Statistical Narrative

Telling Compelling Stories with Numbers

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The information that's stored in our databases and spreadsheets cannot speak for itself. It has important stories to tell and only we can give them a voice. Once we've discovered the stories, telling them in an effective and compelling manner requires skills that most of us have never learned. Statistical narrative—that is, telling the stories that reside within quantitative information—is essentially like storytelling of all types; it boils down to communication. Just as storytelling is communication of a particular type, storytelling that involves numbers is more specialized, but only slightly more complicated. In this article, I would like to share my thoughts about statistical narrative and some of the practices that bring quantitative stories to life.

> "Today, with all manner of electronic media, the possibilities have grown, but essentially we are still telling stories."

In 2006, when Hans Rosling of GapMinder.org spoke at the TED Conference, it was probably the first time that those in the audience ever felt like applauding after viewing a bubble plot. A bubble plot is fundamentally a scatterplot, but unlike a standard scatterplot, the data points vary in size to display a third quantitative variable beyond the two that are encoded by the positions of the points along the X axis (one variable) and the Y axis (the other variable). Rosling's bubble plot exhibited one more feature that hadn't been seen until then: it was animated. The bubbles moved to show change through time. Why did people find Rosling's bubble plot more engaging than most? For two reasons, I believe:

- The story was important; it revealed facts that the audience could easily care about.
- The story was skillfully told in a way that the audience could understand.

Hans Rosling is an all-star of statistical narrative. He will always be recognized as an important pioneer. If you care about quantitative information and watch one of Rosling's presentations, you can't help but be inspired about the possibilities of telling the stories that live in your own data. I suspect that Rosling, if questioned, would tell you that there is more to telling stories contained in numbers than using an animated bubble plot. Several skills are at play when Rosling makes a presentation. Some are basic skills of communication, which apply to communication of all types. Some apply specifically to statistical stories. Beyond those that show up in Rosling's presentation, other principles and practices can be added to the mix to drive our messages home.

The Media of Statistical Narrative

Stories can be told in different ways involving various media. Even when words alone are used, those words can be spoken or written. When spoken, they can be spoken live while standing in front of an audience or they can be recorded and later heard via the radio, a CD, a podcast, or the Web. Historically, words have usually been complemented by physical gestures and sometimes through the use of different voices. Once visual forms of communication arose, the spoken word could be complemented by pictures and diagrams. What was once scratched in the dirt and later drawn on a flipchart can now be projected on a large screen. Once written language emerged, long before electronic communications, stories could be distributed and preserved on portable surfaces such as paper. Today, with all manner of electronic media, the possibilities have grown, but essentially we are still telling stories.

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In this article we'll talk about the primary media that carry stories from the mind of the storyteller to the minds of the audience. Let's break the various media into the following categories:

- Words may be spoken, written, or transmitted using some combination of both.
- When the spoken word is involved, stories may be presented live or recorded for later listening, viewing, or both.
- Whether spoken or written, words may be complemented visually through pictures, diagrams, charts, etc.
- When recorded, stories may be stored and transmitted in print or electronically.

I'm making these distinctions because they sometimes have an effect on the way we tell our stories. We usually cannot tell quantitative stories with words or printed numbers alone; we must use pictures as well. This is certainly true when our stories involve quantitative patterns, trends, and exceptions.

We'll next look at some of the principles and practices that make statistical narrative effective. When these vary due to differences in media, I try to draw attention to this fact.

Principles and Practices of Statistical Narrative

I'm not attempting in this article to provide a comprehensive list of principles and practices for statistical narrative. Although I've thought about this a great deal, I feel as if I'm still just learning how it works. I will suggest a limited list of principles and practices that I've found to be effective. I hope that many of you will respond with your own ideas and that, through collaboration, we can begin to build a set of practical guidelines that will help everyone who cares tell their statistical stories with greater impact.

I believe that effective statistical narratives tend to exhibit the following characteristics:

- Simple
- Seamless
- Informative
- True
- Contextual
- Familiar
- Concrete
- Personal
- Emotional
- Actionable
- Sequential

Simple

The story is more likely to take hold in the minds of our audience if we tell it simply. We must find the core of the message and then present it as simply as possible without any form of distraction. Simplicity isn't always easy. We must think long and hard to discern the vital beating heart of what we want to say before beginning to craft our presentation. Once we have a clear vision, we must then find the simplest, clearest possible way to present it, both in terms of content and the means of expression.

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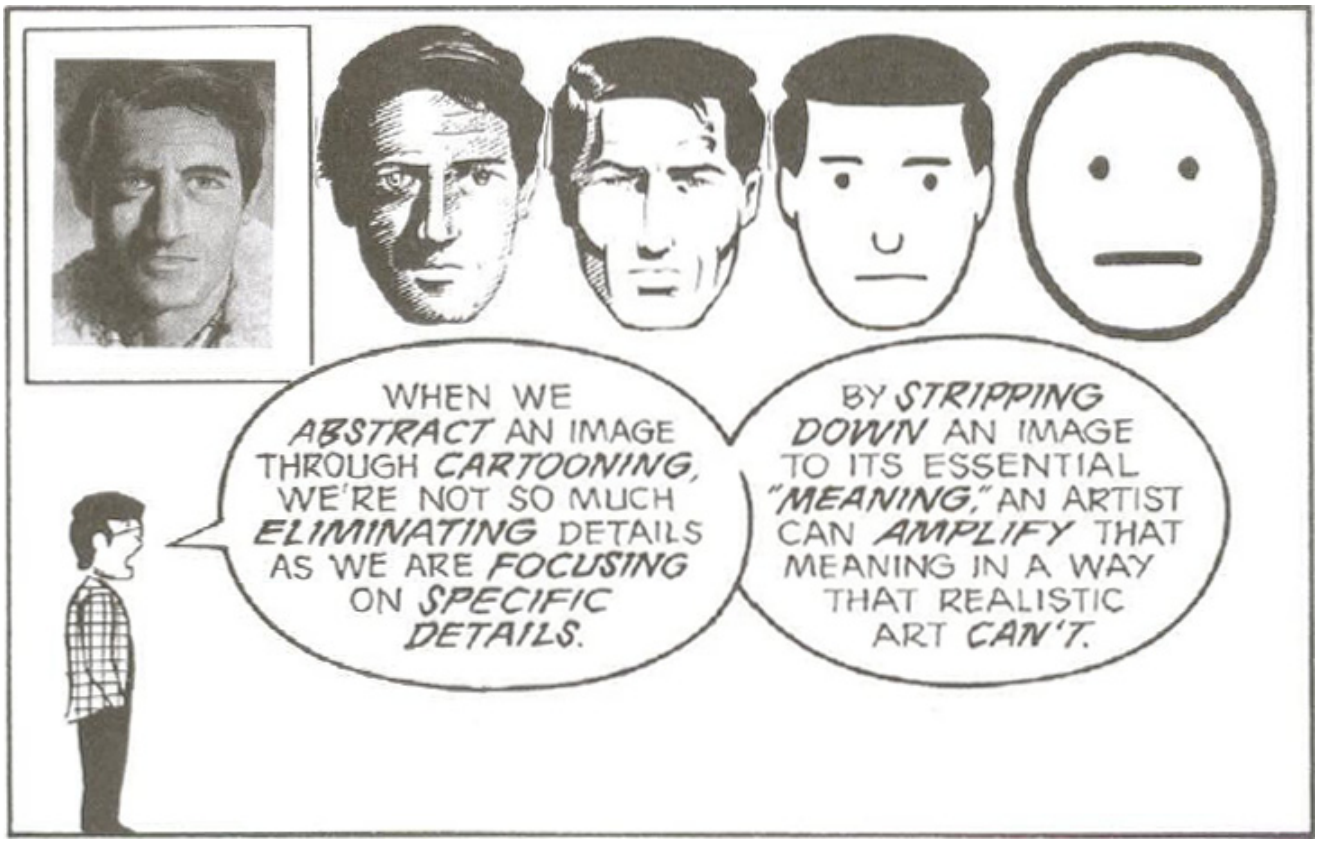
We must simplify the content. Paul Grice, a philosopher of language, developed a series of “conversational maxims”—rules for communicating to one another courteously and effectively. The two following maxims concern quantity of conversation:

- Make your contribution as informative as is required for the current purposes of the exchange.
- Do not make your contribution more informative than is required.

When telling a story, it is up to us to tell our audience all they must know to get the message, but no more. The effectiveness of the story relies on that fine balance between too little and too much.

In addition to simplifying the content, we must also simplify the means of expression. Comic book artist Scott McCloud explains how he crafts his stories as a process of “amplification through simplification.” I’ll let him illustrate the concept in the following panel:



Understanding Comics: The Invisible Art, Scott McCloud, HarperCollins, 1994, p. 30

Simplification involves stripping away all that’s non-essential to the story that we’re trying to tell, which allows our audience to easily focus without distraction on the key information. As Leonardo da Vinci once said, “Simplicity is the ultimate sophistication.”

Seamless

Unlike some stories, statistical narrative almost always requires the integration of words and images. The patterns, trends, and exceptions that constitute the meanings in data must be given visual form, for they are difficult or impossible to construct in our heads from words or tables of numbers. Verbal and visual forms of expression are both languages of sorts. Just as letters combine to form words and words combine to form sentences, graphical marks combine to form visual objects and those objects combine to form more complex objects such as graphs, which can be used to tell quantitative stories. As Jacques Bertin taught in *Sémilogie graphique* (*Semiology of Graphics*) and Robert Horn extended in *Visual Language*, graphics are a specialized language that can communicate quite effectively if we learn the associated rules of syntax and semantics.

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Edward Tufte has long taught the power of using words and pictures together to tell stories, especially when they are seamlessly interwoven. In his books and mine, figures are interwoven with the text that describes them, rather than the easier (and cheaper) method of referencing figures by number and placing them wherever they fit most conveniently. Verbal language communicates some information well, but other information is better communicated visually. Words and images work together elegantly when we refrain from arbitrarily separating them. Tufte says:

> *Data graphics are paragraphs about data and should be treated as such.*
>
> *Words, graphics, and tables are different mechanisms with but a single purpose—the presentation of information. Why should the flow of information be broken up into different places on the page because the information is packaged one way or another?*
>
> *The Visual Display of Quantitative Information*, Edward Tufte, Graphics Press, 1983, p.181

When we combine words and pictures to tell a story to a live audience or by means of a recording, we can speak the words and show the pictures simultaneously. If the images are projected on a screen, you can gesture to those parts that you want your audience to focus on at any one moment. If you speak the words, there is no reason to display them as text on the screen as well. In fact, doing so interrupts the flow of communication. When your audience attempts to both read words on the screen and listen to the words coming from your mouth, the information gets into their brains less effectively than words coming through one channel only. Resist the temptation to force your audience to read when they could be using their eyes to look at an image that complements the words that you're speaking. The simultaneous visual and verbal content, which enter the brain through separate channels, can be perceived and processed together with ease, resulting in richer understanding.

"Words and images work together elegantly when we refrain from arbitrarily separating them."

Informative

Stories are used to inform, to reveal facts or interpretations of facts that the audience doesn't already know. Stories have been used throughout history to pass on knowledge and teach important lessons. There is nothing more boring than being forced to sit through a presentation that does nothing but repeat what you already know. If we want to arouse our audience's curiosity and interest, we should give their brains something new to chew on.

In their marvelous book *Made to Stick*, the brothers Heath (Chip and Dan) describe what's needed to get our messages to stick—that is, to communicate the intended points, be understood, be remembered, and lead to the hoped for response. Several of the points that I'm making in this article are eloquently argued in *Made to Stick*. One means to do this is to surprise the audience in some way by revealing something they didn't expect. This can often be done with images that force people to look at something in a new way, such as this photo of a candy heart with a rather unexpected, unendearing statement.

Hans Rosling's first presentation at the TED Conference worked, in part, because he revealed the relationship between fertility, (measured as the average number of children per woman of child bearing age) and life expectancy at birth (measured as the average number of years a child will live) by country in a new way that was both understandable and unexpected.

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True

Let's not go any further without acknowledging the importance of truth. Stories need not be true to stick—history is strewn with the devastating effects of lies—but they should be true if we hope to make the world a better place. If our audience perceives the story as true, they will care about it more and are more likely to respond. This means that the story should not only be true, but it should be perceived as true. We should back up the story with relevant evidence. We should name our sources to lend credibility both through transparency and by virtue of the source's perceived credibility. If we ourselves believe the story to be true, convinced through hard evidence that it is so, our very demeanor and conviction will signal the truth of our story to the audience. If we ourselves have integrity and consistently exhibit it through our actions, the trust that we've earned carries over to our stories as well.

Contextual

Quantitative stories cannot be told effectively just by throwing numbers at people. Numbers alone—even those that measure something perceived as important—are meaningless unless we present them in context. In part, this means that we should reveal the pedigree of the numbers (that is, where they came from and how we might have adjusted them). Even more importantly, however, this means that we must provide additional information to which the numbers can be compared. We discover the meanings in numbers primarily by comparing them to other numbers and by comparing the patterns, trends, and exceptions that live within them to those formed by other relevant sets of numbers. Appropriate comparisons are the context that make numbers meaningful in a way that allows us to form judgments, make decisions, and take action.

"Quantitative stories cannot be told effectively just by throwing numbers at people. Numbers alone—even those that measure something perceived as important—are meaningless unless we present them in context."

Appropriate comparisons span a long list of possibilities. One of the most meaningful and informative involves comparing what's going on today to what's happened in the past. History provides context that we dare not ignore. Other examples of meaningful comparisons include:

- Targets (for example, budgets and plans)
- Forecasts
- Other things in the same category (for example, comparing a product to other products, or comparing our company to our competitors)
- Norms (for example, comparing the performance of our hospital to the average performance of all hospitals in the country)

For quantitative information, comparisons are vital to the story.

Familiar

Know your audience. It's no secret that we must have a sense of the people to whom we're speaking and customize the presentation to work for them. I don't speak to a group of trained statisticians in exactly the same way that I speak to folks with no statistical training. I don't speak to doctors and nurses the same as I speak to people who work in a marketing department. I might be telling the same story to both groups, but I'll choose my words and images differently. Why? Because I want to express the story in familiar terms.

If you spend your life in a cloister without interaction with those outside the walls, you'll struggle to talk to those who live in the neighboring village. If you're a highly-trained data analyst, you probably speak and think in ways that aren't familiar to others in your organization who lack your expertise. If everyone speaks English (or whatever language you speak), however, an audience with any background—those who share your expertise and those who don't—will still understand you if you use simple forms of expression. If you can tell your story using simple words and images that can be understood by everyone, why use big words and overly

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complex graphs, unless you're trying to impress them with your superior knowledge? If people care about the story, they will be much more impressed with you if you tell it to them in a way that they can understand. Although Hans Rosling is a university professor who could confound most of us with the esoteric knowledge of his field, we respect his work because he cares enough to boil his stories down to simple terms without watering them down, which is a significant accomplishment that deserves respect. People who can't tell their stories in understandable ways are either ignorant (unaware of the world outside of their own small spheres), lazy (unwilling to craft the story in familiar terms), or full of themselves (more interested in impressing than communicating). If our stories are important, we must learn to overcome these obstacles.

> "If people care about the story, they will be much more impressed with you if you tell it to them in a way that they can understand."

Concrete

Even though we humans have evolved the ability to think abstractly, we don't dwell entirely in the cognitive land of abstraction. When our stories involve abstract concepts, which they often will, we should help people build those abstractions in their own minds through the use of the concrete examples and metaphors. The Heath brothers said it well:

> *Concrete language helps people, especially novices, understand new concepts. Abstraction is the luxury of the expert. If you've got to teach an idea to a room full of people, and you aren't certain what they know, concreteness is the only safe language.*
>
> *Made to Stick*, Chip Heath and Dan Heath, Random House, 2007, p. 104

Although we can think abstractly—some better than others—we don't live in an abstract world. The world as we experience it is concrete. Yet so many organizations insist on expressing their mission statements in abstract terms that are shallow, ethereal, and as such, uninspiring. Smart organizations state their missions and objective in concrete terms that people can wrap their heads and hearts around. Abstractions are sometimes used intentionally to hide the truth. Read the following excerpt from Enron's annual report for the year 2000:

> *Enron's performance in 2000 was a success by any measure, as we continued to outdistance the competition and solidify our leadership in each of our major businesses. We have robust networks of strategic assets that we own or have contractual access to, which give us greater flexibility and speed to reliably deliver widespread logistical solutions…We have metamorphosed from an asset-based pipeline and power generating company to a marketing and logistics company whose biggest assets are its well-established business approach and its innovative people.*
>
> Derived from *Why Business People Speak Like Idiots*, Brian Fugere, Chelsea Hardaway & Jon Warshawsky, Free Press, 2005, p. 11

A "success by any measure"? Had the story of what was actually going on been told in concrete ways in that annual report, perhaps some of the employees would have willingly left in disgust before the company's implosion. The leaders of Enron knew what they were doing by keeping the story abstract. They weren't trying to communicate; they were trying to obfuscate.

Personal

Stories rarely work unless people can connect with them in personal ways. A few days ago, I was watching news coverage of a townhall meeting where President Obama was making a case for healthcare reform. In response to people like Sarah Palin who were stirring up fear by referring to government "death panels" that would decide whether grandma would live or die, the president reminded folks that he just lost his own grandmother last year and that it was absurd to suggest that he "ran for public office, or that members of Congress are in this so they can pull the plug on grandma." Referring to his own grandmother demonstrated that the issue was personal for him in a way that allowed the audience to see the situation through his eyes.

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Most of us don't care passionately about people we don't know. We don't naturally care about issues that don't affect us. For instance, many young people who are healthy and whose employer's provide them with medical insurance aren't terribly concerned about healthcare reform. I, whose wife will soon lose the health coverage that she currently has through a previous employer, am especially concerned, because she won't be able to get new coverage under the current system. She has problems with her lungs that will disqualify her. Though she is otherwise healthy and fit, her lungs were damaged through exposure over several years to toxic chemicals that circulated through the ventilation system of the building where she worked—a fact that was not revealed to employees until long after the truth was discovered. Some of you reading this article might have been indifferent about healthcare reform until now, but have just paused to think about it in a new way because of the story that I just told. Even though you don't know my wife personally and perhaps only know me through my books and articles, hearing this account has perhaps made the situation a bit more personal.

Sometimes it is easy to make stories personal, because they involve our audience directly. In such cases, we need to point out in concrete ways how the story addresses their interests. Even when the story is about people and things taking place in some remote part of the planet, there is usually a way to help people connect in some personal way if the story's important. The fact that global warming will literally cause some islands where people now live to be entirely covered with water might not affect us directly, but if we're shown where those islands are on a map along with pictures of those people, we might begin to care about these strangers because we can suddenly imagine what it would be like to be in their position.

Emotional

This characteristic of an effective story is intimately related to the last. When things are personal, they stir up emotions in us; when our emotions become stirred, we tend to experience things personally. As much as we'd like to believe that we are rational creatures, research has shown that most decisions are based on emotion. Our brains are wired to fire up and take action when our emotions are aroused. People will only respond to a story if they care about the message. In other words, they have to feel something. Knowledge of this fact can be used for good or ill.

> "People will only respond to a story if they care about the message. In other words, they have to feel something."

If we rile emotions to get people to make decisions that hurt them, we're manipulating emotions for our benefit, not theirs. Out of shameful self-interest, many individuals and organizations are promoting outright lies to push buttons that are guaranteed to incite emotional reactions against healthcare reform, such as the "death panels" that I mentioned previously, or the homophobic claim that the new healthcare plan will force us to pay for sex-change operations.

On the other hand, if the story we're telling is true, and the action it promotes serves the interests of the audience and the world at large, we must somehow engage emotions, give people a reason to care, if we want them to sit up and listen. The best way to get people to care is to connect the story we're telling to something they already care about. When I read *Made to Stick* I learned about a hospital that wanted to improve its workflow. Its administrators hired the design firm IDEO to help them raise awareness among the hospital staff that improvement was necessary. To do this, IDEO made a video that was shot from the perspective of a patient who enters the emergency room with a fractured leg. When hospital workers watched this video, they experienced what it was like to be a patient helplessly caught in a dysfunctional workflow moved from place to place and waiting for long periods, all the while in pain. For the first time they saw hospital workflow from a different perspective, through the eyes of their patients, and they were suddenly able to care.

We don't always have to make videos to help people connect with our stories emotionally. Sometimes it can be accomplished by doing nothing more than showing the photograph of a real person who's involved in the story to put a face on an otherwise abstract problem. Sometimes it can be done by showing a graph, which in simple and straight-forward terms, reveals the extent of the problem. Bill Gates, the founder of Microsoft, decided to

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focus many of the Bill and Melinda Gates Foundation's philanthropic efforts on solving world health problems when he saw a graph in the *New York Times* that caught his attention and engaged him emotionally. More than anything else, however, you can help others care about your story if you care yourself. Nothing is more powerful than an authentic emotional connection and commitment that permeates your story as you tell it.

Actionable

Despite my reservations about the term "actionable," because of the marketing hype surrounding it, I can't come up with another single word that says what I want to say. Effective stories make it easy for people to respond in the way that you intend—to take action. They suggest—either directly or subtly—one or more ways to respond. If we want our stories to have an effect, we must build a bridge between the lessons we teach and meaningful ways to put those lessons to work.

Sequential

Narrative unfolds in a serial fashion, with a beginning, middle, and end. Stories are usually told sequentially by revealing facts only in their proper time. We might hint at things to come to build anticipation, but we order a story's parts in a way that matches the chronology of events, builds concepts from simple components to more complex wholes, or guides the audience through a series of related ideas by stating the thesis, validating it with evidence, and connecting it to the audience's values, one point at a time in logical order.

If the narrative is presented verbally, with the assistance of visuals, then the visuals should only be revealed when their content has been revealed in the story. When referring to parts of a visual, something should be done to highlight that part, such as pointing or some form of visual emphasis. Your audience should never struggle to find what you're talking about. Whether we deliver the narrative verbally or in writing, if complex concepts are presented, build them piece by piece, adding complexity in stages once each previous stage has been absorbed by the audience.

Despite their many problems, slideware products like PowerPoint can actually be used quite effectively to tell quantitative stories. The sequential nature of slides, transitions, and builds often pairs nicely with storytelling when images can enrich verbal narrative. Although I share Edward Tufte's well-known opinion that PowerPoint encourages horrible presentations, I believe that its limitations and counter-productive recommendations can be bypassed to produce compelling stories. Tufte argues:

> *With information quickly appearing and disappearing, the slide transition is an event that attracts attention to the presentation's compositional methods. Slides serve up small chunks of promptly vanishing information in a restless one-way sequence. It is not a contemplative analytical method; it is like television, or a movie with over-frequent random jump-cuts.*
>
> *Beautiful Evidence*, Edward Tufte, Graphics Press, 2006, p. 160

In fact, the sequential nature of slideware, with its ability to reveal information just when its needed, in no way forces us to show only tiny fragments of information at a time or to venture forward and never backward. Tufte further argues: "The rigid slide-by-slide hierarchies, indifferent to content, slice and dice the evidence into arbitrary compartments, producing an anti-narrative with choppy continuity" (*ibid.*, p. 166). But slides are no more prisoners of a hierarchy than pages of a book. Used properly, they can complement the words of a gifted speaker with images that bring the story to life and express it clearly.

Tufte manufactured an example of a PowerPoint presentation about cancer survival rates to illustrate his case. He *stacked the slide-deck*, so to speak, by breaking a table of survival rates created by Hermann Brenner into six horribly-designed graphs, claiming that PowerPoint's "default-designs cause the data to explode into 6 separate chaotic slides." (*ibid*., pp. 174-176) Contrary to Tufte's argument, this story can actually be told in a clear and compelling way with slideware if you use the tool wisely. In fact, we can tell the story in a way that is more accurate and enlightening than the chart on the following page, which Tufte offers in his book as a solution.

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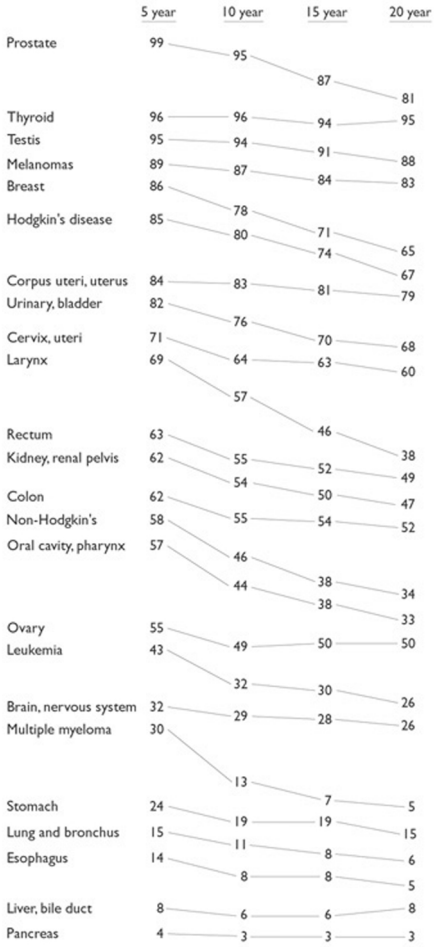

Beautiful Evidence, Edward Tufte, Graphics Press, 2006, p. 176

As you can see, different types of cancer appear along the left edge as unequally spaced rows, and survival rates, expressed as the percentage of people with each type of cancer who survive for 5 years, 10 years, 15 years, and 20 years respectively, appear in four columns.

Tufte's design displays the data as a table/graph hybrid, but by blending the two approaches, he reduces the strengths of each. By presenting all the data at once, he's provided a means for people to discover some of the stories that live therein, but he's done little to tell any of the stories. To tell the stories, rather than showing everything at once, the elements of the stories should be revealed sequentially.

Even if the purpose of this chart is to provide a means to discover the stories, aspects of its design undermine this pursuit. The spatial arrangement of the values, designed to use position as a representation of change from one value to the next, makes it more difficult to lookup individual values than a normal table. This slight inconvenience could be forgiven if the vertical positioning of the values told the truth about the relative survival rates of various cancers, but it doesn't. For example, the fact that the 10 through 20 year survival rates of prostate cancer dip below the survival rates of thyroid cancer is not represented by their relative positions. This is misleading. Also, the vertical distances between the starting 5-year values for various cancers do not correspond to the differences in values. For example, notice that melanomas (89%) and breast cancer (86%) are close to one another, even though they differ by three percentage points, yet breast cancer (86%) and Hodgkin's disease (85%) are further apart, even though they differ by only one percentage point. The proximity of some cancers, based on how close their labels are to one another, such as thyroid, testis, melanoma, breast, and Hodgkin's disease, suggest groupings of similar 5-year survival rates, yet these grouping are arbitrary. Why isn't corpus uteri, which is only one percentage point lower than Hodgkin's disease, included in this group?

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Let's try to tell a story about cancer survival rates, based on this information, and let's use slideware to do it. Many possible stories live in this information that would be of interest to various audiences, but for a hypothetical general audience, let's try to cover some of the highlights to summarize the information as a whole. Rather than trying to describe the story as I would tell it to an audience verbally and visually, with the support of slideware, I've recorded it for you to view: The Story of Cancer Survival.

We don't have to use slideware to tell a quantitative story sequentially. To tell the story in writing, we could produce a similar effect using word processing software. When the medium that we use doesn't enforce the sequence by dividing content into slides or pages or chapters, we might need to find another way to make the sequence obvious. For instance, you can tell a quantitative story on a single large screen or sheet of poster-sized paper. In a situation like this, we can choose from several methods to make the sequence in which information should be viewed obvious to the reader.

One method is the one used in comic books and graphic novels, which sequences the narrative into panels arranged from left to right, top to bottom. Another method involves numbering sections of the display sequentially or suggesting visual pathways, such as by using arrows.

Next Steps

I have by no means covered this topic in a comprehensive way. What I've written is more exploratory than conclusive. The world is waking up to the value of statistical narrative. We have a chance to put this venture on the right path by proposing best practices based on what we already know. Let's work together to find progressively effective ways to tell these important stories.

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About the Author

Stephen Few has worked for over 25 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 bi-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 three books: *Show Me the Numbers: Designing Tables and Graphs to Enlighten*, *Information Dashboard Design: The Effective Visual Communication of Data*, and *Now You See It: Simple Visualization Techniques for Quantitative Analysis*. 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.

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