per page in best-selling books, Internet news sites, and a collection of PowerPoint slides a meaningful measure of effectiveness? Given Tufte's well-known disdain for PowerPoint, as responsible consumers of his evidence against it, we must demand better documentation to assess the integrity of his findings and the merits of his case.

In the introduction to *Beautiful Evidence*, Tufte states that "…the point of evidence displays is to assist the thinking of producer and consumer alike." I hope that this review of Tufte's thought-provoking and insightful but somewhat flawed book has served this purpose as well. Despite this critique and the concerns that I've raised, I remain a grateful admirer of Edward Tufte and his many contributions to the field of information display.

About the Author

Stephen Few has worked for over 20 years as an IT innovator, consultant, and teacher. Today, as Principal of the consultancy Perceptual Edge, Stephen focuses on data visualization for analyzing and communicating quantitative business information. He provides training and consulting services, writes the monthly *Visual Business Intelligence Newsletter*, speaks frequently at conferences, and teaches in the MBA program at the University of California, Berkeley. He is the author of two books: *Show Me the Numbers: Designing Tables and Graphs to Enlighten* and *Information Dashboard Design: The Effective Visual Communication of Data*. You can learn more about Stephen's work and access an entire library of articles at www.perceptualedge.com. Between articles, you can read Stephen's thoughts on the industry in his blog.