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# A General Model of Simple and Complex Systems

By David Alderoty © 2015

## Chapter 12) Changing and Reacting Systems and Creating Models Based on a System Conceptualization

**Over 1,900 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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# Systems that Change and/or React

## Systems that Change

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Most, if not all systems undergo one or more changes, based on time, a cycle, a sequence of actions, a chemical reaction, or as a result of a physical interaction with another entity. Some examples of changes that systems undergo are presented below.

- A predetermined path or orbit of a system: An example is planet Earth, and the seasonal variations that occur as it orbits the sun.

- Built-in or programmed sequence of change, based on time, or level of development of a system: For example, caterpillars develop to a specific point, and then they generate a chrysalis, and go into a state that resembles hibernation. When they emerge from this state, they are butterflies. This appears to be a genetically programmed sequence, based on stages of development.

- Components of some systems change their position: For example, the pistons in a gasoline engine change their position at a very rapid rate, during normal operation.

- The aging process affects most systems: For example, some systems rust, and/or wear out because of friction. This usually takes place over an extended period of time. Another example is plants, animals, and people, grow old, and eventually die.

- Some systems change as the result of erosion, such as beaches, and mountains.

- Some systems change because of chemical reactions: This can involve oxidation of the steel structure of a system, which results in rust. It can also involve two chemicals that react when they are mixed with each other.

- Stars eventually change over many millions of years, because of the depletion of the elements that are needed to maintain a nuclear reaction. Hydrogen is the most important element for these reactions. This change might result in a white dwarf, or a black hole.

- Over time, radioactive material changes to a new element or new isotope of the same element, because of the radioactive decay process.

- Systems interact with each other in various ways, which can lead to changes in one or more systems. Some examples are, a collision between two objects, people organizing social club, animals killing and eating prey.

- Two or more systems merged to form a single system.  An example is two or more organizations or businesses merging to form a new and larger company.



- A system changing its state:  Examples are ice turning into water as it melts, water turning into steam as it boils, a gas turning into plasma at very high temperatures

- Two or more systems combining into one system, and giving off energy:  Example is an exothermic chemical reaction, such as wood burning and combining with the oxygen in the air, to form carbon dioxide and water.

  Using of energy to combine two or more systems, into one or more new systems.  In chemistry, this is an endothermic reaction, which requires an input of energy.

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## Devising Models with a System Theory, To Solve a Problem or Obtain a Goal

## Deriving Models with System a Theory

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System theories, including the **General Model of Simple and Complex Systems** are useful for creating models that relate to problems, goals, problematic systems scientific studies, and industrial projects.  This can involve relatively simple mental models, more complex, conceptual models, scale models, computerized simulation models, or mental simulation models. These ideas are explained under the following subheadings.

## Mental Models & System Conceptualizations

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A simple conceptualization of a system can be achieved with a **mental model.** These models are usually comprised of visual imagery, thoughts, and experiences, retained in long-term memory. Mental models are useful for relatively simple problems and goals. A mental model, and related solutions, can be retained in the mind. Ideally, it is best to write some, or all of the material, comprising the mental model and possible solutions on paper, or in a Microsoft Word document.

## Conceptual Models & System Theory

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Conceptual models can be created with a system theory, which are more complex than a mental model. Conceptual models include many details, involving all the relevant components, and there related dynamics. Models of this nature should be written in a Microsoft Word document.

## Scale Models & Systems Theory

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A scale model is a miniature of a larger system. These models may have, some or all of the functionality of a larger system that is in the design phase. The scale model can be used to spot problems in the design, and to evaluate the overall functionality of the large system, before it is constructed. Scale models are especially useful for evaluating large and expensive systems, such as skyscrapers, jet planes, and ships.



## Computerized Simulation Models, and System Conceptualizations

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Computerized simulation models, can be created based on system conceptualizations. This involves the creation of a virtual system, and a related virtual environment. Generally, with these models it is relatively easy to test a system under different conditions and scenarios. However, computer simulation models cannot simulate **unknown factors and dynamics** of a real system, functioning in a real environment.

These models may be especially useful when all the relevant dynamics are known for a system. They can also be useful, when they are created so they can easily be modified, as new data is obtained from real-world observations, or experimentation.

The creation of computerized simulation models usually requires computer programmers, that a specially trained to create such models. The creation of these models is time-consuming and expensive. A less expensive, and easy to create alternative is presented in the following subsection.

## Creating Mental Simulation Models with System Conceptualizations

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Mental simulation models are similar to the above, but they are created in the mind, instead of a computer. Mental simulation models are useful for relatively simple objectives, which do not involve thousands of details. These models essentially involve imagining, or visualizing, in your mind, various components, related dynamics, and potential roadblocks, in relation to a problem or goal. You have to have the ability to use pessimistic thinking to identify potential problems, so you can redesign your system to circumvent the potential difficulties.

The effectiveness of your mental simulation models can be improved if you carry out Internet research, to obtain the information you need. Consulting experts can also be very helpful. Explaining your mental simulation in writing, in a Microsoft Word document, along with all necessary details will greatly improve your results with this type of model.

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## Guiding Questions, Use or Not to Use a System Conceptualization

## Questions to Ask Yourself, to Help You Apply a System Conceptualization, to a Problem or Goal

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Below there are list of questions that can help you apply a system theory, to solve a problem, obtain a goal, or to carry out a scientific study or research project. The questions should be answered in a Microsoft Word document. Some of these questions may not be relevant for your project. When this is the case, you can either ignore the questions, or modify them so they are relevant to your objective. You should also create your own questions that **specifically relate to your project**.



- What are all the relevant static and dynamic components of the system? List these components, and try to explain how they interact. This can involve diagrams.

- What are the relevant inputs, and outputs of the system? List all of the inputs and outputs channels. Explain what flows through each input or output channel. This can involve input or output of money, data, energy, completed products, customers, etc.

- Does rate apply to any of the inputs or outputs?

- How long will it take to complete this project?

- What are the unknowns that relate to the system? (problem, goal, research project, etc. ) List all of the unknowns, and all the possible ways that you can obtain the needed information.

- What are all the problems that relate to the project? List the problems, and potential solutions.

## When to Use a System Conceptualization

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The application of a system conceptualization is especially useful for relatively complex problems, goals, scientific studies, research, and industrial projects. Systems conceptualization might also be useful when you are unable to solve a practical problem or obtain a goal.

A system conceptualization is especially useful for large industrial projects, which involve thousands of details, and related blueprints, that can be conceptualized into a system. Complex systems such as industrial projects should always be placed in a computerized format, such as a Microsoft Word document.

System conceptualizations can be useful for problems that have many unknowns, and **do not** have any apparent solutions. The conceptualization of the problem, with all of the available information, can be placed in a Microsoft Word document. This might result in a solution, especially if the relevant data is shown to a number of experts from various disciplines.

The ideas presented in the previous two paragraphs can be applied to less complex objectives, such as goals, scientific studies, and research projects.

As explained above, the primary purpose of a system conceptualization is to create models of a project, such as problems, goals, studies, and research objectives. There are several types of models that can be created, with the aid of the systems theory, which is explained under the following subheadings.

System theories are complex models, and they can sometimes be time-consuming, and quite complicated to apply to a problem or goal. This is especially the case if you are not highly knowledgeable and skilled in creating good system conceptualizations. A system conceptualization is usually most useful for highly complex problems and goals.

Listed below there are four examples of when you probably should not apply a system conceptualizations to your project.

1) If you can easily solve a problem, or obtain a goal based on commonsense, or your knowledge and experience, you should not use a system conceptualization. Usually, it is unnecessary to use systems conceptualization with the **simple** problems that we encounter in business, and in day-to-day life.

2) If your attempt at applying a system conceptualization to your objective resulted in unnecessary complications, and/or failures, repeat your efforts **without** using a system concept.

3) If you cannot figure out how to apply a system theory to your objective, use a strategy that you are familiar with, instead of a system conceptualization.

4) If you are doing a typical research project or school assignment, based on looking up information, and using paraphrases and quotes, you probably do not need a system conceptualization. However, it might be interesting and useful to apply a system conceptualization to the topic of

your paper, assume you have adequate knowledge to do so. This would involve explaining your topic in terms of a system. This can be useful for explaining a number of subjects such as organizational behavior, historical events that led to war, and for certain topics in economics.



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