

John Allen Paulos, *Innumeracy*, Hill and Wang, New York (1988).

This pleasantly slim and breezy volume has only 135 pages and five chapters:

1. *Examples and Principles*. The lore of very large (or small) numbers; scientific notation; multiplicative counting, with examples; the Chevalier de Méré (not Mère!) identified as one Antoine Gombaud; safe sex and Caesar's sigh both linked to $(1 - 1/n)^m$.
2. *Probability and Coincidence*. The surprising likelihood of coincidence (e.g. birthdays); hand-shake chains to celebrity; expected value; Myrtle's heart-throbs; the black and white couple in the yellow car; streaks of luck.
3. *Pseudoscience*. Parapsychology, predictive dreams, astrology, alien visitors, quack medicine, numerology — they all get hammered. Also included: conditional probability and the prevalence of false positives in medical tests.
4. *Whence Innumeracy?* The failure of schools both elementary and higher; subjectivity: ego-centrism, filtering, framing; math anxiety; misconceptions about math and its practitioners.
5. *Statistics, Trade-Offs, and Society*. Condorcet's voting paradox and other intransitivities; illusory self-interest; Type I and II errors; polls and confidence intervals; correlation; statistics misapplied.

Innumeracy = ignorance of statistics? This is clearly a very one-sided view of mathematics, and should perhaps have explicitly been presented as such.

However, it is brisk, witty, and intelligible — especially for one who (like me) has taught “finite mathematics” many times. The rave reviews on the book-jacket all come from fellow missionaries like Asimov, Hofstadter, Tobias. I wonder how a true pagan would react to it. If I had to rewrite it, I would heed the following caveats: not to embed sizable computations in the text, but keep examples neatly packaged in separate anecdotes; not to pull rabbits out of the hat (cf. “pi” or “expected value”), but take the time to explain things; not to rush and not to cram, but try to say more with less.

In this summary review, I am most interested in Chapter 4 on the causes of innumeracy. First, the inadequacies of school: rote instead of riddles — which “aren't discussed ... because it's too easy for bright ten-year-olds to best their teachers.” The useless jargon (e.g., “associative operation”), the wasteland of the textbooks with their “unimaginative lists of routine exercises.” Some of the blame lies “with teachers who aren't sufficiently capable”, and some of that, in turn, “with schools of education ... which place little or no emphasis on mathematics.”

“A partial solution might be the hiring of one or two mathematics specialists per elementary school ...” It might even be helpful “if math professors and elementary school teachers switched places for a few weeks ...” In high school, “the problem of teacher competence becomes more critical ... Since at this level a long list of education courses is not as essential ... certifying retired engineers to teach mathematics might be of considerable help.”

“After they get to college, it's often too late for them who lack adequate backgrounds ... I've seen too many bright women go into sociology and too many men go into business, the only difference being that the men managed to scrape through a couple of college math courses.”

Finally there are math anxiety and “romantic”(?) misconceptions: math is a “spiritless affair ... a subject for technicians ... which diminishes one's feelings for nature and the ‘big’ questions”. Paulos doesn't deal quite squarely with this dangerous intellectual virus. He does note that it “makes as much sense as believing that a technical knowledge of molecular biology” dulls one's appreciation for the mysteries of life. I think it actually could have such an effect — but then so could the study of renaissance literature, not to mention psychology.