Sudoku-Yantra

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Sudoku is a number puzzle where a grid of 9 x 9 cells is filled with numbers 1 to 9 in such a way that the numbers do no repeat in any row, or column, or a sub-grid of 3 x 3 columns. Introduced for the first time by *The Times* of London on 12 November 2004, this number puzzle attained a phenomenal popularity since then.[1] Today there is hardly any newspaper or magazine that does not offer these puzzles for the readers to solve. Although the use of this kind of arrangement of numbers for recreational purposes is quite recent, it appears that this arrangement was used much earlier in traditional India in the ritual or sacral context.

Among the papers of my grandfather Sreeramula Rajalinga Sastri, there is a large sheet of paper[2] on which a *Mahâûîtalâ-pûjâ-yantra* is drawn. Superficially, this diagram (*yantra*) resembles the well-known *Úrî-yantra* or *Úrî-caktra.*[3] But in the present *Úîtalâ-yantra,* there are only two interlinking triangles at the centre, which are surrounded by five annuli. As in the *Úrî-yantra,* here also the whole drawing is enclosed in a square frame. The first, second and third annuli are filled with 8, 12, 16 lotus petals respectively, and the spaces within the petals and those between the petals are filled with mystic syllables (*bîja-akṣaras*). The fourth annulus is filled entirely with such syllables. The fifth, and the outermost, annulus contains a long invocation in Sanskrit, requesting the goddess to be benevolent towards my grandfather and his family, to destroy the malefic spirits, to prevent diseases and to confer long life and good health. While the diagram is drawn with a graphite pencil, the letters are written in ink. The diagram is done in a free hand without using a ruler for the straight lines or a pair of compasses for the circles. (See Fig. 1). No date is mentioned on the sheet, but it must have been prepared towards the end of the nineteenth century or the beginning of the twentieth.

In the upper right hand corner of the sheet, there is a grid of 9 x 9 cells which are filled with the numbers 1 to 9 exactly in the same manner as in a

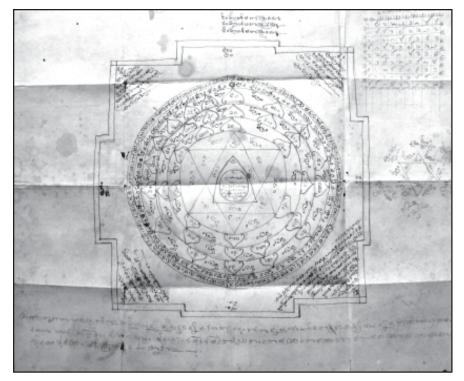* Höehenstrasse 28, 40227 Düsseldorf, Germany. e-mail: SR@Sarma.de.

Fig. 1. *Mahâûîtalâ-pûjâ-yantra*

Sudoku, that is to say, the numbers are not repeated in any column or row, and also not in any sub-grid of 3 x 3 cells. (See Fig. 2). The terminals of the horizontal and vertical lines forming the grid are decorated with trident-like signs. At the top of the grid is written *vijaya* (victory) thrice. A copying pencil was used here to draw the grid and to write the numbers. The Telugu numerals with which the grid was filled are rather different from the standard ones. It looks as if the grid was added later on. It is certain that my grandfather, who was interested in *Mantra-śâstra*, caused this addition to be made because he thought that this arrangement of numbers had some connection with the *Úîtalâ-yantra.*

Recently R. C. Gupta published a very comprehensive study where he discussed the mathematical basis of a large number of *yantras.* The only diagram there which somewhat resembles the 9 x 9 grid on my grandfather's *Úîtalâ-yantra* is the *Namokara-yantra* with 5 x 5 cells filled with the numbers 1 to 5 in such a way that no number repeats itself in any row or column. [4] A similar grid of 5 x 5 cells where the cells are filled with the five syllables *na-maḥ-úi-vâ-ya* is reproduced by Fredrick W. Bunce. [5] These two are simple varieties of the so-
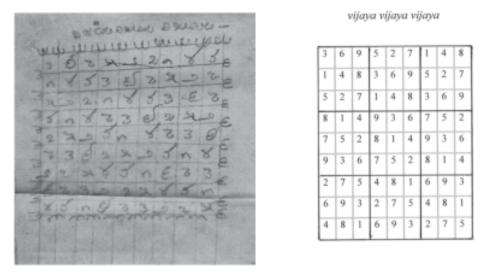
vijaya vijaya vijaya

3	6	9	5	2	7	1	4	8
1	4	8	3	6	9	5	2	7
5	2	7	1	4	8	3	6	9
8	1	4	9	3	6	7	5	2
7	5	2	8	1	4	9	3	6
9	3	6	7	5	2	8	1	4
2	7	5	4	8	1	6	9	3
6	9	3	2	7	5	4	8	1
4	8	1	6	9	3	2	7	5

Fig. 2. "*Sudoku-yantra*" (left) and my transcription (right)

called Latin Squares, where a square of *n* x *n* cells is filled with the numbers from 1 to *n* so that no number repeats itself in any row, column or diagonal.

But the 9 x 9 grid in my grandfather's *Úîtalâ-yantra* has an additional property, viz., that no number is repeated in any of the sub-grids of 3 x 3 cells. Therefore it is mathematically more interesting and, as mentioned, it has exactly the same arrangement as in the *Sudoku* puzzle. Occurring as it does in my grandfather's papers, this *yantra* must be part of an old tradition. I do not know if it had any special name; I shall call it tentatively "*Sudoku-yantra*".

It is not surprising that there is a sacred dimension to this specific arrangement of the nine digits. In the highly numerate society of India, the interest and pleasure in the arrangement of numbers developed, on the one hand, into the mathematics of permutation and combination and, on the other hand, is reflected in diverse ways in other aspects of life, including the religious, be it Hindu, Buddhist or Jain. That is why some Vedic invocations are accompanied by a series of decuple numbers from *eka* (10^0) to *parârdha* (10^{12}); in the Buddhist legend in the *Lalitavistâra,* Siddhârtha Gautama had to prove his prowess, among others, in still higher powers of ten which go beyond the fiftieth decimal place in order to win the hand of princess Gopâ; in the Jain cosmology, the universe is defined quantitatively by means of yet higher orders of numbers. That is also why prescriptions given in the *Śulva-sûtras* for the construction of sacrificial fire altars involved advanced geometrical constructions, including what is now

commonly known as the Pythagoras theorem, or at a later period the twenty-four iconic forms of Viṣṇu (*caturviṃúati-mûrtis*) is developed purely on the basis of the mathematical permutations by interchanging the four emblems of Viṣṇu in his four hands.[6]

Likewise diagrams with specific geometric shapes such as the *Úrî-yantra,* or diagrams with certain arrangements of syllables or numbers, played an important role in the realm of *Tantra.* Contemplation on these diagrams (*yantra*) accompanied by the utterance of certain mystic phrases (*mantra*) is supposed to confer material and other-worldly benefits.

For historians of mathematics, on the other hand, these *yantras* provide important clues for the development of mathematics. Therefore, it is necessary to locate the textual sources for this *Sudoku-yantra* in the *Tantra-úâstra.* It is published here with the hope that some scholar might be able to explain its ritual background.

Notes and References

1.   For the history and popularity of the puzzle, see http://en.wikipedia.org/wiki/Sudoku. In India, *The Hindu* was perhaps the first newspaper to introduce Sudoku puzzles, in early 2005.

2.   It measures 42 x 34.4 cm. The paper is apparently British made; it carries a water mark showing Britannia in an oval frame and the words "Fine Foolscape".

3.   In recent years, many studies have appeared on the geometry of the *Úrî-yantra*, five of them in the *Indian Journal of History of Science*: Alexey Pavlovich Kulaichev, "Sriyantra and its Mathematical Properties,"19.3 (1984) 279-92; Alexey Pavlovich Kulaichev & Dina Mikhailovna Remendie, "Sriyantra: The Ancient Instrument to Control the Psychophysiological State of Man," 24.3 (1989) 137-49; C. S. Rao, "Sriyantra: a Study of Spherical and Plane Forms," 33.3 (1998) 203-27; D. N. Ukidwe, "Sriyantra and Traditional Techniques of its Construction," 41.3 (2006) 327-334; idem, "Srstikrama Construction of Sri-yantra," 43.1 (2008) 92-100.

4.   R. C. Gupta, "Yantras or Mystic Diagrams: A Wide Area for Study in Ancient and Medieval Indian Mathematics," *Indian Journal of History of Mathematics,* 42 (2007) 163-204, esp. p. 167. Gupta's source for this is Jinendra Varni, *Jainendra Siddhânta Koúa,* Part III, Delhi 1997, p. 353. *Namokâra-mantra* is the fundamental *mantra* in Jainism, in which five-fold homage is paid to the *arihantas, siddhas, âcâryas, upâdhyâyas* and *sâdhus.*

5.   Fredrick W. Bunce, *The Yantra of Deities and their Numerological Foundations: an iconographic consideration,* New Delhi 2001, p. 153; his source is Swami Jyotir Maya Nanda, *Mantra, Kirtana, Yantra and Tantra*, Bombay 1975.

6.   Cf. Sreeramula Rajeswara Sarma, "Mathematics and Iconography in Lîlâvatî 263," *Journal of the Asiatic Society of Mumbai,* 80 (2005-2006) 115-126.