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INNUMERACY -- Mathematical Illiteracy and its Consequences by John Allen Paulos.
Penguin Books (1990). Price 4.99 Pounds.□

The Times of India

Whenever a crow would come and perch itself on the tree next to our house, my grandmother would immediately proclaim that some guests would be arriving soon. Countless cups of tea were consumed by astrologers of all varieties who would visit our house and ponder over horoscopes, working out the combinations of auspicious and inauspicious planets. Several visits to famous miracle healers were undertaken with ailing relatives who had tried all other treatments.

These kind of beliefs in astrology, miracle healers and other related phenomenon are a part of what the mathematician John A. Paulos calls innumeracy in his new book of the same name. Innumeracy is, much like illiteracy, 'an inability to deal comfortably with the fundamental notions of numbers and chance'. Paulos explores this very widespread disability with a sympathetic yet critical look.

Ask an innumerate person the difference between a trillion and a billion and the chances are you will get a shrug as an answer. This inability to have a sense of very large and very small numbers is very common, not only in our society but even in advanced high technology societies. The solution to this, according to Paulos, is estimation. To get a handle on very large and very small quantities, we must compare them to other meaningful numbers. For instance, to get an idea of the difference between a million and a billion, it is useful to know that though it takes only about 11 days for a million seconds to tick, it takes almost thirty two years for a billion seconds to pass. Paulos recommends that we should always try and estimate quantities which seem interesting like the number of people who need to stand head on to reach the top of a high building, or the number of sand grains needed to fill a room etc. This way we can build our private lists of numbers which allow us to compare meaningfully. After all, how much sense does our foreign debt of \$ 70 billion have for most people? Express this as \$85 owed to the world by "each" man, woman and child in our country and it registers.

Another phenomenon which Paulos discusses is filtering. According to Paulos, we tend to filter out the bad and the unsuccessful and focus on the good and the successful. This is why most people believe in superstitions, coincidences or even astrology. With a number of interesting and humorous anecdotes, Paulos illustrates the ubiquitous nature of this phenomenon. He is very harsh on the so called 'scientific' basis of astrology. If the gravitational attraction of the distant planets at the time of birth have an influence on a person's destiny, then surely any high school student can tell you that the gravitational force due to a fat obstetrician will have a far greater influence. How come then no body talks about this? The reason is 'our innate desire for meaning and pattern' which can easily 'lead us astray if we don't remind ourselves of the ubiquity of coincidence, an ubiquity which is a consequence of our tendency to filter out the banal and impersonal, of our increasingly convoluted world'.

Medical quackery, ESP, UFOlogy are some of the other targets of Paulos. Once again using elementary ideas from probability and statistics with the help of many incidents, he demolishes the claims of these 'pseudoscientists'. The common perception that it is only

the illiterate and uneducated believe in these things is obviously false as Paulos illustrates with Freud's example who became an ardent believer in numerology. Clearly, there is little correlation between literacy and numeracy.

This book is not only an engaging collection of anecdotes. The author does some analysis of the problem and suggests some remedies. The reason why most people are unable to deal with numbers is traced to a deficient system of education, the impersonal nature of mathematics, a general feeling of 'math anxiety' and a 'romantic misconception' about the nature of mathematics. The mathematician in Paulos suggests several remedies to cure this widespread disease. This very interesting analysis of the sociology of maths may not be directly relevant to our society but it should still be interesting to anyone who is concerned about the state of our education. This is because increasingly our students are losing touch with the world of numbers. For a large number of them, like their counterparts in more advanced nations, calculators have replaced the old fashioned methods of calculation. The feel for numbers is being lost to the calculator display which somehow has acquired an invincible aura. Whatever the LCD tells you, no matter how counter intuitive it is, must be correct; after all, it is a machine. This technology fix, is to say the least, extremely harmful for numeracy.

From stock markets to drug testing to gambling to exit polls, this book has numerous anecdotes about the nature of innumeracy. The central message is clear; if we don't do anything about it , we will have a population which will be helplessly lost in the highly number oriented, computerized world of tomorrow. A population which will be easily manipulated by everyone, from politicians to advertising whiz kids.