Celebrating Puzzles, in 18,446,744,073,709,551,616 Moves (or So)

By MARGARET WERTHEIM
Published: July 25, 2006

Christianity sanctifies Sunday as a day of rest and worship. In the early 19th century, some Protestant communities interpreted the Sabbath sobriety as an injunction against dancing, games and other entertainments. But in Massachusetts a loophole was found.

Nowhere in the Bible could the church leaders of Salem find a prohibition against puzzles, and in the absence of a "no," they filled the gap with a resounding "yes."

At the time, Salem was a center of brisk trade with China, and ship captains would often deliver a wooden chest filled with ivory puzzles as a gift for merchants, what came to be known as "Sunday boxes." A particularly fine example of a Sunday box is one of the centerpieces of a major new exhibition of mechanical puzzles to open next week at the Lilly Library at Indiana University.

The exhibition, which contains many world-class specimens of mathematical and physics-based puzzles, is the first taste of a collection of more than 30,000 puzzles being donated to the library by Jerry Slocum, a retired engineer and a former vice president of Hughes Aircraft, who has been collecting puzzles and researching their history for more than half a century.

Mr. Slocum is the author of 10 books on the history of puzzles, including a recently published account of the sudoku-like 15 Puzzle, which precipitated a puzzle mania across America in the 1880's.

Sitting in his private puzzle museum at his home in Beverly Hills, Calif., Mr. Slocum spoke about the exhibition and the convoluted, puzzlelike stories behind some of the pieces. Around him on shelves stacked from floor to ceiling sat thousands of puzzles of almost every conceivable shape and form: wooden, metal, wire, porcelain, plastic, glass and cardboard. There were Russian puzzle rattles, ancient Chinese puzzle mirrors and a rare example of an American Indian puzzle purse used to carry a version of gaming chips.

Of all the puzzles in the Sunday boxes, Mr. Slocum said, one of the most challenging was a deceptively simple-looking toy called Chinese rings. Its solution requires what
mathematicians call a recursive sequence of moves.

The Chinese rings example in the library exhibition is particularly finely made. A set of rings are threaded over a long, thin loop with wires attached to each ring, tethering it below. Each ring can be taken off the loop or put back on only if the one next to it is on but the others farther down the chain are off. The goal is to get all the rings off.

According to legend, the puzzle was invented in the second century by a Chinese general who gave it to his wife to keep her busy while he was away at war. Logically, Mr. Slocum said, the puzzle is closely related to the Towers of Hanoi problem, which requires one to move a tower of increasingly smaller blocks from one peg to another.

In recursive puzzles like these, as the number of rings (or blocks) increases, the number of moves required to solve the puzzle increases exponentially. Recursive problems are well known to computer scientists, but it is harder for most of us to get a grip on this elusive concept.

Chinese rings make the problem tangible, Mr. Slocum noted, and reveal in a hands-on fashion the exponential growth entailed. There are typically nine rings in a classic set of Chinese rings; if a player makes no mistakes, the puzzle requires 341 moves to solve. Mr. Slocum can solve it in three to four minutes.

But on a table next to the Sunday box sat a version with 65 rings. A perfect solution in that case would take 18,446,744,073,709,551,616 moves, Mr. Slocum said. “Assuming one move every second, that would be 56 billion years, or four times the age of the universe,” he said.

This enigmatic object called to mind the White Queen’s advice to Alice about how the more one practices, the better one gets at believing in impossible things. Though solvable in principle, in practice this puzzle can never be completed. Mr. Slocum’s collection is a mind-boggling compendium of seemingly impossible, wildly improbable and sometimes breathtakingly difficult puzzles.

Breon Mitchell, director of the Lilly Library, said in an interview that the library was attracted to the collection “because we believe puzzles are important in the history of thought, in the history of mathematics and philosophy, and also the history of science.”

Scott Kim, who writes a puzzle column for Discover magazine, said this was the first time a major collection of puzzles would be available in an academic setting.

“Puzzles have always interested scientists and engineers,” Mr. Kim said. “Many popular things, such as comic books, eventually become subjects for scholarly and academic study. Puzzles are on that cusp right now.”

Among the star pieces in the Lilly Library show is an original Rubik’s Cube signed by the Hungarian mathematician Erno Rubik, and a prototype of the first Rubik’s Cube with six rows of six blocks on each side. That is an object long believed impossible to make, Mr. Slocum said. Finally, last year, the Greek inventor Panayotis Verdes managed to build one.

The Rubik’s Cube is an example of a sequential movement puzzle, one of 10 basic categories in what Mr. Slocum called his “puzzle taxonomy.” Other categories include disentanglement puzzles (Chinese rings), interlocking solid puzzles (three-dimensional jigsaws) and take-apart puzzles, which include among their subcategories trick locks, trick knives and secret-compartment puzzles.

A beautiful example of the compartment puzzle is another standout of the Lilly Library show. Made by the Japanese puzzle master Akio Kamei, it appears to be a simple, albeit finely crafted wooden cube. But on the top is a hint of how to gain access to its secret compartment. Inlaid in the dark wood is a series of tiny circles of paler wood. The pattern
matches the arrangement of stars in the constellation Cassiopeia, and the box will open only when the constellation is correctly aligned. A mechanism inside the box includes a compass that triggers a hidden lock.

Mr. Kamei has made a specialty of such science-based puzzles, and the library exhibition includes several striking examples.

Perhaps the most famous class of physics-based puzzles is one of the most ancient: puzzle vessels. Usually built in the form of a cup or a jug, these vessels offer the challenge that one must drink from them, or fill them up, without spilling any liquid. They have strategically placed holes, so it is immediately clear that a trick is entailed. Early precursors to the form date to at least the 10th century B.C., and Mr. Slocum’s collection includes examples from China, Peru, Germany, France and the Middle East.

Not all puzzles are complex. Mr. Slocum said that many of his favorites were the simplest, and that just because a puzzle was simple to look at did not mean it was easy to solve. He particularly likes one that consists of just two three-dimensional pieces that have to be arranged to form a tetrahedron. Another consists of four flat pieces that have to be arranged in the shape of the letter T.

“Both require geometrical reasoning that is counterintuitive,” he said. “Good puzzles always go against the grain of our thinking.”

Visitors to the Lilly Library will be able to play with a range of puzzles and view animations of various geometric puzzles. This involvement is a critical feature of the exhibition, said Dr. Mitchell, the library director.

“Generally,” he said, “you can only study puzzles from books, but when you have three-dimensional puzzles, it’s hard to get a sense of them from books alone.”

In keeping with the spirit of the show, the drawers and cupboards that hold the puzzles will themselves be puzzles.

“The first person who tries to open one each day will have to solve it,” Mr. Slocum said, his eyebrows arching slyly. “With puzzles, there is really no substitute for trying them out yourself.”

Need to know more? 50% off home delivery of The Times.