

Electronic Reference Book on Physical contradictions

Y. Danilovsky, PhD, TRIZ Master

Gen3 Korea Innovation Consulting / Solving
Department, Bundang, S. Korea / Ur7@mail.ru

S. Ikovenko, PhD, TRIZ Master

Gen3 Partners / Education Department,
Boston, USA / sergeiikovenko@aol.com

Calculating concepts using the model of PC

Useful prototypes for creating concepts

History of technology



- What can be there instead of “buttons”?
- Disadvantage (D)
- Model of describing disadvantages consisting of TWO parameters (EC)
- **Model of describing disadvantages consisting of ONE parameter (PC)**
- Description of D in the language of functions

<http://www.triz-solver.com/index.php/teoriya-nedostatkov/223-fp-kak-elektronnyi-spravochnik-chemovik>

Yu.Danilovsky, S.Ikovenko © 2014 www.triz-solver.com E: ur7@mail.ru

Historical analysis existing technologies for solve PC

History of PC model

<http://www.altshuller.ru/triz/ariz85v-t2.asp>

- G. Altshuller considered 11 main mechanisms for solving PC

http://www.kitway.com/artbase/triz21_2.html

- G. Ivanov considered main 4 mechanisms for solving PC and recommended principles

Technology 1



Technology 2

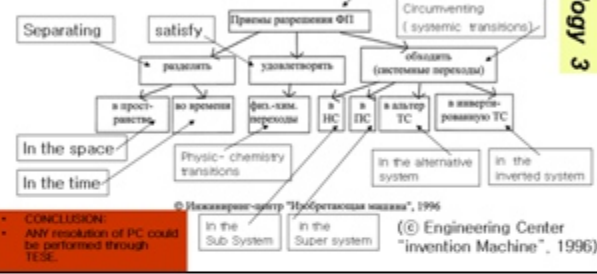
Solving PC via ARIZ 91 (L)

Разрешение ФП по АРИЗ 91-Л

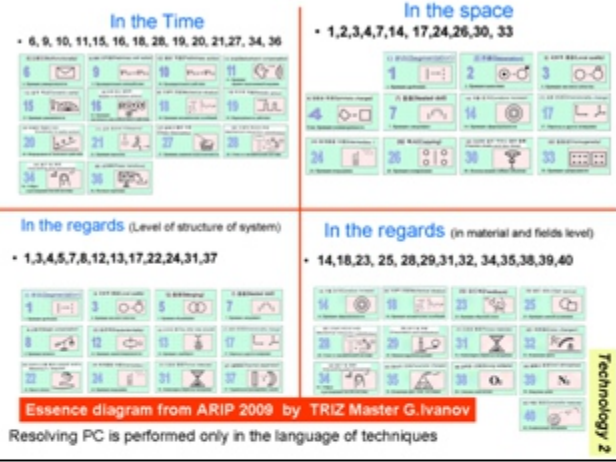
5.3.3. Выйти на группу приемов разрешения ФП.

Примечание

1. Поиск необходимой группы приемов производится по следующей схеме:



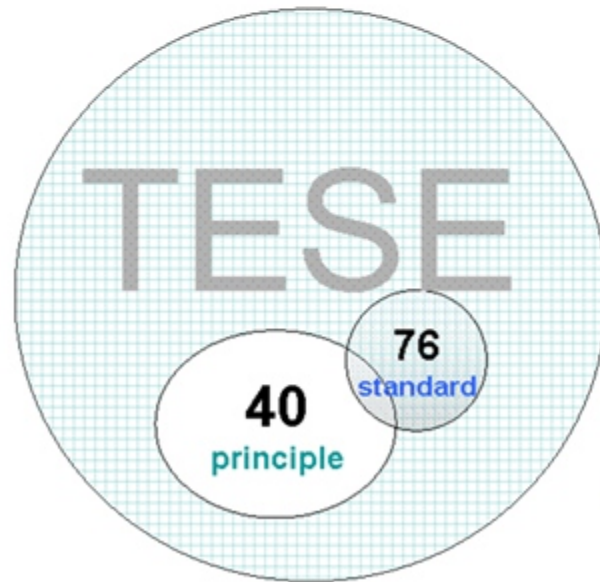
Technology 3



Technology 2

<http://www.altshuller.ru/triz/ariz85v-t2.asp>

- We must understand:
- 40 principle
- 76 standard is different mechanisms of TESE



All recommendations from ARIZ are fundamentally recommendations from TESE, 40 techniques and 76 standards.

HOWEVER, TESE includes also 40 techniques and 76 standards.

CONCLUSION:

ANY resolution of PC could be performed through TESE.

List of important parameters for PC and resources analysis

Physical contradiction

ELABORATION CAUSE-EFFECT CHAIN ANALYSIS

disadvantages

open close
big small

parameter

Selecting of important parameters

Основная статья: Основные единицы СИ

Величина		Единица			
Наименование	Размерность	Наименование		Обозначение	
		русское	французское/английское	русское	международное
Длина	L	метр	mètre/metre	м	m
Масса	M	килограмм	kilogramme/kilogram	кг	kg
Время	T	секунда	seconde/second	с	s
Сила электрического тока	I	ампер	ampère/ampere	А	A
Термодинамическая температура	Θ	кельвин	kelvin	К	K
Количество вещества	N	моль	mole	моль	mol
Сила света	J	кандела	candela	кд	cd

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

Simplest "candidates" to the list of parameters for digital description

유도량	이름	기호
넓이	제곱미터	Surface area/m²
부피	세제곱미터	Volume of cube/m³
속력, 속도	미터 매 초	Velocity/velocity m/s
가속도	미터 매 초 제곱	Pressure/distance m/s²
밀도	킬로그램 매 세제곱미터	Density/density kg/m³
농도	몰 매 세제곱미터	Concentration/concentration mol/m³
광휘도	칸델라 매 세제곱미터	Illuminance/illuminance cd/m²

$$7 + 22 + 7 = 36$$

Graph of resources

Macro - Micro

completeness

MATCHEM

Calculation of X elements via graph of resources

DOS

Disadvantages

dynamicity

conductivity

Harmonization Non-harmonization

Time

Substance

Field

Space

Need

knowledge

TESE

function

patents

History of products

New technologies

S Curve models

Ideality

FOS

Approach for solve PC "by Gen 3 Korea Innovation Consulting, Ltd"

Can we solve Physical Contradiction via TESE?

Macro - micro m

completeness C

Macro - micro m

Вещность v

dynamicity D

conductivity

ideality I

harmonization H

completeness C

Transfer to SS

Time S

Space S

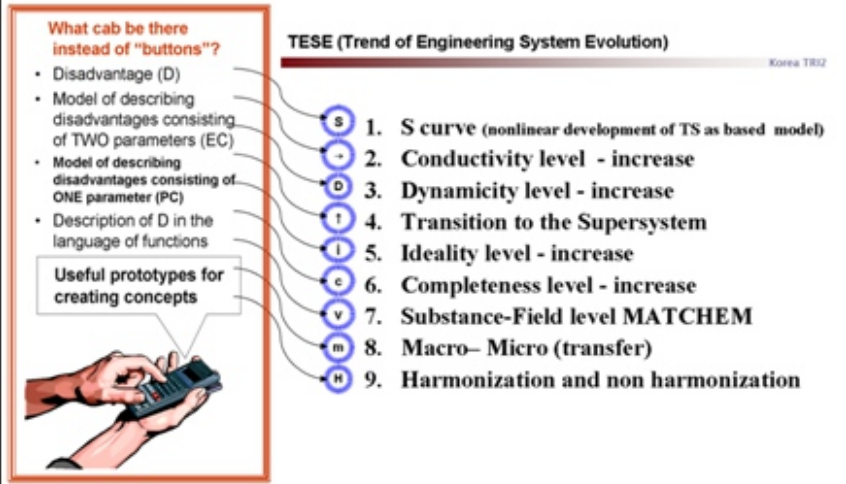
Substance & Field (Materials)

System Level

3.1 In the regards 3.2

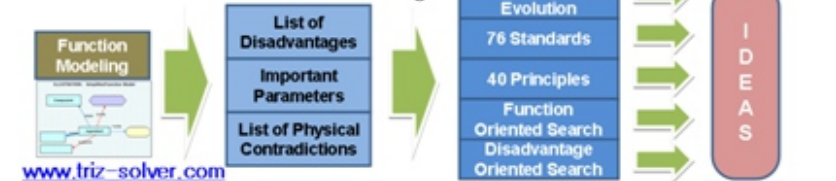
Y.Danilovsky_2012

Proposed methodological approach in resolving PC for the manual



Typical problem (simplify list)	Trends (simplify list)	helper in 40principles family	Suitable Standards
Small capacity	S S curve model (mono- bi-poly) consider non linear process of development	5,6,7,20,38,39,40	2.1.2 , 3.1.1, 3.1.1, 5.3.3 , 5.3.4
small reliability of system, big tiredness	C Completeness consider in crease of part until to robotic system	9,10,12,23,32,34,37,38	1.1.3,1.1.7,2.4.11,5.2.2,5.2.3,5.4.1
High cost of result	I Conductivity increase different ways for increase of productivity	4, 9,14, 15,18, 17,21,25	2.2.4,2.3.1,5.2.1,5.4.2
small amount of function, big amount of parts	I Ideality consider increase amount of function and decrease of spending materials/ time, movement	4,5,6,7,8,9,10,16,19,20,22,24,25,26,27,32	1.1.4,2.3.3,3.1.4,4.5.2,5.1.3,5.2.1
Expensive resources, (perfect) system	I Transfer to SS consider contact with super system	2,6,11,13,26,38	5.1.1.1,5.2.3,5.1.3,5.4.1,5.2.2
Size of system before application	D Dynamicity consider bond between parts of system	1,7,13,15,17, 18,25,29,30	2.2.2,2.2.5,2.4.3,5.1.4
Small efficiency	V MATCHEM consider probability of change type of energy for process	5,6,8,9,10,19,22,23,24,28,32,34, 36,37	1.1.1,1.2.5,2.1.1,2.2.1,4.3.2,5.3.4,5.3.5
Cost reduction, old system	M Macro- micro consider every condition of substances	1,5,6,23,27,28,29,30,31,34,35,36,38,39,40	1.1.2,1.1.5,2.2.2,2.2.3,2.2.6,5.1.1,1.1,5.1.4,5.3.1,5.3.3,5.3.5
Small convenience	H Harmonization consider in crease level of conveniences	1,2,3,7,9,10,12,23,24,33,39	1.1.4,1.1.6,1.2.1,1.2.4,2.2.5,2.2.6,2.3.1,3.1.3,4.2.2,4.2.3,5.5,1.4.5,2.3.5,3.3.5,1.1,1

TRIZ Electronic reference book for trainings



Resource Category	Key Problem Classification			Recommended Solving Tools		
	№	Disadvantage (by parameters)	Simplest Examples	Trends	Standards	Inventive Principles
SUBSTANCE	1	Harmful substances	Tobacco smoke Scum on the heater of the washing machine Control	Ideality MATCHEM Coordination	2.2.3 3.1.5 5.1.1.1 5.1.3	2, 4, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40
SUBSTANCE	2	Presence of expendable substances	Fountain pen - computer, generated text	Transition to Supersystem, Macro - micro Ideality	2.2.1, 5.1.1.1, 5.1.3	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40
SUBSTANCE	3	Low efficiency	Fan - electric ventilator Boiler house	MATCHEM Conductivity Ideality	1.1.1, 1.1.4, 1.1.5, 2.2.2, 2.2.4, 3.2.1, 5.2.1, 5.2.2	8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40

Several Hyperlinked Databases

Calculating concepts using the model of FC

Useful prototypes for creating concepts

Current approach



- What can be there instead of "buttons"?
- Disadvantage (D)
- Model of describing disadvantages consisting of TWO parameters (EC)
- Model of describing disadvantages consisting of ONE parameter (PC)**
- Description of D in the language of functions

- This is the zone of location of databases according to physical contradictions PC.
- Having selected a disadvantage, which has to be eliminated, it is easy to identify the parameter, which would be the basis creating PC. It is necessary to click on the line field and to see the menu of parameters.

FIELD	Harmful fields	Noise, overheat, vibration other examples	MATCHEM Macro - micro Harmonization	1.1.4,1.1.5,1.1.6,1.1.7,1.1.8, 1.2.1,1.2.3,1.2.4,1.2.5,2.2.5,2.2.6, 3.1.3,4.2.2,4.2.3,4.5.1,4.5.2, 5.1.1.1,5.2.1,5.2.3,5.3.3,5.3.4	1,2,3,7,11,17,24,31,35,36,40	7
FIELD	Significant weight	Traffic control barrier with a weight, wheel – caterpillar drive of the tanks	Dynamization Transition to Supersystem Harmonization	1.1.1,1.2.2,1.2.4,1.1.4,1.6,1.1.7, 1.2.4,2.2.3,3.1.3,4.5.1,4.5.2, 5.1.1.1,5.1.4,5.2.1,5.2.3, 5.3.3,5.3.4	1,2,5,8,13,15,28,29, 30,31,35,36,37	8
FIELD	Significant total energy consumption, including utilization of system after using it	Glue lamp – OLED, benzene engine - diesel	Transition to Supersystem Macro – micro Ideality	2.2.2,3.1.1, 3.2.1,5.2.1, 5.3.2,5.3.5	35,36,12,28,1	9
FIELD	High energy consumption in switching on	Opening a knife or an umbrella using two hands – using one hand, in case a spring is inserted	Completeness Conductivity Dynamization	2.4.1,3.1.5, 5.1.1.1,5.2.1, 5.4.1	9,23,15,17	10
FIELD	High energy consumption in switching over	Manually controlled gearbox of the car – automatic gearbox other examples	Ideality, Conductivity Transition to Supersystem	3.1.5,5.2.1, 5.4.1	12,15,17,10,25,23	11

Let us suppose that we are solving a problem, in which temperature is an important parameter. It is necessary to retrieve the collection of examples of PC for the parameter "temperature" and to look through analogs, which could help you in formulating your idea in the current project.

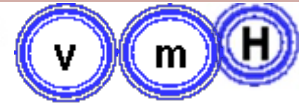
Fields and characteristic parameters

- Energy (Joule)
- Weight (kg)Вес (кг)
- Energy expenses prior to main process (Joule or %)
- Energy expenses after main process (Joule or %)
- Energy expenses for charging system (Joule or %)
- Energy expenses on switch-over of modes (Joule or %)
- Force (Newton)
- Power (Watt)
- Pressure (Pascal)
- **Temperature (Kelvin)**
- Heat conductivity (Watt/ m.Kelvin)
- Heat capacity (Joule/Kelvin)
- Electric charge (Coulon)
- Difference of potentials (Volt)
- Resistance (Ohm)
- Electric capacitance (Farad)
- Magnetic flow (Weber)
- Magnetic flow (Weber)
- Magnetic induction (Tesla)
- Inductivity (Henry)

Set of examples for resolving the PC as applied to each of the parameters as a manual



FIELD	Harmful fields
FIELD	Significant weight
FIELD	Significant total energy consumption, including utilization of system after using
FIELD	High energy consumption in switching on
FIELD	High energy consumption in switching over
FIELD	Many moveable parts



Resolving a PC – the temperature should be high and low through “harmonization”

MATCHEM Macro – micro

PC: The temperature should be both high and low

1.2.1 "glove for a saucepan"

Physical Contradiction easy example
Surface in the glass of tea must be warm, because I like warm tea, but glass of tea must be cold, because warm surface of glass is danger for peoples.

Solution 1

24) 매개물질 이용(Intermediary)

24) Triparamon incorporation

3) 국부적 품질(Local quality)

3) Triparamon incorporation

PC: The temperature should be both high and low

5.1.1.1 "Magic of emptiness"

"Hessen crucible". 16th century. It was used for discovering aluminum.

7) 중첩(Nested doll)

7) Triparamon incorporation

PC: The temperature should be both high and low

5.3.3, "Combination of aggregate states"

Glass with double walls. Inside the walls there is air.

35) 매개물질 이용(Intermediary)

35) Triparamon incorporation

24) 매개물질 이용(Intermediary)

24) Triparamon incorporation

PC: The temperature should be both high and low

Air cooling installed on a Volkswagen "Bug"

1.1.4. "Substance from environment free of charge"

24) 매개물질 이용(Intermediary)

24) Triparamon incorporation

PC: The temperature should be both high and low

5.2.3, "Substance as field"

Decision / Pause

3) 국부적 품질(Local quality)

3) Triparamon incorporation

24) 매개물질 이용(Intermediary)

24) Triparamon incorporation

PC: The temperature should be both high and low

1.1.4, "Substance from environment free of charge"

Ranque effect

1.1.4, "Substance from environment free of charge"

24) 매개물질 이용(Intermediary)

24) Triparamon incorporation

Separation of a compressed gas into a hot stream and a cold stream
The vortex tube, also known as the Ranque-Hilsch vortex tube, is a mechanical device that separates a compressed gas into hot and cold streams.

PC: The temperature should be both high and low

1.1.4, "Substance from environment free of charge"

Evaporative cooler

Uses Heat of vaporization: 2257 KJ/kg of water
Cooling = 2140 BTU/kg evaporated

36) 상변화(Phase transition)

36) Triparamon incorporation

PC: The temperature should be both high and low

5.3.3, "Combination of aggregate states"

Image 1: Typical steam-heated kettle reboiler for distillation towers

36) 상변화(Phase transition)

36) Triparamon incorporation

24) 매개물질 이용(Intermediary)

24) Triparamon incorporation

PC: The temperature should be both high and low

1.1.4, "Substance from environment free of charge"

Crio-needles (throttling of nitrogen yields the temperature of -40)

It is possible to control the temperature by changing the rate of gas flowing

36) 상변화(Phase transition)

36) Triparamon incorporation

24) 매개물질 이용(Intermediary)

24) Triparamon incorporation

This type of disadvantage in the manual has recommendations concerning trends for resolving the PC

examples	Conductivity	3.1.5, 5.2.1.5.1.4	28.29.30.35.36.37
SPACE Large dimensions in storage	Foldable umbrella with 5 folds other examples	MATCHEM Dynamization Coordination Transition to Supersystem	2.2 5.3
SPACE The shape is not coordinated with Supersystem	A bottle of juice in the form of a parallelepiped for preserving in a frig. other examples	Harmonization Dynamization Conductivity	2.2 5.1
SPACE Banal shape and color	Banal shape and color Blue ketchup, a pack of cigarettes in the form of a book	Ideality, Transition to Supersystem, Coordination	2.2
SPACE Short run distance	Alkaline cell – ion-lithium battery other examples	Completeness, MATCHEM, Transition to Supersystem	3.1 5.2
SPACE No mobility	Organ – Russian accordion Table phone – mobile phone other examples	Transition to Supersystem, Dynamization Ideality	5.1
TIME Short life duration (longevity)	Protection from corrosion other examples	Coordination, Ideality, Dynamization	1.2 3.2



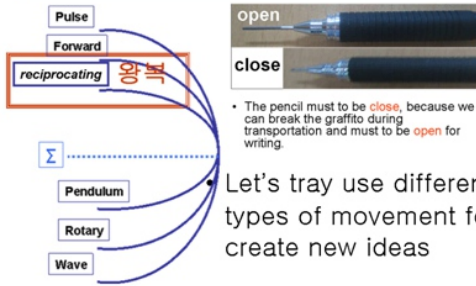
Resolving a PC –"open – close" and low through "conductivity"

Physical Contradiction and TESE

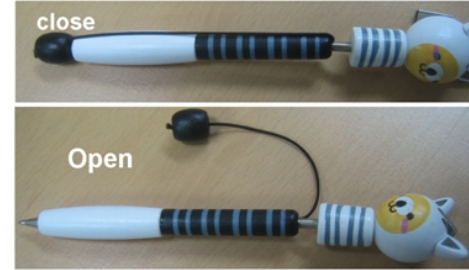


- The pencil must be **close**, because we can break the graffito during transportation and must to be **open** for writing.

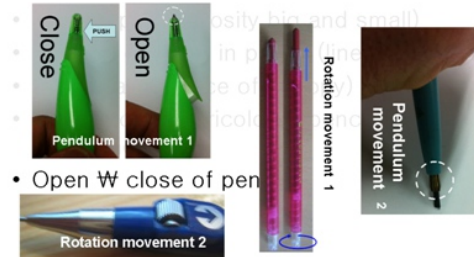
Solve PC via type of movements



impulse movement



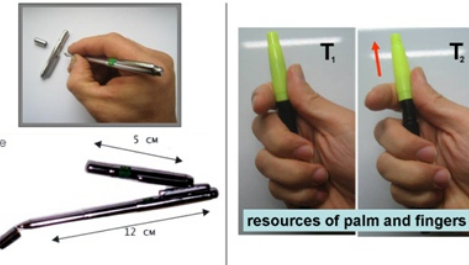
Pendulum and revolving



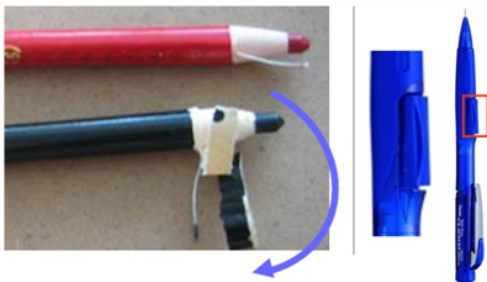
Pendulum movement



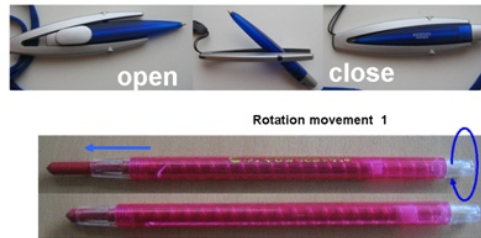
Forward movement



Rotary and forward

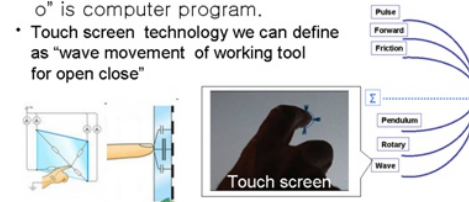


Rotary movement and turn of axis



Open- close in "wave movement"

- Wave movement means "vibration" in mechanical level, and I don't found pencil with vibrational system for function "open – close".
- But next generation of systems for "create info" is computer program.
- Touch screen technology we can define as "wave movement" of working tool for open close"



Resolution of PC: the weight should be great and the weight should be small

FIELD	Problem	Example	TRIZ Principles	Principles	Principles	Field
FIELD	Harmful fields	Noise, overheat, vibration ... other examples	MATCHEM Macro - micro Harmonization	1.1.4.1.1.5.1.1.6.1.1.7.1.1.8. 1.2.1.1.2.3.1.2.4.1.2.5.2.2.5.2.2.6. 3.1.3.4.2.2.4.2.3.4.5.1.4.5.2. 5.1.1.1.5.2.1.5.2.3.5.3.3.5.3.4.	1.2.3.7.11.17.24.31.35.36.40.	7
FIELD	Significant weight	Traffic control barrier with a weight, wheel – caterpillar drive of the tanks	Dynamization Transition to Supersystem Harmonization	1.1.1.1.2.2.1.2.4.1.1.4.1.6.1.1.7.1.2.4.2.2.3.3.1.3.4.5.1.4.5.2. 5.1.1.1.5.1.4.5.2.1.5.2.3.5.3.3.5.3.4.	1.2.5.8.13.15.28.29.30.31.35.36.37.	8
FIELD	Significant total energy consumption, including utilization of system after using it	Glue lamp – OLED, benzene engine - diesel	Transition to Supersystem Macro – micro Ideality	2.2.2.3.1.1. 3.2.1.5.2.1. 5.3.2.5.3.5.	35.36.12.28.1.	9
FIELD	High energy consumption in switching on	Opening a knife or an umbrella using two hands – using one hand, in case a spring is inserted	Completeness Conductivity Dynamization	2.4.1.3.1.5. 5.1.1.1.5.2.1. 5.4.1.	9.23.15.17.	10
FIELD	High energy consumption in switching over	Manually controlled gearbox of the car – automatic gearbox ... other examples	Ideality, Conductivity Transition to Supersystem	3.1.5.5.2.1. 5.4.1.	12.15.17.10.25.23.	11



Resolution of PC: the weight should be great and small through dynamization and Harmonization- Non-harmonization



Kg Resolution of EC: the weight should be great and the weight should be small

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

Crane type Water well

5.2.3. "Substance as Field"

8. Principle: compensation

Kg Resolution of EC: the weight should be great and the weight should be small

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

Boom barrier with a counterweight

5.2.3. "Substance as Field"

8. Principle: compensation

Kg Resolution of EC: the weight should be great and the weight should be small

5.2.3. "Substance as Field"

- The balloon, filled with hydrogen (Charlière)*
- Ballast (water, sand) of a Gas balloon.
- A gas balloon may also be called a **Charlière** after its inventor, the Frenchman Jacques Charles.

29. Principle: compensation

8. Principle: compensation

Kg Resolution of EC: the weight should be great and the weight should be small

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

Balloon of (Montgolfier) type. (air heating) Hot air balloon. A hot air balloon created on December 14, 1783 by the Montgolfier brothers.

1.1.1. "Add field"

29. Principle: compensation

8. Principle: compensation

Kg Resolution of EC: the weight should be great and the weight should be small

Submarine. It uses pumping water into the deadweight vessels and compresses air for controlling the depth of submerging.

5.2.3. "Substance as Field"

1.1.4 "Take the substance from environment"

29. Principle: compensation

8. Principle: compensation

Magnus Effect - 1

5.2.1. "Rotation"

5.2.3. "Substance as Field"

14 revolutions per minute

The American company Airtek proposed a project of a rotating shell Cigarone

- Volume of shell is 9 500 u3
- Rotation speed is 14 rev. per minute
- Length 60 m
- Diameter 20 m
- Engines 4x 110 kW
- Lifting capacity 2 tons
- 50% "Archimedes"
- 50% "Magnus"
- Speed 80 km/h
- Flying model of the apparatus has been manufactured
- Additional filling with helium 5% annually

29. Principle: compensation

8. Principle: compensation

Kg Resolution of EC: the weight should be great and the weight should be small

Device for flights based on a water jet, directed downwards

5.2.3. "Substance as Field"

1.1.4 "Take the substance from environment"

29. Principle: compensation

8. Principle: compensation

Kg Resolution of EC: the weight should be great and the weight should be small

Vessel on a water cushion – the air jet is directed downwards

5.2.3. "Substance as Field"

1.1.4 "Take the substance from environment"

15. Principle: compensation

8. Principle: compensation

Kg Resolution of EC: the weight should be great and the weight should be small

Helicopter. It uses the rotation of the blades for a height and weight are regulated by the rotation

5.2.1. "Rotation"

1.1.4 "Take the substance from environment"

14. Principle: compensation

8. Principle: compensation

Calculating concepts using the model of PC

Useful prototypes for creating concepts



- What can be there instead of “buttons”?
- **Disadvantage (D)**
- Model of describing disadvantages consisting of TWO parameters (EC)
- **Model of describing disadvantages consisting of ONE parameter (PC)**
- Description of D in the language of functions

Certain popular disadvantages of engineering systems

- 1) Harmful substances 2) Presence of consumable substances 3) Low efficiency 4) Low energy intensity of the substance 5) Necessity to utilize substances 6) Poor control of substance flows
- 7) Harmful fields 8) Significant weight 9) Great overall energy consumption, including the utilization of system after use 10) High energy consumption in switching on 11) High energy consumption in switch-over 12) Many moveable parts
- 13) Large dimensions in transportation 14) Large dimensions in storage 15) The shape is not harmonized with the supersystem (SS) 16) Banal shape and color 17) Short distance of travel 18) Absence of mobility
- 19) short life of the system (longevity degree is low) 20) Long recharging period 21) short period of stationary work 22) Long period of preparation for use 23) Long period of process performance 24) Long period of mastering the skills
- 25) No corrective function 26) Excessive level of function performance 27) Insufficient level of function performance 28) Few additional function 29) Low reliability 30) Requires the presence of additional systems (trimming as a transfer of function to other components of the system)

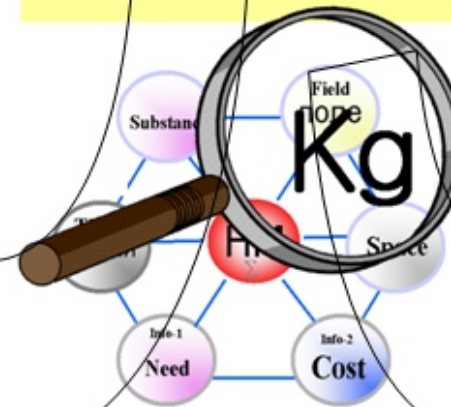
DOS for parameter Kg (set of examples for search of useful prototypes)

Field	Harmful fields -	Notes, overhead, location, etc. examples -	MATCHES: Macro...macro...transmission -	114151516 1171158 121123124125 226 228 -	1 2 3 7 11 17 24 28 36 40
Field	Significant weight -	Traffic control barrier with a weight, wheel - computer drive of the tanks -	Automation: Transition to supersystem - transmission -	111 122124114 16117 124 223313 451 452 -	12 8 9 15 26 28 30 36 38 39
Field	Significant total energy consumption including utilization of system after using it -	Use lamp - VCLC turbine engine - diesel -	Transition to Supersystem: Macro...macro...shelly -	222 251 - 221 241 - 332 334 -	3 8 12 28 31
Field	High energy consumption in switching on -	Opening a knife or an umbrella using two hands - using one hand, in case a spring is inserted -	Completeness: Conductivity - Transmission -	241 250 - 274 22 - 343 -	8 20 15 17
Field	High energy consumption in switching over -	Manually controlled gearbox of the car - automatic gearbox - other examples -	Shelly, Conductivity, Transition to Supersystem -	215 221 - 343 -	12 15 17 19 26 29

Disadvantage as an independent category in search for prototypes

- Very often the identified Disadvantage could become a motive causing the inventor to create a new system.
- In this case the heuristics of reasoning the format of PC (physical contradiction) is **not used**, while the identified Disadvantage is used as a resource (as a REASON) for creating a new design. In order to single out the work with parameters in the models of PC and EC a new term is introduced, namely, Disadvantage Oriented Search (DOS), which has been created as an analog of the term Function Oriented Search.
- The main criterion of the search for a prototype is not the function, not the PC and not the similar EC, but a disadvantage as a motive causing the inventor to create a new design. The disadvantage as a "resource of engineering evolution". The key formula of all presented terminology is preconditioned by the vector of reasoning: "People develop the technology in the direction of eliminating Disadvantages, using for this purpose the closest (inexpensive) resources, which are available at the current moment".
- The content of a cell in the reference book, which follows the column "typical disadvantage" is given below. This column contains supporting collection of examples of inventions within the scope of DOS approach to each of the disadvantages, which are singled out.

Weight resource - parameter Kg



- Very often some disadvantage could cause the inventor to create a new invention, for example, according to the mechanism of technique 22 "Blessing in disguise" or according to the mechanism of IFR Technique 25 "self-service"

25) 셀프 서비스 (Self-service)

25 Принцип самообслуживания

22) 마이너스를 플러스로 바꾸는 (Blessing in disguise)

22 Вред в пользу

Lecture for Level 4 (fragment)



- Collection of DOS for illustrating the use of parameter WEIGHT (Kg) as the REASON for creating inventions in fairly different industries **WITHOUT** formulating PC: the weight should be great and the weight should be small", in order to understand the difference in heuristic methods of searching for prototypes, distinguishing between DOS, EC, PC and FOS.

Use gravity fields

Tongs for railway

OPERATION

For lifting and positioning structural beams, tongs can be used in pairs in combination with a separate beam for additional versatility.

22. 3D-Elemental Solution: 물라스로교로 바꾼다 (Blessing in disguise)

22. 3D-Elemental Solution: 22. 3D-Elemental Solution

The rocket could INDEPENDENTLY hold ITSELF on the starting table due to its own weight

Vessel start system

Weight of Rocket holds the rocket

The starting table of the rocket (the heavier the rocket, the firmer it is held by its own weight, in order "not to hold", "not to move".

22. 3D-Elemental Solution: 22. 3D-Elemental Solution

The suitcase ITSELF shows the weight

<http://www.trizland.ru/ideas/2629/>

Using of gravity field in watch

Water watch "clepsydra"

http://naturalhistory.nv.gov/Heronology/Stat/Egypt_1_files/image006.jpg

Use gravity fields

The toothbrush can INDEPENDENTLY hold itself in the vertical position due to a gravity field, which acts as an "X-element" here

Prototype via FOS: "OCTUGI"

22. 3D-Elemental Solution: 22. 3D-Elemental Solution

Use resources of information DOS

Pencil + "octugi"

22. 3D-Elemental Solution: 22. 3D-Elemental Solution

IFR for iron

Iron can ITSELF change position

Mass of Iron = Gravity field = (it is X element)

Version 1: Exist some X element for solve of current problem (remove or destroy of existing disadvantages)

Version 2: The system ITSELF can solve problem (remove or destroy of existing disadvantages)

Prototype via FOS: "OCTUGI"

22. 3D-Elemental Solution: 22. 3D-Elemental Solution

"octugi"

The sweeper can INDEPENDENTLY Hold itself in vertical position due to a field of gravity, which acts here as an "X-element".

Of course, in each house there is a sweeper and a hand spade for rubbish. How could we do without them? Having understood that most often they cannot do without each other functionally, the designers long ago learned to integrate this rubbish-collecting couple.

Fundamentally the difference of the concept "Roly-poly Cleaner" from other similar concepts is the new degree of convenience in using the hand spade and the sweeper. More than that, they are united into one stylish structure, since this elegant aggregate also permanently occupies vertical position.

Designer Hyelin Lee, who created the concept of "Roly-poly Cleaner", made it according to the principle of a popular toy "Weeble" ("rolling doll" or "octugi"). It means that the hand spade and the sweeper will remain in the vertical position in the place, where you will put it.

<http://www.trizland.ru/ideas/2670/>

Using weight and gravity field + piezoelectric generator of energy

The Road can supply itself with electric energy due to the weight of the automobiles and due to gravitational field, which functions here as an "X-element".

<http://www.membrana.ru/facts/73499>

22. 3D-Elemental Solution: 22. 3D-Elemental Solution

The dust HOLDS ITSELF, because it has weight

The air ITSELF performs the cleaning

Centrifugal force (it is an X-element)

Version 1: Exist some X element for solve of current problem (remove or destroy of existing disadvantages)

Version 2: The system ITSELF can solve problem (remove or destroy of existing disadvantages)

We use mechanical energy of air motion for air cleaning

22. 3D-Elemental Solution: 22. 3D-Elemental Solution

The bottle can open ITSELF independently due to the fact that the wine has weight

Banned!

Download of movie http://www.youtube.com/watch?v=IGRL8_n0HP0

Weight and gravity field = magnet force + gyroscope effect

Levitron — anti-gravitational toy

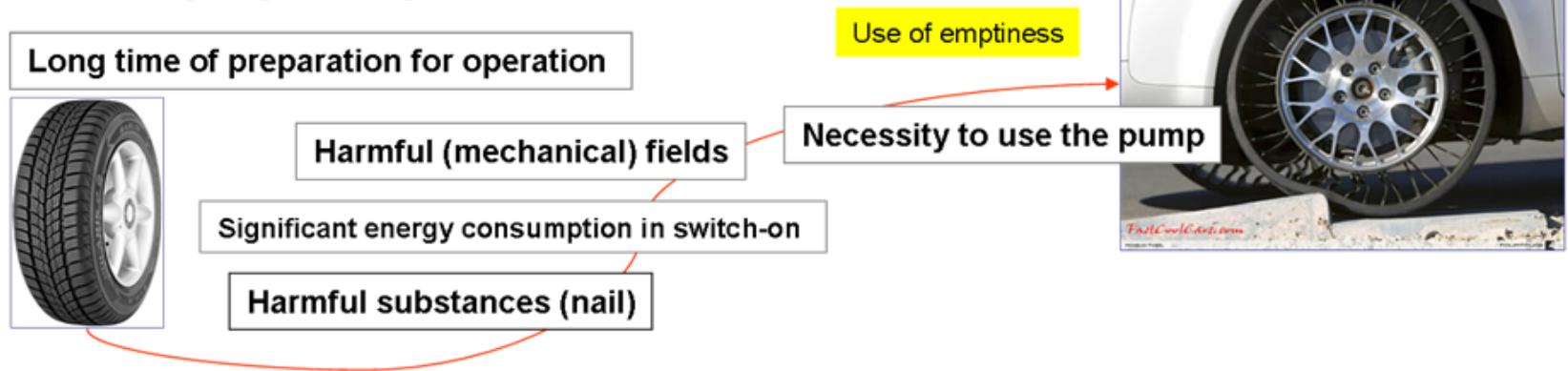
Magnetic whipping-top holds in the air ITSELF due to the system of constant magnets and gyroscopic effect caused by rotation

22. 3D-Elemental Solution: 22. 3D-Elemental Solution

Conclusions regarding the “Electronic Manual of Physical Contradictions (PC)”

- Developed manual in the form of an electronic manual is intended for coachings as part of a training course on the topic “increase of competitiveness of marketable goods and circumvention of patents using TRIZ”.
- The manual is based on the method of analogy according to which it is possible to find the prototypes by the criterion of similarity of functions, similarity of disadvantages, similarity of PC and similarity of scenarios of engineering evolution.
- Long experience of the authors in the field of actual design shows that the number of generalized functions, number of PC and the number of popular disadvantages are FINITE, which enables to be oriented at the formalization of the process of support of engineering creativity in the form of electronic manuals.
- The manual is oriented at the independent work of the starting TRIZ users and the supporting collections of examples enable (like in the actual process) to formulate a particular identified disadvantage in fairly different ways.
- This approach enables to significantly increase the efficiency of TRIZ knowledge application. An example of formulating the disadvantages as applied to the situation with a blown-up tire is given below. Different methods of formulation in this or that way will bring the user to realistic concepts.

Variants for describing the disadvantages for explaining the existing engineering solution on the standard 5.1.1.1

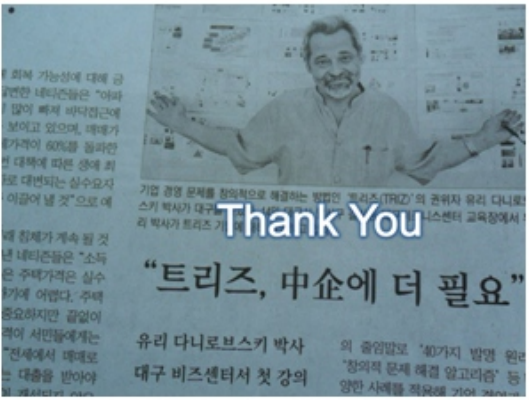
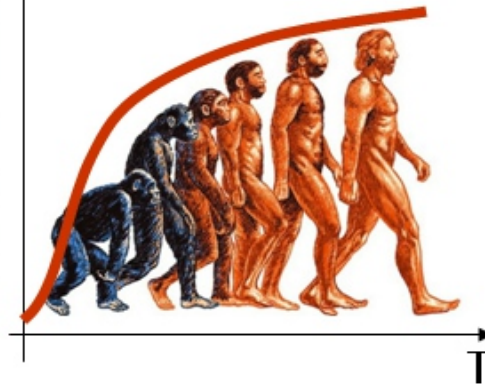




1 -Y.Danilovsky PhD, TRIZ Master, 2- S.Ikoenko , PhD, TRIZ Master, President of MATRIZ
 3 - V. Leniachine , TRIZ Master, Chairman of council for Level 4 Certification in Asia
 4 - KJ – Jung, MBB 6 sigma, CEO Gen3 Korea Innovation Consulting, Ltd



IQ after learning TRIZ



- To subscribe for coachings, visit the web-site:
<http://www.gen3.co.kr/>
- Or use the following phone number
 010-2224-9900