Klaus Hoechsmann, February 1996

Fear and Loathing in Mathematics.

Here are my two thoughts of the week — partly stimulated by the reading of Paulos's *Innumeracy*, an idiosyncratic but pleasant book.

Fear. Sometime soon I'll visit an elementary school to conduct a "work-shop" for bright youngsters in grades 5 to 7. If this were to be (say) a history workshop, I would do some last minute skimming of assorted books by way of preparation. Though I am not a historian, I am pretty sure I could engage them in a fascinating discussion of some sequence of events that I happen to have read up on. If one of them asks about Diocletian, I'll invite him to tell us what *he* knows, then ask for comments from the group, make my own suggestions — and gently bring them back to Constantine.

Mathematics is different. As Paulos says (p.74): "Puzzles, games, and riddles aren't discussed ... because it's too easy for bright ten-year-olds to best their teachers". Having seen many problems and stood in front of many classes, I think I'll be alright. But there remains a slight possibility that I'll make a complete fool of myself, thus discredit the University, and — worst of all — further undermine the already shaky image of my profession. So I am facing my school visit not without a faint tingling of fear.

Loathing. When, in my reading outside mathematics, I come across a page disfigured by formulas, equations, tables, or graphs, a kind of revulsion makes me I feel like skipping to a more hospitable one. For I know what awaits me here: slowing way down, scanning the passage forward and backward, labouring to decode it, to reconstitute its (often complex) meaning, to get at what linguists would call its "deep structure". It's like turning off a highway onto the proverbial mud road.

"L'homme est programmé pour parler, pour apprendre les langues, quelles qu'elles soient, mais non pour apprendre la physique ou les mathématiques" says Marina Yaguello in *Alice au pays du langage* — a book about linguistics, not mathematics. She could have chosen another example (could she?), but she picked the one that everyone agrees on. Our innate ability to deserialize even the most intricate meanings of "natural" utterances seems to fail us when it comes to mathematics. Why?

Mathematics creates and studies a filigrane universe of mental objects. Its referents aren't just out there: they have to be redrawn every time — with tools that do not obey straightforward volition but often move in spasms. Apparently the word "theorem" originally meant "something to behold". Indeed, theorems are a bit like those three dimensional images that pop into view only after a subtle kind of exertion (and for some not at all). Being wrestled to the ground by logic is not enough for me to "see" a theorem.

Here we are not talking about research (the hunt for Moby Dick), but about the mere attempt to understand existing theorems. Even that requires an effort from which my instincts often recoil. Since much of that energy goes into "refreshing the screen", regular *practice* is very helpful, and so is a familiar *context*: any scenery left lying around in the mind will make the next rebuilding of the stage less onerous (the joy of specialization).

"They have no mathematical frame of reference", says Paulos (p.88) of the innumerate, "and no basic understandings on which to build." Hence their greater fear and loathing ... To mend this state of affairs, those puzzles, games, and riddles may need to be embedded — and at times submerged — in a strong story line.