

# Preface to the Second Edition

The reader response to the first edition of this book has been gratifying. Especially because of the Internet, and the cognate rapid and free dissemination of scholarly work, people are now paying more attention to the quality of writing. And we are all benefiting from the result.

The essential principles of good writing have not changed for many years. In this new edition, I am not going to revise my advice about grammar and syntax and organization and style. I will certainly update and amend and correct certain passages. But the basic message will be much as in the first edition.

I will still insist that writing is a yoga, and a healthy one. It is a discipline that one must cultivate in oneself, and it is one worth cultivating. In today's world, good writers are respected and admired. They are granted a considerable measure of accord and prestige. They are a crucial part of our discipline.

What will be truly new in this second edition is an extensive discussion of technological developments. Today the Internet virtually consumes all of our lives (and especially of the lives of writers). As both readers and writers, we are all aware of blogs and chat rooms and preprint servers. There are now electronic-only journals and print-on-demand books and Open Access journals and joint research projects such as `MathOverflow`. Not to mention a host of other new realities. It truly is a brave new world, one that can be overwhelming and confusing.

Put slightly differently, information-and-misinformation are today vastly more accessible to everyone than they were yesterday. This basic fact has altered, and largely benefited, communication, education, and scholarship. It has redefined, perhaps in some sense toppled, the Ivory Tower. And it has heightened our responsibility to be accurate, responsible, and concise communicators of our science.

With some trepidation, I have attempted here to describe and catalog this new technological landscape and to help encourage the mathematical community to express itself in it as cogently as possible.

As I lay out this mind-boggling new scenario, I endeavor to be as specific as possible. I give lots of concrete examples and plenty of detailed description. At the risk of overstating the obvious, I leave nothing to the imagination.

Fortunately, information and writing are today vastly more accessible to virtually everyone than in past times. But that puts a heavier burden on the writer to be careful, accurate, and responsible. It certainly gives one pause for thought before picking up the pen.

I continue in this new edition the practice from the first edition of labeling mistakes with the symbol ✘ . I hope that this habitude helps the reader to understand what is going on.

I conclude by noting that I am a nontrivial presence in the mathematical publishing world. I have a considerable relationship with Springer, with Birkhäuser, with Taylor & Francis, with the Mathematical Association of America, and with the American Mathematical Society. I have published a great many books with these publishers and with others as well. There is no doubt that my publishing experiences have influenced what I have to say, and I apologize for that in advance. Because of my background I can claim to be knowledgeable, but I cannot claim to be completely objective.

As always, I thank my editor Sergei Gelfand and my readers and colleagues for their support and their friendly, constructive criticism. Sheldon Axler, Don Babbitt, David Bailey, Harold Boas, John P. D'Angelo, Fausto Di Biase, John Ewing, Jerry Folland, Peter Gilkey, David Hoffman, Dmitri Khavinson, Blake Thornton, and Steve Weintraub have been particularly helpful. When it comes to careful use of language, Randi D. Ruden is always my best teacher. She deserves my profound thanks for her careful reading and cogent criticisms.

Special thanks go to Lynn Apfel and Robert Burckel for an especially detailed reading and many incisive remarks, criticisms, and suggestions.

I look forward to reader feedback on this new edition.

S.G.K.  
St. Louis, Missouri

# Preface to the First Edition

The past fifty years have not seen as much emphasis on the quality of mathematical writing as perhaps one would wish. Because of competition for grants and other accolades, we hasten our work into print. An obituary for Hans Heilbronn (1908-1975) asserted that, after he wrote (by hand) a draft of a paper, he would put it on the shelf for one year. Then he would come back to it with fresh eyes, read it critically, and rewrite it. In effect, after a year's time, Heilbronn was reading his own work as though he were unfamiliar with it and had to understand each point from first principles. It is perhaps worth dwelling on this exercise to see what we might learn from it.

There is no feeling quite like that which comes after you have proved a good theorem, or solved a problem that you have worked on for a long time. Driven by the heat of passion, the words burst forth from your pen, the definitions get punched into shape, the proofs are built and bent and patched and shored up, and out goes that preprint to an appreciative audience. The whole paper sparkles—both the correct parts and the incorrect parts. A friend of mine, who solved a problem after working on it to the exclusion of all else for over fifteen years, used to rise up in the middle of the night just to caress his manuscript lovingly.

In circumstances like these, you find it virtually impossible to distance yourself from the material. Everything is emblazoned in your own mind and is crystal clear; you are unable to take the part of the uninitiated reader. You are torn between the desire (expeditiously) to record and validate your ideas, and the desire to communicate and explain.

In today's competitive world, you probably do not feel that you have the luxury of setting a new paper aside for a year. The paper could be scooped; the subject could take a different direction and leave your great advance in the dust; the NSF might cancel your grant; the Dean might not give you a raise; you might not be invited to speak at that big conference coming up.

Now let us look through the other end of the telescope. The harsh reality is this: If you prove the Riemann hypothesis, or the three-dimensional Poincaré conjecture, or Fermat's Last Theorem, then the world is willing to forgive you a lot. It is nice if your paper is well written, for then more people will benefit from it more quickly. But—even if the paper is abysmally written—a handful of experts will be able to slug their way through it, they will teach it to others, perhaps more transparent proofs may come out, textbooks will eventually

appear. Science is a process that tends to work itself out.

In fact most of us do not produce work at the high level just described—certainly not consistently so. If your work is not written in a clear fashion, so that the reader may quickly apprehend what the paper is about, what the main results are, and how the arguments proceed, then the reader will likely set it aside before reading much of it. Your work will not have the impact that you had hoped or intended.

I am certainly not writing this book to advocate that you set aside each of your papers for a year, in the fashion of Heilbronn, and then rewrite it. Rather, I am asking you to consider the value of learning to write. Heilbronn had his techniques for sharpening up his prose. Each of us must learn our own.

I know many examples of mathematicians  $A$  and  $B$ , of roughly similar talent, with the property that  $A$  has enjoyed much greater success than  $B$ , and considerably more recognition for his/her ideas, because  $A$  wrote his/her work in an appealing and readable fashion and  $B$  did not. The  $A$ s and  $B$ s that I am thinking about are not at the Fields Medal level; Fields Medalists are exceptional in almost every respect, and clearly do not need my advice. Instead, the examples of which I speak are several notches down from that august level, like most of us.

Even if you accept my thesis—that it is worthwhile to learn to write mathematics well—you may feel that fine writing is not an avocation that you wish to pursue. Fair enough: if you had wanted to become a writer, then probably you would have done so. But I submit that a reasonable alternative might be to spend an hour or two with this book, and perhaps another hour or two considering how its precepts apply to your own writing. The result, I hope, will be that you will be a more effective writer and will derive more enjoyment from the writing process.

As a scholar, or a scientist, you do not make widgets, nor do you grow wheat, nor do you perform brain surgery. In fact, what you do is manipulate ideas and report on the results. Usually this report is in written form. What you write is often important, and can have real impact. Freshman composition teachers at Penn State like to tell their students of the engineers at Three Mile Island, who wrote to the governor of Pennsylvania three times to tell him that a nuclear disaster was in the making at their power plant. Their prose was so garbled that the poor governor could not determine *what* in the world they were talking about. The rest is history.

The very act of writing has, in the last twenty years, taken on a new shape and form. Whereas, years ago, it entailed sharpening a quill and buying a bottle of ink, nowadays most of us do not even own a quill knife. Instead we boot up the computer and create a document in some version of  $\text{T}_{\text{E}}\text{X}$ . This being the case, I have decided to devote a (large) portion of this book to *techniques* of effective writing and another (much smaller) portion to the *instruments* of modern writing. This book is intended in large part for the novice mathematician. Fresh from graduate school, such a person must engage in the struggle of figuring out how to survive in the profession. The lucky budding mathematician will have gone to a graduate program that provided experience in technical

writing and the use of hardware and software. If not, then perhaps that person is presently in a working environment that makes it easy to learn the technical aspects of writing. But I think that it is useful to have a reference for these matters. I intend, with this book, to provide one.

My credentials for writing this book are simple: I have written about one hundred articles and have written or edited about fifteen books. I have received a certain amount of praise for my work, and even a few prizes; and I have received plenty of criticism. Let me assure you that one of the most important attributes of a good writer is an ability to listen to criticism and to learn from it. Everyone finds it difficult to read criticism without becoming defensive; nobody wants to be excoriated. But even the most negative, uncharitable review can contain useful information. You profit not at all by becoming emotional; but if you can use the criticism to improve your work, then you have trumped the critic.

This book is a rather personal tract, containing personal recommendations that reflect my own tastes. I have reason to believe that many others share these tastes, but not all do. There certainly are treatments of the art of mathematical writing that are more scholarly than this one—I note particularly the book [Hig] of Higham. He has careful discussions of how to select a dictionary or a thesaurus, careful catalogings of British usage versus American usage, a history of mathematical notation, clever exercises for developing skill with English syntax, tutorials on revision, and so forth. Higham’s book is a real labor of love, and I recommend it highly. But there is no sense for me to duplicate Higham’s efforts. Here I will discuss how to write, why to write, and when to write. However, this is not a scholarly tract, and it is not a text. The book is intended, rather, to be some friendly advice from a colleague. If an Assistant Professor or Instructor were to come to my office and ask for suggestions about writing, then I might reply “Let’s go to lunch and talk about it.” This book encompasses what I would say over the course of several such meetings.

In this book I shall not give an exhaustive treatment of grammar, nor of *any particular aspect* of writing. When I do go into some considerable detail, it is usually on a topic not given extensive coverage elsewhere. Examples of such topics are **(i)** How to organize a paper, **(ii)** How to organize a book, **(iii)** How to write a letter of recommendation in a tenure case, **(iv)** How to write a referee’s report, **(v)** How to write a book review, **(vi)** How to write a talk, **(vii)** How to write a grant proposal, **(viii)** How to write your Vita.

I have adopted the practice of labeling *incorrect* examples of grammar and usage with the symbol ✘. I do this so that examples of what is wrong will not be mistaken for examples of what is right.

I have benefited enormously from many friends and colleagues who were kind enough to read various drafts of the manuscript for this book. Their comments were insightful, and in many cases essential. In some instances they saved me from myself. I would like particularly to mention Lynn S. Apfel, Sheldon Axler, Don Babbitt, Harold Boas, Robert Burckel, Joe Christy, John P. D’Angelo, John Ewing, Gerald B. Folland, Len Gillman, Robert E. Greene, Paul Halmos, David Hoffman, Gary Jensen, Judy Kenney, Donald E. Knuth, Silvio Levy,

Chris Mahan, John McCarthy, Jeff McNeal, Charles Neville, Richard Rochberg, Steven Weintraub, and Guido Weiss. George Piranian generously exercised his editing skills on my manuscript, and to good effect. I thank Randi Ruden for sharing with me her keen sense of language and her sharp wit; she showed no mercy, and spared no pains, in correcting my language and my logic. Josephine S. Krantz provided valuable moral support. I find it a privilege to be part of a community of scholars that is so generous with its ideas. Pat Morgan, Antoinette Schleyer, and Jennifer Sharp of the American Mathematical Society gave freely of their copy editing skills. Barbara Luszczynska, our mathematics librarian, also gave me help in tracking down sources. My work at MSRI was supported in part by NSF grant DMS-9022140.

It would be impossible for me to enumerate, or to thank properly, all the excellent mathematical writers from whose work I have learned. They have set the example, over and over again, and I am merely attempting to explain what they have taught us. Several other authors have addressed themselves to the task of explaining how to write mathematics, or how to execute scientific writing, or simply how to write. Some of their work is listed in the Bibliography. (See also [Hig] for a truly extensive enumeration of the literature.) The present book interprets some of the same issues from my own point of view, and filtered through my own sensibilities. I hope that it is a useful contribution.

S.G.K.  
St. Louis, Missouri