A Better Way to Shuffle Cards

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Oct. 6, 2000 — Dealers for poker, bridge and other card games may get to play more and shuffle less, thanks to a new study that reveals fewer shuffles are needed to scramble a deck of cards than previously thought.

Ten years ago, researchers determined that decks had to be shuffled seven times to thoroughly mix the cards up. The new study suggests only five or six shuffles are required.

Lloyd N. Trefethen, professor of numerical analysis at Oxford University, and his father, Lloyd M. Trefethen, professor emeritus of mechanical engineering at Tufts University, analyzed decks of cards as though they were computer chips consisting of bits of information.

According to their report in the Oct. 8 issue of the *Proceedings of the Royal Society*, an unshuffled deck contains 225.58 bits of information.

Information, in this case, refers to the order of the cards and what that order might convey to someone. Card counters, for example, could easily identify cards without turning them over in a new, unshuffled deck. The information in such a fully ordered deck dilutes with every shuffle.

The two Trefethens used a computer program to "riffle shuffle" the cards, which involves dividing a pack in two and then bending each half up with the thumbs so that the cards fold into each other.

"The riffle shuffle is roughly what most shufflers do," explained L.N. Trefethen.

One riffle shuffle leaves 173.58 bits of information in the deck. The second brings that figure down even more, to 121.58 bits.

After seven shuffles, only .5239 bits of information are left, but five or six shuffles are sufficient to randomize the deck, according to the researchers.

"After six shuffles, the deck has lost 99 percent of its information," explained L.N. Trefethen.

Alan Feldman, vice president of Public Affairs at the MGM Mirage hotel in Las Vegas, said that he and his staff have also studied card shuffling over the years and have devised another system.

He explained that in a six-deck box full of cards, the entire pack is divided. The dealer takes one-fourth of each stack, shuffles the cards, cuts the stack and straightens out the cards. The process is repeated several times, creating a new randomized stack, with the customer performing the final cut.

"So in some respects, we're already practitioners of a simplified shuffle process," said Feldman.

While the new shuffling discovery may not affect casinos, L.N. Trefethen said the randomization process he and his father describe could apply to research on magnetics, superconductors and cryptography — secret code studies — in the future