

From the shelves of the National Library ...

*The Number Sense:
How the Mind Creates Mathematics*

• by **Stanislas Dehaene, Penguin, 1997, xi + 274 pp.**

*The Universal History of Numbers:
From Prehistory to the Invention of the Computer*

• by **Georges Ifrah, Wiley, 2000, xxii + 633 pp.**

Both books are translated from the original French versions, the first being done by the author (Dehaene) himself while the latter by David Bellos, E.F. Harding, Sophie Wood and Ian Monk. Both would appeal to those who are interested in the origin of numbers as a concept and as symbols.

One takes you into the realm of developmental psychology and neuropsychology and offers an evolution-by-selection view of the current state of mathematics. Dehaene was a mathematician by training and has conducted research in cognitive psychology and neuroscience in efforts to unravel the physiological transformations that occur when the human brain processes language and numbers. You will learn something about the school of constructivism in

developmental psychology through the pioneering work of the Swiss psychologist Jean Piaget (1896 - 1980) which sought to explain how children conceptualizes numbers in terms of "sensorimotor" interactions with the external world (through the senses involved in seeing, touching, hearing and physical movement). This explanation is, however, no longer accepted, and the book amasses evidence from anthropological, cultural, psychological and physiological sources to show that the human brain (in fact, the brain of many birds and animals) possesses an innate non-digital conception of numbers.

There are some very interesting experimental observations on the effects of different languages on the memory and computing skills of school children. Apparently Asian languages like Chinese

have an advantage over western languages. Questions about the biological basis of mathematical talent and the cerebral localization of mathematical thinking are discussed with reference to experimental data. (Some rare cases of "arithmetic epilepsy" or seizures induced by computing activity are known to have a neurological basis.) Dehaene thinks that current methods of teaching mathematics to children run counter to the natural way in which the brain processes numbers. From the fundamental question of "What is a number?", he goes on to the wider issues of what makes mathematics what it is today as a body of knowledge and as a powerful intellectual tool. He proposes an evolutionary point of view in the continuing debate on whether mathematical entities exist in a separate realm or whether they are inventions of the human mind.

Because of the abundance and diversity of scholarly and scientific facts on psychology and biology, Dehaene is not easy reading. Indeed, on a first reading, you may wish to skim over some of the more technical details and retain only the trend of thought and argument. Even with the need to be scientifically accurate, the author's style is seldom dry but is instead engaging and thought provoking. A little concentration, however, will reward you with some fascinating insights in an area of on-going research on the connections between biology, psychology and mental activity. Far from being a technical exposition, the book contains numerous amazing and captivating stories and anecdotes about calculating animals, human speed calculators and mathematical prodigies. Any one interested in mathematics or the psychology of mathematical thinking should read Dehaene at least once.

The book by Ifrah is an updated and expanded version of his earlier book (originally published in French in two volumes) which was translated into English and published in 1985 as "From one to zero: a universal history of numbers". The author is a former teacher whose interest and curiosity in the origin and history of numbers was fired one morning in his mathematics classroom by some simple questions posed by his students and the naïve remarks they generated. The interaction on that fateful morning must have haunted him subsequently for it started him on a personal quest to unravel the mystery of one of the

greatest inventions of the human intellect: numerals.

The result is a labour of love that produced an encyclopedic compendium of information on the incredibly diverse range of numeric symbols and number systems that have ever been invented by the human race and subsequently unearthed and deciphered by archeologists. In addition to the almost universal Hindu-Arabic notation now in use, different cultures around the world still express numbers in their own languages in their own unique ways, often retaining remnants of a defunct mode of counting. You will learn that fingers (and toes too) are not the only parts of the body that are used for counting. Different parts of the body have been used to represent specific numbers, a practice still in use today in New Guinea. The need to record the results of counting, originally made imperative by commercial transactions and official stock taking, was first met by notches on tally sticks or marks on clay tablets. Yet there were some ancient cultures like the Incas which did its numerical accounting without any written symbol and which used a sophisticated system of knots tied along strands of coloured strings.

There were only four civilizations of antiquity (the Babylonian, Mayan, Indian and Chinese civilizations) which introduced a convention of positional value in representing numbers and which made it necessary, if only implicitly, to introduce a symbol, if not notion, for the number "zero".

Ifrah believes that the abstraction of this fundamental entity as a number is essentially an Indian contribution.

Flipping through the pages of this book is like taking a peek into a forgotten past or being transported into different civilizations. You will come face to face with alien and exotic signs and symbols of cultures now extinct and of different languages from all over the world. It will never fail to amaze you of the ingenuity and imagination of the human mind in taking the leap from the concrete world of numeral symbols to the abstract realm of numbers.

Both of these books will raise more questions about the psychological, physiological and cultural origins of mathematics. Your personal quest for their answers may have just begun.

Reviewed by
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