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**MSc Sociology 3Rd Semester Regular**

**Sociology of change**

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**What is chaos in sociology?**

The word Chaos comes from the Greek word “Khaos”, meaning “gaping void”.

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The word Chaos comes from the Greek word “Khaos”, meaning “gaping void”.

Mathematicians say it is tough to define chaos, but is easy to “recognize it when you see it.” Chaos in other words means a state of total confusion or predictability in the behavior of a complex natural system. Chaos theory (Devaney 1989) is the concept that a small change now can result in a very large change later. It is a field of study in mathematics, with applications in several disciplines including physics, engineering, economics, biology, Sociology (Morse 1967), and philosophy which primarily states that small differences in initial conditions (such as those due to rounding errors in numerical computation) can yield widely diverging outcomes for chaotic systems, rendering long-term prediction impossible in general.

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Chaos theory is a field of study in mathematics; however, it has applications in several disciplines, including sociology and other social sciences. In the social sciences, chaos theory is the study of complex non-linear systems of social complexity. It is not about disorder but rather about very complicated systems of order.

Nature, including some instances of social behavior and [social systems](https://www.thoughtco.com/social-system-3026595), is highly complex, and the only prediction you can make is that it is unpredictable. Chaos theory looks at this unpredictability of nature and tries to make sense of it.

Chaos theory aims to find the general order of social systems and particularly social systems that are similar to each other. The assumption here is that the unpredictability in a system can be represented as overall behavior, which gives some amount of predictability, even when the system is unstable. Chaotic systems are not random systems. Chaotic systems have some kind of order, with an equation that determines overall behavior.

The first chaos theorists discovered that complex systems often go through a kind of cycle, even though specific situations are rarely duplicated or repeated. For example, say there is a city of 10,000 people. In order to accommodate these people, a supermarket is built, two swimming pools are installed, a library is erected, and three mosques go up. In this case, these accommodations please everybody and equilibrium are achieved. Then a company decides to open a factory on the outskirts of town, opening jobs for 10,000 more people. The town then expands to accommodate 20,000 people instead of 10,000. Another supermarket is added, as are two more swimming pools, another library, and three more mosques. The equilibrium is thus maintained. Chaos theorists study this equilibrium, the factors that affect this type of cycle, and what happens (what the outcomes are) when the equilibrium is broken.

**Contexts of Chaos**

Many people have speculated as to whether chaos theory has significant implications as a new paradigm for understanding complicate physical and social systems. Indeed, the notions of chaos and classical unpredictability have led to better understanding and intuition about a wide range of systems. Chaos theory has been successful in describing physical systems like turbulent air flow, convection, population growth, and even signals in squid neurons and the beating of hearts. It has provided a framework for understanding and examining change, unpredictability and nonlinearity in a scientific way. The mathematics and the geometry underlying chaotic behaviour have been rewarding as well. Chaos theory has also provided a metaphorical language for describing networks of people, social groups and the contemporary world, leading to a new paradigm for understanding changing processes and changing institutions in the social world. It is this new paradigm, which has emerged from chaos theory and which continues to be explored by researchers in complexity, that 1 argue can lead to new ways to interpret and address complex, macro-level social problems- Central features of the new paradigm which stem directly from chaos theory are the concepts of nonlinearity and resulting micro-macro connections, as well as new notions of processes of change in systems. These are related to sensitivity to initial conditions, bifurcations, attractors and sensitivity to system parameters. Furthermore, the shady of nonlinear systems has led to new insights about cause, effect and determining processes in systems. The central feature of this new paradigm in terms of this thesis is the notion of micro-macro connections. The study of nonlinear systems has shown that small-scale, micro events can develop into macro-level effects. In chaos theory, this is due to extreme sensitivity to initial conditions; small changes in initial conditions always become large changes in eventual system behaviour when a system is chaotic. It is this notion, and the metaphorical exploration of chaos theory in social systems, what was the basis of my interpretations of possible micro-macro connections in social change. In this whole context, 1 explore the foundations of micro-macro connections in chaotic systems. Micro-macro connections in chaos theory are closely related to unpredictability. Indeed, unpredictability is probably the most well-known and profound discovery in connection with chaos theory. The discovery that systems which were thought to be completely orderly and predictable can easily develop unpredictability is central to chaos theory. While the development of quantum mechanics questioned determinism at the scale of atoms and molecules, it was chaos theory which threw predictability of human scales systems into question. As we will see, the discovery of unpredictability in larger-scale systems is based on sensitivity to initial conditions. In chaotic systems, a very small change in the initial state of a system can result in a large difference in the systems behaviour, so that if the initial condition cannot be known exactly, then the behaviour after some period of time cannot be predicted. This is the essence of Lorenz's famous conclusions about the impossibility of predicting the weather, since the exact condition of the atmosphere cannot be known at any time. Accepting that nonlinear systems, which are very common in nature, can exhibit this fundamental unpredictability was the first step in the creation of the new paradigm for social sciences; it was now possible that there were aspects of social systems (as well as chaotic physical systems) which simply would not be predictable. However, the idea of unpredictability and random-seeming behaviour coming From simple systems can also mean that where we have observed seemingly random behaviour, there may be simple rules which give rise to complex patterns and turbulent changes. In this sense, chaos theory allows us to mode1 systems which were believed to be too random or too complicated to be understood in simple terms. This modeling lets us understand how the behaviour of those systems is consistent with the simple rules which evolve them. This model-based thinking is the root of a different approach in the social sciences, this time based on flattering quantitative understanding, and ultimately for the purpose of furthering predictability. This is in contrast to the metaphorical paradigm which emerged from chaos theory, emphasizing that predictability might not be possible at all. 1 would argue that this disparity is the root of a long-term dichotomy in the Iiterature on chaos, complexity and social systems, between metaphorical understandings of the relationships between these theories, social systems and quantitative models attempting to uncover details about social system dynamics. It is important to understand that there is a difference between chaos and disorder. In common usage, 'chaos' is synonymous with lack of order.' In the mathematical sense, however, 'chaos' is closer to 'order without periodicity or stability'. For example, the moon is periodic. It continues to repeat the same orbit around the Earth, and this orbit is stable. When a meteor hits the moon and makes a crater, the orbit of the moon does not change very much. A small perturbation in the moon's mass and momentum causes only a small change in the orbit. In contrast, in a chaotic system there will not be repeated motion, and any time that the motion appears to be repeating will be brief Furthermore, a small perturbation can drastically change the motion of the system, no matter how small the perturbation is. It is also important to distinguish chaos from nonlinearity. The moon's orbit around the Earth is nonlinear, as are the gravitational equations describing it, but the moon's orbit is not chaotic, while all chaotic systems are nonlinear, not al1 nonlinear systems are chaotic. Like the moon, they may be very stable and periodic.

**Characteristics of a chaotic system:**

(I) No periodic behavior.

(ii) Sensitivity to initial conditions.

(iii) Chaotic motion is difficult or impossible to forecast.

(iv) The motion looks random.

(v) Non-linear.

**Qualities of a Chaotic System**

A chaotic system has three simple defining features:

* Chaotic systems are [deterministic](https://www.thoughtco.com/what-is-hard-determinism-2670648). That is, they have some determining equation ruling their behavior.
* Chaotic systems are sensitive to initial conditions. Even a very slight change in the starting point can lead to significantly different outcomes.
* Chaotic systems are not [random](https://www.thoughtco.com/simple-vs-systematic-random-sampling-3126369), nor disorderly. Truly random systems are not chaotic. Rather, chaos has a send of order and pattern.

**Concepts**

There are several key terms and concepts used in chaos theory:

1. Butterfly effect (also called sensitivity to initial conditions): The idea that even the slightest change in the starting point can lead to greatly different results or outcomes.
2. Attractor: Equilibrium within the system. It represents a state to which a system finally settles.
3. Strange attractor: A dynamic kind of equilibrium which represents some kind of trajectory upon which a system runs from situation to situation without ever settling down.