



Research Methods for Simple and Complex Systems

By David Alderoty © 2015

Chapter 1) A Basic Introduction to System Theories **Over 1,380 words**

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After I complete a writing task, I select a number of websites from other authors, and link to them. The links are the blue underlined words, and they can be seen throughout this book. The [in-line links, such as the link on these words](#), are to support the material I wrote. The links presented at the end of some of the paragraphs, subsections, and sections are for websites with additional information, alternative points of view, and/or to support the material I wrote. The websites contain articles, videos, and other useful material.

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Page
2 / 10

Notes and Related Concepts for this Chapter

The Meaning of the Word System

This chapter deals with systems, and system theories. 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 chapter, and to system theory. The second definition is **not** relevant for the system concepts presented in this text.

The Focus of this Chapter and the E-Book

This book is primarily focused on research strategies, and related concepts. However, this chapter is focused on the broad concept of system theory. **Some** of the material in this chapter is general, or theoretical, and it may **not** relate directly to research. However, this material, and **the links it contains to other websites**, will provide a detailed background in systems theory, which is useful for all of the following:

- Scientific studies and research
- Problem solving and goal attainment
- For devising experiments, based on a system concept
- For studying and/or writing about scientific research in terms of a system.

Conventional Definitions and Descriptions Of a System and System Theory

The Purpose of This Section

The material presented in this section is simplified, and brief. The purpose of this material and the hyperlinks it contains is to provide a general background in system theory. A basic understanding of systems theory is needed to comprehend the other chapters in this e-book.

Conventional Definitions of a System and System Theory

There are many definitions and descriptions of a system, and system theory. In this subsection, I present definitions I obtained from web searches, for system, and system theory.

The following quotes do **not** contain all of the material that was displayed on the websites. If you want to access the original source, for more information, left click on the blue underlined words.

Definitions of a system from the [Marian Webster dictionary](#) are presented below:

a group of related parts that move or work together

a body of a person or animal thought of as an entire group of parts that work together

a group of organs that work together to perform an important function of the body

Page
4 / 10

Definitions of a system from the [TheFreeDictionary.com](#) (www.TheFreeDictionary.com/system) as follows:

- 1.** A group of interacting, interrelated, or interdependent elements forming a complex whole.
- 2.** A functionally related group of elements, especially:
 - a.** The human body regarded as a functional physiological unit.
 - b.** An organism as a whole, especially with regard to its vital processes or functions.
 - c.** A group of physiologically or anatomically complementary organs or parts: *the nervous system; the skeletal system.*
 - d.** A group of interacting mechanical or electrical components.
 - e.** A network of structures and channels, as for communication, travel, or distribution.
 - f.** A network of related computer software, hardware, and data transmission devices.

A definition of system theory from [Wikipedia](#), is presented below:

Systems theory is the interdisciplinary study of systems in general, with the goal of elucidating principles that can be applied to all types of systems at all nesting levels in all fields of research.

A Simplified Definition and Description Of a System and System Theory

A general definition of a system is a set of components that function together, which comprise one of the following: a machine, a living organism, a business organization, a society, or another entity. The underlined words, in red type, are examples of systems.

A simple definition of system theory is a set of principles (or a theoretical framework) that apply to various types of systems. The general principles are used to understand the behavior of the system, or to solve problems that relate to a system.

The set of principles used in systems theory come from many disciplines. For example, the set of principles of physics and chemistry, including the formulas, can be used to evaluate, and solve problems that occur in many types of systems, such as plants, animals, and agricultural and ecological systems. However, the principles and formulas of physics and chemistry **cannot** be used for social systems, but there are other principles that can be used. For example, input, output, feedback, correction, and control would apply to social systems, as well as the biology of plants and animals.

Biological entities, especially a cell, are good examples of a system. Interestingly, one of the most important contributors to

systems theory was a biologist, [Ludwig von Bertalanffy](#). His system theory is presented in his book [General System Theory](#).

There are [many other system theories](#), but most of them are more or less, similar to the description presented above.

An Alternative Presentation of System Theory, Based on the Way System Theory is Used

Another way of explaining what system theory is, is to explain what system theory can be used for, and what an individual would do when they are using a system theory. This type of explanation is presented in a brief and simplified way, in the following three paragraphs.

System theory can be used to solve a problem, obtain a goal, to carry out a study, or to perform experimental research, in relation to a specific system. A system theory can also be used to build a system, such as a social group, a business, and automobile, a manufacturing facility, etc.

When using a system theory, the individual considers all of the components, and factors that relate to the system that they are working with, or building. This includes how the components and factors of the system interact with each other. They also consider the impact of the environment and other systems, on their system. They understand that changing the environment, or any component in a system, may affect the system, in a way that is functional, dysfunctional, or neutral.

They might also draw diagrams, indicating a process, with the related series of steps that takes place in the system, and the rates of inputs and outputs. Examples of inputs are raw materials, supplies, and profits. Examples of outputs are money for expenses, manufactured products, and disposal of waste materials.

People Were Probably Using Some Type of System Theory Before it was Precisely Described in Words

Systems theory might be used with various types of advanced technologies, such as software and computers. However, as can be seen from the descriptions presented in this section, the delineation and application of a system theory does not require advanced technology. Thus, people were probably using some type of system theory, many years before it was precisely described in the 1930s. This is suggested by the technological achievements that took place before the 30s. Four examples are presented below:

- The building of ancient structures, such as the Egyptian pyramids
- The invention of the radio
- The invention of the steam engine, and its application for moving ships, and for running the machines used in manufacturing.

- The invention of the airplane

See the Following Websites from other Authors for Additional Information, and Alternative Perspectives on A System, and System Theory

Page
8 / 10

- 1) [General Systems Theory © 1993, David S. Walonick, Ph.D.,](#)
- 2) ["General Systems Theory: A Framework for Analysis and Social Change" Robert J. Gregory, Ph.D.,](#)
- 3) [BERTALANFFY'S GENERAL SYSTEMS THEORY By Gregory Mitchell,](#)
- 4) [General Systems Theory: Applications for Organization and Management FREMONT E, KAST,](#)
- 5) [General Systems Theory: A Knowledge Domain in Engineering Systems Fleming Ray October 25, 2000 ESD.83 Research Seminar in Engineering Systems,](#)
- 6) [SYSTEM THEORY System Theory: social units: composition and relation with environment,](#)
- 7) [Ludwig von Bertalanffy, Excerpted from General Systems Theory,](#)
- 8) [What is Systems Theory?,](#)
- 9) [Systems Theory, by Bruce D. Friedman and Karen Neuman Allen,](#)
- 10) [6 Change in Thinking - Systems Thinking,](#)
- 11) [Systems thinking: an introduction,](#)
- 12) [Systems Thinking white boarding animation project,](#)
- 13) [TheFreeDictionary,](#)
- 14) [Management for Health Care Professionals Series Systems & Systems Theory, by Dr. Yaseen Hayajneh,](#)
- 15) [SYSTEMS THINKING A Dissertation, by Derek Anthony Cabrera, May 2006,](#)
- 16) [The Origins and Purposes of Several Traditions in Systems Theory and Cybernetics ,](#)
- 17) [Cybernetics and Systems Theory,](#)
- 18) [Systems theory, information theory and cybernetics,](#)

- 19) [Video: Management Cybernetics & Chaos Theory,](#)
- 20) [Video: Key Concepts in Systems Theory,](#) 21) [Stanford Chaos and Reductionism](#)

[To go to the first page of this chapter left click on these words](#)

HYPERLINK TABLE OF CONTENTS

Below is the hyperlink table of contents of this chapter. If you left click on a section, or subsection, it will appear on your computer screen. Note the chapter heading, the yellow highlighted sections, and the blue subheadings are **all active links**.

<u>Chapter 1) A Basic Introduction to System Theories.....</u>	<u>1</u>
<u>To Access Additional Information with Hyperlinks.....</u>	<u>1</u>
<u>Notes and Related Concepts for this Chapter</u>	<u>2</u>
<u>The Meaning of the Word System</u>	<u>2</u>
<u>The Focus of this Chapter and the E-Book.....</u>	<u>2</u>
<u>Conventional Definitions and Descriptions Of a System and System Theory.....</u>	<u>3</u>
<u>The Purpose of This Section</u>	<u>3</u>
<u>Conventional Definitions of a System and System Theory</u>	<u>3</u>
<u>A Simplified Definition and Description Of a System and System Theory</u>	<u>5</u>

<u>An Alternative Presentation of System Theory, Based on the Way System Theory is Used.....</u>	<u>6</u>
<u>People Were Probably Using Some Type of System Theory Before it was Precisely Described in Words</u>	<u>7</u>
<u>See the Following Websites from other Authors for Additional Information, and Alternative Perspectives on.....</u>	<u>8</u>
<u>A System, and System Theory</u>	<u>8</u>

To go to the first page of this chapter left click on these words

If you want to go to the next chapter left click on the link below

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