Predicting a die throw

September 12 2012

Vegas, Monte Carlo, and Atlantic City draw people from around the world who are willing to throw the dice and take their chances. Researchers from the Technical University of Lodz, Poland, have spotted something predictable in the seemingly random throw of the dice. By applying chaos theory and some high school level mechanics, they determined that by knowing the initial conditions – such as the viscosity of the air, the acceleration of gravity, and the friction of the table – it should be possible to predict the outcome when rolling the dice.

The researchers created a three-dimensional model of the die throw and compared the theoretical results to experimental observations. By using a high speed camera to track the die's movement as it is thrown and bounces, they found the probability of the die landing on the face that is the lowest one at the beginning is larger than the probability of landing on any other face. This suggests that the toss of a symmetrical die is not a perfectly random action.

"Theoretically the die throw is predictable, but the accuracy required for determining the initial position is so high that practically it approximates a random process," said Marcin Kapitaniak, a Ph.D. student at the University of Aberdeen, Scotland. "Only a good magician can throw the die in the way to obtain the desired result."

These results suggest that randomness in mechanical systems is connected with discontinuity as the die bounces. "When the die bounces on the table, it is more difficult to predict the result than in the case of a die landing on the soft surface," Kapitaniak said.

More information: "The three-dimensional dynamics of the die throw" is accepted for publication in *Chaos*.

Provided by American Institute of Physics