Letters to the Editor

The Mathematical Intelligencer *encourages comments about the material in this issue. Letters to the editor should be sent to the editor-in-chief, Sheldon Axler.*

Ethics of Mathematics

Reuben Hersh's article "Mathematics and Ethics" (*Mathematical Intelligencer*, Summer 1990) mentions only trivial ethical problems in pure mathematics. He misses the big one. Mathematical research occupies the lives of a large proportion of the world's best thinkers, who could have been doing some very useful things otherwise. Either the theorems they discover have an intrinsic value comparable to medical discoveries, say, or inventions in telecommunications, or they don't. If not, it must be ethically unjustified for mathematicians to spend their lives finding them, and positively criminal to corrupt the youth by attracting them into the discipline. If theorems do have value in themselves, it would be good to say so and stop selling the subject to the public on such predominantly utilitarian grounds.

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Fractal Theory

I would like to suggest an Hegelian solution to the controversy between Steven Krantz and Benoit Mandelbrot (*Mathematical Intelligencer*, Fall 1989) about the significance of fractal theory. Mathematics always comes with tension between the pure and applied, the abstract and concrete; every mathematician must choose some position on this board.

Fractal theory has its roots in the mathematics that was fashionable in the first quarter of our century. It involves a mixture of several fields developed in that period: dynamical systems, geometric function theory, Brownian motion, Lebesgue integral, etc. Looming in the background are the nineteenth century ideas of Felix Klein and Sophus Lie that the "symmetries" of a situation determine the fundamentals.

Mandelbrot was himself trained in the tradition of very abstract, pure French mathematics. He realized that what he dubbed fractal theory was an important applied complement to this tradition. Perhaps this "rebellion" against the Bourbaki dogma is his own Hegelian antithesis? Unfortunately, the mathematicians at the major mathematical centers who dominate the agenda are, by and large, not sympathetic to research like his that tries to combine ideas from different parts of the board; he had to be theatrical to overcome deeply ingrained prejudices. Krantz is also right in pointing out that most of the major ideas were in existence and the theorems were proved by the 1920s. In his earlier writings, Mandelbrot mentioned his intellectual debt to the ideas of Paul Lévy, the mathematical poet of Brownian motion theory (where many of the beautiful intuitive ideas in the fractal work originated!), but that has tended to be forgotten in the recent popularizations.

What is most important about this controversy is its lessons for the future interaction between mathematics and other disciplines, and the related educational questions. I cannot go into it here in detail; I am already infamous in certain circles for writing and preaching *ad nauseam* about this topic. However, I cannot resist pointing out that the most important moral of the fractal story is the opposite of the one that is implicitly assumed in the general scientific press—and by government agencies looking for something to fund that will lead to important applications or catch the public's eye—namely, that the concrete and pragmatic parts of mathematics are of most importance for practical results. Fundamental physics illustrates the principle in its purest form: relativity, quantum mechanics, and elementary particle physics are based on differential geometry, Hilbert space, and Lie group theory, not exactly subjects a student is likely to learn playing glorified video games on his or her PC. Even computer science—for all its triumphs of building better machines and more efficient software—is still tied to seemingly useless ideas generated by a few

mathematical logicians sitting around the Common Room at Princeton in the 1930s. I suggest that our role as mathematicians is to provide the mathematical fuel for *new* science!

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Poetry

Neither in the articles of Jonathan Holden and W. M. Priestley (*Mathematical Intelligencer*, Winter 1990), nor in the ensuing correspondence has anyone yet mentioned the work of the contemporary German poet, Hans Magnus Enzensberger. His *Mausoleum*, subtitled "thirty-seven ballads from the history of progress," is a latter-day *Spoon River Anthology*. Unlike Masters's graveyard, however, Enzensberger's crypts are peopled by real historical personages, among whom are Leibniz, Babbage, and Turing. In a later collection of Enzensberger's poetry there is also his *Hommage à Gödel*, in which the first incompleteness theorem is stated and playfully contrasted with one of the tales of Baron Münchhausen. That poem, moreover, was subsequently set to music by Hans Werner Henze in his Second Violin Concerto! This raises a new question: Apart from Tom Lehrer's facetious "tribute" to Lobachevski, has any mathematician besides Gödel been memorialized in music?

For those who do not read German, *Mausoleum* is available in English; the title and publisher (Suhrkamp) are the same. A performance of Henze's Violin Concerto is also available, on British Decca LP HEAD 5. The accompanying program notes include the full German text of Enzensberger's poem, together with English and French translations of it.

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I hold Mr. D'Alembert to be a great mathematician *in abstractis*, but when he makes incursions into applied mathematics, I lose all of my esteem . . . and it would be better for the true physics if there were no mathematicians on the earth.

Daniel Bernoulli

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