Electronic Reference Book on Physical contradictions

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Calculating concepts using the model of PC

Useful prototypes for creating concepts

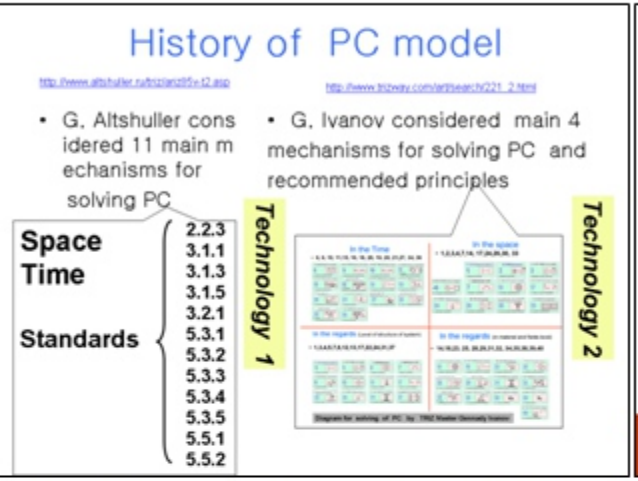
History of technology

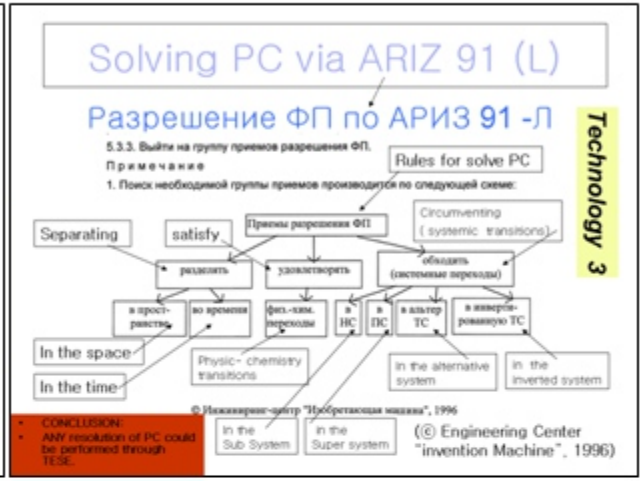
- **What cab be there instead of “buttons”?**
- Disadvantage (D)
- Model of describing disadvantages consisting of TWO parameters (EC)
- **Model of describing disadvantages consisting of ONE parameter (PC)**
- Description of D in the language of functions

http://www.triz-solver.com/index.php/teoriya-nedostatkov/223-fp-kak-elektronnyj-spravochnik-chernovik

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

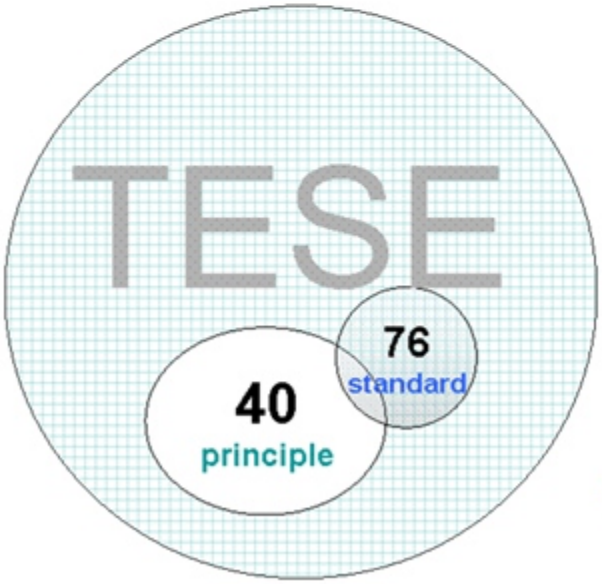
Historical analysis existing technologies for solve PC





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

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



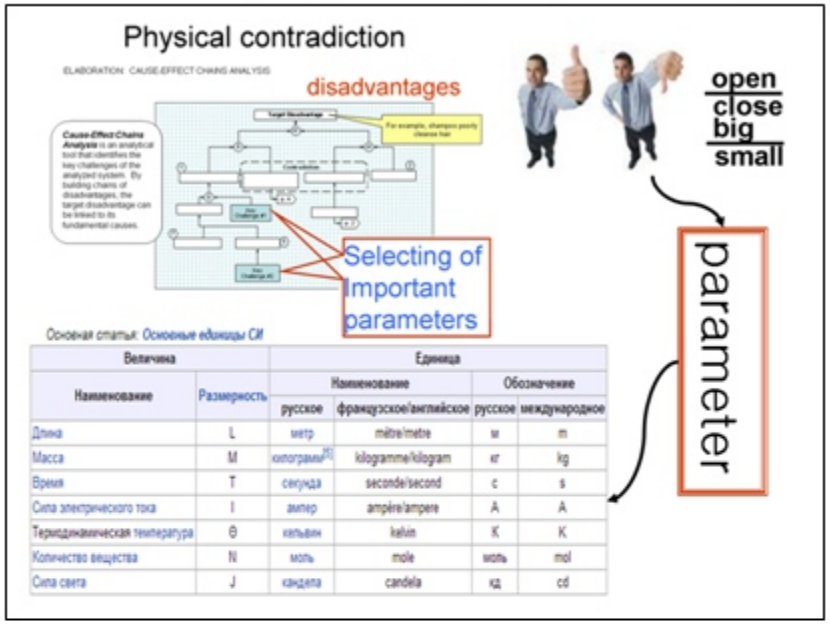
All recommendations from ARIZ are fundamentally recommendations from TESE, 40 techniques and 76 standards.

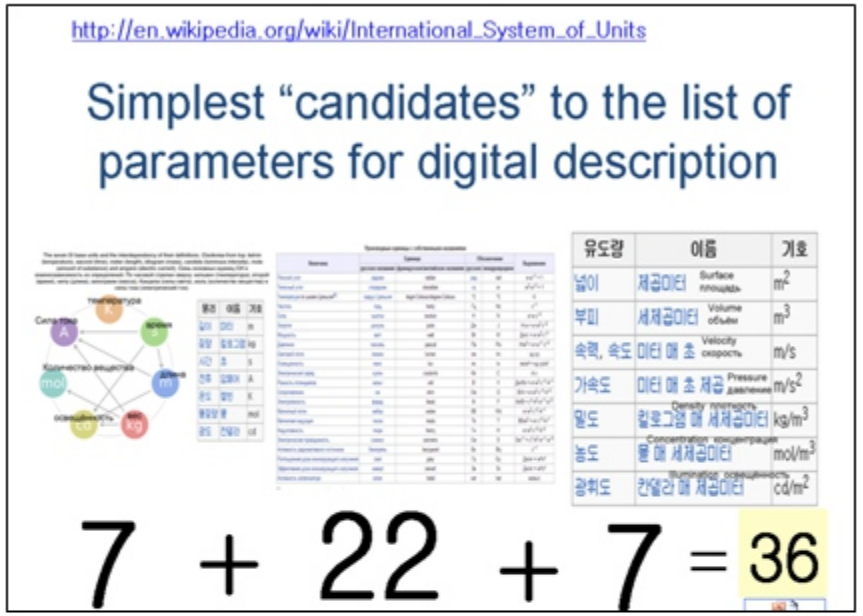
HOWEVER, TESE includes also 40 techniques and 76 standards.

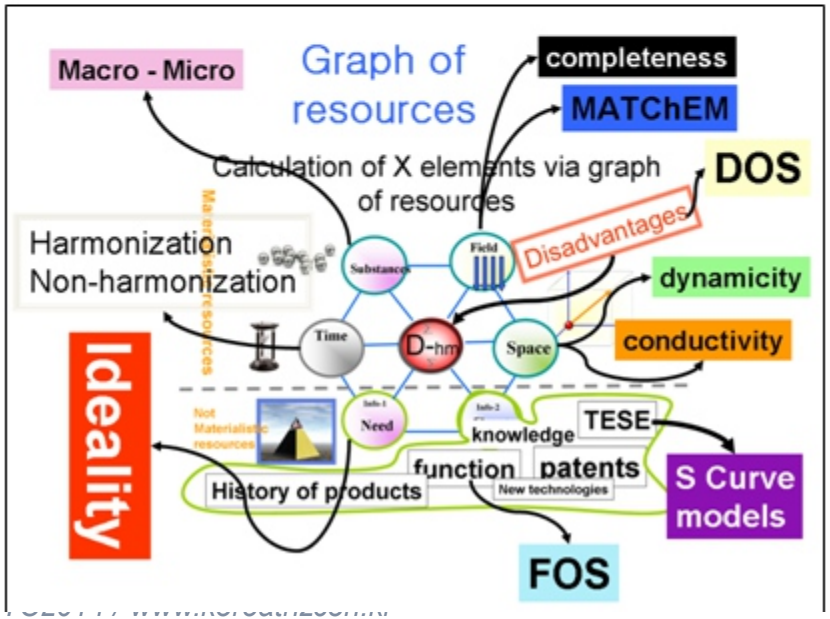
CONCLUSION:

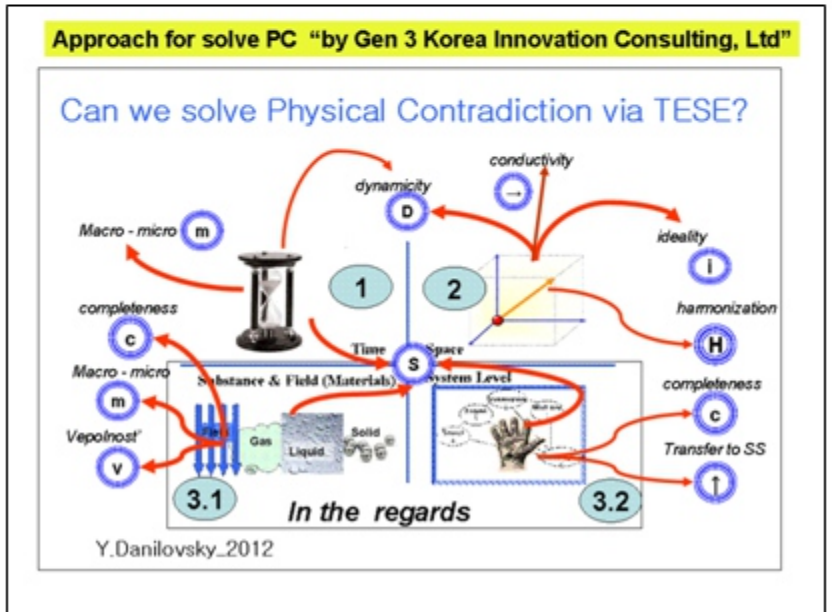
ANY resolution of PC could be performed through TESE.

List of important parameters for PC and resources analysis









Proposed methodological approach in resolving PC for the manual

What cab 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

Useful prototypes for creating concepts

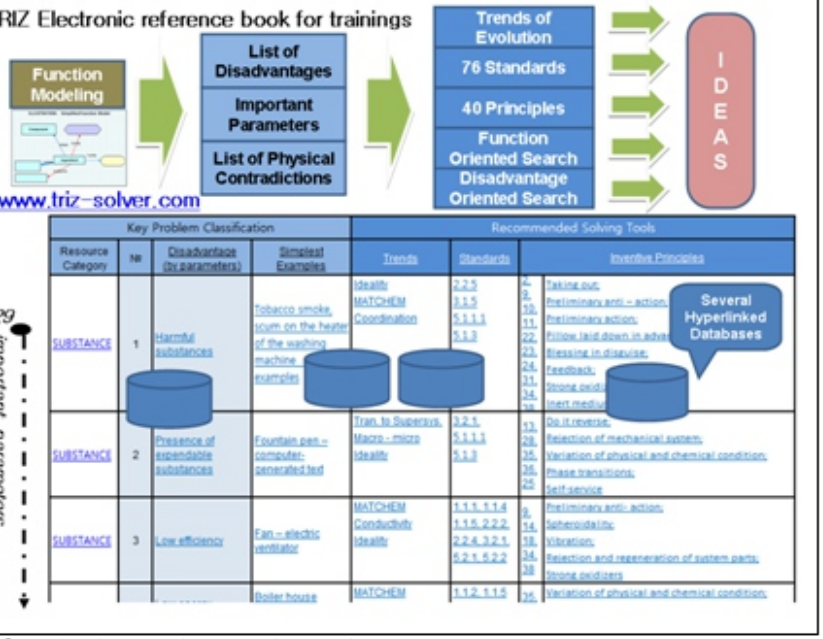
TESE (Trend of Engineering System Evolution)

Korea TRIZ

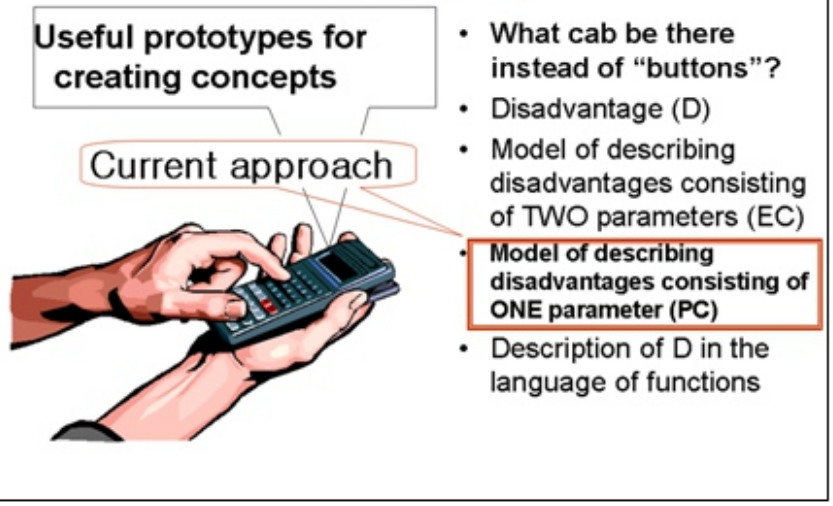
1. **S curve (nonlinear development of TS as based model)**
2. **Conductivity level - increase**
3. **Dynamicity level - increase**
4. **Transition to the Supersystem**
5. **Ideality level - increase**
6. **Completeness level - increase**
7. **Substance-Field level MATCHEM**
8. **Macro– Micro (transfer)**
9. **Harmonization and non harmonization**

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 increase 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 (→)	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, old (perfect) system (↑)	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 , 5.1.4., 5.3.1 ,5.3.3 ,5.3.5
Small convenience (H)	Harmonization consider increase 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

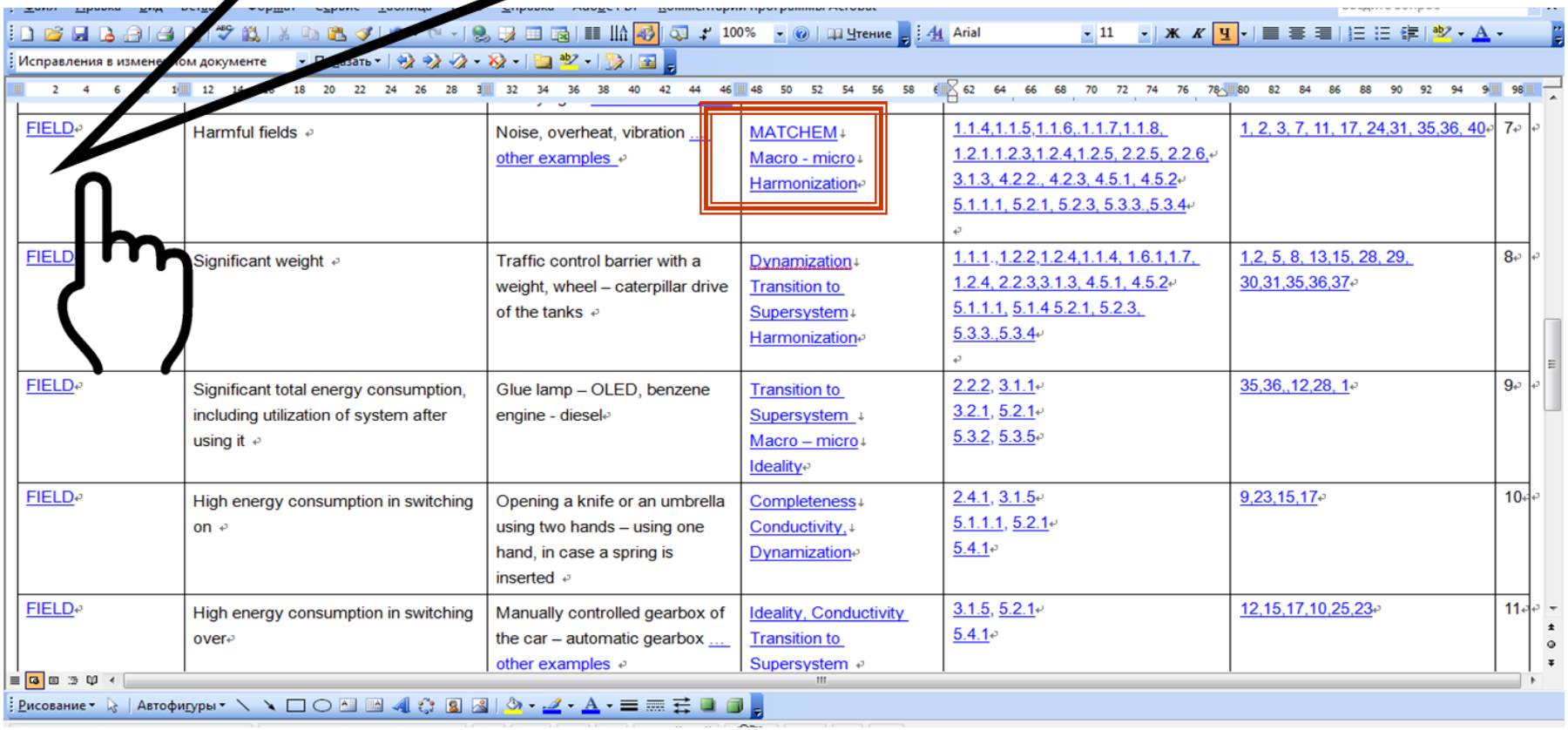
TRIZ Electronic reference book for trainings



Calculating concepts using the model of FC



- 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.



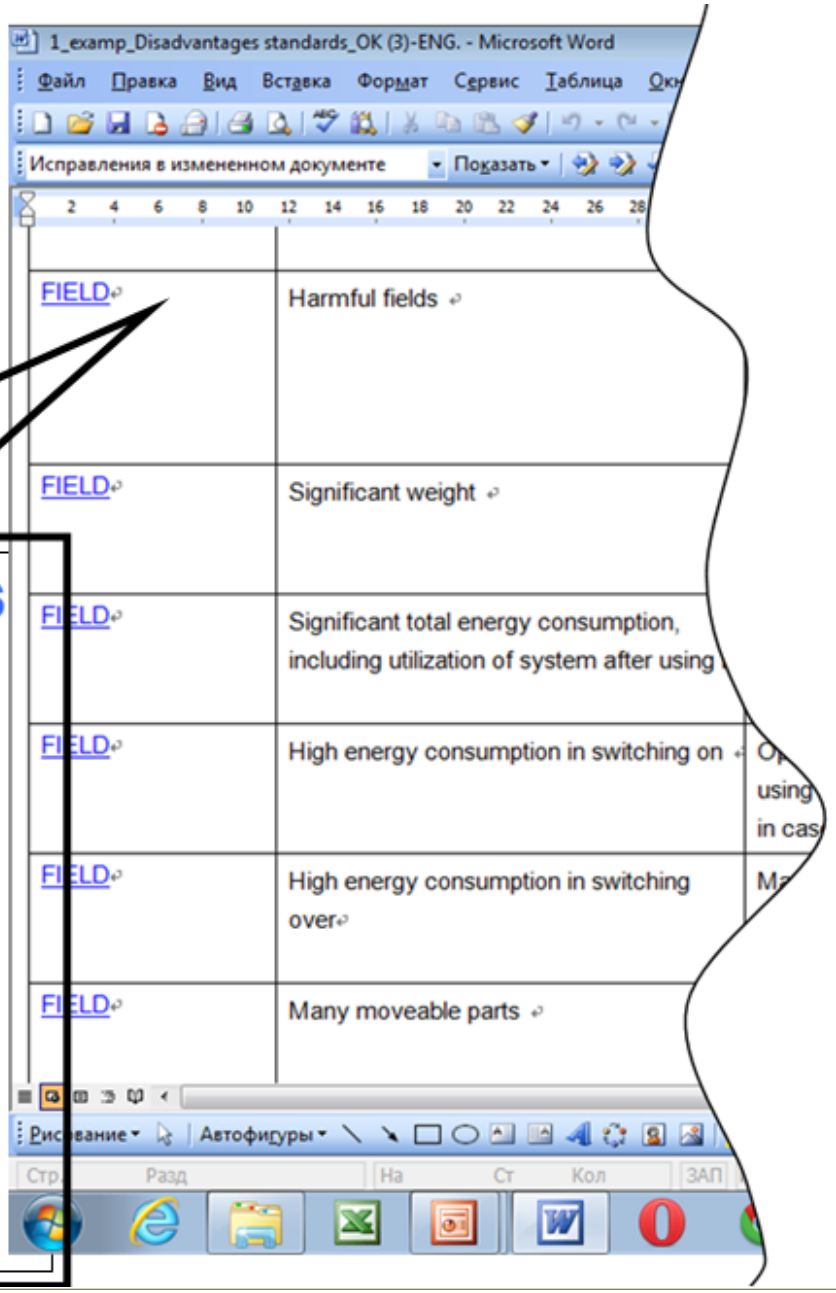
FIELD	Harmful fields	Noise, overheat, vibration .... other examples	MATCHEM Macro - micro Harmonization	1.1.4,1.1.5,1.1.6,.1.1.7,1.1.8, 1.2.1.1.2.3,1.2.4,1.2.5, 2.2.5, 2.2.6, 3.1.3, 4.2.2., 4.2.3, 4.5.1, 4.5.2 5.1.1.1, 5.2.1, 5.2.3, 5.3.3.,5.3.4	1, 2, 3, 7, 11, 17, 24,31, 35,36, 40	7
FIELD	Significant 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

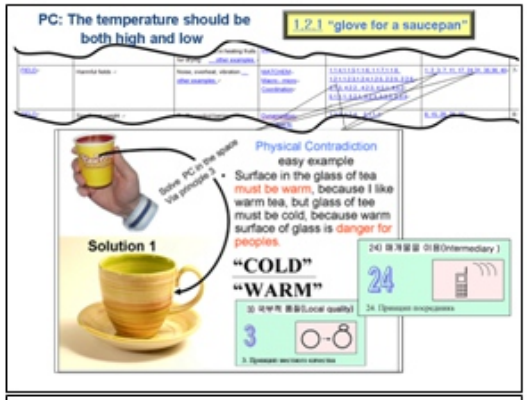
- **Energy (Joule)**
- Weight (kg)Вес (кг)
- Energy expenses prior to main process (Joule or %)
- Energy expenses after main process (Joule or %)
- Energy expenses for charging system (Joule or %)
- Energy expenses on switch-over of modes (Joule or %)
- Force (Newton)
- Power (Watt)
- Pressure (Pascal)
- 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)

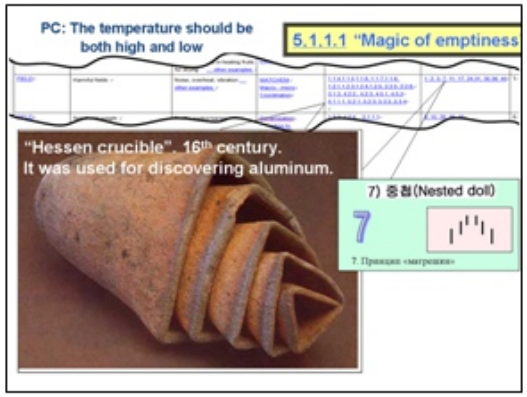
Set of examples for resolving the PC as applied to each of the parameters as a manual

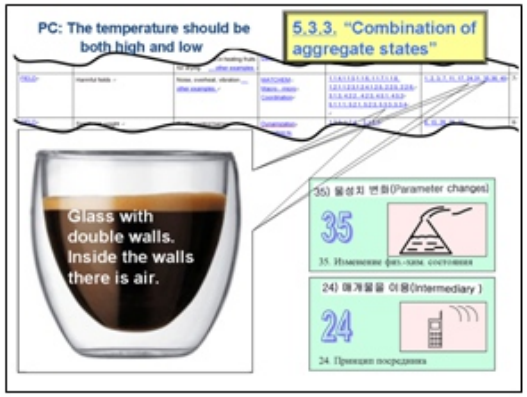


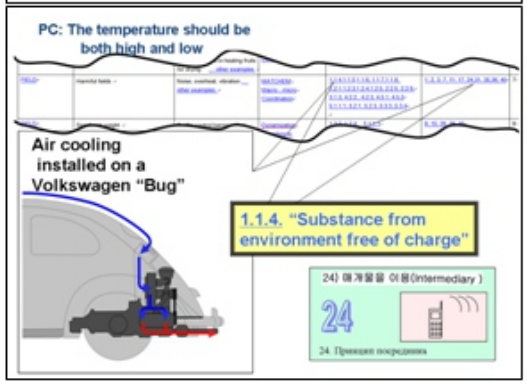
Resolving a PC – the temperature should be high and low through "harmonization"

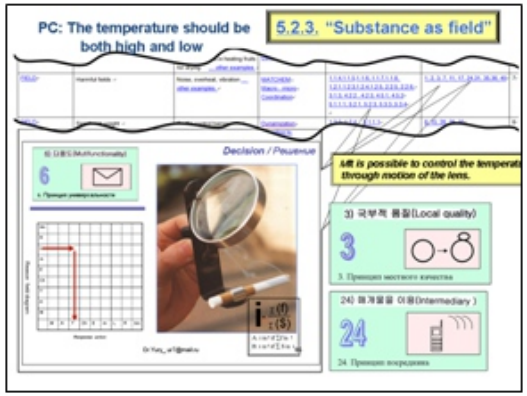
MATCHEM Macro – micro

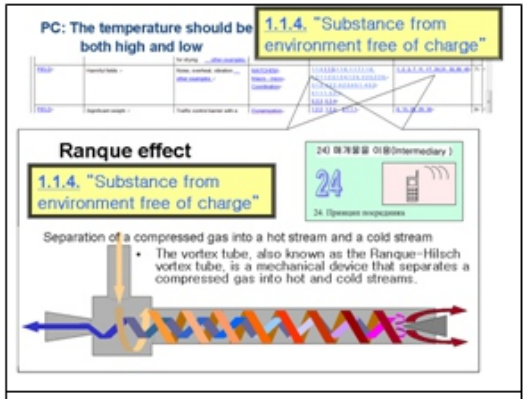


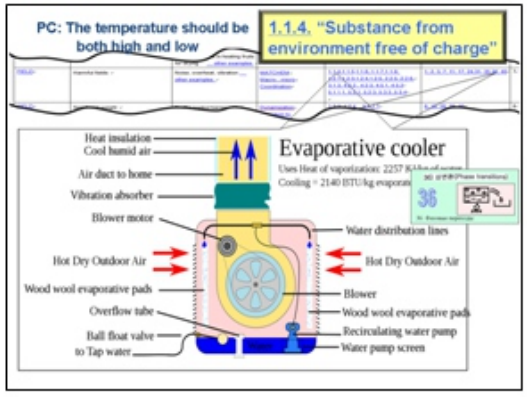


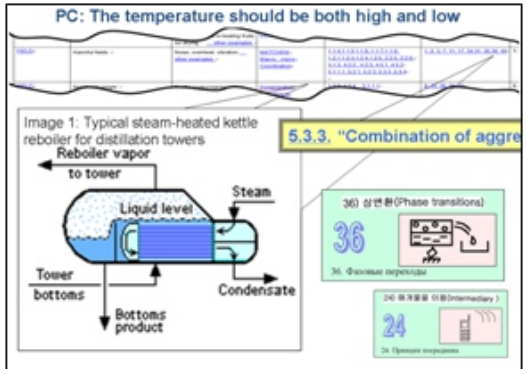


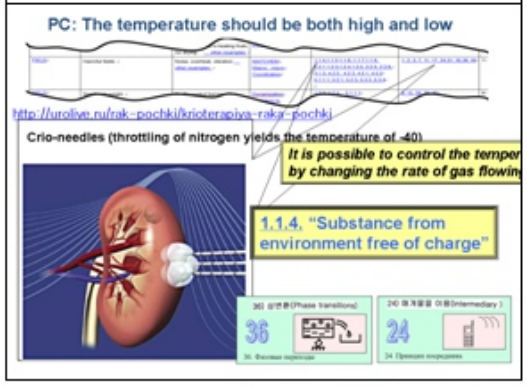




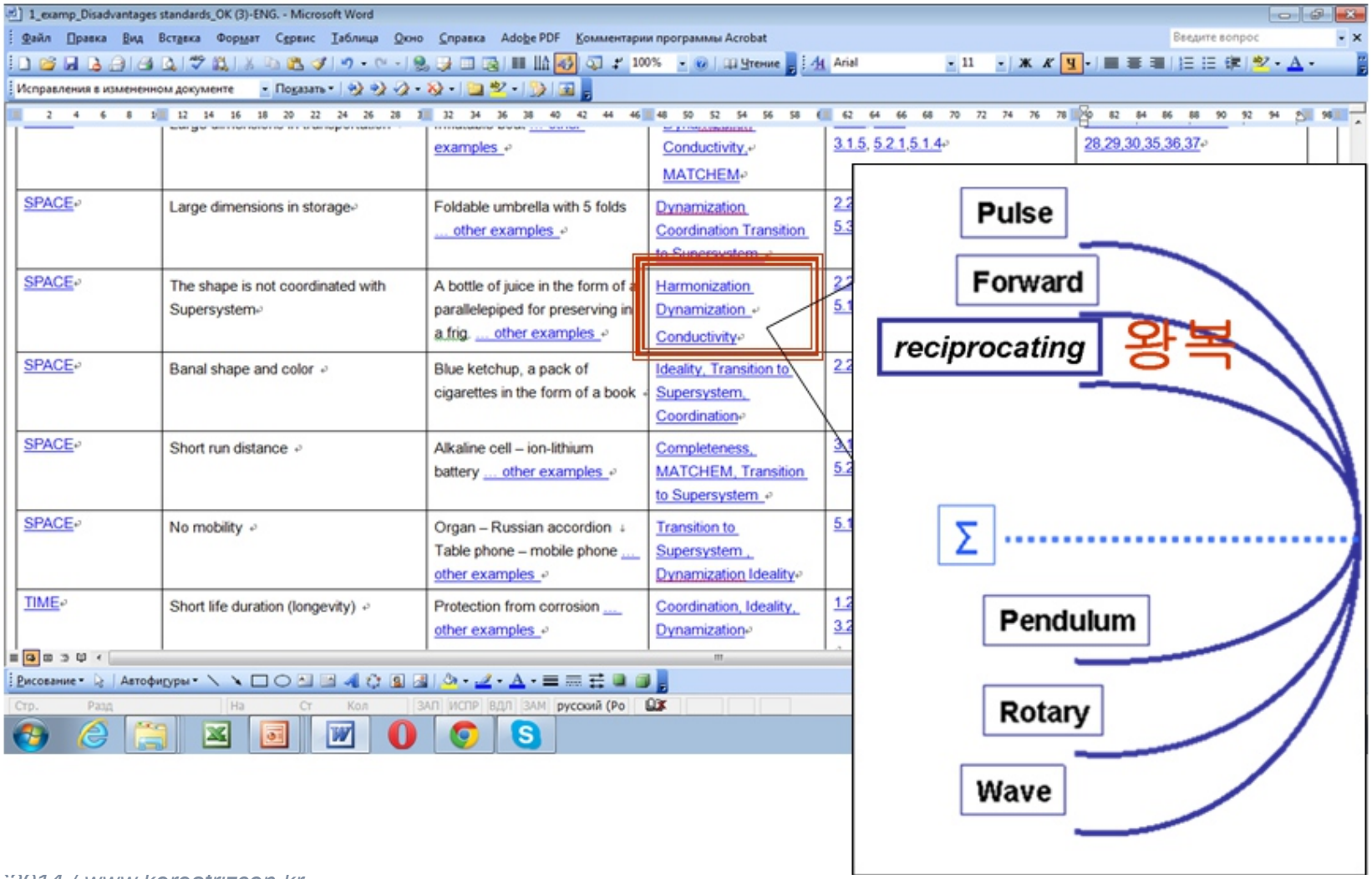








This type of disadvantage in the manual has recommendations concerning trends for resolving the PC



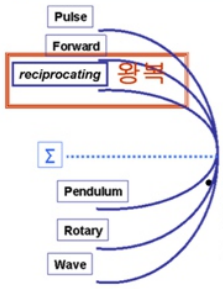
		examples	Conductivity, MATCHEM	3.1.5, 5.2.1,5.1.4	28,29,30,35,36,37
SPACE	Large dimensions in storage	Foldable umbrella with 5 folds ... other examples	Dynamization Coordination Transition to Supersystem	2.2 5.3
SPACE	The shape is not coordinated with Supersystem	A bottle of juice in the form of a parallelepiped for preserving in a frig. ... other examples	Harmonization Dynamization Conductivity	2.2 5.1
SPACE	Banal shape and color	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

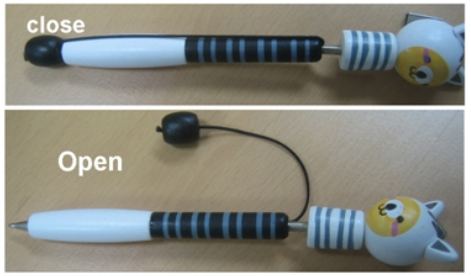
- The pencil must to be close, because we can break the graffito during transp ortation and must to be open for writin g.

Solve PC via type of movements

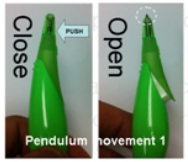


- The pencil must to be close, because we can break the graffito during transportation and must to be open for writing.
- Let's tray use different types of movement for create new ideas

impulse movement



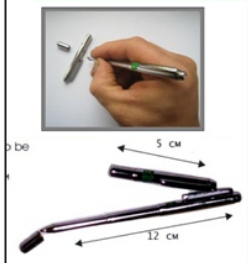
Pendulum and revolving

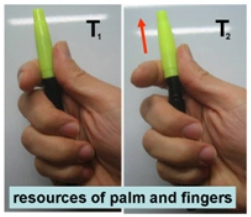


- Open ₩ close of pen

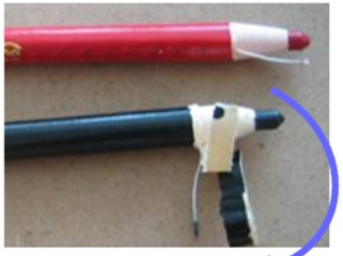
Pendulum movement

Forward movement

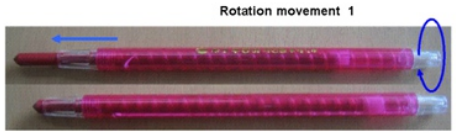




Rotary and forward

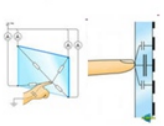


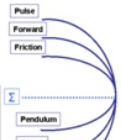
Rotary movement and turn of axi s



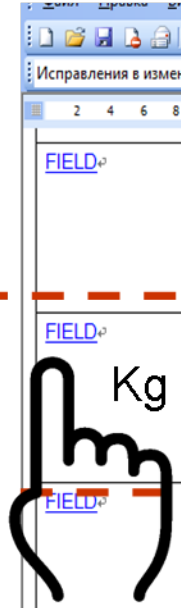
Open– close in "wave movement"

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



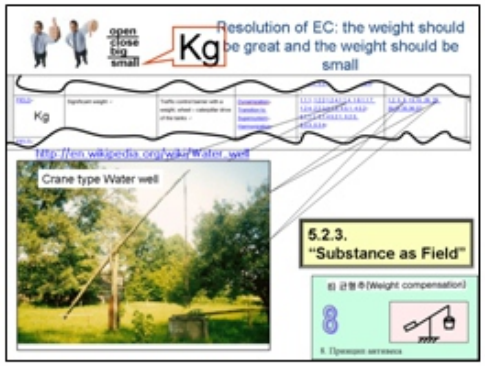


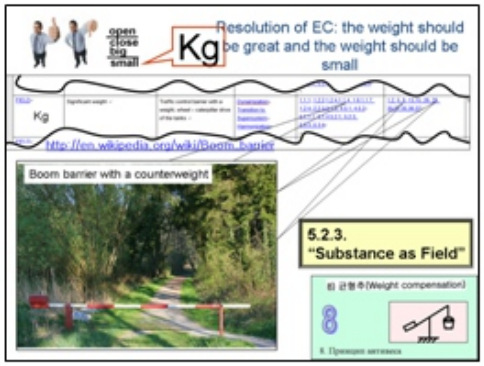
Resolution of PC: the weight should be great and the weight should be small

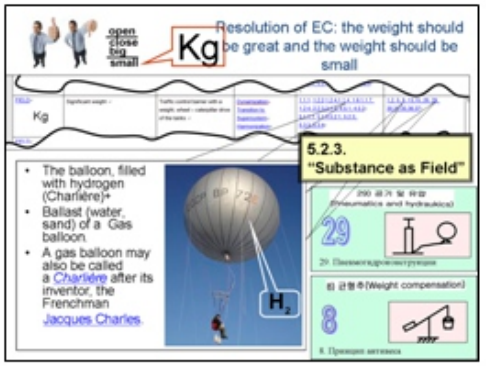


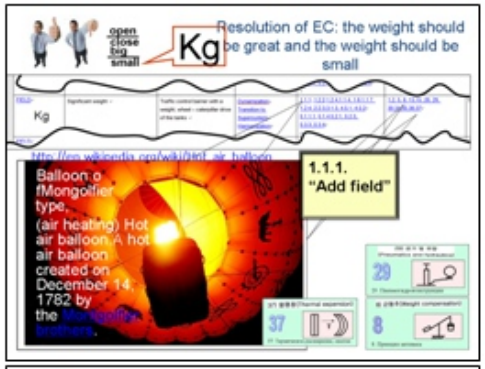
FIELD	Harmful fields	Noise, overheat, vibration …. other examples	MATCHEM, Macro - micro, Harmonization	1.1.4,1.1.5,1.1.6,.1.1.7,1.1.8, 1.2.1.1.2.3,1.2.4,1.2.5, 2.2.5, 2.2.6, 3.1.3, 4.2.2., 4.2.3, 4.5.1, 4.5.2 5.1.1.1, 5.2.1, 5.2.3, 5.3.3.,5.3.4	1, 2, 3, 7, 11, 17, 24,31, 35,36, 40	7
FIELD	Significant 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

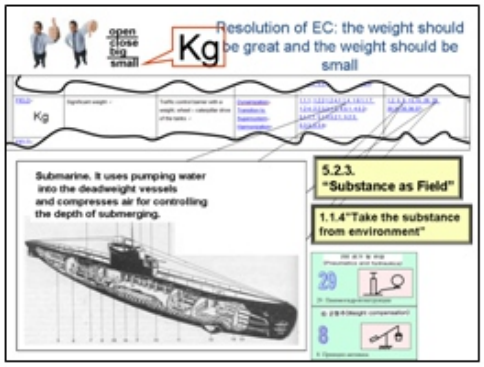
Resolution of PC: the weight should be great and small through dynamization and Harmonization- Non-harmonization

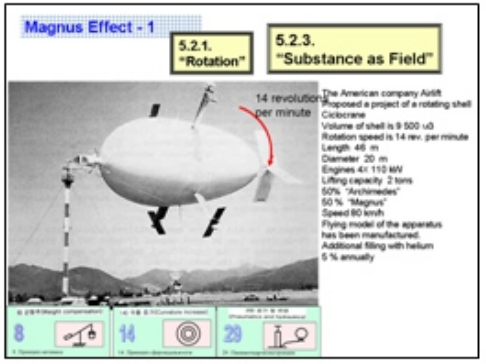


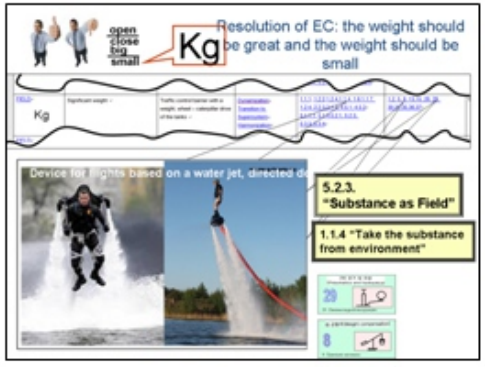


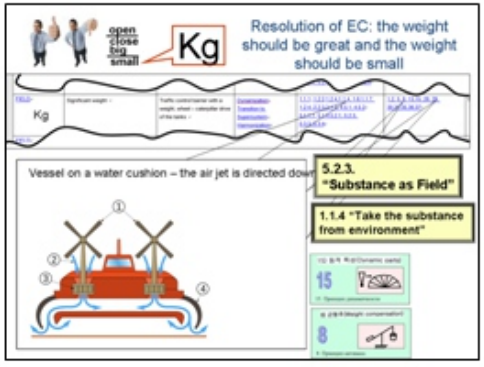


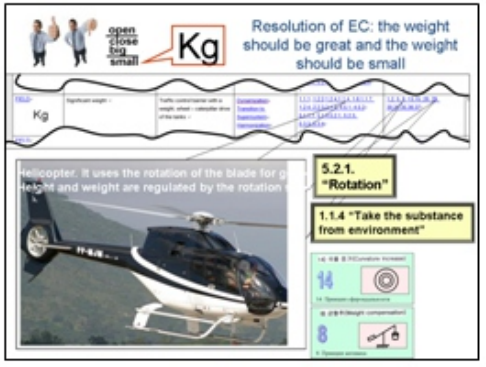












Calculating concepts using the model of PC

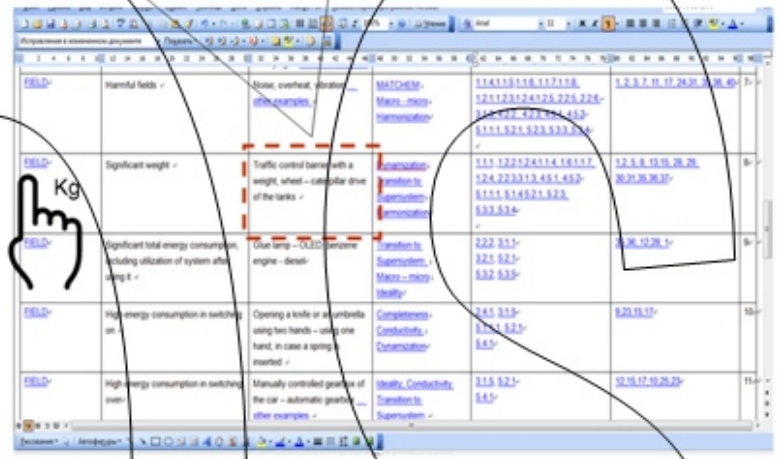
Useful prototypes for creating concepts

- What cab 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) Absense 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)

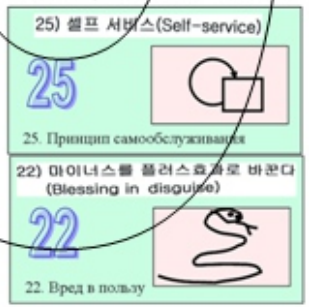


Disadvantage as an independent category in search for prototypes

- Very often the identified Disadvantage could become a motive causing the inventor to create a new system.
- In this case the heuristcs of reasoning the format of PC (physical contradiction) **is not used**, while the identified Disadvantge 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 nre term is introduced, namely, Disadvantage Oriented Search (DOS), which has been created as a 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 sof examples of inventions within the scope of DOS approach to each of the disadvantages, which are singled out.

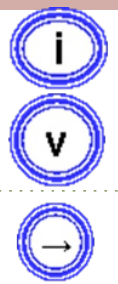
Weight resource – parameter Kg

- 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"



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 sahould 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

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 suitcase ITSELF shows the weight

http://www.trizland.ru/ideas/2828/

Using of gravity field in watch

Water watch "clepsydra"

http://naturalhistory.narod.ru/Hronolog/Stat/Egypt_1.files/image006.jpg

Use gravity fields

Prototype via FOS : " OCTUGI"

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

Use resources of information DOS

Pencil + "octugi"

IFR for iron

Iron can ITSELF change position

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

Prototype via FOS : " OCTUGI"

"octugi"

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

http://www.trizland.ru/ideas/2570/

Using weight and gravity field + piezoelectric generator of energy

http://www.membrana.ru/lenta/?5466

- 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".

The dust HOLDS ITSELF, because it has weight

- The air ITSELF performs the cleaning

Centrifugal force (it is an X-element)

We use mechanical energy of air motion for air cleaning

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

Bamm!

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

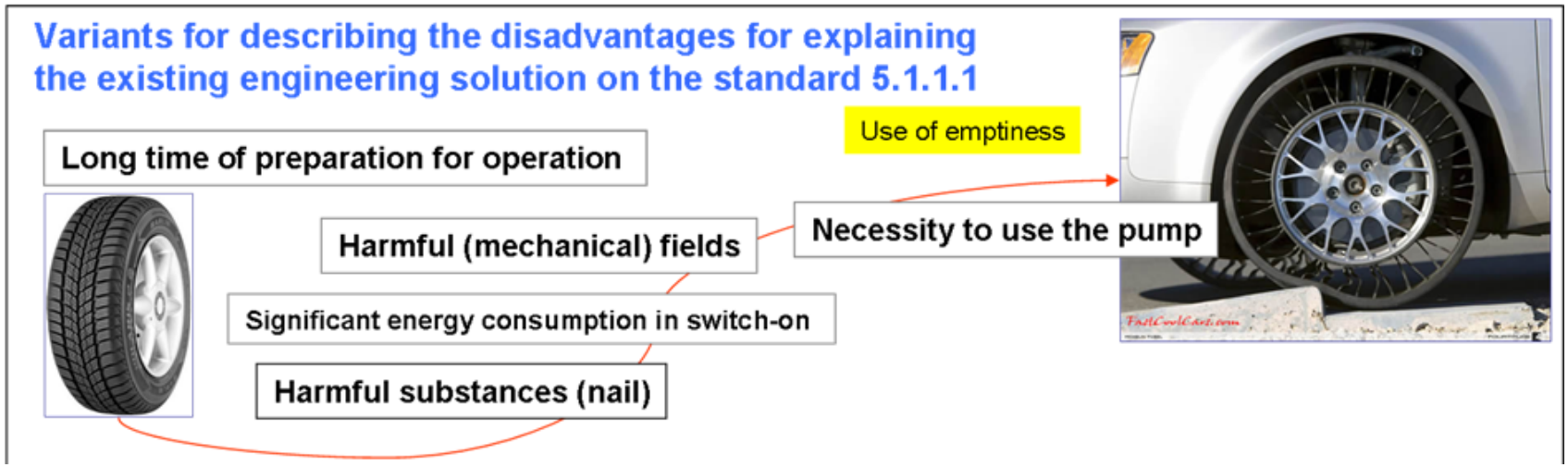
Weight and gravity field = magnet force + gyroscope effect

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

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 th 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 wil;l bring the user to realistic concepts.



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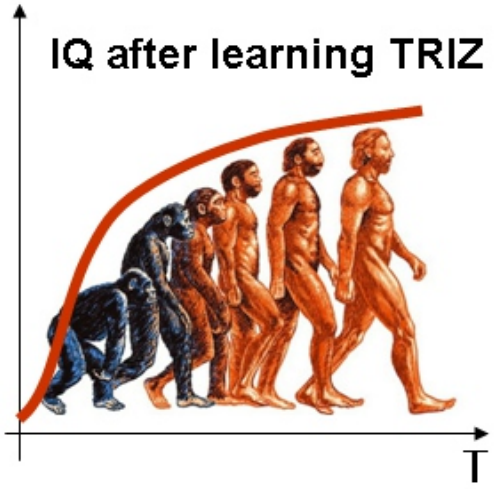
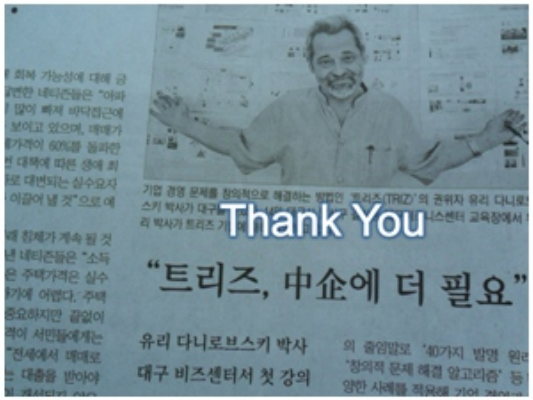
QM&E
Business Consulting





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