A TechForText Website
A network of websites offering information resources, downloads, and quality products and services



# A General Model of Simple and Complex Systems
By David Alderoty © 2015

## Chapter 2) Dynamic Systems, and Related Concepts
**Over 2,770 words**

**To contact the author left click for a website communication form, or use: David@TechForText.com**

**To go to the previous chapter left click on one of the following links:**
**For HTML**
**www.TechForText.com/Sm/Chapter-1**

**For PDF**
**www.TechForText.com/Sm/Chapter-1/PDF.pdf**
**If you want to go to the table of contents of this chapter left click on these words**

## To Access Additional Information with Hyperlinks

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 primarily to support the material I wrote, or to provide additional details. The links presented at the end of some of the paragraphs, subsections, and sections are primarily for websites with additional information, or alternative points of view, or to support the material I wrote. The websites contain articles, videos, and other useful material.

If a link fails, use the blue underlined words as a search phrase, with www.Google.com. If the failed link is for a video use www.google.com/videohp. The search will usually bring up the original website, or one or more good alternatives.



**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.**





## Dynamic Systems, with Related Concepts

### Systems can be Dynamic or Static

***A General Model of Simple and Complex Systems, by David Alderoty, 2015***

Some or all of the components that form a system, can interact dynamically to form a dynamic system. Any system that has moving components, flowing liquid or gas, or releases waste, or energy into the environment, is a dynamic system. A tree is an example of a dynamic system. However, if the tree withers, and dehydrates, it becomes a static system. This is because the dead tree does not grow, or consume energy, and water and nutrients do not move through its roots and stems. Static systems do not have any moving components, but they still can be complex.

Static systems will be discussed in more detail in a separate section. This section is focused on dynamic systems, which will be discussed in detail under the following subheadings.

# Dynamic Systems with Cause-and-Effect-Sequences, A Simplified Explanation with Examples

***A General Model of Simple and Complex Systems, by David Alderoty, 2015***

Dynamic systems often have cause-and-effect sequences of varying complexity, which involve moving components at the mechanical, molecular, atomic, or subatomic levels. This involves one sequence initiating another sequence, or an action causing a reaction, such as **A** causes **B**. The sequence can involve a number of actions and reactions, such as the following: (The arrows represent the word causes)

**A→B→C→D→E→F→G→...**

An example of a dynamic system with a relatively simple cause-and-effect sequence is a basic steam engine. Specifically, water is converted to steam, in a closed boiler. Because the boiler is closed, the steam is under pressure, and it is piped into a cylinder, where it moves a piston. The back-and-forth movements of the piston, is converted to circular motion with a crankshaft, such as to turn the gears of a machine.

The above example of a steam engine can be summarized, in terms of the following cause-and-effect sequence, which has four components: **1)** Boiling water in a closed vessel, **causes 2)** steam under pressure, and this **causes 3)** a piston to move, which **causes 4)** a crankshaft to move and convert the back-and-forth movements of the piston to circular motion.

The above represents the functioning of a very simple steam engine, and cause-and-effect sequences are usually far more complex than this simplified example. Complex cause-and-effect sequences take place in living entities, the system that comprises the atmosphere, and in ecological systems. A detailed example of a complex system is presented below.

Animals have internal and external cause-and-effect sequences. The internal sequences involved various chemical reactions for energy production, growth, and the production of neural electrical impulses. External sequences involve responses to biological needs, such as searching for food, avoiding predators, and sleeping. The internal cause-and-effect sequences of animals are needed to initiate and maintain the external sequences. The external sequences are required to provide energy and other resources in the form of food, which are needed to maintain the internal cause-and-effect sequences.

## A Precise Definition of a Cause-and-Effect-Sequence

***A General Model of Simple and Complex Systems, by David Alderoty, 2015***

From the perspective of the system concept that I am presenting, a cause-and-effect sequence is an action, event, or flow of energy that causes a reaction. The reaction is an action, event, or flow of energy, which may cause a second reaction. The second reaction may cause a third reaction, which may cause a fourth reaction, etc. The actions and reactions involve energy, which is explained under the following subheadings.

# Types of Energy for the Cause-and-Effect Sequences of Dynamic Systems



Most of the cause-and-effect sequences of dynamic systems involve one or more of the following types of energy: Mechanical, Thermal (heat), Chemical, Electrical, Magnetic pulses, Nuclear energy, or Electromagnetic radiation  This is briefly explained in the following paragraphs.

Mechanical energy involves moving parts, such as the moving components of an automobile.  This type of energy has been used since the Stone Age, because it can be produced with the muscle power of people or animals.  Mechanical energy can also be produced with naturally flowing or falling water with a waterwheel.  A windmill can convert the wind to mechanical energy.  In modern times, mechanical energy is usually produced by electricity, chemical reactions involving combustion, and heat, such as to run steam turbines.

Thermal energy or heat energy involves moving and/or vibrating molecules or atoms.  Heat energy is used in many systems, such as to run steam engines, purify metals, and to fabricate plastic and metal parts.  Heat energy is usually produced with chemical reactions involving combustion, nuclear reactions, or from electricity.

Chemical energy is produced by exothermic chemical reactions.  This involves reactions that involve molecules and/or atoms.  An example of chemical energy is the reactions in a battery, which produce electricity. Another example is the combustion of fuel with the oxygen in the air, to operate gasoline engines.

Electrical energy involves moving and/or vibrating electrons, such as lightning, or the electricity used to operate home appliances. Electricity is an extremely versatile form of energy, because it can be converted to many other forms of energy, such as heat, mechanical movements, electromagnetic radiation, and magnetic pulses.

Magnetism is a force, and it is **not** a form of energy. However, magnetic pulses are a form of energy, which consists of magnetic forces that **change constantly** in strength, and/or in north-south orientation. The rate of change usually ranges from several times a second, to **over** 20,000 times a second. Magnetic pulses can be produced by mechanical movements of a magnet, or with electricity. Electricity is often converted to magnetic pulses to operate electric motors, speakers, and headphones. Magnetic pulses, produced by mechanical movements are commonly used to generate the electricity used in homes, offices, and factories.

Nuclear reactions involve atoms splitting into subatomic particles, which release energy, and form new atoms. Examples are atomic reactions in nuclear reactors, and the energy produced by the sun and stars. This form of energy is often used to run steam turbines, to create mechanical energy. The mechanical energy is used to create magnetic pulses, by rotations in a magnetic field. The magnetic pulses act on a copper coil, which generates electricity.



Electromagnetic radiation is a general term, which includes, x-rays, ultraviolet, visible light, infrared, microwaves, and radio waves. Electromagnetic radiation travels in waves, at a velocity of 186,000 miles per second. This is **approximately** 300,000,000 meters per second. Because of this very high velocity, electromagnetic radiation, in the form of radio waves or microwaves, is useful for long distance communication, especially for space satellites. Electromagnetic radiation can be converted directly to heat, electricity with photoelectric cells, and to chemical energy, such as by photosynthesis, which takes place in green plants.

*A General Model of Simple and Complex Systems, by David Alderoty, 2015*

## Dynamic Systems, & Exothermic, Endothermic, and Programmed Cause-And-Effect Sequences

### Three Types of Cause-and-Effect Sequences of Dynamic Systems

*A General Model of Simple and Complex Systems, by David Alderoty, 2015*

Cause-and-effect sequences can be placed into three broad categories, which I am calling **exothermic**, **endothermic**, and **programmed**. The exothermic sequences take place spontaneously, and release energy. Endothermic cause-and-effect sequences only take place if there is an input of energy. Programmed cause-and-effect sequences are governed by instructions, such as from DNA, RNA, or computer software. These ideas will be discussed in detail under the following subheadings.



## Exothermic Cause-and-Effect Sequences of Dynamic Systems



Exothermic cause-and-effect sequences do not require an input of energy for the sequence to take place. However, they often require a small amount of energy to trigger the sequence.

The energy required to run an exothermic sequence, is stored as **potential energy** in the components that comprise the cause-and-effect sequence. This potential energy can be in the form of molecular, atomic, or nuclear bonds. The energy can be stored many other ways, such as with a stationary object and gravitational forces.

A simple example of an exothermic cause-and-effect sequence is a row of dominoes that are arranged next to each other, in a horizontal position. Potential energy is essentially stored in the dominoes as a result of their horizontal position and gravity. If a small amount of energy is applied to the first domino, to push it over, the potential energy will be released in the form of kinetic energy, as all of the dominoes fall over, one after the other.

Another example of an exothermic cause-and-effect sequence is a forest fire. The potential energy for this sequence is stored in molecular bonds, from the chemicals produced by green plants.  A tiny amount of energy from a match, will release this energy in the form of heat and fire, and activate the cause-and-effect sequence.  This may initially involve the burning of dried leaves and twigs.  As the sequence progresses, the burning material will ignite a tree, which will ignite other trees.



## Endothermic Cause-and-Effect Sequences of Dynamic Systems

***A General Model of Simple and Complex Systems, by David Alderoty, 2015***

Endothermic cause-and-effect sequences do not have a source of potential energy stored in their components, to carry out the sequence.  Thus, an input of energy is required to run and endothermic cause-and-effect sequence.  An example of an endothermic cause-and-effect sequence is the movements of the components of a steam engine.  This sequence takes place when energy is used to boil water.  This produces steam that moves a piston, which moves a crankshaft that converts the up-and-down movements of the piston to rotary motion.

The above concept applies to the cause-and-effect sequences produced by all conventional engines, which usually obtain their energy from fossil fuel.  However, the cause-and-effect sequence in the fuel is exothermic, and the energy it releases is used to carry out the endothermic cause-and-effect sequence of the engine.

Another example is electric motors, and other electronic devices, produce endothermic cause-and-effect sequences, when there is an input of electric energy. An example of endothermic cause-and-effect sequences that involves chemistry is splitting water molecules into hydrogen and oxygen by passing an electric current through the water.

## Programmed Cause-and-Effect Sequences of Dynamic Systems

*A General Model of Simple and Complex Systems, by David Alderoty, 2015*

Based on the way I am using the terminology, a programmed cause-and-effect sequence, is a set of consecutive **actions** that are directed by a **program,** such as from DNA, RNA, computer software, or any other type of instructions. The **actions** are carried out one after the other to obtain a goal, or specific result. The **program** contains the information (or instructions) to direct a mechanism to carry out the sequential set of actions. To carry out the actions of a programmed cause-and-effect sequence requires an input of energy. In the following paragraphs, there are some examples of programmed cause-and-effect sequences.

Plants and animals have instructions encoded in DNA, which initiate programmed cause-and-effect sequences involved with building structures, such as roots, stems, leaves, flowers, organs, brains, nerves, bones, blood, skin, and limbs.

Certain types of programmed cause-and-effect sequences are controlled by feedback mechanisms. Most of the sequences governed by DNA appear to have these feedback mechanisms. For example, there appears to be a feedback mechanism that limits the size of organs in a developing fetus.

Feedback and control mechanisms can be built into machines that are designed to carry out programmed cause-and-effect sequences. An example is a system that controls the fuel of a rocket engine, and the speed and direction of the rocket. Another example is presented below.

There are robotic machines used in manufacturing that carry out programmed cause-and-effect sequences. Sophisticated versions of these machines, designed to carry out complex tasks, may have sensing devices, and a feedback control mechanism.

The concept of a programmed cause-and-effect sequence can be applied to human behavior, workgroups, and organizations. A simple example is a factory worker fastening a part onto the body of a car, on an assembly line. This represents a simple programmed cause-and-effect sequence, and the instructions to perform the task are retained in the brain of the worker.

Computer programs can be thought of as a **set** of programmed cause-and-effect sequences. I have created many computer programs based on this concept, all of which are online calculation devices. The software I created is comprised of a series of formulas that are connected together sequentially. When the first formula in the sequence receives data, it carries out a calculation, and then sends the calculated result to the second formula in the sequence. Then the second formula carries out an additional calculation, and transmits the result to the third formula, etc. A more complex version of the above, involve a programmed cause-and-effect sequence that activates two or more programmed sequences. At the end of the sequences there is a displayed box, with the final result.



Listed below, there are links to access the calculation devices I created using the concept of programmed cause-and-effect sequences. **1)** The Radius-Sphere Calculator, **2)** The Double-Integral-Calculus-Generator, **3)** The PolyTrig Calculator: for Trigonometric Calculations, **4)** Physics Calculator for Molecular Speed, **5)** The Basic Integral Calculus Generator, **6)** The Quadratic Equation Calculator, **7)** An Online Calculation Device For Hyperbolic Functions, And Related Mathematical Concepts, **7)** Online Tutorial on Algebra with Hyperbolic Functions In The Form of JavaScript Calculation Software, **8)** The Percentage Clock-Calendar, **9)** An Online Computer Tutorial on Calculus, For The Hyperbolic Functions Sech and Csch, **10)** Counting Down to the YEAR 3000, with the Experimental Countdown Timer for Multiple Units

## Problem-Solving: Programmed Cause-and-Effect Sequences and Human Behavior

*A General Model of Simple and Complex Systems, by David Alderoty, 2015*



The concept of programmed cause-and-effect sequences has potential utility, for studying, and evaluating human and animal behavior. This involves, observing, and documenting the sequential set of actions that are associated with a behavioral sequence. Specifically, the idea is to list each of the basic actions associated with a behavior in sequence, or in a series of consecutive steps. This should include the trigger of the sequence, when it is relevant to the study or goal.

In the following subheadings, there are some examples, where the concept of programmed cause-and-effect sequences may be useful.

## Habits: Programmed Cause-and-Effect Sequences General Model of Simple and Complex Systems

*A General Model of Simple and Complex Systems, by David Alderoty, 2015*

A habit is a good example of a programmed cause-and-effect sequence. That is habits are behavioral sequences, which are acquired through learning and repetition. They consist of a set of actions that follow one after another, which is rewarding in some way. Adverse habits are usually associated with some type of pleasurable sensation, and desirable habits are usually focused on a goal or sub-goal. For example, over eating is associated with the enjoyment of food, and good eating habits are associated with the goal of maintaining good health.



## Tasks: Programmed Cause-and-Effect Sequences

***A General Model of Simple and Complex Systems, by David Alderoty, 2015***

Many tasks or jobs consist of one or more, programmed cause-and-effect sequences. Breaking down these tasks, or jobs, to a set of sequential actions (or steps) can sometimes be useful. This can be helpful in learning how to perform certain tasks or jobs more efficiently. Evaluating, the way an individual performs a task, in terms of programmed cause-and-effect sequences, can be useful in identifying dysfunctional work habits, and poor technique. These problems can be eliminated if the individual practices an improved or optimized set of sequential actions (or steps) that relate to the task.

## Human and Animal Behavior: Programmed-Cause-and-Effect Sequences

***A General Model of Simple and Complex Systems, by David Alderoty, 2015***

The concept of programmed cause-and-effect sequences, can be used for studying human and animal behavior. This involves, inconspicuous observation of the subjects, in terms of the way they perform task that are relevant to a study. This generally should include the artifacts, tools, and equipment they use to carry out the task.

Dysfunctional behavior patterns can be evaluated in terms of programmed cause-and-effect sequences. The primary objective is to determine what triggers a specific sequence of dysfunctional behavior, in a specific individual. For example, children often display dysfunctional behavior, when they are bored, tired, frustrated, or under stress. When the trigger and sequential actions of the dysfunctional behavior are identified, it will probably be helpful in resolving the problem.

**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.**

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**

**For HTML**

**www.TechForText.com/Sm/Chapter-3**

**For PDF**

**www.TechForText.com/Sm/Chapter-3/PDF.pdf**

**If you want to see a list of all**

**the chapters in this e-book go to**

**www.TechForText.com/Sm**