

# UC Berkeley

## UC Berkeley Previously Published Works

### Title

Editors' remarks: "Some basic information on information-based complexity theory" [Bull. Amer. Math. Soc. (N.S.) 26 (1992), no. 1, 3-27; MR1102755 (94e:68077a)] by B. N. Parlett and "Perspectives on information-based complexity" [Bull. Amer. Math. So...

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Hirsch, Morris W  
Palais, Richard S

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## EDITORS' REMARKS

MORRIS W. HIRSCH AND RICHARD S. PALAIS

The two papers that follow are controversial—in two senses. First, the authors express opposing and strongly worded views on what “complexity theory” should be. Second, the decision to open the Research-Expository Papers section of the *Bulletin* as a forum for such a debate may also be considered controversial; and, in fact, the wisdom of this decision was the subject of some dispute within the editorial board. It was made by us jointly as present and past chairs of the editorial board.

As to the controversy in the first sense, we let the papers speak for themselves. However, since their publication is a precedent of sorts, we feel it is important to clarify our general attitudes toward articles of a controversial nature.

As mathematicians we have the good fortune to be able to settle in a straightforward and objective way one sort of controversy which, in other disciplines, often leads to quite rancorous disputes. While there are occasional disagreements over the correctness of a paper, the strictly logical nature of mathematical proof usually permits a quick resolution of such issues that is agreed to by all sides. But this should not blind us to other mathematical controversies that are less objective in their nature, and not so easily settled.

For example, we have probably all heard the story that some mathematicians felt it was scandalous for Cantor to claim that, in demonstrating that the algebraic numbers were countable while the real numbers were not, he had given a new proof of the existence of transcendental numbers. After all, his proof gave no way to construct even a single transcendental number. Echoes of this controversy are heard down to the present day in the now somewhat muffled debate over “Constructivism versus Classical Mathematics.” Similarly, we read that Hilbert’s approach to Invariant Theory, using his Basis Theorem and other nonconstructive, abstract methods, provoked controversy in a mathematical world still steeped in the concrete methods of the classical tradition, where solving a particular problem in Invariant Theory had always meant exhibiting a specific basis for the invariants. Other controversies include debates over the status of infinitesimals, irrationals, imaginary numbers, large cardinals; the proper treatment of geometry, logic, set theory, foundations of mathematics; the role of computer science; the use of mathematics in the social sciences; and perennial issues in mathematical education.

And not all such controversies are ancient history! Fifteen years ago there was a sharp controversy over purported excesses in the applications of Catastrophe Theory, and currently there is a similar controversy concerning what some see as an overselling and overpopularization of “fractals” and “chaos.” Another simmering debate has grown out of the current renewal of the on-again, off-again love affair between Mathematics and Theoretical Physics. We have learned to accept that different standards of mathematical rigor may be appropriate when mathematics is being used as a tool to gain new insights about the physical world.

But what standards should we apply to judge a paper that uses nonrigorous or semirigorous methods from physics to suggest important new insights into our own mathematical world, particularly if those insights seem beyond the reach of current rigorous mathematics?

Especially because such questions cannot always be answered by logical principles alone, we believe that it is important for mathematicians to confront them. Even when rational discussion and debate does not completely resolve differences, at least it may clarify the issues.

Traditionally debate about issues of this sort has been carried on in non-scholarly journals, and for questions that are less weighty or more transitory in significance this is appropriate. We certainly have no intention to open these pages to emotional debate over whether the C programming language is better or worse than Pascal! But when a controversial matter comes up that is of serious concern and long-term significance to the mathematical community, and so deserving of careful debate, then such a debate belongs in an archival journal. This does *not* mean we are inviting authors to submit some new category of “controversial issue” paper to the Research-Expository Papers section. On the contrary, as always, any paper will judged on its intrinsic interest and merits, and controversial papers will no doubt have to jump through a few extra hoops. What we are saying is that we will not reject a paper solely because the ideas presented in it may not be universally accepted or subject to mathematical proof or disproof.

DEPARTMENT OF MATHEMATICS, UNIVERSITY OF CALIFORNIA AT BERKELEY, BERKELEY, CALIFORNIA 94720

DEPARTMENT OF MATHEMATICS, BRANDEIS UNIVERSITY, WALTHAM, MASSACHUSETTS 02154-9110