

All Write Now

Can a typo send a man to hell? Some authorities claim that such a fate befell Ben Jonson (the Elizabethan dramatist, contemporary of Shakespeare, and convicted murderer), whose grave marker in Westminster Abbey reads, “O RARE BEN JOHNSON”. The variation in the spelling of the name is not an issue, but the space after the “O” is. Some argue that the initial word of the inscription should have been the Latin verb “Orare”, the intent being to exhort the beholder to pray for Jonson’s salvation. Thus an engraver’s error may have cheated Jonson out of centuries of prayers for his soul.

Similarly, a mistake in a single character in a mathematics paper can wreak havoc on the reader’s comprehension. A wrong minus sign ruins a calculation, and confusing ρ with p turns the Navier-Stokes equations into nonsense. A discussion about the structure of rings of functions had better not mix up the words “homomorphic” and “holomorphic”. Inattention to such details can have catastrophic consequences: the \$125 million Mars Climate Orbiter was lost in September 1999 due to a mix-up concerning the units of measurement of the thrust of the rocket engines.

The moral is the expositor’s version of Murphy’s Law: namely, anything that *can* be misunderstood *will* be misunderstood. This being my last issue as editor of the *Notices*, I take the opportunity to expound on the principle.

One of the great challenges of writing expository articles about mathematics is that the audience is unknown. Because the printed medium lacks interaction, the author cannot be sure that the reader interprets such terms as “Riesz representation theorem”, “harmonic”, and even “integer” the same way that the author does. Moreover, the author cannot determine whether the reader knows the Gauss-Bonnet theorem, the definition of the wave-front set, or the proof of Hilbert’s Nullstellensatz. Unable to engage readers in a dialogue, authors must design the exposition to give implicit reminders about mathematical topics that may be fuzzy in readers’ minds and to bolster readers’ confidence that they are following the discussion.

What may authors of *Notices* articles assume about the readers? The *Notices* reaches a wide audience that includes graduate students, college and university teachers, and mathematicians working in industry. Readers may be presumed to have an interest in learning about contemporary developments in mathematical research, but not all readers are themselves engaged in research. Thus, an article whose first paragraph expects readers to know about last year’s breakthrough in the theory of (say) pseudo-pyroclastic prosthaphaeresis is inappropriate for the *Notices* audience. Indeed, the intersection of the mathematical backgrounds of all the readers of the *Notices* is a set of measure zero (possibly void). Consequently,

authors who hope to reach a substantial fraction of the *Notices* audience must constantly look for ways to make contact with parts of mathematics likely to be familiar to most readers. Canny authors skip the subtleties and the abstractions; instead they present the simplest nontrivial examples.

Good expositors also take pains to eliminate ambiguities that could cause confusion or uncertainty in the reader’s mind. A careful author avoids writing $r^{s+1/2}$, for readers may be in doubt about whether the author is following the convention that treats the exponent as $s + (1/2)$. Similarly, an argument should not depend on a proper interpretation of the relative pronouns “which” and “that”, for many readers are unsure about the conventional difference in meaning between these two words. Nor should authors place excessive demands on the acuity of the reader’s eyesight: a formula that uses both a and α is begging for misinterpretation. One of the reasons I became an analyst rather than an algebraist is that when I was a student, I could not distinguish \wp from \mathfrak{V} and \mathfrak{E} from \mathfrak{G} ; neither the algebra book nor the teacher provided a chart of the Fraktur letters.

Quality mathematical writing requires not only thoughtful organization, clear explanation, and meticulous attention to detail but also the ability to view the subject from a nonexpert’s viewpoint and the willingness to revise and rewrite multiple times. Writing well requires different skills from proving theorems. It is hard work, but I have learned as editor of the *Notices* that there is an enthusiastic and appreciative audience for good mathematical exposition.

In the year 2000 the AMS established a new prize that recognizes the value and the importance of communicating mathematics to a broad audience. The annual Levi L. Conant prize is awarded for the best expository paper published in either the *Notices* or the *Bulletin of the AMS* in the preceding five years. Prospective authors in search of models to emulate might start with the prize-winning papers listed at the Internet address <http://www.ams.org/prizes/conant-prize.html>.

I am pleased that the Society honors good mathematical writing. It is an activity I hold dear: that is why I devoted the past three years to fostering mathematical exposition. I hope that readers of the *Notices* will study the masters and then try their own hands at writing papers worthy of a prize.

—Harold P. Boas, Editor

Letters to the Editor

Poor Quality Textbooks

The mathematical community should pay more attention to the quality of textbooks printed in this country. Sometimes it looks as if the author is unfamiliar with the standard terminology or lacks elementary logic.

For the current academic year our department adopted a book on introductory statistics. I became struck by the shortcomings of the book. Here are two examples.

(i) Marginal probability is defined as the probability of a single event without consideration of any other event. Marginal probability is also called simple probability.

Stated in those general terms, without specifying that the word marginal is applicable only in the case of a two-way classification of the outcomes of an experiment, this definition is unscientific and misleading. The term simple probability seems to be the author's invention.

(ii) The author makes several "Important Observations", and one of them is: Two events are either mutually exclusive or independent.

Is it not amusing? An unqualified reader most likely would conclude that if two events are not mutually exclusive, then they are independent, which is indeed an absurdity.

I do not want to go into details of other weak features of the book, such as a huge number of unneeded definitions, which can only overload a student's memory; the monotony of many absolutely similar exercises, where exactly the same formula is used and only numerical values and item names differ; and the lack in most sections of even minimally challenging problems, which would require students to do a little bit of reasoning of their own.

No wonder that with such textbooks and under growing pressure from the university administration to reduce the percentage of failing grades, many of our graduates prove to be less prepared in mathematics

than their counterparts in, for example, Europe, Japan, China, and Israel.

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Towards More Varied and Better Calculus Texts

The letter by Ostrovskii in the September 2003 issue of the *Notices* addresses an important issue for all mathematicians. Quality teaching is a major part of our profession. How we teach is not just supported, but strongly influenced by the textbooks we use. His suggestions are interesting. While I do not necessarily agree with all of them, I would like to add a few remarks on distributed authorship and on dissemination/improvement mechanisms that may encourage those of us who have similar concerns and hopes for novel approaches to calculus.

Distributed authorship can turn into a logistical nightmare. However, it might be realizable by modularizing the text. As long as each module has clearly stated prerequisites and learning objectives, there is no reason why modules on differential equations and on differentiation formulas could not be written by different people. This approach will not lead to compartmentalization if the authors communicate with each other and appropriate cross-references are implemented.

Rapid improvement of a text can come from multiple authors who proofread each other's work, but also (and maybe more rapidly) through fast reactions to user comments. Some people say that textbooks get really good only after the second or third edition. These editions take about ten years to materialize because of the way books are currently disseminated. On-demand publishing may become a new avenue that allows more rapid product improvement while lowering the overall prices.

With present-day typesetting tools, a book with (near) professional quality layout, fonts, graphics, etc., can

be produced by the author in pdf form. Rather than printing the book off the pdf, then storing the hard copies and eventually shipping them across the country to be sold, why not sell the right to print the pdf to the adopting campuses? This will reduce the cost of texts, because the only overhead encountered is the electronic transmission of a file (essentially zero cost) or the mailing of a disk (negligible cost). The price will be the cost to print the text locally (which is low for high-quality grayscale production), plus an author's royalty, plus the bookstore markup, plus (if so desired) a markup that goes to the adopting school's mathematics department for scholarships or similar purposes. Even with all these markups, a high-quality 600-700-page text should cost the student less than \$40. Moreover, because the texts exist primarily in electronic form, errors can be removed and new exercises and projects can be incorporated immediately. A new pdf can be posted every semester. That means that after ten years such a text could be (at least) in the twentieth "edition" and it should have benefited from multiple user input. The early thresholds (second, third edition) will be passed before the end of the first two years, though the time scale may need to be adjusted slightly.

The creation and dissemination process described above sounds terribly easy. It will not be that trivial once the rubber hits the road. Yet I know that soon there will be truly high-quality alternatives to the current textbooks. If they are good alternatives, they will thrive. If not, we have lost nothing by trying.

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