APPLIED THEORY

SUMMARY
- **Analyzes Edward Tufte's case against PowerPoint and reveals its shortcomings**
- **Establishes that slides can be effective, even if most are not**
- **Proposes commonsense guidelines for more effective slides**

The Cognitive Style of PowerPoint: Slides Are Not All Evil

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Several hundred million copies of Microsoft PowerPoint are turning out trillions of slides each year. Those of us who frequently attend presentations probably agree that most of these slides are ineffective, often detracting from what presenters are saying instead of enhancing their presentations. Slides have too much text for us to want to read them, or not enough for us to understand the point. They impress us with colors, clip art, and special effects, but not with content. As a sequence of information chunks, they easily create a feeling of tedious linearity, failing to reveal any memorable (hierarchical) organization of content. Slides are a difficult art.

Nonetheless, few of us, I expect, would argue that PowerPoint is "making us stupid," that we should not trust speakers who rely on it, and that slides should be replaced altogether by paper handouts. These surprising claims are part of the case made in a recent booklet (2003) by Edward Tufte, well-known authority on visual communication (1983, 1990, 1997). From a lesser-known author, such an extreme position might be disregarded with no more than a shrug. From the man whose first book was dubbed "a visual Strunk and White" by the *Boston globe*, however, it deserves careful analysis—and a careful response.

At first reading, perhaps the most serious blow to the booklet's credibility is its dogmatic, judgmental, often sarcastic tone. The abundance of words such as *stupid*, *lousy*, and *atrocious* make the 28 pages sound unscientific to say the least, and the ridiculing of Stalin-era military parades—or of school plays, for that matter—may strike readers as simply out of place. Admittedly, tone may be a largely subjective matter.

Of greater concern than tone are the severe shortcomings of logic: the lack of discrimination between oral and written communication; the confusion of the product (slides), the production tool (PowerPoint or other software application), and the projection tool; and—paradoxically—the poor statistical evidence in support of Tufte's thesis. This article first reviews these three shortcomings, then summarizes the booklet's well-taken points, before offering guidelines for effective slides, no matter the tool. These guidelines and some of the analysis are based on more than 150 in-depth discussions of slides I have conducted with engineers, scientists, executives, and other professionals at workshops.

ORAL PRESENTATIONS ARE NOT WRITTEN DOCUMENTS

Technical communicators, accustomed to analyzing not only content and audience but also purpose, may be struck by the complete lack of attention to purpose in Tufte's discussion. Three commonsense considerations related to purpose thus invalidate much of Tufte's case against the use of slides:

- Oral presentations typically have a different purpose than written documents (different even than companion documents).
- Slides in oral presentations are viewed while the presenter is speaking, not read in silence like written documents.
- Tables and graphs, too, may serve a range of purposes, from analysis by oneself to communication to an audience.

Engineering reports, scientific papers, and business communications, whether written or oral, aim at getting messages across (Doumont 2002a). Largely, they strive to *convince* an audience, if only of the soundness of the information presented. Written documents and oral presentations, however, differ in how they can do so. Ideally, written documents convince by conveying detailed evidence that readers can review in the order and at the pace they choose, as many times as they choose. As Tufte points out, they allow high transfer rates of words and data.

Oral presentations, by contrast, are slower, but richer: they transfer fewer words per minute in the verbal channel, but also convey nonverbal information (body language), known for its impact on credibility (Mehrabian 1981). In a

Manuscript received 4 April 2004; revised 22 September 2004; accepted 23 September 2004.

sense, presentations are more expensive in audience time as they do not allow each audience member to hear only what he or she chooses to hear. Optimal presentations, therefore, attempt to convince the audience of key messages with selected evidence and with nonverbal communication. Researchers at a conference, for example, should not attempt to cover everything that is in their proceedings paper: some of the written details may not be of interest to all audience members, or perhaps not at the time of the presentation.

In view of the complementarity between documents and presentations, Tufte's recommendation to provide a paper handout is well taken; his proposal to replace slides with handouts, however, mixes two purposes. In this respect, the booklet provides no indication as to when and how such a handout should be used. Should the presenter distribute it before the presentation? Should he or she refer to it during the presentation? Or should he or she encourage audience members to read it later, in silence, at their leisure? In the last option, which is my preference, then handout and slides do not compete with one another, so one does not exclude the other: they serve different purposes.

In contrast to a companion document such as a handout, slides are viewed while the presenter is speaking: there lies their main limitation, at least as far as word transfer rate is concerned. Indeed, text processing is in essence sequential, and the human brain cannot, in first approximation, process two sequential entries at the same time. When presented with a slide full of text, we are faced with a dilemma: either read the text or listen to the speaker. We cannot do both, unless the speaker reads the text with us, in which case we might question the added value of either speaker or slide (except in the few cases when the text on the slide is the very object of discussion, as in some presentations analyzing legal texts).

When Tufte criticizes three Boeing presentations for having "only 10 to 20 short lines of text per slide" (p. 7), a "standard [PowerPoint] format problem," we might argue that these are too many lines already—not too many for a substantial narrative, which is Tufte's concern, but too many to avoid interfering with the presenter's spoken words. The recommendation that text on slides be "at the level of scientific journals, much *higher* resolution than speech" (p. 19) suggests a misunderstanding of the nature of oral communication, and of slides as a presentation aid. If maximizing the transfer rate of words and data is our sole guide, we might as well suppress oral presentations entirely, not just the slides. To my surprise, a reworking of one infamous Boeing slide, proposed by Shwom and Keller (2003) in critiquing Tufte's objections, displayed even more text, forcing a type size that is uncomfortably small in most conference rooms (see Figure 1).

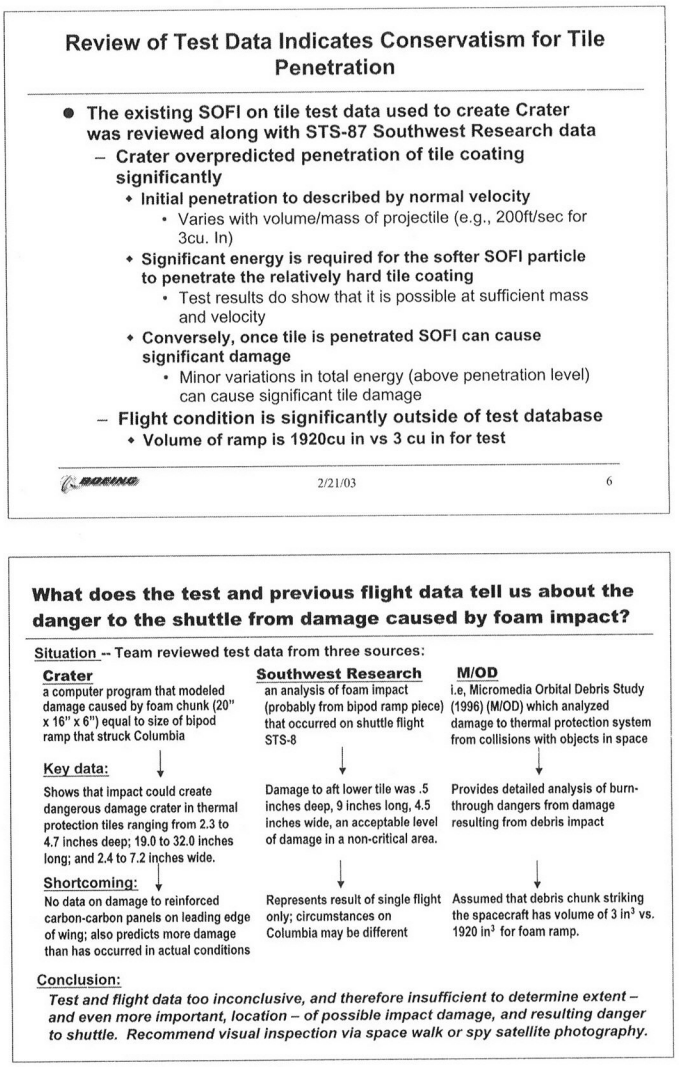

Figure 1. Shwom and Keller (2003) proposed an alternative (below) to the Boeing slide criticized at length by Tufte (above). Alas, even their new version would meet sharp criticism from the engineers and scientists who take part in my workshops, with such remarks as "I don't feel like reading all this information on screen" and "the type is too small for me to read anyway." Both slides are viewed on this printed page much like a projected slide would be viewed in a well-designed conference room (that is, at a viewing distance up to six times the slide width).

As further evidence of his misunderstanding the role of slides, Tufte seems to consider throughout the booklet that the slides *are* the presentation—in other words, that audience members must be able to understand the complete case from the slides alone (or, more exactly, that their

inability to do so suggests not to use slides). He thus discusses example slides out of context, with no effort whatsoever to imagine what the presenters might have said while showing them.

I, too, am a fierce advocate of slides that stand on their own, but not of slides that tell all the details on their own. In an anecdote from IBM on his opening page, Tufte reminds us that the presentation is about what the presenter has to say, not about what can be read from the slides. Why, then, complain that the slides do not, on their own, tell the whole story? Obviously, they should not distort or truncate the messages, but they should merely (in a sense) support the presenter, not replace him or her.

Comparing slides and documents thus makes little sense, unless of course slides are used as written documents, for example when distributed in printed format, circulated by e-mail, or posted on a Web site. Perhaps the most useful lesson in Tufte's booklet, although not his main point, is that a slideware application is little suited to producing written reports or, equivalently, that presentation slides do not double up effectively as presentation handout. But that is a different argument.

Tables and, especially, graphs are a useful alternative to long text passages on slides. A well-designed graph can get a point across in little enough time that it hardly interferes with simultaneous spoken text. Better still, a truly visual graph is not processed sequentially, so it does not compete for the same intellectual resources as text, even if it takes a (short) while to be processed (Doumont 2002b): its complexity is often in its depth, not its breadth. Still, not all graphs are created equal, and a different purpose may require a different graph. Complex graphs and, all the more, large tables may be perfect for silent analysis or, to a point, for a group discussion, but seldom for formal exposition of salient features to a large audience—another point ignored by Tufte. The "real table[s]" (p. 20) in his booklet have unlikely purposes for oral presentations: they are large compilations, such as cancer survival rates by cancer site, or mere look-up tables, such as weather forecasts for cities around the world.

THE TOOL IS NOT THE PRODUCT

Strikingly, Tufte's booklet takes little or no notice of the difference among the slides themselves, the software tool that produced them (so-called "slideware"), and the technology that projects them in front of the audience (transparencies placed on an overhead projector or a computer connected to a video projector). Although the booklet—if we judge by its title (*The cognitive style of PowerPoint*) and its opening question ("What is the problem with PowerPoint?")—is supposed to discuss a specific piece of slideware, its criticism is often aimed at slides in general or at computer-run slide shows, and sometimes more specifically at PowerPoint's "standard ready-made templates" (p. 14) or at such features as its AutoContent Wizard. (Little of the booklet, moreover, is about *cognition*, at least in the sense that readers of this journal would understand this word.)

This confusion, alas, is widespread: in my workshops, participants often exclaim "oh, but I do not use transparencies: I use PowerPoint." What they mean is that they do not print their PowerPoint slides on plastic foils but project them directly from their computer with a video projector. Making *PowerPoint* synonymous with *slide show* certainly speaks to the impact of its animation gadgetry, which is likely positive on Microsoft sales and negative on presentation effectiveness, but it is inaccurate. Presenters used PowerPoint to create overhead transparencies long before the widespread use of LCD projectors, and many still do (Doumont 2002c).

The confusion between products and tools pervades Tufte's booklet and weakens or invalidates the reasoning. Criticizing, perhaps usefully so, PowerPoint's emphasis on "deeply hierarchical" bullet lists, its "preoccupation with format not content," and the "smarmy, incoherent graphs" of its default designs (pp. 4, 16), Tufte ends up recommending that we replace slides with handouts. What about slides produced with other tools? What about using PowerPoint without the default templates? Pointing out the pitfalls of a tool might be an argument against using it (or at least using it carelessly), but it is no argument against creating the products that this tool is geared toward.

The confusion around projection technology is a particularly blurry issue. In a section titled "Extremely low resolution of PowerPoint" early in the booklet, Tufte states that "[PowerPoint] slides projected up on the wall are very low resolution—compared with paper, 35-mm slides . . . " (p. 4). Without further qualification, this statement is incorrect: overhead transparencies are printed at the printer's resolution just like paper documents (nowadays, often 1200 dots per inch for desktop printers) and computer screens are projected at increasingly high resolutions. In a well designed conference room, about six times as long as the screen is wide (Gould 1973), the audience views slides on a screen roughly as readers would view three-inch-wide slides on a printed page (Figure 1). With 1024 pixels in width, a projected computer screen thus has an equivalent resolution of about 300 dots per inch—admittedly a back-of-the-envelope calculation (near and far vision are not so easily compared), but certainly nothing like an "extremely low resolution." Tufte probably means that slides encompass a limited space compared with paper (though not compared with 35-mm slides). With the above correspondence, one might say that an A4 or letter-size sheet of paper could accommodate roughly six to nine slides; in

fact, printing PowerPoint slides as a six-per-page handout (bringing slide width to about three inches) is a straightforward test of viewing comfort: whatever strains the eyes of handout readers is likely to strain the eyes of slide viewers.

In a similar confusion, the "Sequentiality of the slide format" (another section heading) apparently—and, if so, mistakenly—attributes the "method of line-by-line slow reveal" (p. 23) to PowerPoint or, at least, to computer-run slide shows. More than a quarter century ago, when scientists and engineers used handwritten transparencies full of text and equations that resembled written documents (Tufte's preference), some of them already masked their slides with a piece of paper, which they progressively lowered to reveal one line at a time. If anything, such stripteases were worse than today's buildups, for they conspicuously hid something from the audience, raising curiosity about what was hidden, not attention to what was shown (Doumont 1999). Systematic line-by-line reveals can sure get on the nerves of the audience, but they are no signature of the "cognitive style of PowerPoint."

Finally, and as another misleading line of reasoning, many of the shortcomings pointed out by Tufte are by no means typical of PowerPoint, or even of slides, and might as easily creep up in the paper handouts he recommends for "serious presentations" (p. 11). The limitations of bullet lists emphasized by the study he cites from the *Harvard business review* apply to any medium. Mechanical and typographical inconsistencies plague written documents as much as slides (some are even to be found in Tufte's own booklet). And "presenters who don't have all that much to say" (p. 12) are unlikely to have more to write.

The booklet's foremost piece of evidence against PowerPoint—a single slide from the Boeing report on space shuttle *Columbia* in January 2003 (Figure 1), discussed over two pages—mostly shows faulty reasoning, lack of emphasis, and "ambiguous language" (p. 9); unfortunately, engineering writing is riddled with all three as well. PowerPoint does not help, but what software application can?

TUFTE'S EVIDENCE IS FLAWED

Paradoxically, and to the booklet's further discredit, Tufte's evidence against PowerPoint slides is flawed in many respects: the slides discussed are arguably not representative of current practice and certainly do not include best practice; the comparison points are inappropriate or absent; and the discussion lacks objectivity to the point of being erroneous at times. As a lesser point, the case about fundamental flaws is diluted by what some might call petty remarks, such as the use of an *X* instead of a multiplication sign being "distinctly unscientific" (p. 19).

First, the slides discussed in the booklet are a biased sample. Out of the three much criticized Boeing reports, only three slides are shown (one of them a backup slide, although the booklet fails to indicate so) and only one is analyzed—the worst one, I cannot help but think. Aside from these, the presentations analyzed were found on the Internet and in PowerPoint textbooks. The first are thus de facto slides-used-as-written-documents, a severe bias if any: if serious speakers do not make their slides available but use handouts instead, they have not been included in the analysis. The second are likely to focus on technology, not content, and to use textbook examples, not real-life ones. The engineers, scientists, and executives I have worked with have not needed PowerPoint textbooks to master the tool, so these are hardly relevant to Tufte's focus on corporate planning and scientific practice.

The spoof of Lincoln's Gettysburg Address and the other attempts to ridicule PowerPoint's automated features simply illustrate that an inappropriate use yields inappropriate results. Yes, AutoContent provides a simplistic, overly generic outline, but what else did you expect? Yes, it is possible to turn a table of 96 survival rates into six different, overdecorated, ineffective graphs, but who would want to show this detailed information as part of a formal presentation anyway? Surely presenters would extract from the table whatever information supports their specific message, and perhaps refer to a paper copy of the full table in a handout or a proceedings paper. Tufte himself argues that a table, not a graph, is the best way to show the cancer data, so why blame PowerPoint for its inability to turn this table automatically into effective graphs? As a side note, Tufte's "table-graphic" (p. 18) of the same data, which is the only graphical display presented as effective in the booklet, could be severely criticized for showing incorrectly spaced data and suggesting that intersecting lines do not intersect.

Second, and unexpectedly from someone who believes that "the fundamental analytical act [for statistical data] is to make comparisons" (p. 4), comparison points are inappropriate or absent. Yes, a typical PowerPoint slide shows far thinner data than a page of the *Physicians' desk reference*, but are these to be compared? Yes, the shortcomings of PowerPoint may reflect the corporation behind it, "a big bureaucracy engaged in computer programming . . . and in marketing" (p. 13), but is this not the case for most popular applications, slideware or other? What tool can help presenters produce the recommended handout (surely not Microsoft Word)? Even if we do not condone software commercialism, we are left wondering about alternatives, as Tufte's booklet proposes none.

Finally, and irritably so, the booklet is frequently unfair to PowerPoint slides, if not outright misleading. It sounds as if the Gettysburg slides were created automatically by

the AutoContent Wizard or the six cancer graphs by ready-made templates. They were not: someone had to key in the information and specify a chart format. According to Tufte, the "key slide in the Boeing PowerPoint reports" on the *Columbia* accident shows six different levels of hierarchy ("a PowerPoint festival of bureaucratic hyper-rationalism"), whereas *The Feynman lectures on physics* use only two (pp. 7, 8). In the first case, however, everything is accounted for, including parenthetical information as the sixth level; in the second, only chapters and sections: what about paragraphs (Level 3) and parentheses (Level 4)? Tufte's points about inappropriate graphs or excessive hierarchies are solid ones; his evidence is not.

In a similar way, Tufte's acerbic criticism of some slide features could apply to his own booklet. His complaint about "over-generalizations," for example, fittingly applies to his section heading "Bullet outlines dilute thought," and his point about "sequentiality" might be used about his 13 same-level sections, whose headings would be found lacking parallelism in both form and content by critical readers of this journal (p. 4). Overall, the frequent references to scientific practice as opposed to "an attitude of commercialism" (p. 4) contrast sharply with this confused, subjective, highly emotional case against a software application. One wonders why this case was not published as a paper in a refereed journal instead of as a for-profit booklet.

STILL, MANY SLIDES ARE INDEED INEFFECTIVE

Despite incorrect (implicit) assumptions and flawed evidence, Tufte's booklet makes several valid (or at least defendable) points about slides, no matter the slideware used to produce them. Slides help the audience to understand the material better; they should not be intended to help the speaker to remember what to say (or, worse, to be read to the audience).

Many slides out there have a low *relative* content: they contain much noninformation that dilutes or distracts (noise), such as unnecessary clip art, colors, or typographical features, and of course overdecorated graphs and self-promoting animations. Bullet lists are not necessarily as synthetic or thoughtfully organized as they may look, and need not be the default slide format. Deeply nested hierarchies in lists are ineffective and uncalled-for. Sentences or, at the very least, verb forms can help clarify what might otherwise be vague or cryptic. A long sequence of slides gives an unstructured impression of linearity, unless the presenter takes steps to convey a hierarchical structure to the audience. And handouts *are* a good idea—as a companion to the oral presentation, not as a replacement for slides.

If asked to point out an explanation for the many poor slides, especially in the business world, I would more readily blame corporate culture than software tools. Young professionals, trying their best to fit in, learn by imitation; those who deviate from the norm, for example by designing their slides markedly differently or—heaven forbid—by not using slides at all, may be frowned on by middle or even upper management, who implicitly set expectations for poor slides even if they suffer the consequences. Time pressure, moreover, does not help; neither do corporate templates featuring small fonts, tight spacing, and dazzling colors. These constraints cannot be ignored, yet they are hardly an excuse for the resulting practices.

Slideware applications, such as PowerPoint, could of course be designed to discourage the typical shortcomings of slides. They could better separate the tool that helps presenters organize their ideas from the one that actually creates the slides, offer fewer sources of potential noise and provide low-noise templates, move the focus away from bullet lists, and offer alternatives to the purely linear ordering of slides within a set. So doing, alas, they would probably move away from what customers want and instead offer what customers need but may not want; perhaps slideware applications would no longer sell as many copies.

YET SLIDES CAN BE EFFECTIVE

Contrary to what Tufte argues, I believe that effective slides—slides that are helpful to the audience—are no impossible mission. Below are the guidelines that participants and I reconstruct in every workshop I present on the basis of the example slides they bring and their experience as presenters and as audience members. These guidelines build on my three "laws of communication" (2002a): adapt to your audience, maximize the signal-to-noise ratio, and use effective redundancy.

If effective communication is about getting messages across, then slides should focus on conveying these messages: not the detailed information (the *what*), but what this information means to the audience in view of the presentation's purpose (the *so what*). To avoid competing with the spoken text for the audience's attention (that is, to avoid being noise), slides should have as little text as possible. For effective redundancy, both slides and spoken text should be stand-alone: "deaf" audience members (non-native speakers with poor listening comprehension skills, for example) should be able to understand the messages by looking at the slides only, while "blind" ones (those taking notes, for example) should be able to understand the messages by listening to the presenter only. Effective presenters can, if required, get their messages across without the help of their slides. In this respect, I recommend that speakers rehearse their presentation at least once without their slides, as a test.

Effective slides are thus redundant, stand-alone, and visual. There lies the challenge: to express a message unambiguously with as little text as possible. Because visual codings are in essence ambiguous (Doumont 2002b),

effective slides almost always include some text: the message itself, stated as a short sentence (thus including a verb). Beyond this text statement, the message should be developed as visually as possible: this development should include only whatever words or phrases are necessary for the slide to stand on its own, and preferably no long sentences, which would require uninterrupted chunks of exclusive processing time on the part of the audience.

An effort to limit text, however, is no excuse for cryptic slides or for arbitrary word counts. Slides need not say everything, but what they do say should make sense on its own: bullet lists of isolated words may remind the speaker of what to say next, but they will hardly help the audience get the point. What constitutes "little text" cannot easily be quantified in number of words, as it depends on how these words work together to create meaning: rules such as "no more than four bullets of five words each" (Hart 2004) make little sense. If rules of thumb are needed, visual limits are better guides than verbal ones: given a sufficiently large font size, each item should run on no more than two lines—a goal to be reached through clever rephrasing, not random content truncation.

Slides, like all communication elements, benefit from a high signal-to-noise ratio, both in design (no unnecessary information) and in construction (no unnecessary "ink"). Effective slides convey messages clearly and accurately, yet with as little ink as possible: they are visually concise. Typically, they use a consistent layout throughout the presentation, use a single typeface at few different sizes, and use colors sparingly: presenters can usefully develop a first design in black and white, then add color in light touches, for emphasis or identification.

If slides must double up as a paper handout (a less-than-ideal choice, as discussed earlier), I recommend printing them in reduced view at six per page or more (or perhaps three on a half page if space must be left for notes). Such a printout is in any case an excellent legibility test. In reverse, it suggests that text on A4 or letter-size slides should be set at sizes roughly three times those used for comfortable reading of paper documents.

Proposing a truly effective version of the much criticized Boeing slide would require further information from the authors as to their intent (to convey a message) and the available data (to support this message visually). Based on the information in the original slide, however, one might propose a simpler text slide, limited to what the audience must remember (see Figure 2).

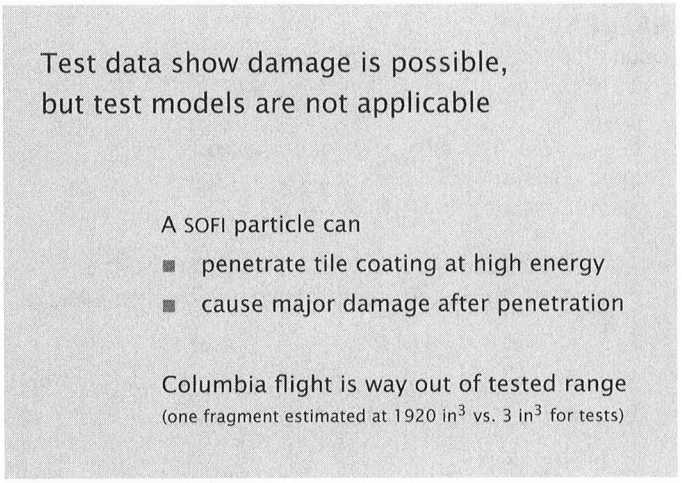

Figure 2. A possible improved version of the Boeing slide, showing a high relative content (no unnecessary ink, to avoid distracting the audience) but a low absolute content (little text, to avoid competing with the spoken text). The title states the message, that is, what the presenter wants the audience to remember (not a question, as in Figure 1, but an answer). Clearly, supporting this message visually works better still, whenever possible.

FINAL WORDS

I am hardly a proponent of Microsoft products. I decided long ago that PowerPoint did not offer what I needed—and came with much that I did not need. Yet I do create slides with other (less popular) tools, and I help engineers, scientists, and executives create slides that their audiences find effective, with or without PowerPoint. My workshops are software-free.

This article, therefore, is no apologia of PowerPoint or of any other slideware application. Many software tools, like many how-to books, indeed make false promises when pretending to offer an effortless road to effectiveness or when suggesting that users or readers need no longer think. Not so, of course: what comes out of PowerPoint depends largely on what goes into it, and the tool will likely neither improve poor thinking nor corrupt sound reasoning. It is after all but a production tool: a way to write and draw what presenters have in mind. Without surprise, then, the main reaction to Tufte's booklet, as evidenced for example by the discussion on his Web site, is an exhortation not to blame the tool for the way people use it.

While I do not discourage speakers from using slides in their presentation, I share Tufte's view when it comes to poor slides. Contrary to what presenters seem to think, ineffective slides are seldom "better than nothing": because they detract from what the presenter says, they are worse than showing no slides at all. Preparation time is thus better invested in planning and structuring the presentation carefully than in cranking out quick-and-dirty slides; hence, presenters under time pressure would be better off forgetting about slides altogether and focusing on defining their key messages instead. There is no excuse for poor slides. TC

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