

Zeitschrift: L'Enseignement Mathématique
Herausgeber: Commission Internationale de l'Enseignement Mathématique
Band: 16 (1970)
Heft: 1: L'ENSEIGNEMENT MATHÉMATIQUE

Artikel: HOW TO WRITE MATHEMATICS
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Vorwort: 0. Preface
DOI: <https://doi.org/10.5169/seals-43857>

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HOW TO WRITE MATHEMATICS

P. R. HALMOS

0. PREFACE

This is a subjective essay, and its title is misleading; a more honest title might be HOW I WRITE MATHEMATICS. It started with a committee of the American Mathematical Society, on which I served for a brief time, but it quickly became a private project that ran away with me. In an effort to bring it under control I asked a few friends to read it and criticize it. The criticisms were excellent; they were sharp, honest, and constructive; and they were contradictory. "Not enough concrete examples" said one; "don't agree that more concrete examples are needed" said another. "Too long" said one; "maybe more is needed" said another. "There are traditional (and effective) methods of minimizing the tediousness of long proofs, such as breaking them up in a series of lemmas" said one. "One of the things that irritates me greatly is the custom (especially of beginners) to present a proof as a long series of elaborately stated, utterly boring lemmas" said another.

There was one thing that most of my advisors agreed on; the writing of such an essay is bound to be a thankless task. Advisor 1: "By the time a mathematician has written his second paper, he is convinced he knows how to write papers, and would react to advice with impatience." Advisor 2: "All of us, I think, feel secretly that if we but bothered we could be really first rate expositors. People who are quite modest about their mathematics will get their dander up if their ability to write well is questioned." Advisor 3 used the strongest language; he warned me that since I cannot possibly display great intellectual depth in a discussion of matters of technique, I should not be surprised at "the scorn you may reap from some of our more supercilious colleagues".

My advisors are established and well known mathematicians. A credit line from me here wouldn't add a thing to their stature, but my possible misunderstanding, misplacing, and misapplying their advice might cause them annoyance and embarrassment. That is why I decided on the unscholarly procedure of nameless quotations and the expression of nameless

thanks. I am not the less grateful for that, and not the less eager to acknowledge that without their help this essay would have been worse.

“Hier stehe ich; ich kann nicht anders.”

1. THERE IS NO RECIPE AND WHAT IT IS

I think I can tell someone how to write, but I can't think who would want to listen. The ability to communicate effectively, the power to be intelligible, is congenital, I believe, or, in any event, it is so early acquired that by the time someone reads my wisdom on the subject he is likely to be invariant under it. To understand a syllogism is not something you can learn; you are either born with the ability or you are not. In the same way, effective exposition is not a teachable art; some can do it and some cannot. There is no usable recipe for good writing.

Then why go on? A small reason is the hope that what I said isn't quite right; and, anyway, I'd like a chance to try to do what perhaps cannot be done. A more practical reason is that in the other arts that require innate talent, even the gifted ones who are born with it are not usually born with full knowledge of all the tricks of the trade. A few essays such as this may serve to “remind” (in the sense of Plato) the ones who want to be and are destined to be the expositors of the future of the techniques found useful by the expositors of the past.

The basic problem in writing mathematics is the same as in writing biology, writing a novel, or writing directions for assembling a harpsichord: the problem is to communicate an idea. To do so, and to do it clearly, you must have something to say, and you must have someone to say it to, you must organize what you want to say, and you must arrange it in the order you want it said in, you must write it, rewrite it, and re-rewrite it several times, and you must be willing to think hard about and work hard on mechanical details such as diction, notation, and punctuation. That's all there is to it.

· 2. SAY SOMETHING

It might seem unnecessary to insist that in order to say something well you must have something to say, but it's no joke. Much bad writing, mathematical and otherwise, is caused by a violation of that first principle.