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Systems Engineering

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A Quotation to Open On

“Injustice anywhere is a threat to justice everywhere”

-Martin Luther King

Featured Article

What is Complexity Theory? Features and Implications

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The term 'complexity' is often loosely appropriated by both academics and practitioners to describe things that lack simple explanations. However, little conceptual clarity exists regarding the meaning of complexity. This is, in part, due to the diverse history of complexity theory, which evolved from the interplay of several disciplines, including physics, mathematics, biology, economics, engineering, and computer science. Furthermore, its theoretical predecessors include movements such as cybernetics, autopoiesis, general systems theory, the theories of artificial intelligence and artificial life, chaos theory, and information theory.

Cybernetics: A theory based on feedback, entropy and information that can explain the operation of machines, as well as biological and social phenomena (Nobert Wiener). **Autopoiesis:** A system's capacity for self-production and maintenance through feedback loops (Humberto Maturana and Francisco Varela). **General Systems Theory:** A logico-mathematical field in which the principles that are applicable to systems in general are derived and formulated (Ludwig von Berthalanffy).	**Artificial Life:** The study of living systems in artificial environments (Christopher Langton). **Chaos Theory:** A field that addresses systems that display bifurcation, sensitivity to initial conditions, and other mathematically defined behaviour (Edward Lorenz). **Information Theory:** A branch of applied mathematics and electrical engineering involving the quantification of the information content in a message (Claude E. Shannon).

Although it is beyond the scope of this article to study these influences in detail, one broad question that I shall try to address is '*What is complexity theory?*' More specifically, I shall discuss two schools of thought on complexity, and try to highlight the implications that these discussions hold for how we view the goal and status of scientific practices.

Restricted vs. General Complexity

With regard to the two schools of complexity, I follow the French philosopher and complexity theorist, Edgar Morin (2007), in distinguishing between (what he calls) *restricted complexity* and *general complexity*. The central difference between these two paradigms concerns our *attitude* towards complex phenomena:

It is generally recognised that complex systems are comprised of multiple, inter-related processes. In terms of restricted complexity, the goal of scientific practices is to study these processes, *in order to uncover the rules or laws of complexity*. Researchers at the Santa Fe Institute (founded in 1984, and dedicated to the study of complex systems) support this goal, as is clear from the Institute's aim, which is:

To discover, comprehend, and communicate the *common fundamental principles* in complex physical, computational, biological, and social systems that underlie many of the profound problems facing science and society today (my italics).[1]

For these researchers, complexity becomes the umbrella term for the ideas of chaos, fractals, disorder, and uncertainty. Despite the difficulty of the subject matter, it is believed that, with enough time and effort, we will be able to construct a unified theory of complexity – also referred to as the 'Theory of Complexity' (TOC) or the 'Theory of Everything' (TOE) (Chu, Strand & Fjelland 2003). In other words, the hope is that, as with chaotic phenomena, complex phenomena can also be encapsulated in a precise definition or mathematical equation. Prominent attempts at formulating such a TOC include Langton's (1992) ideas on life at the edge of chaos, Bak's (1997) work on self-organised criticality, and Kaufman's (1993) work on attractors and strange attractors.

Life at the edge of chaos: Describes transition phenomena first observed in the behaviour of cellular automata.

Self-organised criticality: A phenomenon whereby certain systems reach a crucial state through their intrinsic dynamics, independently of the value of any control parameters.

Attractor: A point or an orbit in the phase space where different states of the system asymptotically converge.

Strange attractor: An attractor for which the approach to its final point in phase space is chaotic.

However, whilst such research has undoubtedly led to important advances in formalisation and modelling, attempts at formulating a TOC have failed. Seth Lloyd, a professor in mechanical engineering at MIT, has compiled a list of 31 different ways in which one can define complexity! As a result of the lack of conceptual unity, Jack D. Cowan (in Horgan, 1995: 104), one of the Institute's founders, concludes that the major discovery to have emerged from the Santa Fe Institute is that 'it's very hard to do science on complex systems'.

Some of the ways in which to define complexity (Horgan, 1995: 107) include:

Entropy: Complexity equals the entropy or disorder of a system, as measured by thermodynamics. **Information:** Complexity equals the capacity of the system to "surprise," or inform, an observer. **Fractal dimension:** The "fuzziness" of a system, the degree of detail it displays at smaller and smaller scales. **Effective complexity:** The degree of "regularity" (rather than randomness) displayed by a system. **Hierarchical complexity:** The diversity displayed by the different levels of a hierarchically structured system.	**Grammatical complexity:** The degree of universality of the language required to describe a system. **Thermodynamic depth:** The amount of thermodynamic resources required to put a system together from scratch. **Time computational complexity:** The time required for a computer to describe a system (or solve a problem). **Spatial computational complexity.** The amount of computer memory required to describe a system. **Mutual information**. The degree to which one part of a system contains information, or resembles, other parts.

Those who support a notion of *general complexity* would argue that it is *impossible* to do science on complex systems, if by science we understand the practice of uncovering the rules and laws that govern all phenomena. It is simply fallacious to reason that because computers following simple sets of mathematical rules give rise to extremely complicated patterns, worldly phenomena (which are also characterised by extremely complicated patterns) must therefore also be governed by simple rules (which we can unearth with the help of powerful computers) (Horgan, 1995). To equate complexity with original simplicity is to recognise complexity by decomplexifying it.

In terms of general complexity, attempts at formulating a TOC will necessarily fail because complexity *itself* is not accounted for. If we accept the fact that things are inherently complex, then it means that *we cannot know phenomena in their full complexity* (Morin, 2007; Cilliers 1998). In other words, complex phenomena are irreducible. Acknowledging complexity therefore has a profound impact not only on the status of scientific practices, but also on the status of our knowledge claims as such. More specifically, because our knowledge of complex phenomena is limited, our practices should be informed by, and subject to, a *self-critical rationality* (Preiser & Cilliers, 2010). We are not busy with an objective pursuit of truth, but rather working towards finding suitable strategies for dealing with complex phenomena. These strategies can, however, backfire and therefore it is important to remain self-aware and critical of our practices, and – if necessary – subject our knowledge claims to revisions. Acknowledging the irreducible nature of complexity also influences our understanding of the general features of complexity:

Features of Complex Systems

Complex systems are constituted by richly interconnected components

Complex systems consist of a *large number of interrelated components*, with *fairly-short range interactions*. In simple phenomena the system is the additive result of its components, whereas in complex phenomena, the system is the result of the nonlinear, dynamic relations between its component parts and is thus incompressible (Cilliers, 1998). This insight has important methodological implications:

The traditional scientific paradigm is premised on a *reductive methodology* in that it is believed that complex systems can be completely understood in terms of their components parts. Such analyses, however, serve to destroy the complexity, since what is of interest in complex systems is not the components themselves, but the interrelations between component parts. This is because these relations give rise to self-organising, non-linear and emergent behaviour. As such, reductionism is an inadequate methodology for understanding complex phenomena. This is a rather uncontroversial point, as, today, the weaknesses of the reductive approach are widely recognised. In response, many scientists have therefore turned to the system (rather than its constituting parts) as the object of analysis, in the hope of unearthing those principles that are common to all systems[2]. However, this approach is equally problematic, as it is based on the *principle of holism*, which, as Morin (1992: 372) explains, is also a form of reductionism:

> Holism is a partial, one-dimensional, and simplifying vision of the whole. It reduces all other systems-related ideas to the idea of a totality, whereas it should be a question of confluence. Holism thus arises from the paradigm of simplification (or reduction of the complex to a master-concept or master-category).

In order to understand complex systems, we therefore need to account for a) the systemic identity of component parts; and, b) the complex nature of interrelations between the component parts, and between the component parts and the system as a whole.

The component parts of complex systems have a double-identity

The component parts of complex systems have a *double-identity*, which is premised on both a diversity and a unity principle (Morin, 1992). With regard to the *diversity principle*, we can say that the identities of the system's components are irreducible to the whole, since each component still retains its own unique individual identity. For example, the fact that I enjoy painting cannot be deduced from my role as a philosophy lecturer at a university, although it is part of what makes me unique. However, the coupling of components also gives rise to a common identity (*the unity principle*) which constitutes their citizenship in a system. Therefore, the fact that I interact with other academics and students on a professional basis, constitutes behaviour that supports the goals of the university, and thus confirms my identity as a philosophy lecturer in the academic system. Despite the nature of the example, this point applies generally: when thinking about complex systems, this double-identity needs to be accounted for, because – on the one hand – if we forego the diversity-principle, our thinking becomes increasingly homogenised (holism); and – on the other hand – if we forego the unity-principle, our thinking loses a sense of unity (Morin, 1992).

Upward and downward causation give rise to complex structures

In complex systems, the *competitive* and *cooperative* interactions between component parts on a *local level* give rise to *self-organisation*, which is defined as 'a process whereby a system can *develop a complex structure from fairly unstructured beginnings'* (Cilliers, 1998: 12; my italics). Consider, for example, a group of students who come together to form a reading group on complexity theory. Through cooperating, their actions give rise to certain structures, thereby transforming their uncoordinated individual activities into coordinated, goal-orientated, group activities. In turn, these self-organising processes *feed back* to constrain the behaviour of the parts through a process of *downward causation.* In my example, the behaviour of the individuals in the reading group is constrained by the goals of the group itself. In other words, in the context of the reading group, it would be inappropriate to instigate a conversation on where I intend to go on vacation. In understanding complex phenomena, we must therefore substitute the principle of reductionism with a principle that conceives of whole-part mutual interaction (Morin, 1992). These mutual interactions result in, what Morin (2008: 49) terms, 'organizational recursion' where 'the products and the effects are at the same time causes and producers of what produces them.' This means, for example that, as individuals we create, engage in, and challenge our practices (including scientific practices), which simultaneously serve to shape us.

In sum, the complex interrelations between components and systems give rise to the following three systemic characteristics (Morin, 1992):

- *The whole is greater than the sum of its parts,* in that systemic attributes cannot be reduced to the parts alone, but are the result of interconnections between the parts.
- *The whole is less than the sum of its parts,* since some of the qualities of the parts are suppressed under the constraints that result from systemic organisation.
- *The whole is greater than the whole*, due to the dynamic organisation that takes place is systems where local interactions between components give rise to phenomena that are dependent on the base, but simultaneously

supersede that base.

In order to adequately understand this last characteristic it is necessary to turn to the next feature of complex systems, namely *emergence*.

Complex systems exhibit self-organising and emergent behaviour

In order to make the case for self-organisation, it is necessary to show that 'internal structure can evolve without the intervention of an external designer or the presence of some centralised form of internal control' (Cilliers, 1998: 89). Self-organisation is a necessary condition for emergence, which is defined as 'the idea that there are properties at a certain level of organization which *cannot be predicted from the properties found at lower levels*' (Emmeche, Koppe & Stjernfelt, 1997: 83; my italics). Specifically, self-organisation draws attention to the *structural* and *temporal* dimensions of emergence. Systems develop structure (i.e. hierarchies) by processing information and developing 'memory'. The example of neural networks offers a good explanation of this principle: neural networks are chemically-connected or functionally-associated neurons. The interconnections between these neurons are called synapses. Over time, certain pathways are established in the brain, meaning that some of the synapses are reinforced through impulses, whereas others die off. In this way, structure develops as groups of neurons are selected, reinforced and transformed through interaction with their environment .This implies that a fairly undifferentiated brain develops structure or consciousness over time[3] (Cilliers, 1998).

The previous section concluded with the idea that the whole is greater than the whole; and, indeed, one can convincingly argue that the mind is 'greater' or 'more' than the brain (which is made up of self-organised neurons or synapses). It therefore seems that, whilst *self-organisation is a necessary condition for emergence*, it is *not sufficient*. As such, anyone working with complex systems must take note of (and try to formulate answers to) the following questions pertaining to the nature of emergence.

- Does our notion of emergence depend on the nature of the system under study?
- How should emergence be defined and are ideas such as irreducibility, unpredictability, conceptual novelty, ontological novelty, and supervenience necessary for understanding emergence?
- What categories of entities can be emergent: properties, substances, processes, phenomena, patterns, laws, or something else?
- Is emergence an objective feature of the world, or is it merely in the eye of the beholder?
- What is the scope of actual emergent phenomena?
- Does the emergence imply or require the existence of new levels of phenomena?

Complex systems are open systems

Compounding the issue further is the fact that complex systems are open systems. Unlike isolated systems, the intelligibility of *open systems* can only be understood in terms of their relation with the environment. This is because there is an energy, material, or information transfer into or out of a given system's boundary. The nature and content of the system's interaction with the environment is discipline-dependent. Whereas homeostatic systems are merely dependent on the environment for their survival (in that they are capable of facilitating their own production and maintenance through feedback loops) (Maturana & Varela, 1980); human identity, for example, is, in part, constituted by the environment. This is because our identities develop over time within a network of relationships with other identities. As such, who I become (i.e. my emergent identity) is not only a function of my genes, but also of my context (Woermann, 2010).

Regardless of the system under study, we can say that, methodologically-speaking, it is very difficult to study open systems. This is because the environment is simultaneously *intimate* and *foreign*: it is both part of the system (in that we reproduce the system-environment distinction when we model) and remains exterior to the system (Morin, 2008). In other words, the environment cannot be appropriated by the system. This means that the *boundary* between a system and its environment should be treated both as a *real*, *physical category*, and *a mental category or ideal model* (Morin, 1992). This last point has implications for how we view the boundaries of systems: although boundaries are a *function of the activity of a system itself*, they are also the *product of the description* that we give to the system. Hence, boundaries must be thought of 'as something that *constitutes* that which is bounded' (Cilliers, 2001: 141) rather than an objective demarcation of a system. The fact that we cannot draw a system's boundary in any unproblematic fashion introduces further complexities, which is denoted by the *observer problem*.

Implications

Complex systems are not complicated systems

Engaging with complexity necessitates an acknowledgement of the fact that complex systems are, in principle, unsolvable; or, in the words of the evolutionary biologist, Robert Rosen (1985: 424), a system is complex precisely 'to the extent that it admits non-equivalent encodings; encodings which cannot be reduced to one another.' Herein lies a distinction between complicated and complex systems: whereas a complicated system may initially look complex (due to the large number of components that may constitute the system, and/or the sophistication of the tasks that the system can perform), *the hallmark of a complicated system is that* – unlike a truly complex system – *we can figure it out*. In this regard, an engine serves as an example of a complicated system (Cilliers, 1998).

Restricted complexity is premised on the belief that complex systems are merely complicated systems; and that, with enough hard work, we can get to the underlying principles that govern these systems. Admittedly, the distinction between complicated and complex systems is often undermined in practice by powerful new technologies, where complex phenomena turn out (on further inspection) to be merely complicated. However, despite the fact that this distinction cannot be drawn in an unproblematic fashion, it nevertheless remains a useful analytical tool, as it determines whether the study of complexity constitutes a search for rules, or whether it constitutes an engagement with both complexity and the implications that arise from complexity.

Modelling complexity is partly a normative exercise

We cannot understand phenomena in their full complexity, and therefore modelling is a necessary condition for creating meaning. In terms of restricted complexity, modelling complexity remains a purely descriptive task, in that the goal is to describe (preferably in mathematical terms) the principles and rules that underlie complex systems. In terms of general complexity, modelling necessarily involves a *normative component*, as we must make choices, judgements, and assumptions when deciding on the factors that are relevant in modelling complex systems. It is precisely because we *cannot escape the realm of choice* that complexity involves ethics (and often also politics!) (Preiser & Cilliers, 2010). The fact that an engagement with complexity is not a purely objective exercise, does not imply an 'anything goes' approach. Indeed, as Allen (2000: 93) states, '[a] representation or model with no assumptions whatsoever is clearly simply subjective reality' and therefore 'does not concern systemic knowledge'. The point is that we must apply our complexity reduction assumptions honestly. We should forego the desire to prove the 'truth' of our models and instead focus on the *pragmatic criterion* of whether the systemic knowledge provided by our models is *useful* or not. In order to safeguard the integrity of scientific practices, we must recognise that our framing or modelling strategy represents one choice amongst many; and that each choice gives rise to 'a different spectrum of possible consequences, different successes and failures, and different strengths and weaknesses' (102).

Therefore, modelling complexity (i.e. partitioning ambience into a system and an environment) enables us to reduce the complexity and to gain systemic knowledge of our world. However, a problem arises when weak reductionism (i.e. assuming a conscientious and critical attitude towards modelling) transforms into strong reductionism (i.e. modelling in order to uncover the truth). This is because when the scientist views operational closure as a systemic feature rather than an observational difficulty, one is led 'to a vision of the world that is classificatory, analytical, [and] reductionist, with linear causality' (interpretation of Maruyama in Morin, 2008: 12).

We must take responsibility for the consequences that arise from our models

If our models do not correspond with reality, and if they are the outcomes of certain choices, then we must also take *responsibility* for both the *intended* and *unintended consequences* that arise from our modelling strategies. Indeed, it may sometimes be the case that our actions 'fly back at our heads like a boomerang' (Morin, 2008: 55). As scientists, the critical attitude therefore also lies in acknowledging that:

> There is no science of science, and even the science of science would be insufficient if it did not include epistemological problems. Science is a tumultuous building site, science is a process that could not be programmed in advance, because one can never program what one will find, since the characteristic of a discovery is in its unexpectedness. This uncontrolled process has led today to the development of potentialities of destruction and manipulation, which *must bring the introduction into science of a double conscience: a conscience of itself and an ethical conscience* (Morin, 2007: 21; my italics).

Science cannot be practiced in a vacuum, since our scientific practices are intricately connected with other aspects of our lives. Given the myriad crises that we face today, it is no longer viable to separate disciplines, cognitive difficulties, and challenges from one another. We have a moral obligation to account for the consequences that arise from our practices; and, if need be, to take *corrective action*.

Conclusion

Although this article does not provide practical guidance on how to model complex systems within a systems engineering environment, it does seek to focus attention on the general features of complex systems that should be considered when modelling, as well as on the ethical implications that arise when we model complex phenomena. Above all, a serious engagement with complexity implies that we should be critical of the reach of our claims, practice science modestly and vigilantly, and avoid falling in love with our models!

References

[1] http://www.santafe.edu

[2] See: von Bertalanffy, L. (1972) 'The history and status of General Systems Theory' in The Academy of Management Journal, 15(14): 407 – 426.

[3] What should be clear from this description is that the structural and temporal dimensions of self-organisation (as an emergent process) do not allow for an understanding of complexity in terms of absolute thresholds (as implied, for example, by von Neumann's (1966) use of the term 'complexity barrier'). It is not the case that simple systems suddenly start showing emergent behaviour. As soon as dynamic and complex interactions between systemic components exist, systems start developing structures. However, complexity is also not an additive process, since the interactions between components are non-linear and allow for surprising reconfigurations of systemic structures. As such, trying to pinpoint optimal levels of organisation, through recourse to terms such as 'self-organised criticality', again denies a measure of complexity. Some of these questions are briefly addressed in the introduction of Bedau and Humphreys' (2008) jointly edited book, entitled 'Emergence: Contemporary Readings in Philosophy and Science'.

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About the Author

Dr Minka Woermann is a lecturer in philosophy and applied ethics at Stellenbosch University, South Africa. Her research interests include complexity theory, ethics, business ethics, and post-structural philosophy. She recently completed her PhD, entitled 'A Complex Ethics: Critical Complexity, Deconstruction, and Implications for Business Ethics'.

Systems Engineering News

Upcoming Submission Deadlines and Themes for INSIGHT

INSIGHT is the newsletter of International Council on Systems Engineering. It is published four times per year (January, April, July, October). INSIGHT features status and information about INCOSE's technical work, local chapters, and committees and boards. Additionally, related events, editorials, book reviews, trends, and how-to-do articles that are pertinent to the many aspects of a systems engineer's job are also included, as space permits.

Upcoming submission deadlines and themes for INSIGHT

INCOSE eNote February 2011 v8 Issue 2

In this issue, read how attending IS can earn you credits toward recertification, which SE Standards are available free to INCOSE members and how to help PhD SE students with research surveys..

More information

Lockheed Martin to Leverage INCOSE's Systems Engineering Certifications Starting in 2011

"Lockheed Martin engineers drive innovation in our Corporation," said Dr. Ray O Johnson, senior vice president and chief technology officer at Lockheed Martin. "As technology becomes more complex, systems engineering is increasingly important in the development of relevant, affordable solutions for our customers. This agreement with INCOSE complements our technical workforce development initiatives, and it provides an independent and consistent assessment of our systems engineering community."

More information

Systems Engineering Journal

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A list of papers in Volume 14 Issue 1 of the Systems Engineering Journal is at http://onlinelibrary.wiley.com/doi/10.1002/sys.v14.1/issuetoc

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University of Arizona Systems Engineering Pioneer Dies at 84

Professor emeritus Wayne Wymore, who in 1960 founded the world's first academic department of systems engineering at the University of Arizona, died Feb. 24 at age 84

More information

Accelerated Reliability Webinars

Hobbs Engineering now offer webinars in addition to their regular seminars.

More information

New System Dynamics Journal

At the initiative of Dr. Ahmad Taher Azar, Assistant Professor of Electrical Communication and Electronics Systems Engineering at the Modern Science and Arts University in Egypt, the publishing company IGI is establishing the International Journal of System Dynamics Applications, with Dr. Azar as Executive Editor. The journal is scheduled to commence in 2012.

More information

Establishment of INCOSE Reliability Engineering Working Group

Reliability engineering should be practised as an integral part of systems engineering. The possibility of establishing an INCOSE working group on reliability engineering was discussed at the 2011 INCOSE International Workshop held in Phoenix, USA in February 2011. A decision was taken by the attendees to establish a new working group, which should address reliability engineering as it relates to systems engineering throughout the acquisition life-cycle. The first step in this process is to compile a charter for consideration by INCOSE Technical Operations. The first activity of the working group will be to review and update or improve the reliability engineering content as published in the current INCOSE Systems Engineering Handbook.

If you are interested in joining this working group, please contact Albertyn Barnard for more details.

Featured Society

TRIZ Societies

International TRIZ Association (MA TRIZ, in Russian МАТРИЗ)

The International TRIZ Association was created to insure broad and open dissemination of knowledge and applications of TRIZ for management of innovation related activities. The Association is comprised of various not for profit Regional Associations. These Associations represent major international companies and small businesses, consultants and academia. MA TRIZ shares a desire to advance TRIZ and its applications and to spread its knowledge around the world.

MA TRIZ strongly believes that we live in the era of expedient creative activities. We are destined to improve the world around us and that is what distinguishes us from other known living species.

The activity of MA TRIZ is controlled by an elected Supervisory Board, consisting of TRIZ Masters. Executive Director is Bojtsov Lyudmila Romanova, St. Petersburg, Russia.

In various countries of the world MA TRIZ has given 62 certificates to TRIZ specialists and 64 certificates to TRIZ users in accordance with the system of multi-step attestation and certification. MA TRIZ has reached an agreement on cooperation with Altshuller's Institute (USA). The Association has also covenanted for cooperation with the TRIZ Association of Korea.

MA TRIZ holds conferences, carries on publishing activity, stimulates research activity in the field of TRIZ, holds TRIZ seminars. At the same time it holds international seminars for advanced TRIZ specialists from the USA, Netherlands, France, Korea, Japan, etc. The leading specialists of MA TRIZ give lectures. These seminars continue the tradition of TRIZ Association seminars which were first held in the 90s.

MA TRIZ distributes information letters on regular basis; it also supports an Internet site, publishes an on-line "MA TRIZ bulletin" and forms a resource of TRIZ materials.

MA TRIZ meetings, meetings of MA TRIZ Presidium take place routinely; there is an Expert Board and Methods Board attached to MA TRIZ, system of vice-presidents and advisers to MA TRIZ President on different spheres. All MA TRIZ staff and members work on a voluntary unpaid basis. MA TRIZ does its best to promote free development and expansion of TRIZ in the world; for this purpose the declaration "TRIZ without limits" was adopted.

MATRIZ sponsors an annual international TRIZ*fest* conference.

More Information: http://www.matriz.org/start.php?mlang=2&p=41&t=4

TRIZ (in Russian: Теория решения изобретательских задач (Teoriya Resheniya Izobretatelskikh Zadatch)) is a problem-solving, analysis and forecasting tool derived from the study of patterns of invention in the global patent literature. TRIZ (pronounced treez) was developed by the Soviet inventor Genrich Altshuller and his colleagues, beginning in 1946. In English the name is typically expressed as "the Theory of Inventive Problem Solving)".

Following Altshuller's insight, the Theory developed on a foundation of extensive research covering hundreds of thousands of inventions across many different fields, to produce a theory which defines generalisable patterns in the nature of inventive solutions, and the distinguishing characteristics of the problems that these inventions have overcome.
An important part of the Theory has been devoted to revealing patterns of evolution and one of the objectives which has been pursued by leading practitioners of TRIZ has been the development of an algorithmic approach to the invention of new systems, and the refinement of existing ones.

TRIZ presents a systematic approach for analysing the kind of challenging problems where inventiveness is needed and provides a range of strategies and tools for finding inventive solutions. One of the earliest findings of the massive research on which the theory is based is that the vast majority of problems that require inventive solutions typically reflect a need to overcome a dilemma or a trade-off between two contradictory elements. The central purpose of TRIZ-based analysis is to systematically apply the strategies and tools to find superior solutions that overcome the need for a compromise or trade-off between the two elements.

TRIZ is used worldwide.

The Altshuller Institute for TRIZ Studies

The Altshuller Institute is a U.S.A. 501(c) (3) Non-Profit organization that exists for the benefit of those who:

1. know the TRIZ Methodology,
2. for those who want to learn TRIZ, and
3. wish to export TRIZ for the benefit of all mankind.

The Institute is associated with Kent State University, MA, USA.

The Institute states that it is the only organization officially authorized by Genrikh Altshuller, the founder of TRIZ, to use his name.

The Altshuller Institute provides many services to the world TRIZ community. In addition to disseminating TRIZ training at its annual TRIZ conference, TRIZCON, the Altshuller Institute also promotes other global TRIZ events and links to other TRIZ-related sites. The Altshuller Institute's General Store makes the largest collection of TRIZ materials in the world available to everyone. This web site also provides news sections for any member of the TRIZ community to post press releases. There are monthly online periodicals, articles and papers relative to current TRIZ usage.

Anyone can subscribe to a free monthly E-Newsletter.

The Altshuller Institute is governed by elected offices supported by standing committees. President at this time is Mr. Mansour Ashtiani, who is based in Michigan, USA.

More information: http://www.aitriz.org/index.php?option=com_frontpage&Itemid=1

European TRIZ Association (ETRIA)

The European TRIZ Association (ETRIA) aims to function as a connecting link between industrial companies, institutions, educational organizations and individuals concerned with conceptual questions pertaining to organization and processing of innovation knowledge.

TRIZ is considered as a cross-disciplinary, generic methodology, but it has not previously been presented in terms of logic or any other formal knowledge representation. Most of the concepts introduced in TRIZ are fuzzy, and most of the techniques are still heuristic and only partially formalized. For further development and conceptual re-organization of the TRIZ knowledge base, ETRIA will involve and collaborate with TRIZ experts and professionals from the fields of logic, organization science, informatics and linguistics.

The ETRIA has been set up to accomplish the following tasks:

1. Promotion of research and development on organization of innovation knowledge in general and particular fields by integrating conceptual approaches to classification developed by artificial intelligence (AI) and knowledge management communities;
2. International observation, analysis, evaluation and reporting of progress in these directions;
3. Promotion on an international level of the exchange of information and experience of scientists and practitioners in TRIZ, of universities and other educational organizations;
4. Development of TRIZ through contributions from dedicated experts and specialists in particular areas of expertise.

To achieve these tasks, ETRIA has formed an open community which aims to unite the efforts, suggest opportunities for global standardization, conduct further research and development, and provide mechanisms for the exchange of information and knowledge on TRIZ and TRIZ-based innovation technologies.

Functioning of ETRIA is coordinated by an elected ETRIA Executive Board. The ETRIA Country Representatives Group is empowered to carry out all regional functions and tasks, including organization of local ETRIA events. Fourteen countries, not all in Europe, have country representatives at this time.

Membership in ETRIA is open to any corporation, university, individual, partnership, governmental body or international organization, which accepts and supports the objectives and tasks of ETRIA. The members are not restricted in any way from designing, developing, marketing and producing any TRIZ-based, derived or competitive methods, methodologies, services or software applications. Members are not bound to implement or follow to any recommendation from ETRIA.

More information: http://etria.net/portal/

Japan TRIZ Society

The Japan TRIZ Society is an organization set up in 2007. This society's aim is the contribution to both the improvement of technological innovation, industrial activation and life/culture and also sustainable global environment maintenance through creativity improvement, through the use of TRIZ. The Japan TRIZ Society is planning to continue to hold an annual TRIZ Symposium in Japan and to promote activities on a regular basis such as research, utilization, penetration, snd communication related to TRIZ.

More information: http://www.triz-japan.org/english_top.html

San Francisco Bay Area TRIZ Society

This society was formed by Igor Polk, aiming to find TRIZ aficionados in San Francisco Bay Area, in California, USA. Polk attended TRIZ school at Minsk in about 1980-1983, studying under Tsourikov, Kozlovski, Boiko, Khomenko and others.

More Information: http://www.virtuar.com/triz/index.htm

Collaborative Board of TRIZ Promoters and Users in Japan (Japan TRIZ CB)

This board is the forerunner to the Japan TRIZ Society. The website contains a host of resources.

More Information: http://www.osaka-gu.ac.jp/php/nakagawa/TRIZ/eTRIZ/elinksref/eJapanTRIZ-CB/eJapanTRIZ-CB.html

Apeiron-Italian Triz Association

Aiperon promotes systematic innovation methodologies with a special focus on TRIZ theory, problem solving approach, creativity and innovation tools.

More information: www.apeiron-triz.org

INCOSE Technical Operations

Systems Science Working Group

http://www.incose.org/practice/techactivities/wg/syssciwg/

Charter

Promote the advancement and understanding of Systems Science and its application to SE.

Leadership

Co-Chair: Dr. James N Martin, Principal Engineering, The Aerospace Corporation

Co-Chair: TBD

Contact Systems Science Working Group for additional information or to join this group.

Objectives

1. Encourage advancement of Systems Science principles and concepts as they apply to Systems Engineering.

2. Promote awareness of Systems Science as a foundation for Systems Engineering.

3. Highlight linkages between Systems Science theories and empirical practices of Systems Engineering.

Systems Engineering Software Tools News

The Connector, Journal of isee systems , Volume 14 Issue 1

Isee systems is the commercal home of systems thinking software: STELLA and iThink. The Connector contains news relevant to these applications.

More information

Altia Announces New Product Releases

Altia announced Altia Design 9.2 DeepScreen 6.0, PhotoProto 2.0 and FlowProto 1.5 - new releases of their award-winning suite of HMI engineering software.

More information

Systems Engineering Books, Reports, Articles and Papers

Interaction between Requirements Engineering and Systems Architecting: An Emerging Theory Based on a Suite of Exploratory Studies

By Remo Ferrari
Publisher: LAP LAMBERT Academic Publishing (February 25, 2011)
ISBN-10: 3844310363
ISBN-13: 978-3844310368

Product Description

Requirements Engineering (RE) and Systems Architecting (SA) are often considered the most important phases of the software development lifecycle. Because of their close proximity in the software development lifecycle, there is a high degree of interaction between these two processes. While such interaction has been researched in terms of new technology, there is a distinct lack of empirical understanding regarding the scientific properties of this interaction. For instance: What is the impact of an existing system's architecture on requirements decision-making? What requirements-oriented problems are encountered during SA? What is the impact of requirements engineering knowledge on systems architecting? There is little in the literature addressing such questions. This book explores such issues through a suite of empirical studies. From the observations, a theory is proposed that describes the impact of human and technical factors in the interaction between RE and SA. The new knowledge has impact on: technology development for RE and SA; hiring and training personnel for RE and SA processes in industry; curriculum improvement in academia; and future empirical research.

More information

Systems Thinking Revolutionises Car Industry

Peter Madden

Better Place is a fascinating example of a systems approach to innovation, combining technology change, software, and a new business model. Agassi carefully mapped his system, before picking the intervention that could disrupt the whole system. He successfully harnessed a major incumbent – Renault Nissan - to come on the journey with him, immediately gaining scale and credibility. And he has spent time assessing the wider impacts of his approach on energy demand to maximise the sustainability benefits. This is a tantalising proposition. It does rely heavily on tax breaks , and of course it helps to be rich and well connected like Agassi when starting such a venture. But if it works, it will show that an entrepreneur disruptor, taking a systems approach, can change a major global industry.

More information

CATWOE Analysis: How & When to Use It

The major obstacle in resolving issues applying systems principles is defining the problem...

CATWOE according to Peter Checkland is a simple checklist that can be used to stimulate thinking about problems and solutions...

More information

Conferences and Meetings

Requirements Engineering Track – 4th Edition

Part of the 26th ACM Symposium on Applied Computing
March 21 - 25, 2011, Tunghai University, TaiChung, Taiwan
More information

ICST Workshop on Requirements and Validation, Verification & Testing (ReVVerT 2011)

Co-located with the 4th International Conference on Software Testing, Verification and Validation (ICST 2011)
March 21-25, 2011 (one day), Berlin, Germany
More information

Scenario-Based Testing - SCENARIOS 2011

Co-located with the 4th International Conference on Software Testing, Verification and Validation (ICST 2011)
March 21, 2011, Berlin, Germany
More information

1st Int'l Workshop on Variability-intensive Systems Testing, Validation & Verification

Co-located with ICST 2011
March 21, 2011, Berlin, Germany
More information

7th Workshop on Advances in Model Based Testing (A-MOST 2011)

Co-located with the 4th International Conference on Software Testing, Verification and Validation (ICST 2011)
March 21, 2011 – Berlin, Germany
More information

IWEI 2011 - The International Working Conference on Enterprise Interoperability

March 22-24, 2011, Stockholm, Sweden
More information

MoBE-RTES 2011 - 2nd IEEE Workshop on Model-based Engineering for Real-Time Embedded Systems

March 28, 2011, Newport Beach, California
More information

MIT SDM Systems Thinking Webinar Series: Status of Grid-scale Energy Storage and Strategies for Accelerating Cost-effective Deployment NEW

March 28, 2011
More information

REFSQ 2011 - 17th International Working Conference on Requirements Engineering: Foundation for Software Quality

March 28-30, 2011, Essen, Germany
More information

Being A BA Series - Technical Excellence

Tuesday, March 29, 2011 at 12 p.m. to 1 p.m. EDT This webinar is open to IIBA members only.
Register now

Engineering Sustainability Debate

March 30, 2011, City University, London, UK
More information

Engineering Sustainability - Informed Debate on One of the Key Issues of the Century NEW

March 30, 2011, 13:00, Oliver Thompson Lecture Theatre, City University London, Northampton Square, London, UK
More information

Enterprise Architecture Symposium NEW

March 30-31, 2011, Toronto, Canada
More information

EPICAL - Workshop on Empirical Research in Requirements Engineering: Challenges and Solutions

March 31, 2011, Essen, Germany
More information

MBT 2011 - Seventh Workshop on Model-Based Testing

April 2-3, 2011, Saarbrüken, Germany
Satellite workshop of ETAPS 2011
More information

GT-VMT 2011 - International Workshop on Graph Transformation and Visual Modeling Techniques

April 2-3, 2011, Saarbrücken, Germany
More information

Information Systems Summit II

April 4 – 6, 2011, Hyatt Regency Baltimore, Baltimore, Maryland, USA
More information

IEEE International Systems Conference

April 4-7, 2011, Montreal, Quebec, Canada
More information

Symposium on Theory of Modeling and Simulation (DEVS/TMS'11)

April 4-9 2011, Boston, MA, USA
More information

1st International Workshop on Model-driven Approaches for Simulation Engineering

Held under the aegis of the Symposium on Theory of Modeling and Simulation, part of the SCS SpringSim 2011 conference.
April 4-9, 2011, Boston, MA (USA)
More information

International Symposium on Ambient Intelligence

April 6-8, 2011, University of Salamanca, Salamanca, Spain
More information

Workshop on the Reliability of Intelligent Environments (WORIE ’11)

within the International Symposium on Ambient Intelligence
April 6-10, 2011, University of Salamanca, Salamanca, Spain
More information

International Conference on Operations Research and Statistics (ORS 2011)

April 7-8, 2011, Hotel Equatorial Penang, Malaysia
More information

Introduction to Dynamic Modeling with STELLA and iThink NEW

April 11-13, 2011, Loews New Orleans Hotel, New Orleans, LA, USA
More information

Systems Engineering & Architecting Doctoral Student Network (SEANET) workshop

In conjunction with the 9th Conference on Systems Engineering Research
April 14, 2011, University of Southern California, CA, USA
More information to follow

CSER 2011 - Conference on Systems Engineering Research

April 14-16 2011, Redondo Beach Crown Plaza, Redondo Beach, CA, USA
More information

17th International Conference on Information and Software Technologies

April 27th - 29th, 2011, Kaunas, Lithuania
More information

Second Annual West Point Critical Infrastructure Symposium

April 29 - 30, 2011, The United States Military Academy in Newark, NJ, USA
More information

SETE 2011 – Systems Engineering and T&E

May 2-4, 2011, Rydges Lakeside, Canberra, Australia
More information

Lean Software & Systems Conference 2011 (LSSC11) NEW

May 3-6, 2011 at the Hyatt Regency Long Beach, CA, USA
More information

Software & Systems Engineering Essentials

May 9-10, 2011, Frankfurt, Germany
More information

Enterprise Architecture Conference & Expo NEW

May 12, 2011, The Pavilion, Ronald Reagan Building, 1300 Pennsylvania Ave. NW, Washington, DC, USA
More information

Risk-Based Approaches to Major Decisions (Risk '11)

May 13 - 14, 2011, Falmouth, Cornwall, United Kingdom
More information

International Conference on Software and Systems Process (ICSSP 2011)

(co-located with ICSE 2011)
May 21-22, 2011, Waikiki, Honolulu, Hawaii, USA
More information

Sixth Workshop on SHAring and Reusing architectural Knowledge (SHARK 2011)

(co-located with 33rd Int. Conf. on Software Engineering (ICSE 2011))
May 21-28, 2011, Waikiki, Honolulu, Hawaii, USA
More information

RSP 2011 - IEEE International Symposium on Rapid System Prototyping

May 24 – 27, 2011, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany
More information

SPICE 2011 - The 11th International SPICE Conference Process Improvement and Capability dEtermination

30 May - 1 June 2011, Dublin, Ireland
More information

Systems Thinking Techniques to Develop Complex Thinking Skills in K12 Education NEW

June 3-4, 2011, Systems Thinking in Schools Institute, McMenamins Edgefield, 2126 SW Halsey St., Troutdale, Oregon, 97060
More information

Seventh European Conference on Modelling Foundations and Applications

6-9th of June, 2011, University of Birmingham, Birmingham, UK
More information

TTCN 3 - 10th Testing & Test Control Notation User Conference

June 7-9, 2011, Bled, Slovenia
More information

4th Symposium on Resilience Engineering

June 8-10, 2011, Sophia Antipolis, France
More information

2011 U.S. Army Corps of Engineers Infrastructure Systems Conference NEW

June 13, 2011, Hyatt Regency Hotel, Atlanta, Georgia, USA
More information

Security and Privacy Requirements Engineering (SPREE) Workshop

June 15-16, 2011, Carnegie Mellon University, Pittsburgh, PA, USA
More information

ONTOSE 2011 - 5th International Workshop on Ontology, Models, Conceptualization and Epistemology in Social, Artificial and Natural Systems

June 20, 2011, University of East London - Docklands Campus, London, UK
More information

BPMDS'11 Working Conference

in conjunction with CAISE 2011
June 20-21 in London, United Kingdom
More information

FM 2011: 17th International Symposium on Formal Methods

June 20 - 24, 2011, Lero, Limerick, Ireland
More information

The 32nd International Conference on Application and Theory of Petri Nets and Concurrency (PETRI NETS 2011)

11th International Conference on Application of Concurrency to System Design (ACSD 2011)
June 20-24, 2011 Kanazawa Cultural Hall, Kanazawa, Japan
More information

INCOSE 21st International Symposium

June 20-23, 2011 Denver, CO, USA
More information

Swiss Requirements Day

June 22, 2011, Kongresshaus, Zurich
More information

INES 2011 - 15th IEEE International Conference on Intelligent Engineering Systems 2011

June 23-25, 2011, Poprad, High Tatras, Slovakia
More information

CoMetS'11 - 2nd International Track on Collaborative Modeling & Simulation

20th IEEE International Conference on Collaboration Technologies and Infrastructures
June 27 - June 29, 2011, Paris (France)
More information

SoSE 2011 - 2011 6th International Conference on System of Systems Engineering (SoSE)

Jun 27 - 30, 2011, Albuquerque, New Mexico, U.S.A
More information

FMICS 2011 - 16th International Workshop on Formal Methods for Industrial Critical Systems NEW

August 29-30, 2011, Trento, Italy
More information

ICMT2011 - International Conference on Model Transformation Theory and Practice of Model Transformations

Co-located with TOOLS Europe 2011
June 27 - July 1, 2011 - Zurich, Switzerland
More information

15th International Conference on System Design Languages

July 5th - 7th, 2011, Toulouse, France

More information

International System Dynamics Conference

July 24 – 28, 2011, Washington, DC, USA
More information

46th Annual International Logistics Conference and Exhibition (SOLE 2011)

August 2011
More information

ISSEC 2011 - 3rd Annual Improving Systems and Software Engineering Conference

August 2-5, 2011, Novotel Sydney Brighton Beach, NSW, Australia
More information

ISSC 2011 - 29th International System Safety Conference

Aug 8, 2011 - Aug 12, 2011, Las Vegas, Nevada, USA

IHMSC 2011 - International Conference on Intelligent Human-Machine Systems and Cybernetics

Aug 26, 2011 - Aug 27, 2011, Hangzhou, China
More information

TEAR 2011 : Trends in Enterprise Architecture Research (TEAR) Workshop

August 29, 2011, Helisinki, Finland
More information

19th IEEE International Requirements Engineering Conference

August 29 – September 2, 2011, Trento, Italy
More information

19th International Conference on Case Based Reasoning NEW

12-15 September 2011, Greenwich, London, UK
More information

International Conference on Industrial Engineering, Systems Engineering and Engineering Management for Sustainable Global Development (Joint with INCOSE SA Annual Conference)

September 21-23, 2011, Spier Hotel and Conference Centre, Western Cape, South Africa
More information

Second Annual IIBA Conference

October 2011, More details TBA
More information

SASO 2011 - Fifth IEEE International Conference on Self-Adaptive and Self-Organizing Systems

October 3-7, 2011, Ann Arbor, Michigan, USA
More information

IEEE SRDS 2011 - 30th International Symposium on Reliable Distributed Systems NEW

October 4-7, 2011, Madrid, Spain
More information

AGTIVE 2011 - International Symposium on Applications of Graph Transformation with Industrial Relevance

October 4-7, 2011, Budapest, Hungary
More information

ACM/IEEE 14th International Conference on Model Driven Engineering Languages and Systems

October 16-21, 2011, Wellington, New Zealand
More information

APCOSE 2011 - Fifth Annual Asia-Pacific Systems Engineering Conference

October 19-21, 2011, Seoul, Korea
More information

NDIA 14th Annual Systems Engineering Conference

October 24 - 27 2011, Hyatt Regency Mission Bay, San Diego, California, USA
More information

SSEE 2011 - Society for Sustainability and Environmental Engineering 2011 International Conference

October 24-26, 2011, Brisbane Convention & Exhibition Centre, Brisbane, Australia
More information

ICFEM 2011 - 13th International Conference on Formal Engineering Methods

October 25 - 28, 2011, Durham, United Kingdom
More information

CEBM 2011 - 2011 International Conference on Engineering and Business Management (CEBM2011)

Oct 28 - 30, 2011, Shanghai, China
More information

IIBA 2011 Conference

Oct 30 – Nov 3, 2011, Fort Lauderdale, Florida, USA
More information

21st Annual Systems Thinking in Action® Conference

October 31-November 2, 2011, Westin Seattle Hotel, Seattle, WA, USA
More information

ER 2011, 30th International Conference on Conceptual Modeling Brussels, Belgium NEW

October 31 - November 3, 2011, Brussels, Belgium
More information

Complex Systems Design & Management 2011

December 7-9, 2011, Cité Internationale Universitaire, Paris, France
More information

Education & Academia

New Industrial & Systems Engineering Masters Degree

The new University of Washington Professional Master's Program in Industrial & Systems Engineering, offered by the Department of Industrial & Systems Engineering, is designed for engineers and scientists who wish to excel as complex system thinkers in today's global business environment….

More information

Idex Focus Turns To Growing Local Industry

The Institute for Near East and Gulf Military Analysis, a Dubai and Beirut-based think tank, this week announced the launch of a competition for Emirati university students to design, build, test and pilot unmanned aerial vehicles. The contest is being billed as the first of its kind in the UAE.
Engineers from the American defence giant Northrop Grumman, the Higher Colleges of Technology (HCT) and Abu Dhabi Autonomous Systems Investment (Adasi), a local company, will assist the students. The competition will take place on May 4-5 in the capital.

More information

HCT teams with Johns Hopkins University to boost Masters Engineering Program

The International Defense Exhibition and Conference (IDEX 2011) was the venue for showcasing more successful partnerships - this one in the field of education.

Dr Tayeb Kamali, Vice Chancellor of the Higher Colleges of Technology (HCT), announced the launch of a Systems Engineering specialization in its Masters of Engineering Program, a core module of which will be delivered by the prestigious American teaching institution, Johns Hopkins University.

More information

Stevens Institute of Technology Launches New Technical Leadership Program

Stevens Institute of Technology is launching a unique new Technical Leadership Program for selected engineering and technology professionals. The program begins in June 2011. The program features an innovative curriculum emphasizing the experiential approach and systems thinking for which Stevens is internationally known.

More information

Postdoc Position Self-Adaptive (Automotive) Systems at CEA Research Center near Paris

The laboratory LISE (Model Driven Engineering Laboratory for embedded and real-time systems), part of the CEA LIST (450 researchers in the field of software-intensive systems, (see http://www-list.cea.fr/gb/index_gb.htm) has an open position for a research assistant.

More information

Timed Systems for Railway Applications

Applications are invited for a 2 year RA position at Swansea University, Wales, UK, on developing tool support, modelling and verifying railway systems in Timed CSP. Closing date is Thursday 7 April 2011.

The position is part of the EPSRC/RSSB funded SafeCap project, an international cooperation between Swansea University, Newcastle University, the company Invensys as industrial partner, as well as the National Institute of Advanced Industrial Science and Technology (AIST) in Japan.

Enquiries: Dr Markus Roggenbach, on +44 (0) 1792 513578, email: csmarkus@swan.ac.uk
Application form: http://www.swan.ac.uk/personnel/Vacancies/Research/PostTitle,56696,en.php

Some Systems Engineering-Relevant Websites

http://www.iseesystems.com/community/connector/connector.aspx
Systems Thinking newsletter by isee systems.

www.trizsite.com
This is a non-profit site from India containing Lot of TRIZ resources. The site has FAQs, articles, discussion forum, and many examples on principles, trends, inventive problems, sample inventions etc. There are many online TRIZ tools available free.

http://www.triz.org
This is the official website of Technical Innovation Center, the leading publisher of TRIZ books in English.

www.triz-journal.com/
This site provides a monthly journal of high quality research articles on various aspects on TRIZ. You can find about ten new articles every month, contributed by various authors from different parts of the world. All previous articles are well organised in archives.

www.innovationtools. com/resources/triz.asp
InnovationTools is a web site which provides resources on creativity and innovation, and evaluates various tools and techniques of creativity. The objective is to help people to be more innovative. It has a TRIZ discussion forum on the web.

triz.blogspirit.com
This site contains examples on Technical Evolution patterns and other materials on TRIZ.

www3.sympatico.ca/karasik
Although named Anti TRIZ-Journal, the site is not anti-TRIZ. Rather, it is a group of TRIZ professionals who are anti TRIZ-Journal (the popular journal site).

www.ee.iitb.ac.in/~apte/CV_PRA_TRIZ.htm
This is a personal home page on TRIZ with some articles, publications and course syllabus.

www.selectorweb. com/triz.html
A site by Lev Selector, having a good collection on TRIZ and Altshuller.

http://en.wikipedia.org/wiki/TRIZ

The TRIZ page on Wikipedia is quite informative. The contents are contributed by different people around the world.

www.mazur.net/triz/
A site on QFD, Six Sigma and TRIZ. The site contains a nice introduction to TRIZ.

http://triz.it/eng/
The TRIZ.it! Website is offered by Dr. Pavel Livotov from his TRIZ Handbook as a cost-free learning and application platform for inventive problem solving and systematical innovation with TRIZ principles.

http://www.triz-guide.com
The site of Institute of Innovative Design, led by Yuri Salamatov. The site hosts a lot of useful contents on TRIZ.

Standards and Guides

ISO TC 159 – Ergonomics

The ISO TC 159 website lists all the relevant information on this Technical Committee, including the following list of working groups:

Subcommittee/Working Group	**Title**
TC 159/CAG	Chairman Advisory Group *The convener can be reached through the secretariat*
TC 159/AG	AGAD: Advisory Group for Accessible Design *The convener can be reached through the secretariat*
TC 159/WG 2	Ergonomics for people with special requirements *The convener can be reached through the secretariat*
TC 159/SC 1	General ergonomics principles
TC 159/SC 3	Anthropometry and biomechanics
TC 159/SC 4	Ergonomics of human-system interaction
TC 159/SC 5	Ergonomics of the physical environment

The ISO TC 159 Business Plan describes:

- The business environment for ISO/TC
- The benefits expected from the work of the ISO/TC.
- Representation and participation in the ISO/TC
- Objectives of the ISO/TC and strategies for their achievement
- Factors affecting completion and implementation of the iso/tc work programme
- Structure, current projects and publications of the iso/tc

The work programme for each of the working groups of ISO/TC 159 is set out on the ISO website in terms of the standard or project, the Standards Development Process Stage code and the International Classification for Standards (ICS) reference.

The meeting calender is also provided on the website.

More information

IEEE Announces Standards Interest Group (Sig) For India; Move To Propel India's Involvement in the IEEE Global Standards Process

IEEE, the world's largest technical professional association, announced the formation of the IEEE Standards Interest Group (SIG) for India. In the works since last year, the IEEE SIG heralds a new chapter in India's role in the global standards process and will provide a platform for increased involvement of the local technical community in global standards development.

More information

Some Definitions to Close On

Design

Definitions of “design” (verb)

Design (verb): the act of working out the form of something (as by making a sketch or outline or plan): "he contributed to the design of a new instrument"
Source: wordnetweb.princeton.edu/perl/webwn

Design (verb): plan something for a specific role or purpose or effect: "this room is not designed for work"
Source: wordnetweb.princeton.edu/perl/webwn

Design (verb): an arrangement scheme: "the awkward design of the keyboard made operation difficult"; "it was an excellent design for living"
Source: wordnetweb.princeton.edu/perl/webwn

Design (verb): create the design for; create or execute in an artistic or highly skilled manner: "Chanel designed the famous suit"
Source: wordnetweb.princeton.edu/perl/webwn

Design (verb): make a design of; plan out in systematic, often graphic form: "design a better mousetrap"
Source: wordnetweb.princeton.edu/perl/webwn

Design (verb): create designs: "Dupont designs for the house of Chanel"
Source: wordnetweb.princeton.edu/perl/webwn

Design (verb): invention: the creation of something in the mind
Source: wordnetweb.princeton.edu/perl/webwn

Design (verb): design is the planning that lays the basis for the making of every object or system.
Source: en.wikipedia.org/wiki/Design

Design (verb): the act of making solution decisions
Source: Robert Halligan

Definitions of “design” (noun)

Design (noun): blueprint: something intended as a guide for making something else
Source: wordnetweb.princeton.edu/perl/webwn

Design (noun): a preliminary sketch indicating the plan for something: "the design of a building"
Source: wordnetweb.princeton.edu/perl/webwn

Design (noun): the purposeful or inventive arrangement of parts or details: “the aerodynamic design of an automobile”
Source: http://www.thefreedictionary.com/design

Design (noun): the product of making solution decisions
Source: Robert Halligan

Definition of “design description” (noun)

Design description (noun): the product of recording solution decisions
Source: Robert Halligan

Project Performance International News

PPI Launches Its Ground-Breaking 5-Day Systems Engineering Management Course

Yes, there have been rumours, but now it is for real. PPI is pleased to announce the availability, both for registration and on-site delivery, of its "Systems Engineering Management" in-depth five-day course. The course is entirely focussed on "managing the systems engineering", in contrast to our well known five-day "Systems Engineering for Technology-Based Projects and Product Developments" course, which focuses on the principles and methods of "doing the systems engineering". The Systems Engineering Management course is intended for anyone who manages entire projects, or parts thereof, having an engineering content. Those who aspire to team leadership/engineering management roles will also benefit greatly from the course.

Some subject areas of the course are planning the systems engineering work, process planning, requirements management, design management, configuration management, interface management, data management, knowledge management, management of system integration, management of V&V, rist management, performance measurement, and leadership. And much more. Delivery is via video, presentation, facilitated discussion, and workshops.

Public course deliveries will initially be in the United States, Europe, South Africa, and Australia, commencing in June, 2011. Other locations will be added in 2012.
Each course will be delivered by PPI's Clive Tudge, or by Robert Halligan.

See www.ppi-int.com/training/systems-engineering-management-course.php for a full course description and 2011 program.

PPI Delivers First-Ever OCD/CONOPS Course in Japan

In early March, PPI Managing Director Robert Halligan delivered PPI's first ever OCD/CONOPS course in Japan. Delegates attended from Japan, South Korea, Turkey, Bangla Desh and Singapore.

The group has since rallied behind our Japanese friends and colleagues who are so badly affected by subsequent events.

Personal Note from the Executive Editor Robert Halligan:
What has happened in Japan is horrific, and heart-breaking beyond words. PPI has already offered free professional training in Japan during 2012, hoping that by doing so, we can make a contribution within our means to this wonderful people, and to the rebuilding of their country. I encourage other enterprises worldwide, large and small, to help in any way that is welcomed by our Japanese friends. For Japanese readers of SyEN, let the rest of us know how we can help. SyEN will publish any requests for assistance in Japan that are related to systems engineering.

Project Performance International Events

Systems Engineering 5-Day Course

Upcoming locations include:

- Sydney, Australia
- Amsterdam, The Netherlands
- London, UK
- São José dos Campos, Brazil
- Las Vegas, USA

View 2011 Systems Engineering Course Schedule

Requirements Analysis and Specification Writing 5-Day Course

Upcoming locations include:

- Melbourne, Australia
- Adelaide, Australia
- Amsterdam, The Netherlands
- Stellenbosch, South Africa
- Las Vegas, USA

View 2011 RA&SW Course Schedule

OCD & CONOPS in Capability Development 5-Day Course

Upcoming locations include:

- Pretoria, South Africa
- Canberra, Australia
- Brasilia, Brazil

View 2011 OCD/CONOPS Course Schedule

Software Development Principles & Processes 5-Day Course

Upcoming locations include:

- Amsterdam, The Netherlands
- Stellenbosch, South Africa
- Sydney, Australia

View 2011 Software Development Principles & Processes Course Schedule

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Cognitive Systems Engineering 5-Day Course

Upcoming locations include:

- Melbourne, Australia
- Tokyo, Japan
- Las Vegas, USA
- Adelaide, Australia
- London, UK

View 2010/2011 Cognitive Systems Engineering Course Schedule

Requirements Engineering 5-Day Course

Upcoming locations include:

- São José dos Campos, Brazil

View 2011 Requirements Engineering Course Schedule

Introduction to Software Development Principles & Processes 2-Day Seminar

View 2011 Introduction to Software Development Principles & Processes Seminar Schedule

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Introduction to Cognitive Systems Engineering

Upcoming locations include:

- Sydney, Australia

- Singapore
- Canberra, Australia
- Stellenbosch, South Africa

View 2011 Introduction to Cognitive Systems Engineering Seminar Schedule

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Introduction to Requirements Analysis 1-Day Seminar

Upcoming locations include:

- Brisbane, Australia
- Adelaide, Australia
- Melbourne, Australia

View 2011 Introduction to Requirements Analysis Seminar Schedule

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Preparing Great Requirements Specifications 1-Day Seminar

Upcoming locations include:

- Brisbane, Australia
- Melbourne, Australia
- Canberra, Australia

View 2011 Preparing Great Requirements Specifications Seminar Schedule

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PPI Upcoming Participation in Professional Conferences

- SETE 2011 (Exhibiting)
- INCOSE IS10 (Exhibiting)
- MICSSA (Sponsor/Exhibiting)

Kind regards from the SyEN team:
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