Shapes in Action Course

Is there any order into Chaos?

During the last two lectures we enquired which type of statistical properties of *chaotic systems* (as the Lorenz system of equations) could be predicted and, moreover, how to visualize them. Of course, this is a wide subject and, in this brief note, I just want to point out we have just touched the *tip of the iceberg*.

A good illustration that we could believe the title's question answer may be "*yes!*" is given by the Galton Board. However, this is just a starting point for mathematicians, physicists, computer scientists and artists to understand (and hopefully) visualize some "*order inside chaos"*.

Briefly speaking, the reason why we obtain a Gaussian distribution (the Bell curve) in the Galton Board experiment is due to the fact that the events of the bouncing of each single ball in a row in the (Galton) grid are - at least in theory - *independent* of each other. Therefore, we can think about the bouncing in the ball in row in the Galton Board grid as "*flipping a single coin"*. In other words, events as "flipping two coins" or "falling two balls in the galton board" are also *uncorrelated*. We must keep in mind this is a very specific example.

So, what happens if we study a *correlated* system? Non-trivial distributions and patterns may appear. What distribution we could obtain if, for example, we force collision of every two balls before getting into the Galton grid? Or if we force randomly many collisions? Would we obtain a similar distribution shape like the *uncorrelated* Galton Board?

In my opinion, understanding patterns and the behavior of correlated systems are the most interesting phenomena to be investigated by both scientists and artists.