Systems Thinking

"A journey in the realm of systems"

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Systems

A Journey Along theWay

Welcome to a journey in the realm of systems. The journey is still unfolding as this web site continues to evolve over time. Yet, even with the endless changes, there continues to be a connection, in one fashion or another, with systems. And, I continue to find that the lens which provides a systems perspective is the most revealing of understanding found to date.

The real intent here is not to study systems as a discipline, though more an intent to study lots of things and employ a systems perspective to foster understanding. Agreed, this requires some understanding of systems. As such, information is provided to enable one to develop a level of understanding sufficient to delve into the rest of what resides at this web site.

Every attempt will be made to avoid the major failing of "system science." In the words of Ludwig von Bertalanffy, "The student in 'system science' receives a technical training which makes systems theory -- originally intended to overcome current overspecialization -- into another of the hundreds of academic specialities."

Enjoy the journey!

System

The word system probably has more varied meanings than any other word in use today. The definition I have become comfortable with I owe to the late Austrian Biologist Ludwig von Bertalanffy.

A system is an entity which maintains its existence through the mutual interaction of its parts.

The key emphasis here is "**mutual interaction**," in that something is occurring between the parts, over time, which maintains the system. A system is different than a heap or a collection, mostly.

This definition of a system implies something beyond cause and effect. Rather than simply A affects B, there is an implication that B also affects A. Examples of systems are particle, atom, molecule, cell, organ, person, community, state, nation, world, solar system, galaxy, and universe, in increasing levels of complexity. In truth there is only one system, "the Universe," and all other systems are really just sub-systems of this larger

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The Way

of Systems

system. The relevant question has to do with where one chooses to draw boundaries.

Emergence

Associated with the idea of system is a principle called emergence. From the mutual interaction of the parts of a system there arise characteristics which can not be found as characteristic of any of the individual parts.

Stumbling across this as I did was most enlightening. It was probably in high school that I was first acquainted with the idea of synergy; the idea that the whole was greater than the sum of its parts. And, for all the examples ever used, emergence never really hit me until I ran into the right example. The right example just happened to be water! Amazing it took so long since there's so much of it around.

One could study hydrogen and oxygen in isolation from each other forever and never discover the characteristic of wetness. Wetness is an emergent characteristic of the mutual interaction of hydrogen and oxygen when combined to produce the molecular form called water. One has to study the system to get a true understanding of wetness. Studying the parts will not provide an appropriate understanding.

A systems view is somewhat in contradiction to the concept of analysis, which is breaking things down into smaller pieces to simplify the study. Analysis brings with it the risk of potentially loosing the most relevant characteristics of the system, and possibly developing a less than complete understanding. Yes, analysis is an important technique, and at the same time another method of study is also warranted, something I have seen called anasynthis. Anasynthis being the study of the whole, and the parts, in the hopes of developing an appropriate level of understanding.

Classes of Systems

There are multiple ways of characterizing systems. Of those I have come to understand to date, several of the most useful are as follows.

Isolated, Open and Closed Systems

Systems may be characterized as either closed or open. A closed system is one that does not need to interact with its environment to maintain its existence. Examples are atoms and molecules. Mechanical systems are closed systems. Open systems are organic and must interact with their environment in order to maintain their existence. People are open systems in that they must interact with their environment in order to take in food, water, and obtain shelter. People provide waste products to the environment in return.

The examples of the furnace, filling the water glass, adjusting the shower tap are all open systems as there are elements outside the system which are considered to have an effect yet are not elaborated.

An open system may interact with its environment in a growth or balancing fashion. Often the time of influence of the open system on the environment

or the environment on the system may be of such lengthy duration or of such minimal nature as to limit its need to be considered. In 1927 Ludwig von Bertalanffy first proposed that the human organism should be treated as an open system.

Any system taken in a large enough context can be considered a closed system. It is often more appropriate to consider a system as a subsystem of some larger system with which it must interact in some way. Taking the larger system into account is unnecessary for understanding the operation of the subsystem. All systems are both subsystems of larger systems and composed of subsystems at the same time.

Boulding's Classification

Economist Kenneth Boulding, one of the founders of The Society for General Systems Theory, in his book, "The World as a Total System," defined 5 generalized classes of systems which encompasses all other systems. These provide a means of understanding some general characteristics of systems. These systems are arranged in what is considered an evolutionary hierarchy.

Parasitic System

> This is a system in which a positive influence from one element to another provides a negative influence in return to the first element.
>
> I get positive things from you and provide you a negative return in response. Essentially I subsist on you.

Prey/Predator System

> In this type of system the elements are essentially dependent on each other from the perspective that the quantity of one element determines the quantity of the other element. The Foxes/Rabbits example is a prey/predator system. Even though the fox may be detrimental to the continuation of an individual rabbit, the fox is instrumental in maintaining the health of the overall rabbit population.
>
> I will feed upon you even though my existence is dependent upon your existence.

Threat System

> A threat system is one in which one element doesn't do something if the other element doesn't do something else. The U.S./Soviet Arms Race was a specific example. This particular example lead to escalation since each side said to the other, "If you start a war I will destroy you." Yet to continue to validate the threat each side had to continue building arms. It has been said this is a fine example of two countries racing headlong to where neither of them wanted to be.
>
> If you don't do something I don't want you to do then I won't do

something you don't want me to do. This may also be formed as, if you do something I want you to do, then I won't do something you don't want me to.

Exchange System

The capitalist economy is a very good example of an exchange system. Elements of the system provide goods and services to other elements in exchange for money or other goods and services.

If you do something I want you to do, then I will do something you want me to do. This may also be stated as, if I do something you want me to do then I expect you will do something I want you to do.

Our buy now pay later economy has a tendency to change an exchange system into a threat system. Initially we purchase something and in exchange we provide a promise, a promise to pay more later. Once we have received what we wanted the system changes and the bank says if you pay your bills then I won't take the stuff away from you, which is essentially a threat systems.

Employer/Employee systems are often transformed from and exchange systems to a threat system. The employee is hired under an exchange premise. I will pay you (what you want) if you do this work (what I want). Once the employee is hired the situation changes and becomes, if you do what I want I won't fire you.

Integrative System

Examples of an integrative system are charitable organizations or business endeavors where individuals ban together to accomplish some common desired objective or goal.

Where you and I do something together because of what we both want to accomplish.

The greatest leverage is found in integrative systems, where all the individuals are motivated by what they are endeavoring to create. This will be addressed in more detail when we get into building shared vision and team learning.

Generative System

During discussions on the Learning Organization list sometime in late 1995 Michael McMaster proposed another category beyond the Integrative System. Michael proposed what he called the Generative System, which might be represented by a situation where two people come together to create something neither of them had any idea of when they began.

Another Classification

At one time I happened across another definition of a systems hierarchy which seemed to make a lot of sense, yet at present I can't recall the reference from whence it came.

Protection System - act when events occur (reactive)

Regulating System - single loop - continuously measure or sample control variables and compare with pre-set desired values and adjust accordingly to regulate control variables (responsive)

Optimizing System - double loop - regulates selected variables in accordance with desired values and also ascertains what the desired values should be to satisfy pre-determined goals (systemic)

Adaptive System - multi-loop/structural - system changes its internal structure in order to optimize its behavior in spite of continuous changes in the environment... (evolutionary)

Introduction to Systems Thinking

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