A General Model of Simple and Complex Systems

By David Alderoty © 2015

Chapter 1) A System Theory: The General Model of Simple and Complex Systems

Over 1,400 words

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THE FOCUS AND PURPOSE OF THE SYSTEM PERSPECTIVE PRESENTED IN THIS E-BOOK

To prevent confusion, I am placing the following statement at the beginning of each chapter in this e-book. Keep the ideas presented in the following three paragraphs, in mind as you read this e-book.

The main utility of a systems theory, especially the **General Model of Simple and Complex Systems,** is to assist in the study of systems, especially in terms of problem solving, goal attainment, and observational and experimental research. From a system perspective, all the relevant factors of a system are considered to obtain an objective. This can include the behavior and overall functionality of the system, its environment, its components, its structure, and related dynamics, cause-and-effect sequences, inputs, outputs, forces, energy, rates, time, and expenditures.

Examples of a system are atoms, molecules, chemicals, machines, electronic circuits, computers, planets, stars, galaxies, bridges, tunnels, skyscrapers, forests, rivers, streams, oceans, tornadoes, hurricanes, microorganisms, plants, animals, human beings, social groups, small businesses, organizations, political parties, cultures, and the human mind of an individual, including related behaviors and personality traits.

A systems perspective is also useful for writing projects. This involves writing about all the relevant factors of a system, in terms of a thesis, or topic.

The purpose of this e-book is to discuss and explain the many details associated with the systems perspective described above. This required twelve chapters, which are relatively short.

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Notes and Related Concepts for this Chapter

The Meaning of the Word System

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This chapter deals with a system theory. The word system generally has two meanings. **One is a set of organized components that function together, comprising an entity, such as a machine, an animal, a plant, a factory, or a society.** The other meaning of system is an organized method, or procedure for performing a task, or obtaining an objective. The first definition, in red type, applies to this e-book on **A General Model of Simple and Complex Systems**. The second definition is **not** relevant for the system concepts presented in this text, **with the exception of chapter 11.**

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A General Model of Simple and Complex Systems, And Introductory Information

What does the General Model of Simple and Complex Systems Encompass

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I am presenting a General Model of Simple and Complex Systems. This model includes the principles that are found in other system theories, but it includes a number of additional concepts.

The General Model of Simple and Complex Systems deals with static and dynamic systems, of varying degrees of complexity. The following text explains how the complexity of the system can affect its predictability. It also shows that some systems have multiple environments, which can influence the behavior or functioning of a system.

This model shows that a system is a relative concept, which should be defined in relation to a specific study, problem, goal, or research project. The way the system is defined determines the focus of the study. Excessively narrow definitions of the system can interfere with problem solving. It explains that a system is comprised of a specific geometry, and a set of interacting components.

System Theories, are Not Theories, they are Models

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As can be seen from the title of this e-book, (**General Model of Simple and Complex Systems**) I am calling my conceptualization a model, as opposed to a theory. All of the system theories are actually models, and **not** theories. A theory represents a precise principle, or concept that can be experimentally evaluated to determine if it is true or false. The system theories, including my model, represent a collection of principles and concepts, some of which are from other disciplines, such as from physics, chemistry, biology, mathematics, psychology, and sociology.

When a system theory is applied to a problem, a system with real or hypothetical structure is identified. The system is sometimes conceptualized as a living organism, or machine, even when this is not the case. This is coupled with attempts to apply the relevant concepts and principles of the system theory, to solve the problem. This sounds more like a methodology or philosophy, and certainly not a theory. However, all of the principles and concepts mentioned above, especially the structural framework of a system, can be defined as a model. This is the reason I called my conceptualization, the **General Model of Simple and Complex Systems**.

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Definitions and Descriptions of the General Model of Simple and Complex Systems, with Related Concepts

An Introductory Description of a System Theory, General Model of Simple and Complex Systems

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Systems theory is a way of thinking about and exploring a problem, goal, study, or research project. This involves an attempt to evaluate all of the relevant components, and related dynamics and interactions that relate to an objective. Especially important are cause-and-effect sequences involved with the various components. All of the yellow highlighted factors presented above are conceptualized as the system. Often the system may be thought of as a machine, biological entity, or set of interacting components.

Definition of a System for the General Model of Simple and Complex Systems

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Based on the way I am using the terminology, a system is comprised of a **set of arranged components with a specific geometry***. The components interact with each other, or function together to form a system, such as a machine, an automobile, an animal, a plant, a forest, planet, star, a galaxy, a molecule, an atom, a small business, a large organization, a society, and a political party.

*For detailed information about the components, the arrangements and the geometry of a system, read the following three subsections.

What are the Components that form a System?

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The components are the building blocks of the system. Each system is comprised of a unique set of building blocks, or components. The components (or building blocks) that make up various types of systems are presented below. The **components** are illustrated in **bold black underlined type,** and the **systems** are presented in **red bold underlined type**.

- **Subatomic particles** forming **atoms**
- **Atoms** forming **molecules**
- **Cell membrane**, **nucleus**, **mitochondria**, **ribosomes,** and other **organelles,** coupled with **DNA**, **RNA**, **water**, **and other chemicals** forming a **cell**
- **Cells** forming an **organ**
- **Organs, bones, water, and other chemicals** forming an **animal**
- **Atoms of Iron and carbon forming steel, which are** forming **gears**, **pistons** and other **parts**
- **Gears and pistons, and other parts** forming a **machine**
- **Bricks, steel beams,** and **other building materials** forming a **building** (This is a static system, explained in a later subsection.)

Most, if not all, of the **components** that comprise a **system**, can be defined as subsystems. A subsystem is a system within a larger system. For example, molecules are comprised of atoms, and atoms can be defined as subsystems of the molecule.

The Arrangement of the Components, and the Geometry they form, Comprise the System

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The arrangement of components and their geometry comprise a specific structure, which is the system. If the components are rearranged, and/or the geometry is changed, in most cases you will no longer have a system, which is especially the case if the **system is complex**. For example, if you attempt to rearrange the limbs, and organs of an animal, it will obviously die. Similarly, if you change the geometry of the limbs and organs, or the entire animal, the system will cease to exist. However, there will be **no change** in the **fundamental** building blocks of the animal, which are chemicals. This includes proteins, fats, and compounds of calcium, sodium, and potassium, and many other chemicals.

Simple systems comprised of liquids, gases, and in some cases even solids, can usually be rearranged without destroying the system. For example, a cup of water is a system consisting of water molecules, which are the components. If you rearrange the water molecules, the system does **not** change. However, if you change the geometry of the components, such as by splitting the water molecules into hydrogen and oxygen, you will no longer have a cup of water.

A System is More than the Sum of its Building Blocks

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Over the years, I have come across many sources suggesting that human beings, as well as the entire universe are comprised of subatomic particles. This usually is coupled with the implied suggestion that the study of subatomic particles, will result in insights about everything we encounter, including human nature.

In reality, nothing is solely comprised of subatomic particles, not even atoms. However a specific number, and arrangement, and related geometry of **subatomic particles**, form atoms. For example, helium atoms are comprised of two protons, two neutrons, and two electrons. If you split the helium atom into subatomic particles, you destroy the geometry that was formed by the arrangement of the subatomic particles, and you no longer have helium. Helium atoms are systems, and a system is more than the sum of its components.

You generally cannot predict the behavior of a system, by examining its building blocks, WITHOUT evaluating the arrangement and structure of its building blocks, and the resulting geometry of the system. For example, sodium chloride, which is common table salt, is comprised of chlorine and sodium. Chlorine is a very toxic gas. Sodium is also toxic, and it burns vigorously in chlorine gas. After the sodium burns up, you would have a new chemical structure, which is sodium chloride.

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