I-TRIZ: Anyone Can Innovate on Demand

by

Ron Fulbright

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I-TRIZ: Anyone Can Innovate on Demand*

Ron Fulbright
University of South Carolina Upstate
800 University Way
Spartanburg, SC 29303
(864) 503-5683

rfulbright@uscupstate.edu

ABSTRACT
Would it be nice to have Yoshiro Nakamatsu, the world record holder for the most number of patents, consult with you on your next project? Would it be wonderful to bring Thomas Edison in anytime you needed some innovative insight for a day? What if you could consult with Nikola Tesla when faced with your next critical problem? How much better could you solve problems if you could bring the collective innovative force of the entire human race to bear on your next project? This is the promise of I-TRIZ. I-TRIZ is the modern extension, and ongoing development of TRIZ begun some 65 years ago. I-TRIZ represents the distillation of human innovative thought down to a set of principles, tools, and methodologies that can be taught to anyone making it possible for anyone to innovate on demand. TRIZ, I-TRIZ, and new educational initiatives are described as well as potential long-term implications of everyone having the ability to innovate on demand.

1. INTRODUCTION

TRIZ (pronounced "trees") is a Russian acronym for "Teoriya Resheniya Izobretatelskikh Zadatch", the Theory of Inventor's Problem Solving; an effort began by Genrich Altshuller [10] in 1946 to understand the difference in how innovative people think and solve problems. TRIZ is a broad title representing a collection of methodologies, tools, knowledge bases, and model-based technologies for generating innovative ideas and inventive solutions. In continual development for some 65 years, TRIZ and its modern extensions continue to evolve today by the work of numerous colleagues all over the world most of whom have roots leading back to Altshuller and the pre-Soviet era of TRIZ known as *classical TRIZ* [1][3].

Altshuller originally wished to determine what made innovators different from the rest of us and studied thousands of patents in hopes of identifying consistent and recurring themes and patterns. The motivation behind all TRIZ efforts is the belief that universal methods can be identified, refined, and developed and can be applied to new problems in a systematic way to help stimulate new ideas and non-apparent solutions to difficult problems. As Zusman [11] states:

The most important result…is that Altshuller set out to develop a method that would help technical individuals handle difficult technological problems. In fact, he accomplished much more than this, revealing the basic patterns and principles of evolution and creativity that are applicable to any field of human activity requiring creative solutions. He also succeeded in systematizing these patterns and principles, making them available for wider use.

There have been three distinct phases in the 65-year history of TRIZ [11]:

- *Classical TRIZ* – development led by Altshuller from the mid-1940s to the mid 1980s.
- *Contemporary TRIZ Phase I* – development during perestroika in the former Soviet Union from the mid-1980s to the early 1990s.
- *Contemporary TRIZ Phase II* – penetration into the Western world from the early 1990s to the present.

During the Classical TRIZ era, TRIZ was largely unknown to the Western world because it was

*This paper was edited by Senior Editor Brett Trusko carried out behind the Iron Curtain in communist Soviet Union. Yet, scholars, engineers, and scientists learned and practiced TRIZ for decades building a healthy community of colleagues that persists today. In the 1980s, during the era of perestroika, some of Altshuller's work was translated and published in English. This was the first time many outside the Soviet Union had heard of TRIZ. With the collapse of the Soviet Union in the late 1980s, many TRIZ colleagues moved to other parts of the world where they have continued work in TRIZ. Consequently, since the early 1990s, knowledge and use of TRIZ has spread all over the world.

Many former colleagues have started their own companies, served as consultants, and have educated others in the art. Many have continued to extend TRIZ. Today, TRIZ encompasses a vibrant culture employed all over the world by large corporations and individual practitioners alike. A large number of TRIZ-centric Web sites, workshops, books, tutorials, journals, and seminars are available and every year, the number of TRIZ devotees grows.

One of the companies formed in the early 1990s is Ideation International, Inc. located in Michigan (USA). Built around a number of the original Altshuller colleagues and TRIZ masters, Ideation has developed extensions to classical TRIZ and entirely new TRIZ-based methods and tools collectively called *I-TRIZ* (for Ideation TRIZ). I-TRIZ is one of the most robust of the modern extensions to TRIZ and has been applied to a large number of application domains including, but not limited to: scientific work [13], quality management [6], and other non-technical areas [5][14].

TRIZ is important because the tools, techniques, and knowledgebases help the more naturally innovative and creative among us to be even more so, and it allows those of us who are not as naturally gifted to become innovative and much better problem solvers. I-TRIZ methodologies and tools are easily accessible by anyone with a minimum of training. This paper describes several contributions of classical TRIZ, tools of I-TRIZ, and several educational initiatives designed to bring I-TRIZ to the masses.

2. THE PRINCIPLE OF IDEALITY AND CONTRADICTIONS

An important contribution, and basic tenet, of classical TRIZ is the realization that any system can be viewed as a collection of desirable features (called *useful functions*) and undesirable features (called *harmful functions*). To *innovate* means to incrementally improve an *existing* object or system. Therefore, inherent in any innovative effort is analysis of the existing system under study. The useful/harmful way of modeling systems differs from other kinds of systems analysis used in science and engineering but is particularly successful at helping identify areas of a system that need to be, and can be, improved.

The ratio of useful functions to harmful functions yields a relative measure of a system's *idealilty:*

$$Ideality = \frac{Useful}{Harmful}.$$

The ideality of a system can be increased by either increasing the useful or by decreasing the harmful. Since innovation seeks to incrementally improve a system, any innovative improvement seeks to increase the ideality of the system. A perfectly ideal system would be one with no undesirable features at all. Of course, in the real world, no such system exists. Something undesirable is always present in any system. The causes of this harm are called *contradictions* and are what keeps systems from achieving higher ideality. An innovative improvement increases ideality by the removing or mitigating one or more contradictions.

3. LAWS OF TECHNICAL SYSTEM EVOLUTION

During the classical TRIZ era, Altshuller and his colleagues analyzed over 40,000 patents looking for recurring patterns. A major contribution is Altshuller's Laws of Technical System Evolution describing general truths about systems and how they change over time [4]:

3.1 Static Laws

The law of the completeness of the parts of the system

Any working system must have four parts: the engine (power source), the transmission (energy conduction mechanism), the working unit, and the control element.

The law of energy conductivity of the system

Because every technical system is a transformer of energy, the energy should circulate freely and efficiently through its four main parts (engine, transmission, working element and control element).

The law of harmonizing the rhythms of parts of the system

The frequencies of vibration, or the periodicity of parts and movements of the system, should be in synchronization with each other.

3.2 Kinematic Laws

Law of increasing the degree of ideality of the system

The ideality of a system is a qualitative ratio between all desirable benefits of the system and its cost or other harmful effects.

The law of uneven development of parts of a system

A technical system encompasses different parts, which will evolve differently, leading to the new technical and physical contradictions.

The law of transition to a super-system

When a system exhausts the possibilities of further significant improvement, it is subsumed by a super-system as one of its parts. As a result, new development of the system becomes possible.

3.3 Dynamic Laws

Transition from macro to micro level

The development of working organs proceeds at first on a macro and then a micro level. The transition from macro to micro level is one of the main (if not the main) tendency of the development of modern technical systems.

Increasing the S-Field involvement

The fields within a system evolve from mechanical fields to electro-magnetic fields. The dispersion of substances, the number of links increases, and the responsiveness of the whole system tends to increase.

4. LEVELS OF INVENTION

Another important discovery of Altshuller's is how inventions represent vastly different scopes. Altshuller defined five levels of invention [4]:

Level 1 – Apparent Solution
Level 2 – Minor Improvement
Level 3 – Major Improvement
Level 4 – New Paradigm
Level 5 – Discovery

Level 1 invention is obvious and apparent solutions involving well-known methods and knowledge requiring no new invention of any consequence. Level 1 "inventions" represent common, obvious solutions to everyday problems. *Level 2* inventions constitute minor non-obvious improvements to a system, using methods known within the domain of discourse but applied in a new way. *Level 3* inventions involve fundamental improvements to a system involving methods known outside of the domain. This involves applying an idea to the domain that has never been used in the domain previously. *Level 4* inventions entail the development of an entirely new operating principle and represent radical changes. *Level 5* inventions represent a rare scientific discovery or the pioneering of a totally new industry altogether. Naturally, lower-level inventions are easier to come by. A convenient way of visualizing the five levels is based on the amount and kind of knowledge required for level as shown in Figure 1.

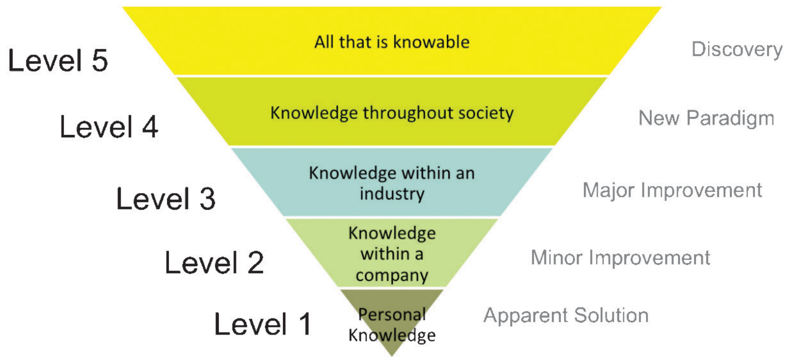


Figure 1. The easier inventive solutions require no more knowledge than that already known by the individual. More complex and difficult inventive solutions require more knowledge.

Paradigm-altering new scientific discoveries (Level 4 and 5) do not happen very often. However, people solve millions of routine, simple problems (Level 1) every day. In fact, over 99% of inventions are Level 1, 2, or 3 as shown in Figure 2.

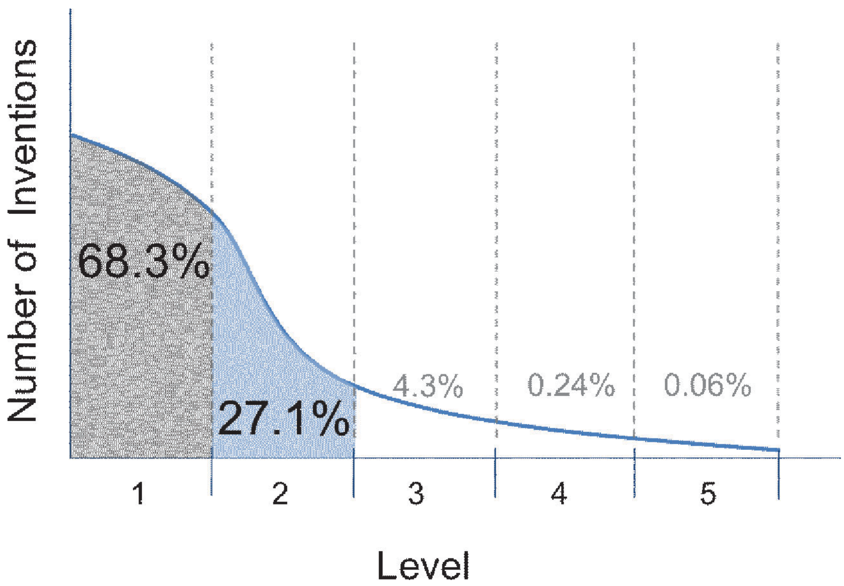


Figure 2. Less complex inventive solutions are much easier, and therefore more plentiful, than more complex inventive solutions.

5. OTHER CLASSICAL TRIZ ACCOMPLISHMENTS

Size constraints prevent this paper from discussing every component of classical TRIZ, but numerous books, journals, workshops, and seminars are available. [7] and [1] are works well-suited to the beginner. Some of the other major accomplishments of classical TRIZ are:

- 40 Innovation Principles
- Contradiction Matrix
- Separation Principles
- 76 Standard Solutions
- Substance-Field Analysis
- ARIZ – algorithm of inventive problem solving

6. I-TRIZ

With the proliferation of TRIZ throughout the world following the collapse of the Soviet Union, it was realized that TRIZ was too cumbersome for the mass market. Historically, proficiency required hundreds of hours of training and years of experience and apprenticeship. In response, researchers began modifying TRIZ to enhance its usability, trainability, and expand its applicability. This effort marks the beginning of contemporary phase of TRIZ, begun in the mid 1980s, and which continues to the present [9][12].

Ideation International was formed in the United States in 1992 and consists of a group of original TRIZ colleagues who have continued to develop what is collectively called I-TRIZ (for Ideation TRIZ). To date, their work covers four main areas [8][9][11]:

- IPS Inventive Problem Solving
- AFD Anticipatory Failure Determination
- DE Directed Evolution
- IP Control of Intellectual Property

Directed Evolution is used to identify future versions of a product and help manufacturers of the product select one of the future incarnations as the goal of production efforts. The IP module allows one to protect future inventions from encroachment by competitors. AFD not only helps identify the causes of problems, but also helps predict critical failure points in a system [8]. The remainder of this paper describes IPS. IPS encapsulates the fundamental body of knowledge and skills needed to be effective in any of the other areas of I-TRIZ.

7. INVENTIVE PROBLEM SOLVING (IPS)

IPS is a component of the I-TRIZ body of work consisting of a methodology, set of tools, and a knowledgebase designed to assist one in inventive problem solving (innovation). Learning the methodology and becoming skillful with the tools and knowledgebase will allow anyone to innovate on demand about virtually any domain of discourse. In this paper, we discuss the basic methodology, useful/harmful function analysis, the Problem Formulator tool, and I-TRIZ operators.

7.1 The Basic Methodology

Figure 3 shows the basic I-TRIZ methodology. The methodology is drawn as a cycle because once one completes one innovative solution, the newly improved system can become the subject of another innovative cycle (possibly focusing on a different area of the system).

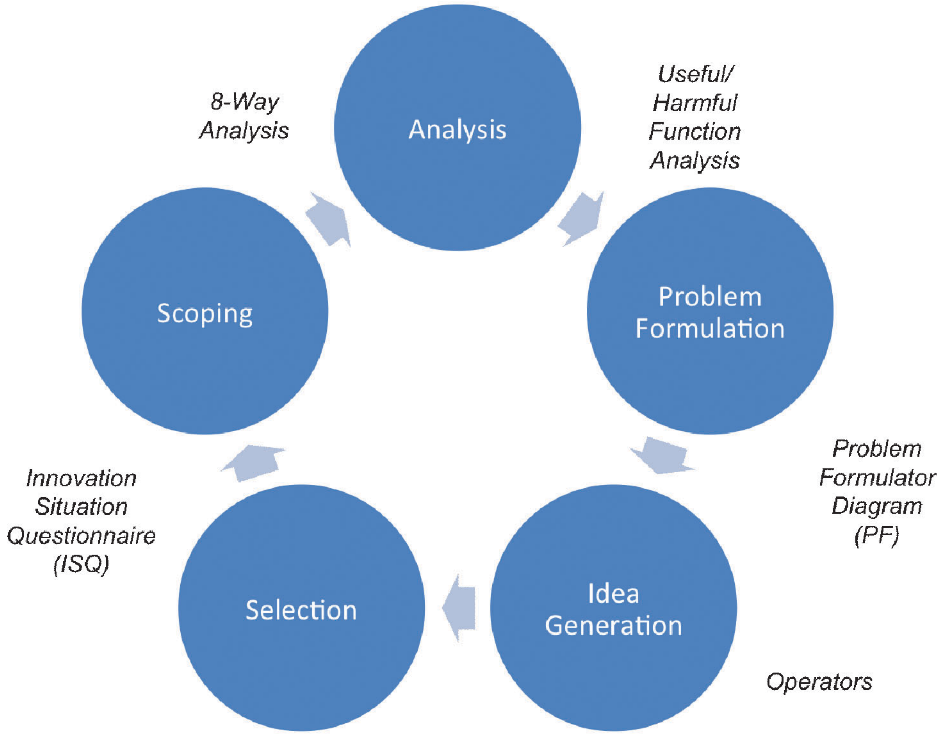


Figure 3.The basic I-TRIZ methodology.

7.1.1 Scoping

In the scoping phase, one defines the system and the problem to be studied. The Innovation Situation Questionnaire (ISQ) is a tool assisting this effort by posing questions to be answered by subject matter experts.

7.1.2 Analysis

In the analysis phase, a tool called the 8-way analysis helps identify the most important aspects of the system being studied. Also in this phase, useful functions, harmful functions, and contradictions begin to become identified giving one a rough idea of the system's ideality.

7.1.3 Problem Formulation

A problem formulator diagram (PF) captures useful (desirable) and harmful (undesirable) aspects of the system being studied and their interrelationships, including contradictions (things causing undesirable things). Diagramming the system exposes the areas of a system most in need of an innovation.

7.1.4 Idea Generation

In the idea generation phase, systematic application of I-TRIZ operators to the contradictions stimulates innovative ideas and helps generate possible solutions. In a full analysis, dozens of operators will be applied and dozens of potential solutions will be generated.

7.1.5 Selection

Careful analysis of each potential idea facilitates selection of one or more for implementation.

7.2 Useful Functions and Harmful Functions

In I-TRIZ, a system is viewed as a collection of desirable features, called *useful functions,* and undesirable features, called *harmful functions*. A function can be virtually anything including but not limited to: a part, a process, a transformation, a feeling, an emotion, an action. Functions are usually named with short phrases like *ring contains fragments*, *fragments damage aircraft,* and *forces pull apart impeller*. The innovation process is easier and more fruitful when function names depict relationships in and of themselves. Practitioners use different approaches when identifying useful and harmful functions. With experience, people tend to develop their own style. When first learning the craft, the following step-by-step process helps:

Step 1
Identify the primary useful function. Every system exists for a reason. The first step is state this reason as the primary function. Since this is the primary reason the system exists, it will be a useful function.

Step 2
Identify what must be true to facilitate the primary useful function. In most cases, since they facilitate the primary function, these will also be useful functions. However, it is possible for a harmful function to be necessary for the system to achieve its primary function.

Step 3
For each function identified in step 2, identify several things that must be true to facilitate the function. In most cases, these will be useful functions, however, not always the case. Sometimes harmful things are necessary evils.

Step 4
For each useful function identified in step 3, identify at least one function that counteracts, prevents, or inhibits the function. These will usually be harmful functions because they diminish useful functions. However, some useful functions come with undesirable side-effects and byproducts. Also for each harmful function identified in step 3, identify any functions that produce, cause, or enhance the function. These will usually be harmful functions since they are supportive of other harm.

Step 5
For any function already identified, note any byproducts produced or enabled by that function.

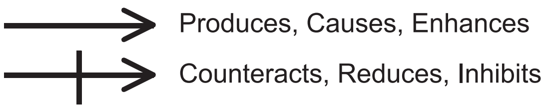
Desirable byproducts are useful functions, undesirable byproducts are harmful functions.

The useful/harmful function analysis results in an abstract description of the system under study. The next section discusses how to turn this abstract description into a graphical representation.

7.3 The Problem Formulator™

One could generate ideas by simply browsing manually though the operators. However, with hundreds of operators and thousands of inter-relationships, "operator space" is overwhelming. Practitioners need a way to intelligently find a trajectory through the operators that identifies the subset of operators most likely to be beneficial to a problem. A software package called the Innovative WorkBench (IWB) includes a tool called the Problem Formulator (PF). PF employs a graphical modeling technique with a deceptively simple graphical vocabulary. Useful and harmful functions are represented as nodes in the diagram:

A function can cause, produce, or enhance another function or counteract, reduce, or inhibit another function. These relationships are encoded in the diagram using:



Sometimes, a useful function in a system causes something else useful to happen—a desirable occurrence. Sometimes, a useful function has undesirable side effects and causes something harmful to happen. (The vice-versa is true too.) These are undesirable occurrences and are called *contradictions*. Any two functions can be related in eight different ways, shown in Figure 4.

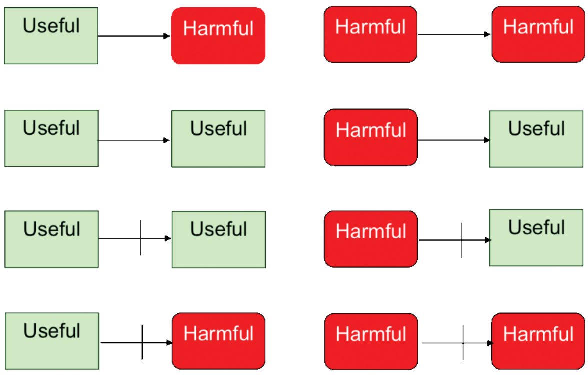


Figure 4. All possible relationships between two functions in a problem formulator diagram.

Any relationship causing a reduction in ideality is undesirable. In Figure 4, four of the relationships either cause harm or counteract good. These decrease ideality. The other four either produce good or counteract harm, so therefore increase ideality. A diagram in the Problem Formulator is essentially a collection of cause/effect relationships describing various situations. Contradictions fall into three categories shown in Figure 5.

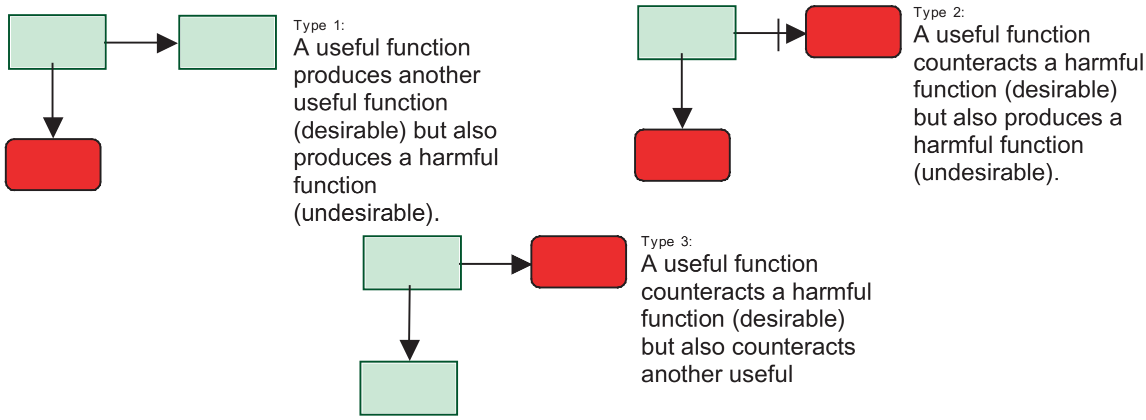
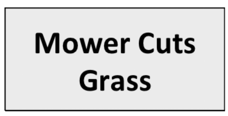


Figure 5. Relationships causing harm or counteracting good are contradictions which reduce ideality. Innovations remove or mitigate contradictions, thereby increasing ideality.

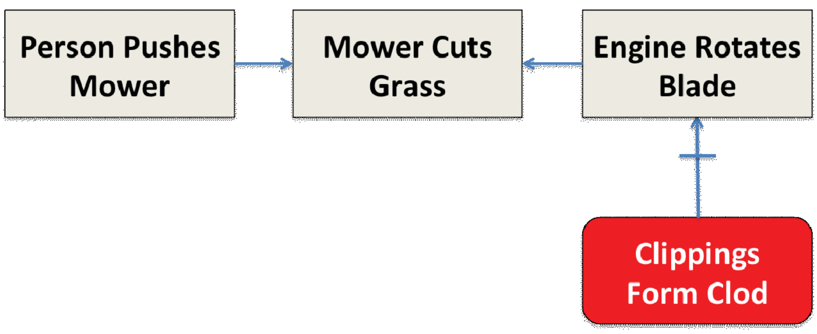
A system without contradictions would be an ideal system, since no harmful effects would be present. In reality, there is no such thing as a completely ideal system, so all systems have at least one contradiction. In fact, the reason why one would be analyzing a system using I-TRIZ in the first place would be to solve a problem with the system.

Although there are several techniques, the following is a 5-step process for drawing problem formulator diagrams mimicking the 5-step useful/harmful analysis described earlier. The *primary useful function* is defined first and diagrammed as a useful function. For example, the primary function of a lawnmower could be diagrammed as:

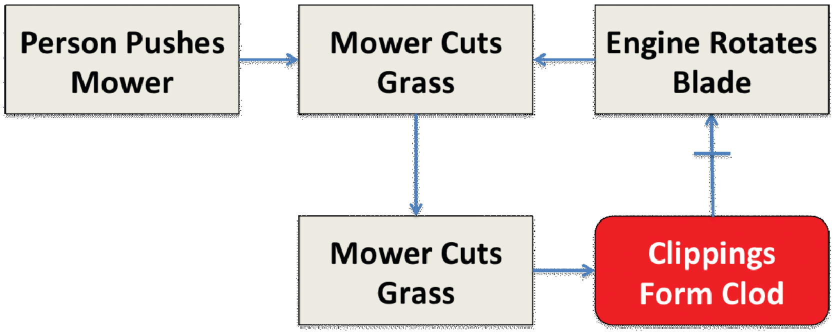


One would then think about what is necessary to make the primary function happen and might diagram the following:

The two functions *person pushes mower* and *engine rotates blade* are drawn as useful functions and linked to the primary function by *produces* relationship arrows indicating they are needed for the primary function to be realized. Next, thinking about what might counteract or inhibit these functions might result in:



Here, *clippings form clods* is an undesirable feature so is drawn as a harmful function. The clods tend to clog the blade and inhibit the blade from rotating, so we connect with a barred arrow indicating a *counteracts* relationship. Finally, identifying byproducts would lead us to identify the clippings as being the byproduct of the mower cutting the grass:



This example shows only a small portion of a diagram. A full problem formulator diagram usually consists of 25-50 functions and at least as many links. The mixture of harmful functions and counteracts relationships identify contradictions threatening to limit ideality. In I-TRIZ, the essence of an innovative solution is to resolve as many contradictions as possible.

7.4 Operators

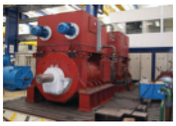
I-TRIZ researchers have studied over 2 million patents and extracted common, recurring principles employed in those patents. Underlying all of I-TRIZ is the collection of these principles called *operators*. An operator is a transformation as denoted by a TRIZ principle, method, standard solution, or utilization of an effect. Over 400 operators have been defined in I-TRIZ. Each I-TRIZ operator focuses thinking toward a specific change. As such, they serve to stimulate new ideas and non-obvious solutions. An operator is intended to:

- Help overcome psychological inertia
- View the problem in a different way
- Offer a solution containing an already solved problem
- Identify a resource needed to solve a problem
- Suggest an evolutionary step (an innovative idea)

We believe the set of I-TRIZ operators represents the most comprehensive catalog of innovative principles. The database of operators and associated illustrative examples represents a distillation of human innovative thought and represents an unparalleled and collection of knowledge. The following are examples of I-TRIZ operators and some illustrative applications of the principle:

7.4.1 Abandon symmetry

If an object is symmetrical, try to reduce its weight by making it asymmetrical for example by excluding a part of the object that does not bear the main load. Example: To save weight, the supporting structure of a large motor can be made much smaller on one side than the other. The side that bears the brunt of the torque needs to be stronger.

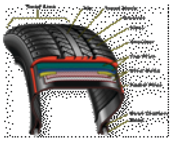


7.4.2 Reduce the weight of individual parts

Try to reduce the weight of those parts that do not bear the main load, especially moving parts. Example: drilling holes in a metal plate reduces weight without compromising strength.

7.4.3 Strengthen individual parts

Try to strengthen the parts that bear the main load and reduce the weight of the other parts. Example: Belts, ribs, shoulders with different densities of rubber as well as steel cords make tires strong while reducing weight.



7.4.4 Use inflatable constructions

Consider using a pneumatic (inflatable) construction instead of a mechanical one. Example: In space, light inflatable material becomes very rigid and structurally sound due to the difference in pressure.

7.4.5 Use flexible materials or links

Consider dividing an object or mechanism into parts connected by flexible or elastic links. Example: metal stirrups replaced by rubber sections allow it to flex and accommodate movement.

Some operators represent a very specific concept while others are very general. The more general the concept, the more likely the operator will be helpful to your project. Operators can be grouped according to their relative applicability. Figure 6 shows the *Universal Operators* and Figure 7 shows a partial list of *General Operators*.

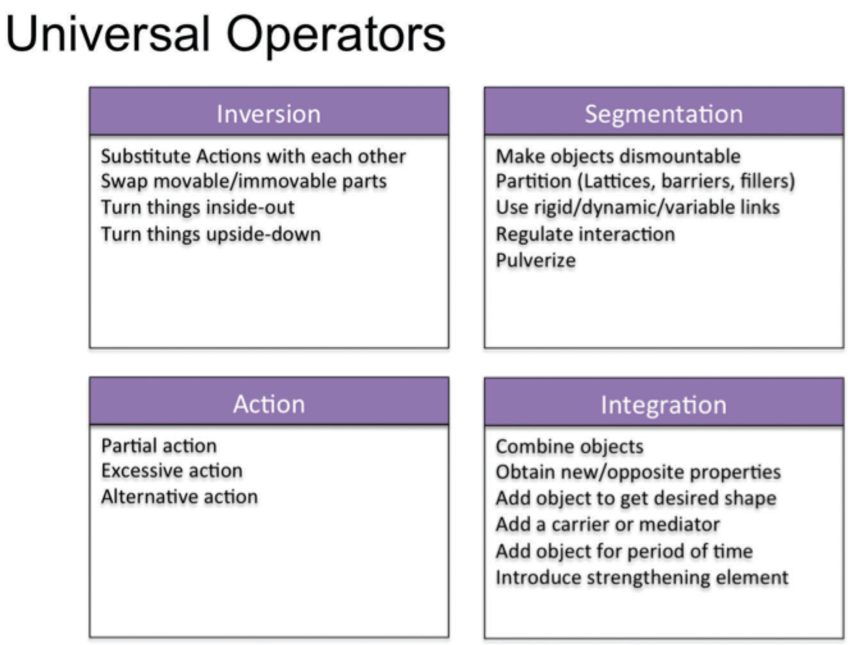


Figure 6. Universal operators represent general concepts that apply to a wide range of systems. The term “universal” reflects their near universal applicability.

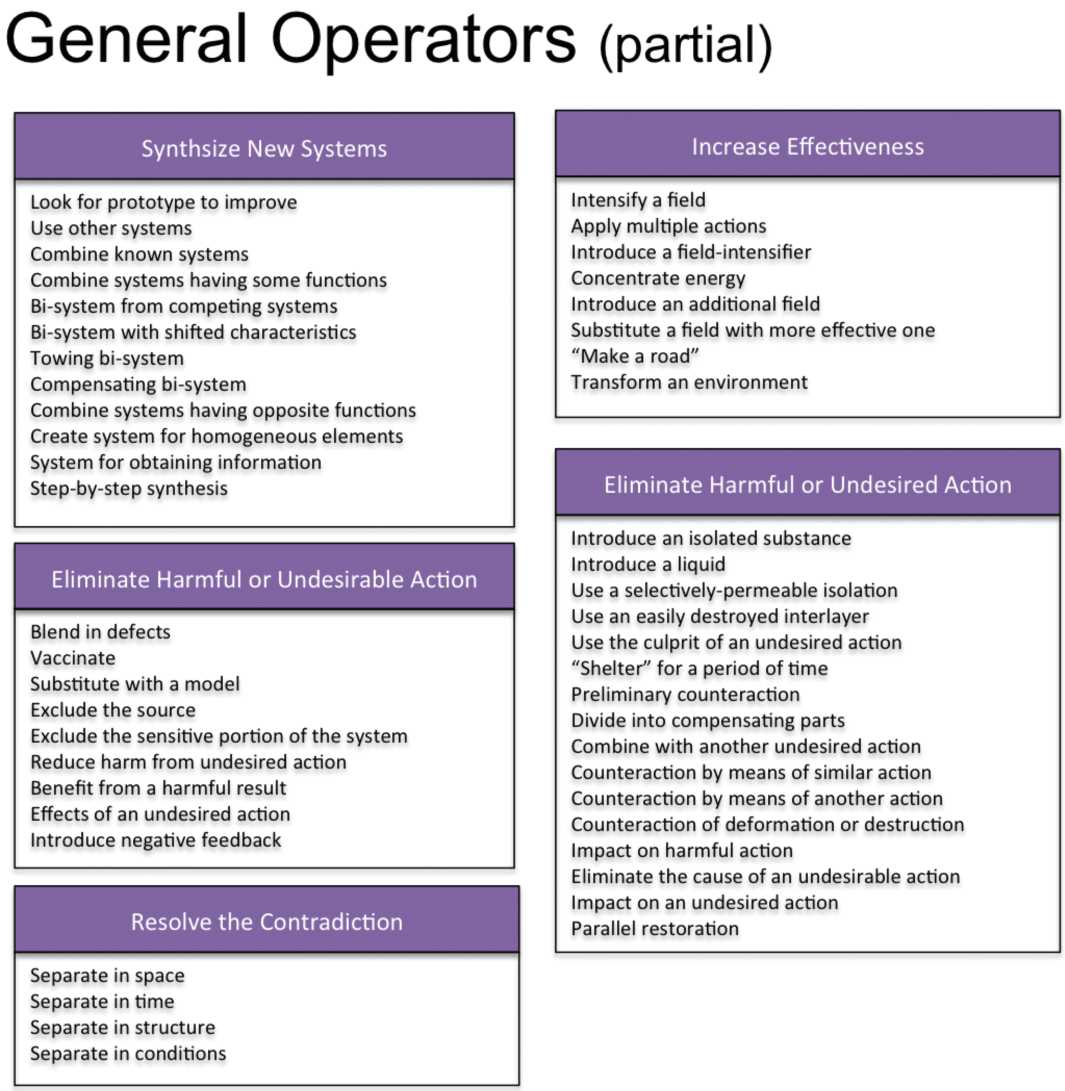


Figure 7. General operators represent concepts with wide applicability but not as wide as universal operators. Only a partial list of general operators are shown here.

Once the contradictions in a system are identified, one systematically considers several operators during the idea generation phase of the methodology. Considering the concept encapsulated in the operators stimulates thinking as to how that principle might be applied to the system under study. Not every operator applies to every system and not every operator stimulates a new idea. However, it is common for dozens, if not hundreds, of operators to be considered during an analysis and dozens of potential ideas generated. The operators help free one from the psychological inertia of "being too close to the forest to see the trees." Repeatedly, analysts using I-TRIZ have found solutions to problems that have stumped subject matter experts for years (even decades). The Innovation Workbench (IWB) software connects the problem formulator diagram to the operator database facilitating quick and easy analysis during the idea generation phase.

8. THE IMPORTANCE OF TOOLS

Humans' creation and use of tools is one thing that differentiates mankind from other animals. Indeed, modern man has become symbiotic with technology. Remove technology and the average person is unable to survive for more than a few days. Man's technology is embodied in the tools he invents allowing him to manipulate the environment.

Throughout history, new technology has created new cultural and social roles, new professions, and new types of workers. Correspondingly, new technology changes the fabric of culture and society along the way. Some of the first tools invented were used for hunting. Hunting transformed man into a predator instead of being just a gatherer and scavenger. The role of *hunter* might be the first technology-enabled human role. Being able to hunt led to a transformation of mankind's evolution. Farming technology (plants and livestock) allowed man to form stationary settlements instead of having to migrate to follow game. New roles like *farmers* and *ranchers* were created. Freeing society from the day-to-day worries of feeding oneself transformed mankind and the pursuit of *intellectual* endeavors like art, science, and math. Metal working technology created various *smithing* roles. Metal weaponry transformed warfare and changed the balance of world power. Mastery over construction and civil infrastructure allowed cities to develop. Congregations of this many people required innovations like government, laws, and courts. Some professions created thousands of years ago are still viable: *carpenters*, *masons*, *artists*, *musicians*, *scientists*, *mathematicians*, *politicians*, *judges*, *lawyers*, etc. All use their "tools of the trade."

The set of tools and methodologies that TRIZ, I-TRIZ and other modern extensions of TRIZ represent should be viewed as an enabling technology on par with inventions like the hammer and saw. Rather than the manipulation of physical objects, innovation technology allows one to work with innovative ideas—a realm formerly thought to be accessible only to the specially gifted. The new innovation technology should lead to the creation of new roles, new job titles, and new services. Possibly, one day in the near future, we will talk about the *innovation worker.*

9. THE INNOVATION AGE AND THE INNOVATION WORKER

Historians tend to partition time into technologically-defined eras such as the *Iron Age* and *Bronze Age*. For example, the *Industrial Age* was defined by the creation of complex tools and machines. In the 20th century, a new kind of machine was developed—the computer. This technology created new professional roles like *computer engineer, software engineer,* and *computer programmer* but also opened up an entirely new realm—information engineering. Having tools to manipulate information has led to the *Computer Age* and the *Information Age* and has created new kinds of workers like the *information worker* and the *knowledge worker*.

The science of innovation represents another kind of revolutionary technology and one that could usher in a new era—the *Innovation Age*. Capturing and making available the body of human innovative thought through a set of tools is a prime example of applied information management. Built on top of the computer revolution and the information revolution, I-TRIZ makes it possible for humans to apply themselves to the "smithing" of innovative ideas. We are moving toward a future where innovation is no longer done by a selected few "innovative people" or "research and development people." In the Innovation Age, the average person and the average employee will have command of a set of tools and techniques that make everyone able to innovate on demand.

If we learn our lessons from history, we should expect the growth of an innovation infrastructure to arise to support this new technology—the *innostructure*. This innostructure, akin to IT infrastructures in companies today, will comprise a myriad of new tools and derivative technologies. We should also expect the creation of new roles, jobs, professions, changes in business practices, and even the creation of a new *innovation industry*. Indeed, the innovation industry is already underway, but still in its infancy. Just like information technology spawned the information worker, we can expect the *innovation worker* to be a new kind of employee —a person adept at using the tools of innovation technology and possessing the ability to innovate on demand.

10. INNOVATION EDUCATION

In order for the "innovation revolution" to happen in any magnitude, one thing that must increase is availability of education opportunities. An ideal place for this to happen is in colleges and universities. The author is currently engaged in three seminal education-related efforts.

First, in conjunction with Edgecomb Community College in North Carolina (USA), a live, 5-day continuing education course has been developed and is being launched in the fall of 2010. This delivery teaches the fundamentals of I-TRIZ and inventive problem solving using the IWB software. The target audience is post-baccalaureate working professionals.

Second, is an 8-module online certification course. This program, called the Certified Innovation Program (CIP) is also being launched in the fall of 2010 at the University of South Carolina Upstate. The CIP is all-online and self-paced but does include numerous assignments that an instructor will critique and interact with the student about. The CIP is intended for working professionals who cannot attend a live class of any kind and for purchasers of the IWB software who want a quick introduction into problem solving with I-TRIZ. The CIP teaches not only how to use the software, but also the art and craft of constructing diagrams and doing system analysis using I-TRIZ and the operator knowledgebase.

Third, is a full-semester course suited for university sophomores and juniors in virtually any discipline. This course is being taught for the first time as SIMS 307: Systematic Innovation at the University of South Carolina Upstate in the fall semester of 2010. It has also been inserted into the Information Management & Systems (IM&S) curriculum as a required course and will be taught every semester. The IM&S program is a Bachelor of Arts (BA) degree in applied, multidisciplinary information technology and management. The IM&S program prepares students to be problem solvers using information management technology. As such, the innovative thinking, creative, and system analysis skills I-TRIZ provides is a critical for our graduates and is different than any other problem-solving methodology taught anywhere else in the curriculum. This is the first degree program of its kind in the world that requires expertise in I-TRIZ of its graduates.

11. WHERE TO FIND MORE INFORMATION

For information about I-TRIZ in general as well as books, workshops, software, and consulting services, refer to the Web site for Ideation International, Inc. at www.ideationtriz.com. Ideation's address is: 32000 Northwestern Hwy, Ste 145, Farmington Hills, MI 48334 and the phone/fax numbers are: 248-737-8854/248-737-8929.

For information about the online Certified Innovation Professional (CIP) program at the University of South Carolina Upstate or the full-semester university course, contact Dr. Ron Fulbright, Chair, Department of Informatics, University of South Carolina Upstate, Spartanburg, SC 29303. The Department of Informatics Web site is www.uscupstate.edu/informatics.

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