GENERAL SYSTEMS THEORY

A focus on computer science engineering

DOUGGLAS HURTADO CARMONA

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GOD Almighty.

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Master of Computer Systems Engineering, Computer Systems Engineering, Minor in Business Administration and Information Systems Security. IBM Certification in Information Systems Management. Diploma in Scientific Research, Development for Web Applications, Computer Security and Forensic Computing, and in education and pedagogy.

Since 2002 he works as Head of Research at the Faculty of Engineering of the San Martín University Foundation Headquarters Puerto Colombia, Barranquilla - Colombia.

National and international lecturer with 12 years of university teaching experience in the areas of Programming Objects, Data Structures Object Oriented, Systems Theory, Systems Analysis and Design, Operating Systems, Compilers, Databases, Programming Concurrent and Client / Server Java, application development for Internet, computer security, computer forensics and contingency plans.

Researcher on the topics of Information Security, Computer Forensics, General Systems Theory and dynamic systems for software engineering, and compiler theory. Developed the research "Analysis of skill development from the use of Computer Assisted Learning" which received Special Mention Awards ACOFI 2007, and "Methodology for the development of systems based on learning objects." Creator OSOFFICE, Educational Software for Teaching Operating Systems.

He has served as Director of software development projects, systems analyst and programmer, IT project manager, information security engineer, independently has advised companies involved in building software.

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By way of prologue

Probably because of our helpful, warm, rising, uninterrupted and stimulating relationship we have built over the past 12 years, "referenced" by the exciting academic activities common to our work in this journey full of feverish, dramatic and diligent actions linked to the "production" of the top engineers in these technologies, modern and captivating, which unquestionably TIC's Clothing and dragging the world of today and tomorrow, the author of the present text, likely fueled by his proverbial generosity, I said the task to concoct some quick and brief way introitus dimensions to its intense, continuous and meticulous scholarly work wonderfully framed in the construction of relevant knowledge and its transmission to the generations that are to mark, to structure and guide them with a vision of transcendence towards society, in these appalling disciplines.

Going against the conventional schemes set out in this kind of exercise, when induced to future readers, whether they be students, teachers, researchers, professionals related to these disciplines guided by the latest technology framed in the so-called knowledge society, preceded the the Information Society that erupted in 2000 with the explosion of the Internet that chain came after the development of post-industrial middle of last century and the Industrial Society itself with identifying or if you want the discovery of electricity in the early nineteenth century who revolutionized factory life and woke up buried artisanal production schemes and goods, which are feeding and which serves the players and leaders, I will not refer to the text that the author makes the demanding close scrutiny of the academic community: The 152 pages, seven chapters covering the General Systems Theory-Foundations for General Systems Theory, Fundamentals of Systems, System Dynamics Computer Modelling, Computer Modelling Concurrent, building models Client-Server Computing conceptual and philosophical essence of the proposal linked inexorably to the aspect of "neural" in the corner over the formation of a systems engineer with a holistic view, we, as it has not be-a who will address the study of General Systems Theory and the training framework, and in the research, now in the discussions and controversies own fascinating scholars from these disciplines, when touched and become involved in dissecting the consideration of proposed text society of scholars of Informatics and perhaps in other disciplines concurrently.

I wish if, draw up a quick touch on the unusual and important features that make it possible to approach the personality, its own profile and hence to their work. the author of the text commented: Born and educated in his early years in a rural par excellence, the municipality of Turbaco settled in the outskirts of Cartagena de Indias, parents from this population and Maria La Baja, also rural, who distinguished themselves in their own work devoted to the support and development partner of six children, with jobs in the National Police as well as in the wholesale of beer the man, and the development of the home itself and the woman responsible for marking tip as the last child of this large family. Sent to the provincial capital, attended high school in the Salesian school-very-distinguished academic advantage over those years among the most remarkable for its promotion and

evidenced a singular coincidence, which was the school where he would attend his secondary education and where he graduated as such, acted as a pioneer-to 1986-in available at that time a computer room in pairs exist at the time, slipping from those early years his curiosity, innate ability and interest in this discipline, just emerging in and strengthened our country in terms of calling for a close family friend, Don Jose Rodriguez or "Pepin" - who presciently sensed to be applied where the engineer in power.

The physical proximity and greater security in those years when the country was fighting a bloody battle against drug lords-1989 with the assassination of Luis Carlos Galan, 1990 and Beyond ", it was determined that the race was taken at Universidad del Norte disregarding the Industrial University of Santander (UIS) highly qualified and attractive to venture into this still new and perhaps unfamiliar discipline.

There, at the Universidad del Norte, the author forged his training of undergraduate and graduate student always standing on both journeys and Distinguished Fellow at the undergraduate as well as by the educational institution as the agreements with companies in the region stimulated talent as it was the foundation of such Mario Santodomingo conglomerate. In this, the Universidad del Norte, began studying for his growing and continued interest in systems theory and a paradox was not her guardian who induced him to travel on this career path because their teachings have never been to his liking, more if the subject itself began to interest you and excite since.

After working a short stay in Cartagena de Indias, and recent graduate of the first stage of their careers, linked from the beginning and continuously breaking our institution as a professor in the Systems Theory course, and soon after all disciplinary areas-career, this topic has made it since then and which has grown slowly and steadily, leading to the production of the text is now given to the academic community for tasting and rigorous scrutiny.

Now in its capacity as a researcher, his intellectual production has been devoted to develop and strengthen three specific topics, in which the Faculty of Engineering and the Foundation San Martín University's headquarters in Puerto Colombia, which through its umbrella of Dr. Jose Santiago Alvear has sponsored the publication of the book object of these dimensions with strong leadership and growing our strong academic and research activities, "mother and guide its tasks has been fortunate with enthusiasm and tenacity led to growing through its evolution: Theory Systems, Methodologies on Learning Objects, and Information Security.

Here's an incontrovertible paradigmatic example of this attractive development, dynamic and vigorous in this exciting production traffic on academic, intellectual and "engineering" of this wonderful specimen, who is part of our quarry prominent academic in the formation of the best and most

transcendent engineers of these brand new generations, who will surely contribute to the transformation and better being of our fellows with a witty and creative technology solutions.

And, in a parody of the jargon so fashionable dining by these Kalends, I predicted "Bon Appetit" its lucky readers.

Jorge A. García Torres
Dean Faculty of Engineering
Fundación Universitaria San Martín, Puerto Colombia headquarters

Barranquilla, April 29, 2010.

BASES ON THE GENERAL SYSTEMS THEORY

Chapter

1

REDUCTIONIST APPROACH

Specialization

We say that a ***specialist*** professional knowledge is highly deepened when studying a small area of knowledge. That is, a cardiologist who is a specialist health be trained in good shape to solve problems concerning the human heart, and a lawyer, a law specialist, will help tackle problems judicial nature.

Specialization has entered the area of knowledge and society with great force, replacing the "Wise Men" of antiquity. Comparing the elementary schools of our parents and grandchildren, are in the first, a teacher who taught all subjects (biology, languages, mathematics, aesthetics, physical education, etc.). But in the latter, subjects are given by various teachers. Similarly, when we consulted a "generalist", a disease that afflicts us, we often "refer" to a specialist in a particular area of health. To where it wants that we watch, we found the specialization, in the work, the schools, the universities, etc. Thus, for the development of any project, specialists of different areas from the knowledge "join" themselves to develop it.

The knowledge areas that represent the expertise are those that focus on a "part" of other areas of knowledge, for example: Each of the Health Sciences (Dermatology, Urology, Histology, etc.), And Engineering (Mechanical Systems, Civil, Electronics, etc.). With specialization, the term Master Integral completely disappears to make room at the end ***specialist.***

Reductionist theory

Reductionist Theory is a methodological approach based on specialization. That is, this theory studies the complex phenomena based on the analysis of its parts [1]. This theory focuses on move from general to particular, and when we have a toothache, we went to dentist (Specialist in Human Teeth) and not the Dermatologist (Specialist in Human Skin).

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[1] Johansen, 1996

In fact, all undergraduate programs at universities are specializations of the total knowledge: the Masters are specialized studies of undergraduate programs; including doctorates so are the Masters and Postdoctoral are of doctorates.

It is known for the great contribution he has made to human knowledge reductionist theory, including the proper treatment of diseases, telecommunications, computer, etc., but it is also true that we do not enjoy the entire show to "specialize" ie, by reducing our object of study too.

Consequently, phenomenons exist like they are the ***Computer Systems*** that require to be analyzed as entireties, without losing of view the internal relationships; and they are not appropriately tried by the reductionist theory. In this type of phenomenons cannot be “known” neither to “predict” their behavior with the simple study of one on their behalves. For example, in the process of definition of the requirements of a software that must be built, it is impossible to determine them with the simple vision of a single user. It is necessary to keep in mind to all the users and clients, and also the relationships between them and their own necessities. When we analyze phenomenons with these characteristics we can fall in the imprudence and to generate missed knowledge and / or broken into fragments, originated the demand of additional resources to amend the error.

If we take as analyzes the behavior of a person in a given population, and we always results in that person complies with the traffic signals, would it be valid to say that everyone in the population also respect the traffic signals?

The great disadvantage of the reductionist theory is to generate ***Specialized Ears*** of specialists who have little communication with other disciplines, due to their knowledge so special. When their ears are more specialized, the lower your participation in a conversation between two or more professionals in different fields to study the same phenomenon. This is the case of a "conversation" between a lawyer and a physical star on worm holes.

THE APPROACH OF GENERAL SYSTEMS THEORY

Approaches to general systems theory

System: Preliminary definition

For now, a ***system*** is defined as the set of parts that interact together to achieve a goal. Own this definition would be: football teams whose objective is to score more goals than your opponent; a refrigerator, parts of which relate to maintaining a temperature within the same; and the human digestive system which aims to transform appropriate energy the food humans eat.

Methodology of General Systems Theory

The ***Methodology of the G.S.T.*** is based on the analysis of phenomena as wholes consisting of parts interacting with each other (systems). Also aims to integrate the analysis of the phenomenon parties to reach a logical whole, where, are important relations between them. Therefore, we argue that the G.S.T. has a methodological basis contrary to the reductionist approach[1].

In G.S.T. the study objects are treated as systems and therefore seeks to overcome the disadvantages of the reductionist theory, forming the so-called ***Generalized Ears***, and developing a framework containing a common language and to allow two or more specialists from different disciplines together to analyze a phenomenon. That is, these generalized ears will be able to "defend" in a communication for teamwork.

With this, the G.S.T. creates a new system, consisting of Generalized Ears (Parties) that communicate (interact) with each other, to analyze a phenomenon (Target). The situation is reflected in the case of a Working System for the construction of an information system, where the Software Engineer, Engineers from other disciplines, administrators, etc., must have the "protocols" right of communication for software development.

Approaches of other authors

Von Bertalanffy[2] defines G.S.T. as a logical-mathematical area whose mission is the formulation and derivation of principles that are applicable to systems in general.

For ***West Churchman***[3], the G.S.T. is a way of thinking about systems and their components. In studying a phenomenon must first identify the objective pursued, and only after its structure.

Frameworks for the study of G.S.T.

To implement the fundamental concepts of TGS in the analysis of the phenomena must choose one of the benchmarks described below:

First frame of reference

The ***first frame of reference*** is to construct a theoretical model to represent general phenomena that are in different disciplines. In fact, seeks in essence conceivable systems reduce to a manageable number. For example, in all areas of human knowledge there are populations of individuals; the idea is to generate a model that is applicable and valid in the different disciplines that have to do with those populations.

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[1] To confront with Latorre,1996 and Johansen,1996
[2] Von Bertalanfy, 1978
[3] Churchman, 1973.

This framework provides an objective low ambition but with a high degree of confidence, trying to discover similarities in the theoretical constructions of different disciplines of knowledge, and developing theoretical methods applicable to at least two areas of study.

Second frame of reference

The second frame of reference consists of a hierarchy of knowledge disciplines in relation to the organizational complexity of their components at a level of abstraction.

This second framework, presents a target of high ambition and low confidence, it seeks to develop a set of interacting theories (System of Systems) in particular areas of human knowledge, directing research to fill gaps. Table 1 describes this System of Systems.[1].

Trends of practical application of G.S.T.

Among the trends of practical application of general systems theory are the following disciplines: cybernetics, information theory, game theory, decision theory, systems engineering.

Cybernetics

Cybernetics[2] is the science that studies the transfer of information to the control and organization of systems. It uses the principles of feedback and homeostasis[3]. The objects of study of cybernetics are called ***cybernetic systems***, which have parts that promote and manage the organization and control within the same, to maintain a balance of the system.

The typical example is the human central nervous system, for informing the brain to make a sudden movement of the right hand is burning, it acts as a cybernetic system, because with this action prevents the imbalance of the system

Information theory

Information Theory is the science that is responsible for reviewing the handling that gives information as a contribution to the organization and implementation of the objectives of the systems. Looking for an Accounting Information System, which has worked well for several years, but at some point the government has enacted new legislation amending the methods of payment of taxes, this information must be handled properly to to keep "alive" to the System. Hence, all information affecting a system must be taken into account to generate new information and actions that impact the survival of the system.

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[1] To confront with the description realised in Johansen, 1996
[2] Cybernetics. Developed by Norbert Weiner. Cybernetics. Cambridge Mass MIT Press. 1961
[3] Homeostasis. It is the property that presents the Systems to stay in balance.

Table 1. Order of Hierarchy of the empirical Fields

Level	Examples
Static systems: They correspond to conceptual or theoretical systems	The Conceptual Models The laws of Newton Trigonometry
Simple Dynamic systems: They correspond to nonorganic systems that transform some type of energy	Solar System The Volcanos The Sea currents
Cybernetic Systems or Control: They are Systems that help others to fulfill their objectives.	The Thermostat The Human Nervous System
The Dynamic systems first Order: Systems with a first degree of organization.	The cells The Virus The Bacteria
The Dynamic systems second Order:	The Flora generally
The Dynamic systems 3° Order:	The Fauna generally
The Dynamic systems 4° Order:	The Man
The Dynamic systems 5° Order:	A Company A family
The Dynamic systems 6° Order:	The absolute thing

Game theory

Game Theory[1] is the science, using mathematical models, study skills or clashes between various systems capable of "reasoning" in which each participant seeks to minimize system losses and maximize profits. Among the cases studied game theory are: Fighting Sports, suppliers of a product on the market (as War of soda), the strategies of two men trying to conquer a lady and a police pursuit.

[1] Developed by Von Neuman and Morgenstein

Decision theory

Decision Theory is the science of fighting between various systems, where some are able to "reason" and others unable to do so, in addition, each participant system capable of "reasoning" seek to make decisions that optimize the results (to minimize losses and maximize profits). Therefore, we conclude that decision theory is a special case of the Theory of Games, where players are rational. The example that stands out the theory of rational decision as no participant is nature. Among the phenomena studied for Decision Theory are: methods to mitigate forest fires, the management of supply and market demand, and prediction of weather and earthquakes.

Computer Systems engineering

Carlos Trujillo[1] defines the Computer Systems Engineering as a discipline that aims to plan, design, test and build complex systems using the G.S.T. and engineering, as distinguished from the others Engineerings at its most integral character to examine the solution of problems.

Oscar Johansen[2] believes that Computer Systems Engineering concerns the planning, design, construction and scientific evaluation of human-machine systems.

For the author, Computer Systems Engineering is responsible for resolving problems, building automated information processing systems, under the approach of General Systems Theory using resources provided by engineering.

FOCUS ART TO SOLVE PROBLEMS

In this section describe two approaches used in general systems theory in solving problems[3]. In the first instance, describes a formal procedure in which everything revolves around around the construction of models, and the second round of creativity. But first, let's define the concept of problem:

What is a problem?

Is defined as a ***problem*** in the abstract difference is obtained by comparing the objectives with the results. Framing in the G.S.T., we can say that every system has goals to accomplish, if your product is different, conceptually to the objectives, it is said that a problem exists.

That is, for example, when a company does not have the right information on time, it produces can not make the right decisions or prevent mishaps, since what is desired (target) is to have all the information possible and have is uncertainty (results).

---

[1] Trujillo, Carlos. Análisis de sistemas. Mimeografiando. Universidad del Valle Colombia.
[2] Johansen B., Oscar. Introducción a la teoría general de sistemas. Limusa. México. P 32
[3] Ackoff, 1998

First approach: modeling from reality

This ***approach to solve problems***, describes a technique that involves the following steps: Identify the problem, decision to resolve the problem, Models of Reality, Use and work with the model and guidelines for action, decision, Commissioning, Operation and evaluation.

Problem identification stage

At this stage, which is seeking System objectives are not being met, making it clearly highlighting the magnitude and characteristics.

For example: In a grocery store a client requests a certain amount of merchandise which after having paid the shopkeeper realizes that there is no stock. The problem here is that there is no inventory control of merchandise.

Decision to resolve the problema stage

At this stage is performed feasibility analysis and decide whether "worth it" to solve the problem. To make the decision to solve the problem is necessary to conduct a feasibility study, which may cover several aspects such as:

- **Economical.** The question is if you have the resources necessary to fund the solution of the problem.
- **Technology.** It considers whether the technology exists to help solve the problem.
- **Operational.** It is important to know whether the proposed solution is applicable, used and accepted.
- **Motivation to solve the problem.** It is vital the actual arrangement to solve the problem.

In the event that one of these aspects is not feasible, you should not consider starting the process of solving the problem.

Models of Reality stage

The central idea of this stage is to model the behavior of the problem itself, guiding the knowledge of the situation and determine the overall objectives. Also, make the description of the system, identifying its supesystem, its subsystems, hierarchy and relationships.

Use and work with the model and guidelines for action stage

The model created in the previous stage is used for options of operation, to be able to define alternative solutions and evaluating them.

Decision stage

At this stage a group of people deal with the actions to follow. The decision may be to accept the proposals given by the study.

Commissioning stage

Is to plan and organize all the activities and tasks under the proposal accepted in the previous stage.

Operation and evaluation stage

This step ensures that the system works or operate regularly. In addition, it verifies compliance with the stated objectives through indicators.

Second approach: creativity and constraints

In modern life, a professional in the area of General Systems Theory, must possess an essential feature that allows you to overcome obstacles and do not be average. This feature is creativity. Many authors argue that creativity is innate and therefore can not be taught or learned. The truth is that every person is born with some degree of creativity that must be developed with proper training from an early age.

Because oddly enough, the creativity of a person is mutilated by the type of education they receive from an early age, where, are taught to students to "think" in accordance with the guidelines of the school, family, country, etc thus suppressing the impulses born creative. By limiting creativity, ensures that institutions and models do not collapse. Thus, the wrongs of humanity are justified to maintain concepts that are the base of the institutions.

In his time, Galileo developed through research, mathematical modeling and observation, the theory that the earth revolved around the sun, it contradicted the arguments "accepted" at that time. Galileo used his creativity and solved a problem in way differently and correctly. Agree at that Galileo was right was to sow distrust of the believers who lead to the establishment of the disaster.

We thought then that if the children at an early age causes them to analyze and question the institutions, dogmas and paradigms, it is certain that revolutionary changes, innovative and useful they would more often when children they are older.It is also true that one way of doing things stops creativity.

For example, a math teacher puts on a review exercise that can be done in 5 different ways, but calls that are carried out by the method he knows. Truth be told, this teacher is teaching only knowledge that it dominates, moreover, does not allow students to develop other ways to solve the exercise, limiting possible learning first, and second, refusing to learn it from their students.

On the other hand, when we meet a group of friends and they say a riddle to solve, many, if we did not know before, we can not solve. This is the result that there is a self-imposed restriction, for example, has the following riddle: How would take a gold ring in a cup of coffee using just one hand, that the ring comes out clean.

In fact, the responses of the group of friends went from silly to ridiculous. All revolved around how to evaporate the water for coffee. The truth is that the solution to the problem was simply to get the ring with one hand full cup of coffee, because coffee is a solid and therefore can not get wet. The self-restriction placed friends restricted their creativity but this was so easy to apply.

We conclude that creativity is limited by self-imposed restrictions; therefore, to "get" Creativity should develop an ability to identify self-imposed restrictions and eliminate them. Clearly, to creatively solve problems is not sufficient to identify the self-imposed restrictions need a stronger boost.