Mastering the Art of Show-and-Tell

The Craft of Scientific Presentations: Critical Steps to Succeed and Critical Errors to Avoid

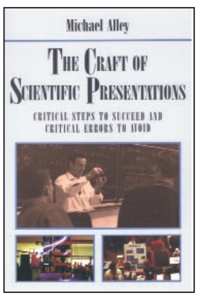
Michael Alley
Springer-Verlag, New York, 2003. $29.95 paper (241 pp.).
ISBN 0-387-95555-0

The Chicago Guide to Communicating Science

Scott L. Montgomery
U. of Chicago Press, Chicago, 2003. $40.00, $15.00 paper (228 pp.). *ISBN 0-226-53484-7, ISBN 0-226-53485-5 paper*

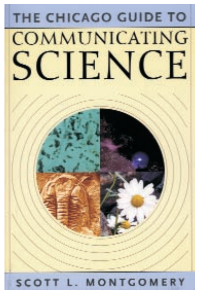
Reviewed by Chris Quigg

Sharing the numinous adventure of discovery is one of the great pleasures of a life in science. As speakers or listeners, writers or readers, teachers or students, we nourish our intellectual lives by exchanging ideas, techniques, hopes, and frustrations. All of these roles are active; for that reason, every memorable talk or research paper is a performance and conversation.



Perhaps some people are born speakers or writers, but in my experience, anyone who claims to be a natural has a faulty memory. Talent may beget craft, but craft is won over time through observation and emulation, through practice and coaching. We become better speakers by becoming more attentive listeners, better writers by becoming more discerning readers, better teachers by becoming more responsive students—and in every case vice versa!

Michael Alley's *The Craft of Scientific Presentations: Critical Steps to Succeed and Critical Errors to Avoid* and Scott Montgomery's *The Chicago Guide to Communicating Science* begin with the premise that good scientific writing or speaking about science is, fundamentally, good writing or speaking. Effective communication is not achieved by filling out a template but by thinking carefully about the topic and the audience, by learning from others, and by never being satisfied. The strength of these books is that they do not merely compile dos and don'ts; they present the reader with issues that require consideration and explore those issues through engaging anecdotes and examples. Alley's and Montgomery's books both have elements of conversation that engage a reader in ways a list of rules would not. They can be profitably read from cover to cover, but they can also be opened to a specific section for reference.



Scientific writing in research journals and writing about science in popularizations call for principles of organization and storytelling that are familiar in fiction and personal essays. Techniques include building a narrative arc, creating and resolving tension, and using the minute particular to attract the reader's attention and frame the discussion. My conception of writing and editing has been enriched by the advice, some of it confessional, of writers I respect. David Lodge's *The Practice of Writing* (Penguin, 1997), Richard Rhodes's *How to Write: Advice and Reflections* (Quill/HarperCollins, 1995), and Robert Graves and Alan Hodge's *The Reader Over Your Shoulder: A Handbook for Writers of English Prose* (Random House, 1979) have reinforced or challenged my instincts.

Scientific presentations, whether for a gathering of colleagues or a general audience, benefit from techniques of stagecraft and rhetoric. A memorable presentation will rarely be an unpunctuated sequence of equations or an uninflected recitation of sources of systematic error. Surprise and drama are precious elements of a talk, and the power of specimens, artifacts, and even souvenirs to engage an audience is too little exploited in physics lectures. Just as a writer makes an implicit compact with the reader, a speaker shapes, and then must meet, an audience's expectations.

Time is the easiest factor to measure, so it is essential to plan an end for your talk. Indeed, it makes good sense to begin planning your talk from the end by asking, "Why am I doing this? What is my punch line?" Because images are so central to many scientific presentations, I find myself returning again and again to Edward Tufte's three classics, *The Visual Display of Quantitative Information* (Graphics Press, 1983), *Envisioning Information* (Graphics Press, 1990) and *Visual Explanations: Images and Quantities, Evidence and Narrative* (Graphics Press, 1997).

Alley's *The Craft of Scientific Presentations* joins his earlier books on writing, *The Craft of Scientific Writing* (Prentice Hall, 1987) and *The Craft of Editing: A Guide for Managers, Scientists, and Engineers* (Springer-Verlag, 2000). Alley is in the mechanical engineering department at Virginia Tech, where his approach to writing and speaking is incorporated into several lab and design courses. He maintains a Web site (http://writing.eng.vt.edu) on writing guidelines for engineering and science students. *The Craft of Scientific Presentations* is informal in tone but serious in intent. Alley makes the reader think about the point of a presentation, about different kinds of presentations, and about different techniques—from writing on a blackboard to using computer slide shows. He shows how to think about finding the right words, structure, and images. He is at his best discussing well-chosen examples from both great and lesser-known lecturers, and his counsel to anticipate what could go wrong is sage advice.

Montgomery's *Chicago Guide to Communicating Science* has all the authority one would expect from the publishers of *The Chicago Manual of Style* (U. of Chicago Press, 2003). Montgomery is a consulting geologist, writer, and independent scholar who covers with scholarly grace topics ranging from writing scientific papers and grant proposals to preparing articles for the general public and for Internet publishing. He, too, emphasizes

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the importance of developing an effective style by studying and imitating successful models and using them to find one's own voice. He shows the value of thoughtful revision and refinement by presenting before-and-after examples (and sometimes after-and-after examples, because once is not enough) of passages from scientific papers.

Montgomery points out that reading widely to become a better writer means reading your own work, too. Many graceful writers have come to value the ear of the native speaker as an editorial instrument. It is important to read your writing aloud, even an article for the *Physical Review*, to measure the cadence and test whether you can follow your own thoughts. Montgomery also offers good advice about graphics by advancing the laudable notion that revision should apply to images as well as words.

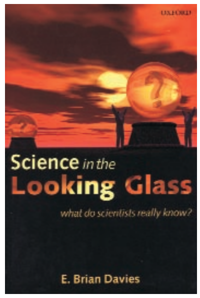
The best advice I can add for a young scientist-writer is to hope that you will meet a gifted editor who believes that your literary soul is worth saving. Until that happy day, spending time with these books will give you food for thought and the encouragement to practice, practice, practice!

Science in the Looking Glass: What Do Scientists *Really* Know?

E. Brian Davies
Oxford U. Press, New York, 2003. $29.95 (295 pp.). ISBN 0-19-852543-5

Science in the Looking Glass: What Do Scientists Really *Know?*, by E. Brian Davies, is a book about science and mathematics, written by a mathematician and intended for the general public. Much of it ought to be understandable for nonscientists. It can perhaps be best characterized as an extended essay that counsels caution against assigning "truth" to scientific models and by implication warns against philosophical overinterpretation of science.

Beginning with examinations of the human visual system, various theories of the mind and consciousness, and the social aspects of language, the author stresses the extra-scientific influences—especially of language—on our scientific view of the world. (I remember a seminar debate, however, in which physics Nobel laureate Percy Bridgman emphatically declared that he did much of his thinking without the use of words!) In two chapters on mathematics, Davies makes clear that, in contrast to many prominent mathematicians, he is not a Platonist: He does not believe mathematical theorems exist in an eternal Platonic universe of pure ideas, ready to be discovered by diligent research. Mathematics, instead, is a human construction. Davies also considers that controversies about the foundations of mathematics, intellectually challenging though they may be, are quite irrelevant to the actual practice of his craft.



Turning next to astronomy and classical physics, the book discusses determinism and its limitations, set not only by the existence of chaotic motions but also by some other, much less familiar breakdowns of the Newtonian equations for particles. In one fascinating example, Davies presents a "noncollision singularity," a five-body system that speeds to infinity in a finite time. The supersession of Newtonian mechanics by the theory of relativity leads the author to make some good points about the difference between the "truth" of a theory and its use as a mathematical model.

After presenting various aspects of probability theory, the book takes up quantum mechanics, rounding up all the usual suspects to show its weirdness. Twice, however, the author commits a basic error: Never mentioning degeneracy or spontaneous symmetry breaking in a confusing discussion, Davies claims that because the quantum mechanical Hamiltonian is invariant under reflection, its eigenstates must also be invariant. Thus the theory would rule out molecules with chirality, which are nevertheless found in nature. He fails to make clear that the puzzle is not the existence of certain molecules that are left-handed or right-handed but the observed prevalence of one isomer over the other.

After a very good discussion of biological evolution and the contemporary assaults on all the variants of Darwinism, the author takes up a subject about which he obviously has intense feelings: He strongly attacks reductionism. However, the implication of his presentation is that reductionists insist that each of the fields in the usual hierarchy—as he puts it, theory of everything ← physics ← chemistry ← molecular biology ← cell biology ← brain physiology ← consciousness ← social structures—requires all the elements of the fields below it for explanations. I know of no reductionist—and I am one—who takes such a position. Davies argues, for example, that because the Navier–Stokes equation governs the behavior of diverse fluids with quite different molecular structures, it is irrelevant that the equation can be derived from the underlying particle dynamics and therefore wrong to think of the motion of a fluid as having been reduced to the movements of its constituents. In his view, it is also perfectly acceptable for the explanation of a phenomenon in one field (say, physics) to use elements from another above it in the hierarchy (say, consciousness). I disagree: My objection to the anthropic principle as an explanation of anything (rather than merely as a peripheral observation) is based exactly on my rejection of explanations of this kind. In my view, the existence of intelligent creatures on Earth no more explains the size of certain constants in the universe than it does the extinction of the dinosaurs. (In fairness, Davies does reject most of the uses of the anthropic principle.)

These criticisms notwithstanding, *Science in the Looking Glass* is worth reading in your leisure time. It is stimulating even when you disagree with the author.

Roger G. Newton
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Modern Cosmology

Scott Dodelson
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When I was a graduate student more than 25 years ago, graduate textbooks on cosmology were few and far between. James E. Peebles's now out-of-print *Physical Cosmology* (Princeton U. Press, 1971) was not a textbook in the conventional sense but more a set of concise review articles. By far the most useful book was Steven Weinberg's magnificent *Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity* (Wiley, 1972). A rich book full of insights, it provided a comprehensive introduction to the literature of the time.

Today's graduate student is spoiled for choice. Graduate textbooks on cosmology include Peebles's surprisingly verbose *Principles of Physical Cosmology* (Princeton U. Press, 1993); John Peacock's quirky *Cosmological Physics* (Cambridge U. Press, 1999); Peter Coles and Francesco Lucchin's