Chaos Theory Essay, Research Paper

Chaos Theory

When Edward Lorenz decided to run his meteorology test from a halfway point in order to save time he had no idea that he would stumble on one of the largest theories of our time. In 1961 he took the data from a computer printout and entered it into the system. The information he was using was the data sheets from a previous test he had run. Now wanting to shorten the time and reach what he wanted to study sooner he put the data from halfway through the test into the computer and went to go get a cup of coffee. When he returned the test was running at completely different levels. After looking into what could have caused this he discovered that the data he put in was not fully accurate. The computer reads data to the sixth decimal place. However, in order to save paper and space Lorenz had only printed out to the third decimal place. Lorenz had entered .506 and the system was really supposed to see .506127. So when he input the data even though the numbers were only off that thousandths of a point the simulated weather system ended up running into a different output.

With theses results Edward Lorenz was able to come up with his theory. Which eventually came to be known as the Butterfly Theory. The flapping of a single butterfly s wing today produces a tiny change in the state of the atmosphere. Over a period of time, what the atmosphere actually does diverges from what it would have done. So, in a month s time, a tornado that would have devastated the Indonesian coast doesn t happen. Or maybe on that wasn t going to happen, does. (Ian Stewart, Does God Play Dice? The Mathematics of Chaos, pg. 141). This theory is also known as Sensitive Dependence on Initial Conditions. A small change in the initial inputs can cause a drastic change in the long-term behavior of the system.

However, now that Lorenz had discovered this he wanted to keep studying it. What he had was twelve equations to explain what he had found. He wanted to simplify those. What he did was make those equations even simpler leaving him with just three equations. Prior to Lorenz s discovery there were only two states. A steady state where variables never change and a periodic behavior where the system repeats itself. Now there was a new state the Lorenz attractor, this is where the variables never settle down to a single point and they never repeat themselves thus not making them periodic. When Lorenz graphed what he found it looked at thought the system just kept looping around.

Later on other scientist as well as many other professions started studying chaos theory. One mathematician that did this is named Helge von Koch. Koch decided to look at fractals, specifically what their make up is. When looking at a smooth line it is one dimension and a square is two dimensions. So a fractal takes up more space than a line but not as much as a square. This means that the dimension of a fractal must be between one and two. Koch devised a Koch Curve to explain what he found. To make a Koch curve take an equilateral triangle and to the middle third of each side ad a new triangle and continue to do so. The interesting thing about the Koch curve is that every time new triangles are added the length of the line gets longer. Although the inner area of the curve remains less than the area of a circle drawn around the original triangle. Basically the line has infinite length but is surrounded by a finite area.

Fractal has come to be any image that displays the attribute of self-similarity. Many people have come up with equations to explain fractals. One of the most widely known equations is the Mandelbrot set. The equation Mandelbrot came up with was very simple z=zX+c. Take a number and square it, then add the original number to it. If one repeats this and the number goes up to infinity then it is not part of the Mandelbrot set. If the number stays below a certain point then it is part of the set.

Chaos theory has been applied to many different points in the world. I have even run across a paper comparing Marxism to Chaos Theory. However, on of the most interesting things that I have come across is music created using chaos theory (http://www.organised-chaos.com/oc/index.html). As well as pictures that have been created using the information that is still being studied today. With the use of computers we are able to mathematically work out equations that we previously could not. I am still trying to fully grasp the concept behind chaos theory and what it might be used for in the future. Right now there are some that speculate that the human brain and DNA could be explained using these theories.