

“summoning up, in choice symbols, the collective psyche of our time”.

But the opera is also pertinent to issues that often arise in *Nature's* pages. The application of science is ever more extended into the workings of the world and is all the more capable of instilling distrust in the society that pays for it. We should expect non-scientists to be wary of a profession that is often as excited, driven and single-mindedly focused as the Manhattan Project scientists.

The end of the opera should leave receptive audiences more aware of the case for scientists engaging with the public. The opera is framed at the beginning and end of each act by electronic soundscapes. The last moments take us beyond the Trinity test to the voice of a Japanese woman begging for water. This is not only a fitting reference to the ethical question that

overshadows the opera, but also a reflection of the societal challenge facing any scientist or technologist today whose research could change people's lives. Scientists still face equivalent moral debates of expediency (is the work justified by the benefits?) and of fundamental principle (is it in opposition to humanity's deepest values and hence to be forbidden?). They can choose to lock themselves away or consider the full implications of what is being achieved and reach out.

The efforts of leading scientists such as Robert Wilson and Leo Szilard to engage with decision-makers over Hiroshima, however debatable, should inspire us today. Adams' opera has helped them to do so in a way that no conventional history can. His music really is necessary. ■

Philip Campbell is editor-in-chief of *Nature*.

Mathematical musings

Euclid in the Rainforest: Discovering Universal Truth in Logic and Math

by Joseph Mazur

Pi Press: 2005. 352 pp. \$14.95, £10.99

Timothy Gowers

Euclid in the Rainforest by mathematician Joseph Mazur is difficult to summarize, as its title perhaps suggests, but here is an attempt. Mazur's central theme is reasoning, both mathematical and scientific, and he divides it into three kinds. First he discusses simple syllogistic reasoning of the kind made systematic by Aristotle, of which the most famous example is the following deduction: all men are mortal; Socrates is a man; therefore, Socrates is mortal.

Next, he shows that this sort of logic is not powerful enough to deal with an essential part of mathematics: the infinite. For thousands of years, mathematicians had to rely on intuition and common sense when, for instance, they

were discussing calculus or sums of infinite series. It was not until the late nineteenth and early twentieth century that formal systems were developed that provided the necessary rigorous underpinning.

The standards of proof in science are very different from those in mathematics, and in the third part of the book Mazur discusses less formal reasoning: what it is that makes certain statements highly plausible, even when it is inappropriate to look for formal proofs. For example, why is it rational to believe that a political party that is well ahead in the opinion polls just before an election will probably win it? Or why am I confident that when I go upstairs I will not fall through the floor?

What this summary of the book fails to convey is any sense of how Mazur writes about these ideas. He does not just dive in and try to explain them as clearly as possible. Rather, he tells stories, many of them about his own life,

which seems to have been very interesting — from time to time one wonders whether he has partly fictionalized it. He then lets his preoccupations emerge, much as a novelist might.

If you are interested in different forms of reasoning and are looking for a systematic treatment, this book is not the place to find it. For instance, Bayesian analysis has a lot to say about plausible reasoning, but Thomas Bayes is mentioned only once, very briefly, in the introduction. Instead, this book is more like a fascinating conversation that stays within certain bounds but nevertheless often moves in unexpected directions.

For example, Mazur discusses, and clearly cares deeply about, a technique called ‘facilitative communication’, which allegedly allows severely autistic children to communicate with the help of a trained intermediary. Sceptics, of whom Mazur is one, ask why we should believe that messages that result from the technique come from the child, rather than the intermediary — a question of some importance, because evidence based solely on facilitative communication has been used to send parents to jail for sexual abuse. The reader is not offered a general method for deciding whether or not a statement is plausible, but the examples that bubble up from the narrative are thought-provoking in many ways.

These qualities make *Euclid in the Rainforest* an unusual book. It even contains, briefly and tastefully, a sex scene, which is probably a first for a popular mathematics book. There are also a few spelling mistakes (for instance, the playwright David Auburn, the philosopher Carl Hempel and Blecker Street are all misspelled), but these contribute to the conversational feel of the book — as if it's the sound that really matters — and add to its charm. Rather than trying to extract general conclusions from the book, the best approach is simply to relax and enjoy the company of its author. ■

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Up close and colourful

Coral reefs are fascinating places. Marine biologists are still seeking to understand the complexity of life within these ecosystems, which also provide a valuable physical barrier, protecting coasts from storm surges. Many divers will have found impressive coral formations and wondered at the colourful fish and crustaceans that inhabit these rich habitats. But few will have ever noticed the subtle variations in colour shown in this photograph of an anemone coral, as the coral polyps emerged at night. In *Another World* (ACC Books, £29.50), photographer Dos Winkel has brought an artist's eye to capture the diversity of colours and textures found on coral reefs.

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