

# The Ideal of TRIZ

## TRIZ as the Way of Life? Part 2

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# 1. Life

## 1.1 Barter

- **Invention of tool** brings about technology. **Invention of language** brings about communication.
- As same as tool and language **“barter” was invented** at some stage of the history of human. What brings about “barter” in history? What “barter” brings about in history? We must answer these two questions by logic.



# 1. Life 1.1 Barter

Before barter was invented, human being does not have the consciousness of individual, community nor possessing.

1. Recognition that my community has something and other community has another thing. Both have attributes to be bartered.

2. Image that we will give you something we have and you will give us something you have.

3. When, where and what quantity?

Something to be bartered is not changed. **Common idea for you and us** in representatives of each community is the start of barter. In this time **two Objects have the same attributes.**

# 1. Life 1.2 Life

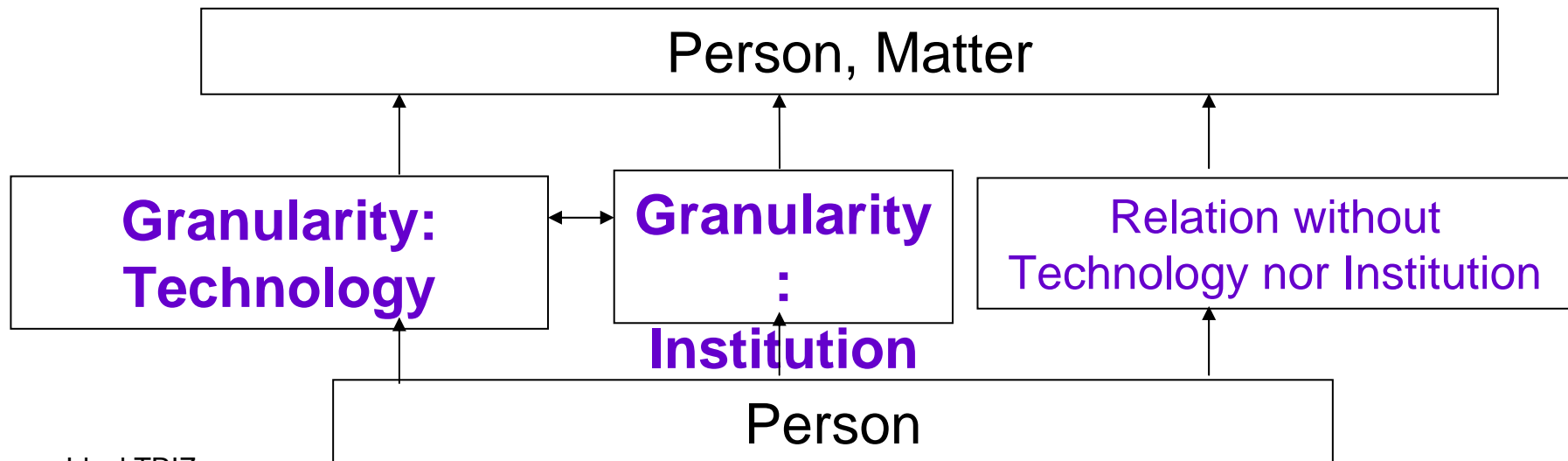
Matter and its movements  
→ **Technology**

Idea and its movements (including religion, sense of value): Common Mind

→ **Institution**

e.g. Politics, Economy, Family, Company

- Intentional change (Resolving Differences) via **Technology and Institution**





## **2. The Ideal of TRIZ 2.1 Purpose**

- **Everyone can fulfill proper purposes immediately without any resources,**
- **by dealing with Object everything one can recognize and**
- **by specifying one of possible types of change.**



## 2. The Ideal of TRIZ 2.2 Starting Point

- TRIZ is an assemblage of **formal methods** consisting of changing 1 value of 1 attribute, handling 2 values of 1 Object (PC), handling 2 attributes (TC) and segmenting and merging of attributes and Objects, which cover **all type of change of Object**. [TS4]
- This seems to mean that TRIZ could be a **unified thought and method** applicable to every action in every area and become **formal basic of operational science**.
- Contents change depending on view of purposes or applied area ( contents of existing TRIZ is preserved) but form can be the same.
- This is the starting point.

# Types of change [TS4]

0 Object, 0 attribute

Generate or delete Object

- 1. Not qualitatively or 2. Qualitatively change one attribute of one Object.
- 3. Handling "physical contradiction"

1 Object, 1 attribute

Segment, add, delete or merge attributes

- 1. Qualitatively transform two attributes.

- 2. Handling "technical contradiction"

1 Object, 2 attributes

Segment, delete or merge Objects

- 1. Qualitatively transform two attributes.

- 2. Handling "technical contradiction"

2 Objects, 2 attributes



## 2. The Ideal of TRIZ 2.3 Object

Requirements of grasping Object in common sense are able

1. To describe differences between Object and other thing.
2. To enumerate kinds of Object which needs different way to handle,
3. To describe inner structure of Object.

These three are indispensable to make us recognize, define Object and change Object.



## 2. The Ideal of TRIZ 2.3 Object

- An element of anything recognizable is called **Object**. I recognize three kinds of Objects. *70/100* cf. Definition by Fey [TJ]
  1. **Matter** : System Object
  2. **Fixed “Mind” or “Idea”** : System Object
    21. Information of individual or common notion which is taken by physical entity
    22. My fixed mind
  3. **Movement or Action** : Process Object      **Movement is process** from a viewpoint of time and **action** from a viewpoint of relation between itself and other thing **to change** itself and other thing.
- → **I, Other Person, Matter, Movement** at different granularity
- **Granularity**= Size, magnitude or scope in space and/ or time and degree of abstraction
- **Function**= (primarily) Meaning of Process Object, (secondly) Meaning of attributes of Object
- **Structure**= Granularity and inner structure



## 2. The Ideal of TRIZ    2.3 Object Fey' s Definition

- **Object - Article, Product**      *50/100*
- A component of the system that is to be controlled, processed or modified (e.g, moved, machined, bent, turned, heated, expanded, charged, illuminated, measured, detected, etc.).

[http://www.triz-journal.com/dictionary/Object -  
\\_Article, \\_Product-253.htm](http://www.triz-journal.com/dictionary/Object_-_Article,_Product-253.htm)

# 2. The Ideal of TRIZ 2.3 Object

Structure of Object except my mind Real World

**Principle U,P,M:**

**Granularity**

Object at some granularity

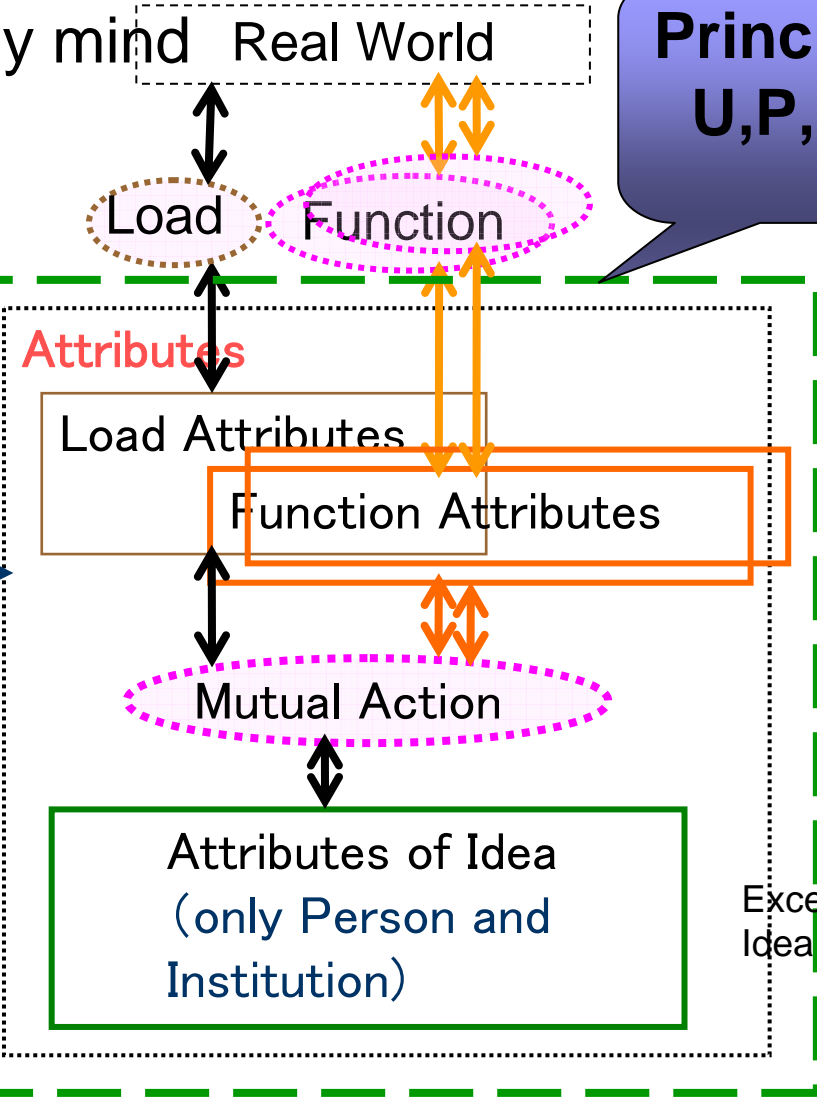
**Principle D**

**Inner Structure**

Elements

Relation between Elements

**Operation R**



Except my Idea



## 2. The Ideal of TRIZ 2.4 **Viewpoint** of Purposes

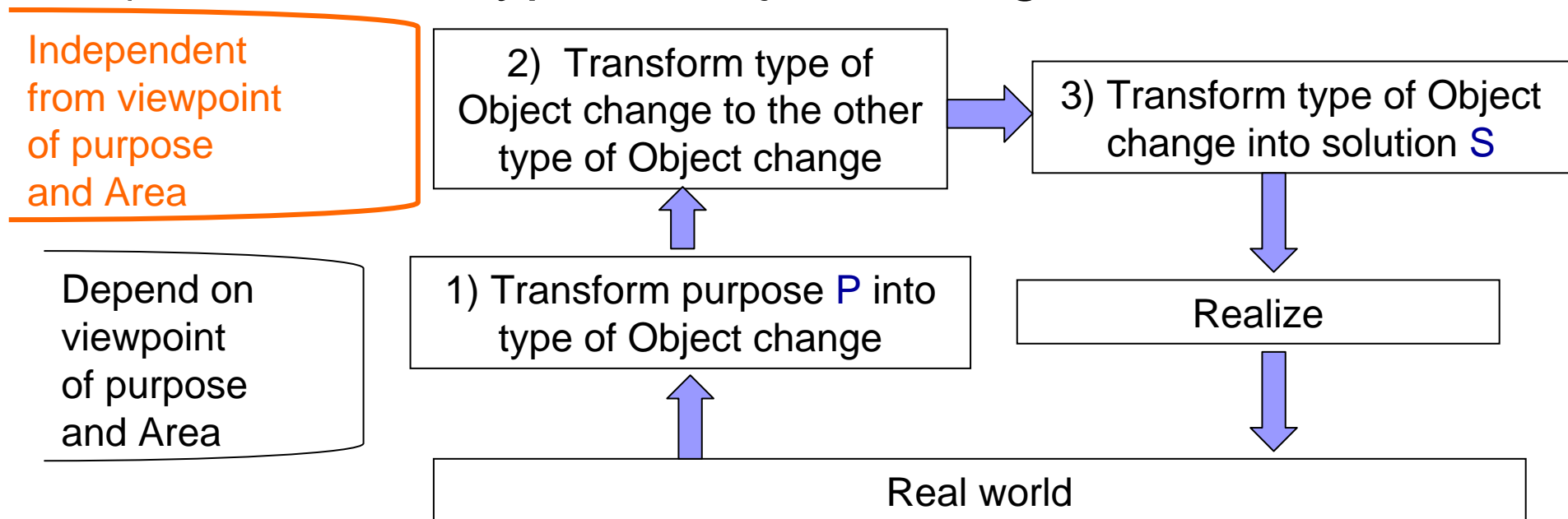
- 1) Make new function : Make new system or add new function to existing system
- 2) Solve issues : Solve problems in existing system
- 3) Idealize : Improve functions in existing system or realize existing functions with less resources

The differences between these three <sup>[TS2]</sup> are relative.

**Any difference or problem is formulated by any viewpoints? using terminology of Object**

## 2. The Ideal of TRIZ 2.5 Elements of Realization

- 1) Transform purpose **P** into type of Object change
- 2) Transform type of Object change to the other type of Object change
- 3) Transform type of Object change into solution **S**





## 2. The Ideal of TRIZ 2.5 Elements of Realization1)-1

### 1) Transform purpose into type of Object change

**P- O1**: **Change one Object**; change one attribute, delete or generate attribute or delete or generate Object within one Object.

a) Purpose can be reached directly by a change of one attribute using existing environment

b) Purpose can be reached by using causal relation



## 2. The Ideal of TRIZ 2.5 Elements of Realization1)-2

P- O2(PC)- S: Transform purpose into **handling two values of one attribute of one Object** which is Physical Contradiction 2 **PC2**

c.f.: Physical Contradiction 1 **PC1** expresses movement of the real world

P- O2(TC)- S : Transform purpose into Technical Contradiction 2 **TC2** with **two attributes of one or two Objects**

Expansion of usual Technical Contradiction 1 **TC1** which is handling two attributes of one or two Objects caused by side effect of solution



## 2. The Ideal of TRIZ 2.5 Elements of Realization2)-1

2) Transform type of Object change to the other type of Object change

**O1- O1**: Transform by the law autonomously  
Change of one attribute can autonomously cause deleting Object or attributes, generating Object or attributes according to the law of the mutual transformation of quantitative and qualitative changes or its expansion.

**O1- O2**: Transform by side-effect autonomously



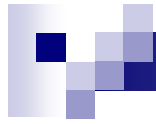


## 2. The Ideal of TRIZ 2.5 Elements of Realization 2)-2

### O2- O2(TC)-S: Handling Technical Contradiction 1 **TC1** to deal with side effects

Dealing with side effects under environment of usual  
Technical Contradiction 1

Even making new function or idealization can cause side effects. Technical Contradiction 1 does not necessarily depend on Physical Contradiction.



## 2. The Ideal of TRIZ 2.5 Elements of Realization<sup>3)</sup>

3) Transform into solution

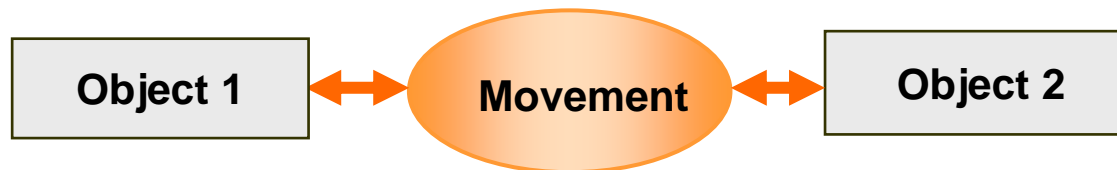
**O1-S**: Transform within one value of one attribute of one (Except my mind) [TS4]

### Method

Object Transformation **Principle U**

Object Transformation **Principle P**

Object Transformation **Principle M**



”**Substance- Field**” is one of the cases Object is matter in **U**

**Object Operation R** : We can bring in, bring out or replace Object or its element



## O1- S : (Continued)

**“object”** is whole Object or element of inner structure of Object.

**Object Transformation Principle D: Change of inner structure consisting of elements and the relation between them**

O2- S : Transform type of Object change into solution within two attributes of two Objects  
This is buried in Separation Principles,  
Contradiction Matrix, 40 Principles [TS4] at present.



## 2. The Ideal of TRIZ

### 2.6 Four Types of Realization

#### 1) P- O1, (O1- O1), O1- S

Change one Object for all purposes.

#### 2) P- O1, (O1- O1), O1- O2, O2- O2 (TC), O2- S

If case 1) would cause side effects we must solve Technical Contradiction 1 TC1 afterwards.

#### 3) P- O2 (PC), O2- S

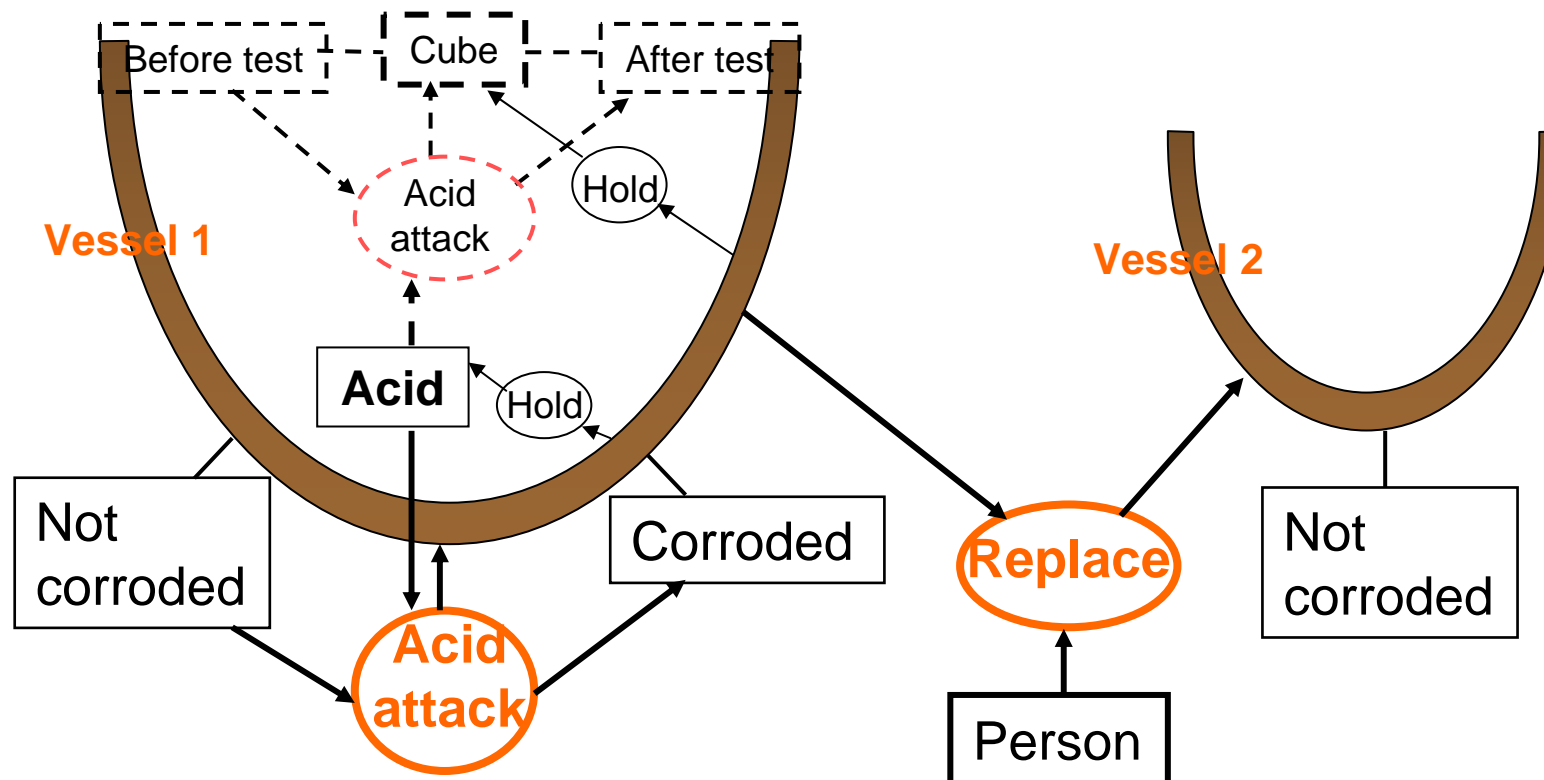
Solve Physical Contradiction 2 PC2 in advance.

#### 4) P- O2 (TC), O2- S

Solve Technical Contradiction 2 TC2 in advance.

## Example: Acid attack-1 [TS2] [TS3]

Cubes are placed in acid to investigate the effect of various acids on the cubes. The vessel that holds the acid and cube is corroded. Because the acid is so reactive, the vessel must be replaced frequently. Reduce the cost of replacing the vessel.



## Example: Acid attack-2

**Enumerate System Objects**: Cubes, Acid, Vessel (Attribute: cost, its value: C)

**Enumerate Process Object**:

Test of Cubes ( Attribute : operating time, its value : t ),

Hold Cubes ( Field: Gravity, Centrifugal Force, Surface Tension, Wind Pressure, Buoyant Force, Current,,)

Corrode Vessel ( Attribute : operating time, its value : t ), (Attribute : rate of corrosion, its value : replace n times in t )

Replace Vessel ( Attribute : cost of vessel, its value : C), (Attribute : cost of work of replace, its value : Cr )

**We can enumerate candidates of purposes from any viewpoint of making new function, solving issues or idealizing**

**Examples of purposes are to**

Minimize cost of replacement per unit time  $(C + Cr) n / t$ : **1**

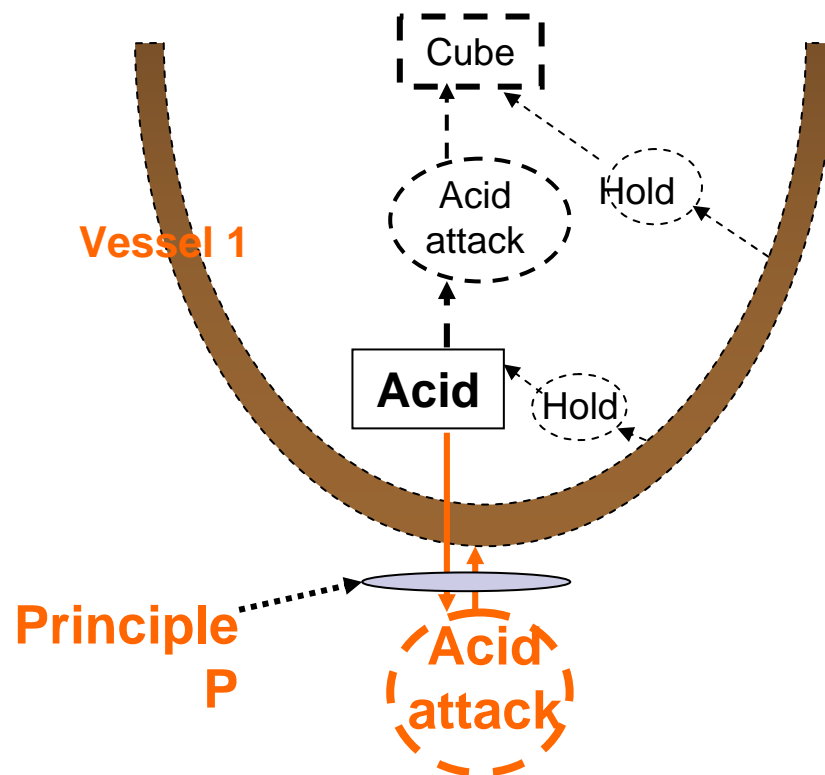
Eliminate Process Object that acid corrodes vessel: **2**

Eliminate Process Object to replace vessel: **3**

## Example: Acid attack-3

Example of solution : If we eliminated vessel to eliminate corroding vessel by acid using Principle P, we could not execute test of cube because of a side effect that vessel lost the function to hold acid and cube.

Solve the technical contradiction at various granularity. **Types of Realization 2)**



Ideal TRIZ

1. Test of cube vs eliminating vessel

2. Holding cube and acid vs eliminating vessel

3. Contact of acid and cube vs eliminating vessel

(4. Contact of acid and cube vs no contact of acid and vessel)

(5. Acid corrode cube vs acid not corrode vessel)



## 2. The Ideal of TRIZ 2.7 TRIZ needs

improvements for **spread to everyone and advance**

- Proper attitude for **Object, granularity, function, purpose, structure of Object and attributes**, Root cause
- **Lack of logical structure and exhaustiveness in object and method.** Mixture of **element, knowledge base** (FAA, Su-F, IS, Effects, Technical Contradiction Contradiction Matrix, 40 Principles, Physical Contradiction, Trend, S-Curve , IFR , Trimming, Resources), **viewpoint** (9 windows, SLP, Ideality) and **total picture/algorithm** (ASIT, USIT, HTA(Larry Ball), ARIZ, OTSM)
- Proper attitude for “institution”
- Methods to synthesize (this paper don't deal with)
- Needs to **activate radical thinking for enumeration** which dialectics and TRIZ originally have some



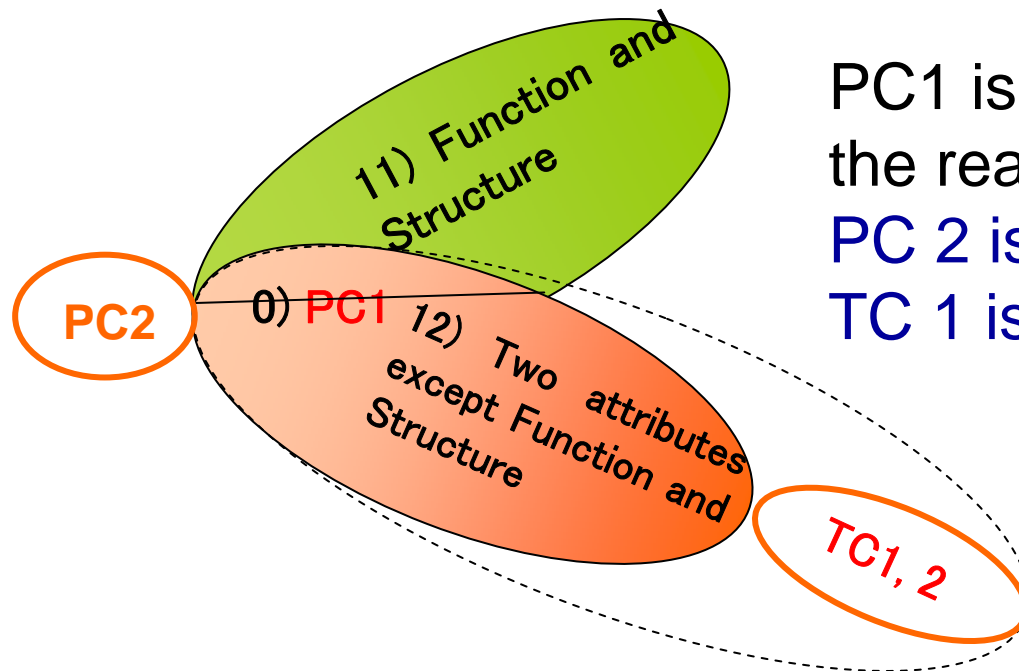
### 3. Radical thinking for enumeration      Structure of Contradiction

Real World and Attitude				Recognition
0) <b>Identity and Difference</b>	11) <b>Form and Content</b>	12) <b>Two attributes except Form and Content</b>	2) <b>Each part of one body, Unity</b>	3) <b>Mutually dependent two different recognitions</b>
Two values of one attribute <b>PC1, 2</b> A state and other state at the same time <b>To be or not to be</b>	Two attributes of one Object <b>Function and Structure</b>	Two attributes (TC1, 2) <b>Opposites of movement except Function and Structure</b>	History and Logic Recognition and Action Purpose and Mean Spread and Advance <b>Objectification and Unification</b> Possession and belonging Emotion and Logic Viewpoint and Attitude Modesty and Criticism	Part and Whole Phenomenon and Essence Concreteness and Abstraction <b>Granularity and Inner Structure</b> Function and Granularity Definition from outside and inside

### 3. Radical thinking for enumeration

#### 3.1 Attitude at the moment

- Viewpoint or attitude; "to be or not to be" (PC1)
- Grasp **function and granularity**, what is important, **PC2 and TC2**



PC1 is Physical Contradiction in the real world.

PC 2 is PC in TRIZ

TC 1 is TC caused by side effect.



## 3.2 Radical thinking for enumeration

For systematic knowledge in situation- independent area

**Radical thinking for structural enumeration to achieve possible extreme change**

**1. For systematic knowledge in situation-independent area such as TRIZ**

(Recognition) In advance 1) on Object and attributes 2)

proposition, law, area, **enumerate types of these and place them in the whole**. Almost done. e.g.: Definition of Object, Enumeration of

opposites, Types of Object, Object change

(Change 2)) As to proposition enumerate subjects having the same predicate and change **granularity** of proposition. e.g.:

Relation between Physical Contradiction and Technical Contradiction

Enumerate elements of input, output and conditions of law and change **each of them and granularity of law** extremely. e.g.:

expansion of the law of the mutual transformation of quantitative and qualitative changes [F09]



## 3.2 Radical thinking for enumeration

For situation- dependent area

**2. In situation- dependent area**, according to the situation, enumerate granularity and value (and purpose which is concrete value). For each granularity, value and purposes,

- Enumerate attributes, Object from viewpoint of definition from outside and inside, Object group, their relation and their movement,
- Enumerate method to obtain Object change, candidates of Object change,
- Seek possibility of radical and extreme change for recognition and change.

Changing attributes of Object includes change values of attributes, attributes themselves and change of inner structure. Especially extreme change to minimize attributes is to delete Object.



## Conclusion

- Trial for **the Ideal TRIZ** is made. Proper attitude for Object, granularity, function, structure of Object and attributes have a possibility to bring about logical structure and exhaustiveness in object and method to TRIZ, preserving existing vast amount of great contents of usual TRIZ. As an example unified method for solution is shown.
- **Radical Thinking for Enumeration** to recognize and change the Real World bring about the contents of this and previous papers [TS1-5]

### Acknowledgement

I express my deep gratitude to Dr. Ellen Domb and Prof. Nakagawa Toru for their comments.



# References

- [TS2] TAKAHARA Toshio: A Method of Resolving Differences Based on the Concepts of Function and Process Object , The Second Symposium in Japan, Japan, Sept. 2006.
- [TS3] TAKAHARA Toshio, A Method of Resolving Differences Based on the Concepts of Functions and Process Objects: Part 2, The Third TRIZ Symposium in Japan, Japan, Sept. 2007." A Collection of Papers Written by Toshio Takahara (2003-2007)  
<http://www.osaka-gu.ac.jp/php/nakagawa/TRIZ/eTRIZ/epapers/e2008Papers/eTakahara2003-2007/eTakaharaBiblio080323.html>
- [TS4] The General Picture of TRIZ From the Viewpoint of Changing Objects —A Method of Resolving Differences Based on the Concepts of Functions and Process Objects Part 3— The Fourth TRIZ Symposium in Japan, Sept. 2008.  
<http://www.osaka-gu.ac.jp/php/nakagawa/TRIZ/eTRIZ/epapers/e2009Papers/eTakaharaTRIZSymp2008/eTakahara-TRIZSymp2008-090708.html>