

What to do!

Spin the brass knob. The motion of the pendulums continually changes and it's impossible to predict from one minute to the next. That's chaos!

What is going on?

It's easy to predict the motion of a single ordinary pendulum. But each of these pendulums influences the motion of the others, so their combined motion is very complex. If you could start the pendulums the same way every time, the motion would look the same every time. But the tiniest difference in the motion, due to slightly different starting conditions or a small bump on the enclosure, grows exponentially in time until the motion of the pendulums is completely different from what it would be without that difference. The extreme sensitivity of future behavior to small differences at earlier times is a characteristic of chaotic systems.

Chaotic Pendulum

So What?

This extreme sensitivity also affects predictions. Even if the model is perfect in every detail, the future behavior of a chaotic system is unpredictable because the starting conditions for the model can never be 100% accurate.

For example, the chaotic nature of weather makes accurate long-term forecasts impossible. To predict the future weather, the current conditions are used as input. Any small difference between the true conditions and those used as input will lead to huge errors in the forecasts later on.

Many other natural systems—from a dripping faucet to a column of smoke—also behave chaotically.