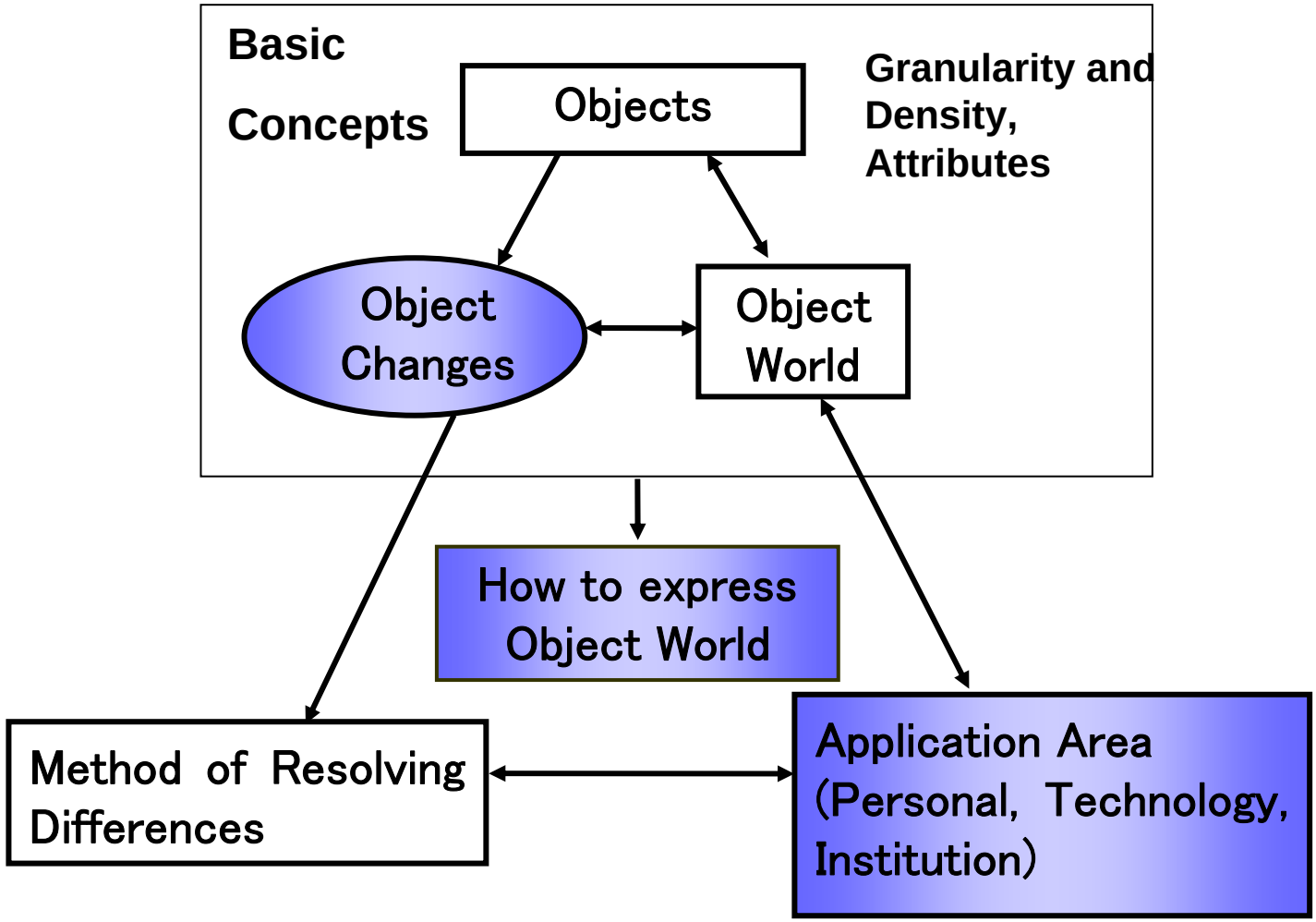
The General Picture of TRIZ
From the Viewpoint of Changing Objects

TAKAHARA Toshio 2008.09.11

Posted in "TRIZ Home Page in Japan", Jul. 2009 The Fourth TRIZ Symposium in Japan on Sept 10-12, 2009, at Laforet Biwako 1

1. Preface
1.1. Total Picture of Study



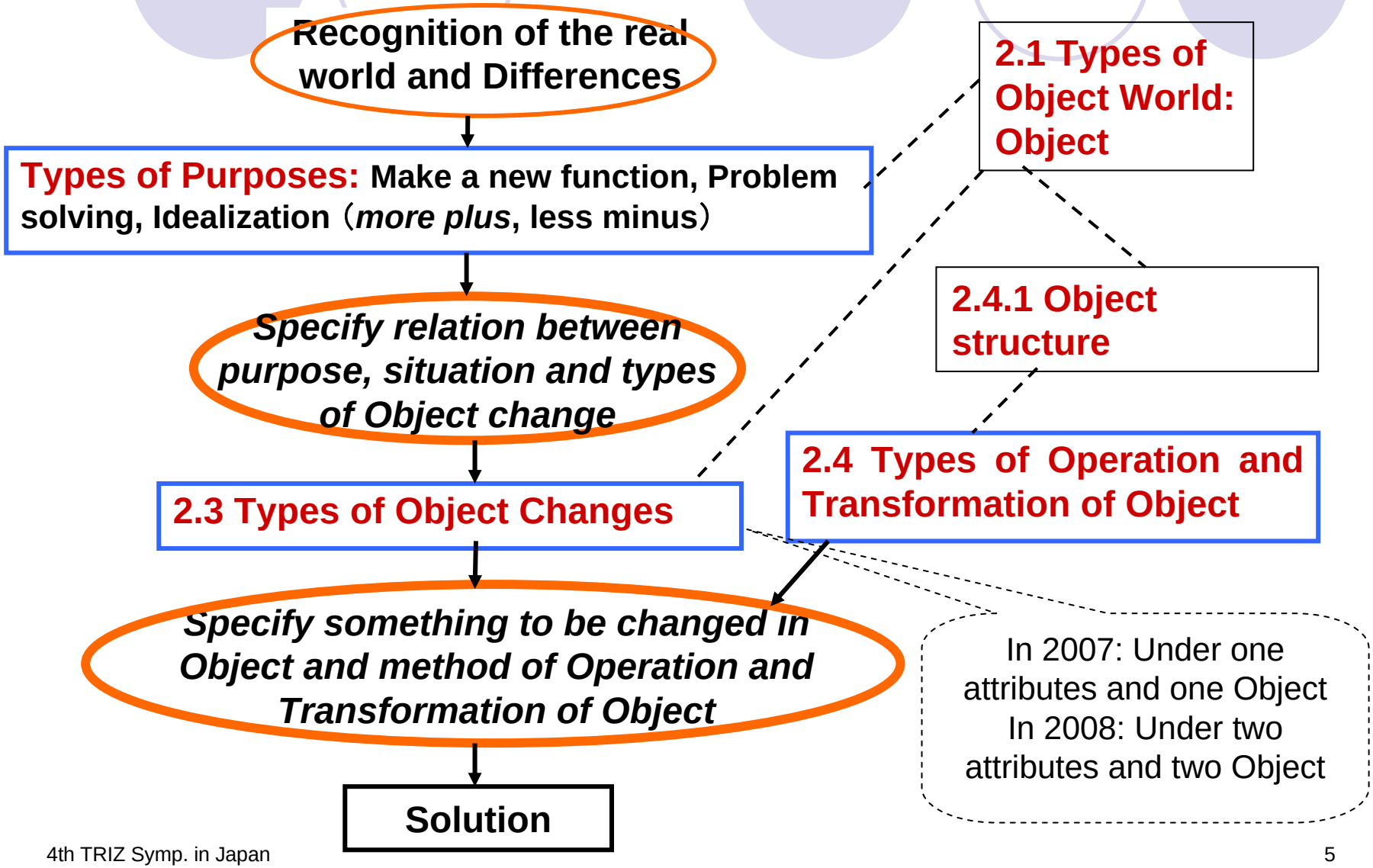
1.2. Important Thing

- An important thing is only to make a necessary change on a necessary Object in some necessary way. In
  1. Application Area
  2. Object
     - Especially Thing to be operated in Object
  3. Method to change
- Formal Theory for these requirement

1.3. Key of Method

- If we could find minimum **types of elements** of something at adequate granularity,
- 1. in which we can deal with the same type in the same way and in the different type differently,
- 2. by the combination of which we could reconstruct the original one uniquely,
- in the area of Object, Object changes and application area
- it could be said to obtain unified method to change Object in every application area.

1.4./2.4.5./6.3. Total Picture of Types

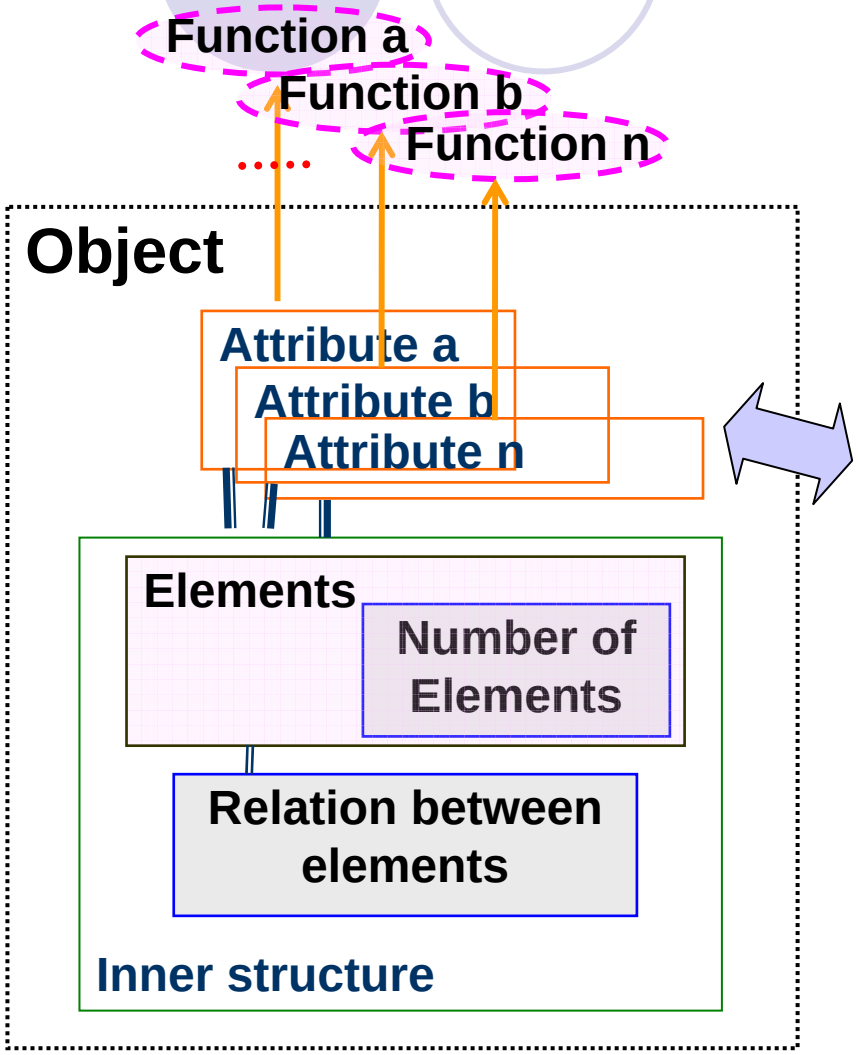


2. Object and Types of Objects Change
2.1. Object, Granularity, Attributes

- **Object: Types of Object World**
- **Object**＝ Something to be recognized
- 1. **Matter (Being)**：System Object
- 2. **“Idea” (Being)**：System Object
- 21. Information of individual or common notion which is born by physical entity　e.g.: Information on document
- 22. My idea
- 3. **Movement or Action**：Process Object

- **Granularity**＝**Scope or Sphere in space and time**
- **Density**＝ **Density of inner structure, Degree of abstraction**

2.2. Structure of Object



- *Three granularities of Attributes in Object*
- ***Attributes 1*** *is everything that concretely describe Object*
- *Attributes 1=* ***Attributes 2*** *in narrow sense + Inner Structure*
- *Attributes 2 in narrow sense* ***= Attributes 3*** *difficult to change in most narrow sense + State easy to change*

2.3. Types of Objects Change within one Attribute and one Object

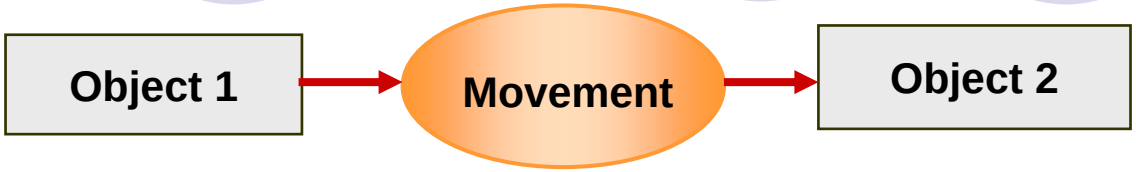
- 1. Generate or delete Object *
- 2. *Generate or delete attributes* *
- 3. Change attributes of Object
- 1) *No change of attributes*
- 2) Change attributes of Object not qualitatively
- 3) Change attributes of Object qualitatively
- * To generate Object or attributes is to bring in to the stage of Object World. To delete Object or attributes is to bring out from the stage of Object World.

2.4. Types of Object Operation and Transformation
2.4.1. Types of Object Transformation 1: Principle D

- **Object Transformation Principle D**
- ***Change of inner structure consisting of elements and the relation between these*** *can generate new Object, delete Object itself and change plural attributes of Object.*
- （an expansion of the law of the mutual transformation of quantitative and qualitative changes）

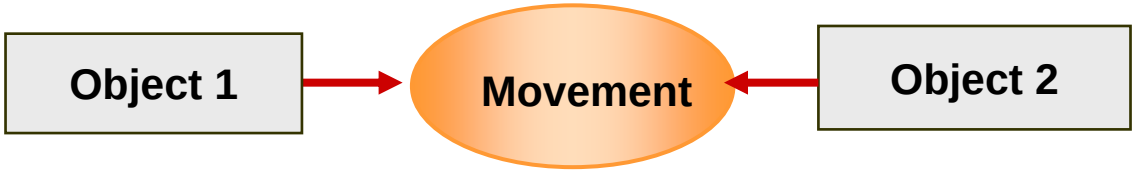
- ***Basically Principle U,P change attributes 2***

2.4.2 Types of Object Transformation 2: Principle U, P



Object Transformation Principle U

Object 1and movement can change *attributes of* Object 2 or Object 2 itself.



Object Transformation Principle P

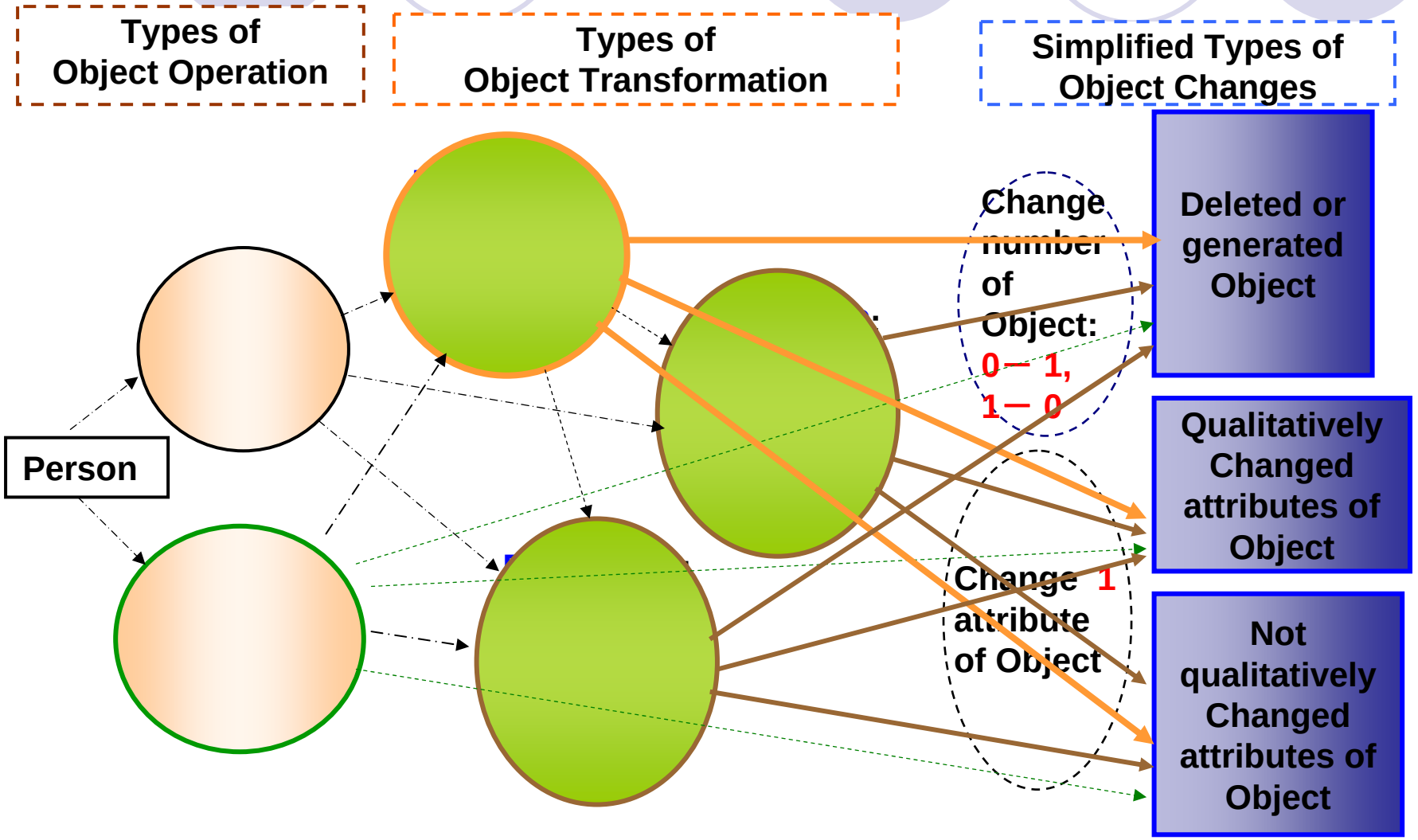
Object 1 and Object 2 can change *attributes of* movement or movement itself.

2.4.3. Types of Object Operation: Operation A, R

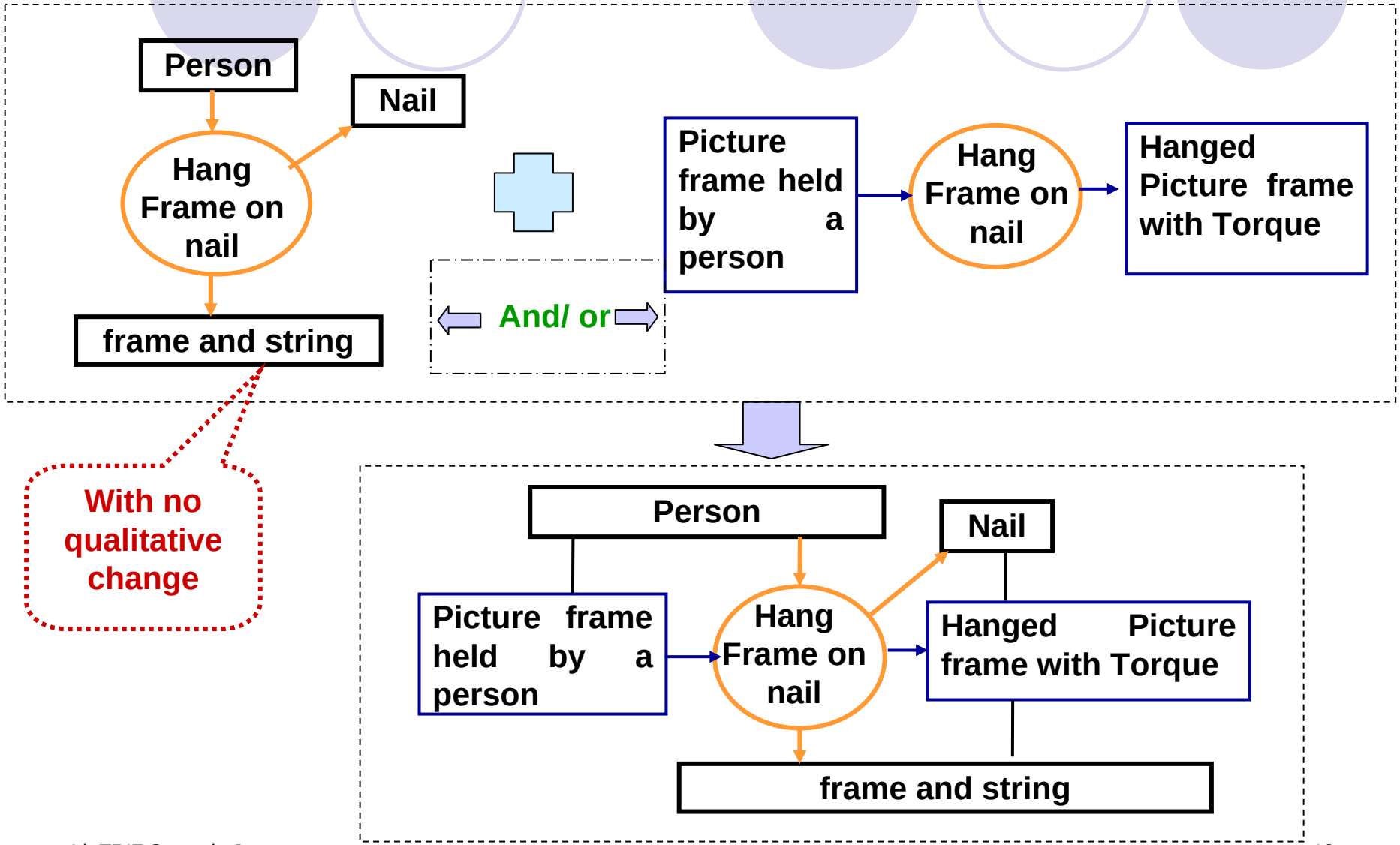
- **Object Operation A**：We can operate *existing single Object or* Object in “Object 1- Process Object- Object 2 model”.

- **Object Operation R**： We can bring in, bring out or replace Object or its element of *existing single Object or* Object in “Object 1- Process Object- Object 2 model” freely regardless they are existing or not.

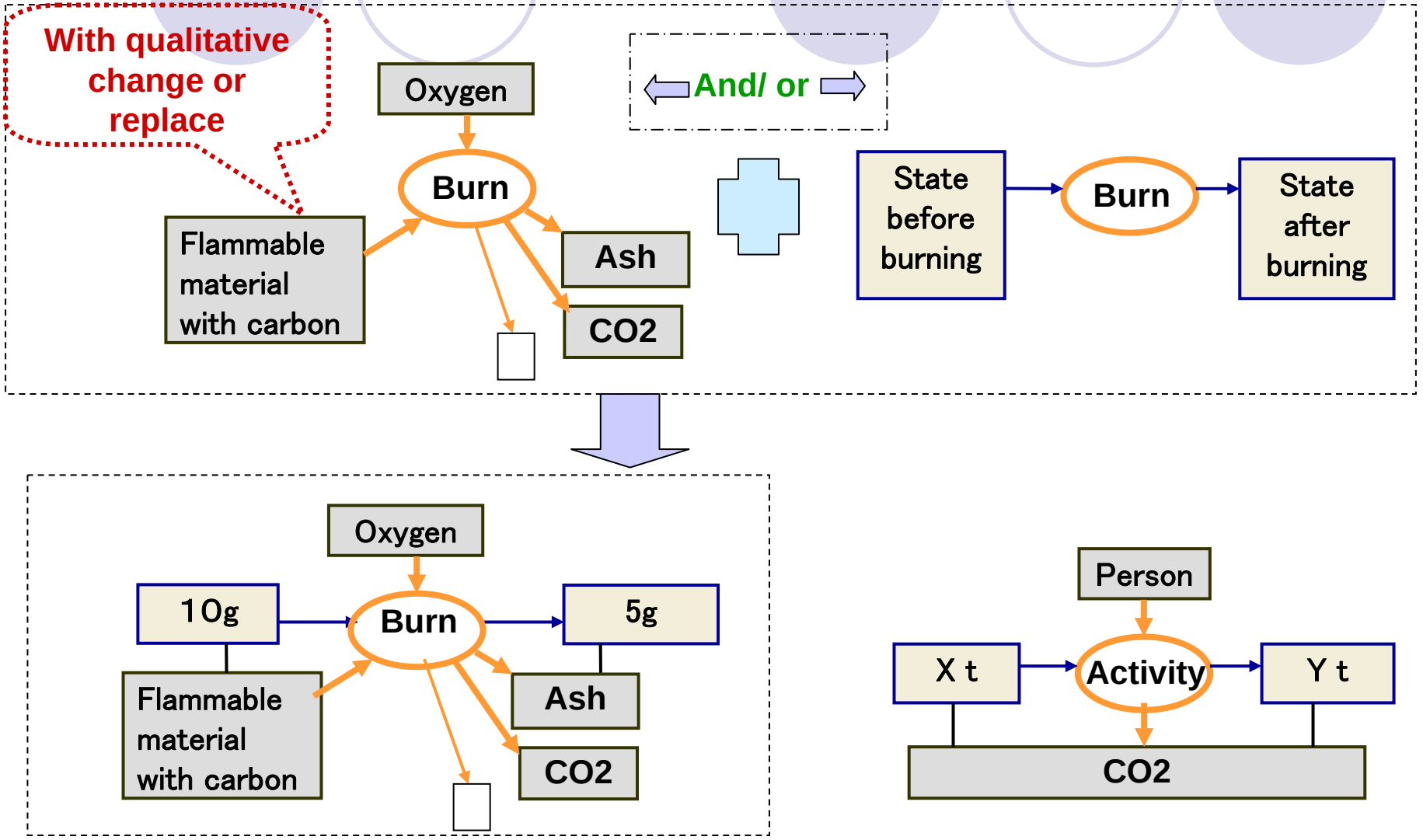
2.4.4. Relation between Types of Object Operation, Transformation and Objects Change within One Object



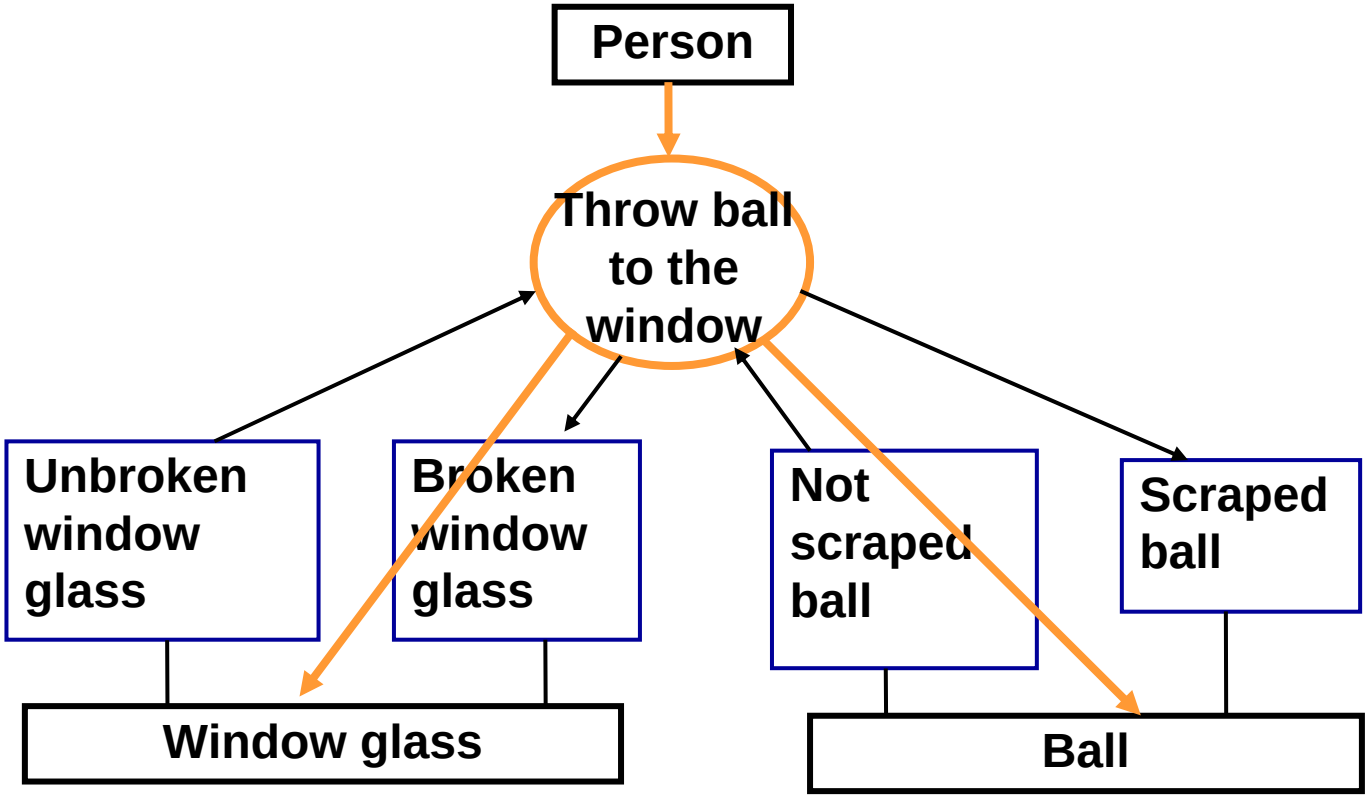
2.5.1. How to Express 1: by Example of Picture Frame



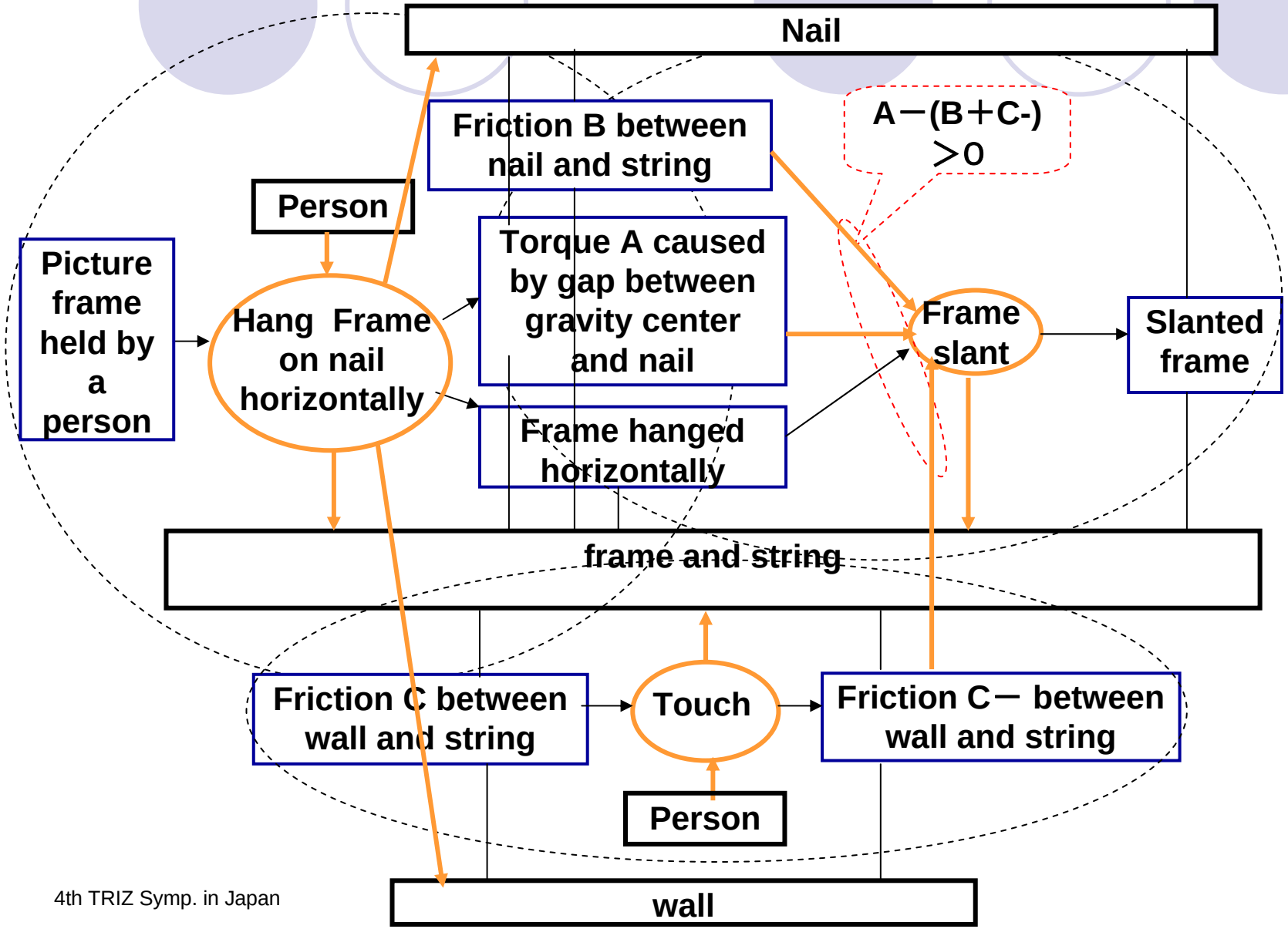
2.5.2. How to Express 2：by Example of Burning



2.5.3. How to Express Broken Window



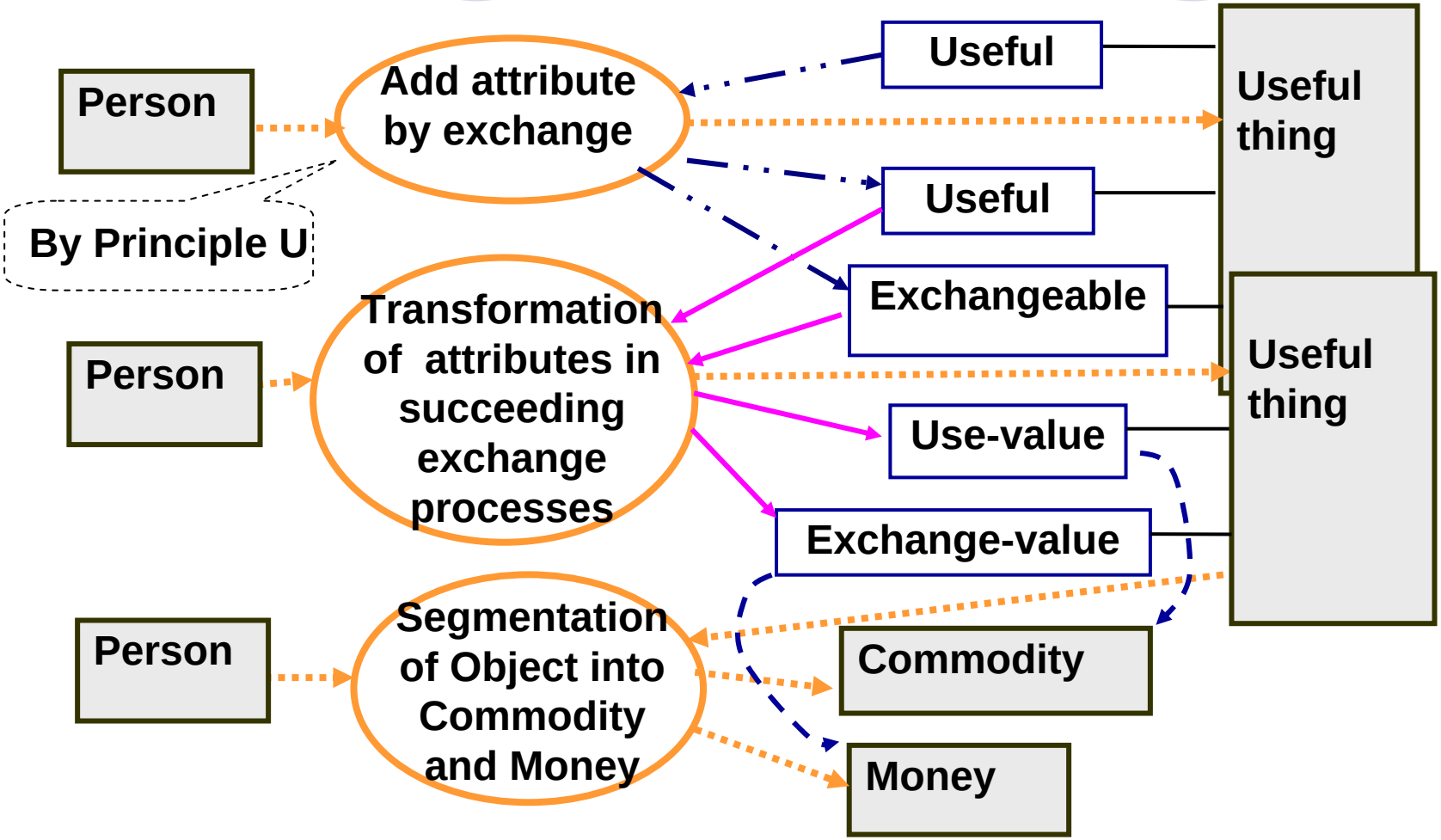
2.5.4. How to Express Detailed Picture Frame



3.1. Technology and Institution

- Technology：Things between Person and Nature
- Institution：Common Idea between Person and Community
- 1. Person and Thing take Common Idea
- Institution of Exchange (e.g. language, money)
- 2. Person takes Common Idea:
- Common Subject (e.g. thought, philosophy, religion, moral)
- System Institution (e.g. nation, corporation, family)
- Social Institution (e.g. law, politics, economics)

3.2. Example of Institution: Birth of Commodity and Money



3.3. Change and Contradiction

- Change is an assemblage of
  - intentional change (Resolving Differences)
  - unintentional change
  - autonomous change without human activity
- Technology was conformed mainly to the law of movement of matter without purpose
- Institution was conformed to the law of movement of community to realize purposes grasped at granularity as autonomous

3.4. Technology and Institution

- **Technology**
- 1. Movement of technology itself has no purposes. 2. In technological area change is achieved by Resolving Differences using cause- effect relation. We can make use of knowledge of contradiction.

- **Institution**
- 1. Movement of institution is to realize purposes. 2. In institutional area change is also achieved by Resolving Differences using cause- effect relation as an element of whole movement. We can make use of knowledge of contradiction.
- 3. In addition to this, in institutional area we must continue to ask for what is common subject to be and continue to verify the result of action.

4. Types of Objects Change and TRIZ
4.1.1 Preparation: Two Viewpoint

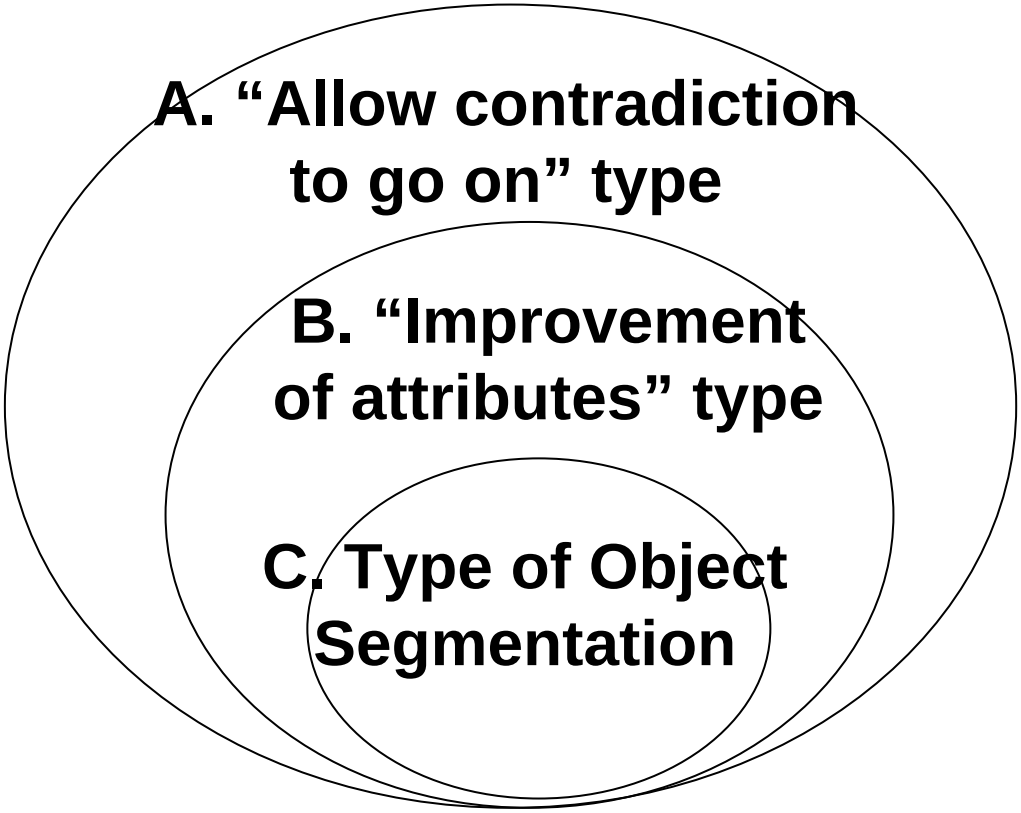
- Hierarchy of change
  - A1. Change of number of Objects
  - A2. Change of number of attributes
  - A3. Change of attributes
- How to change
  - B1. By Basic Principles
  - B2. Resolving Contradiction
  - B3. Simple Change of Attributes

4.1.2 Types of Objects Change and TRIZ Preparation : Types of Resolving Contradiction

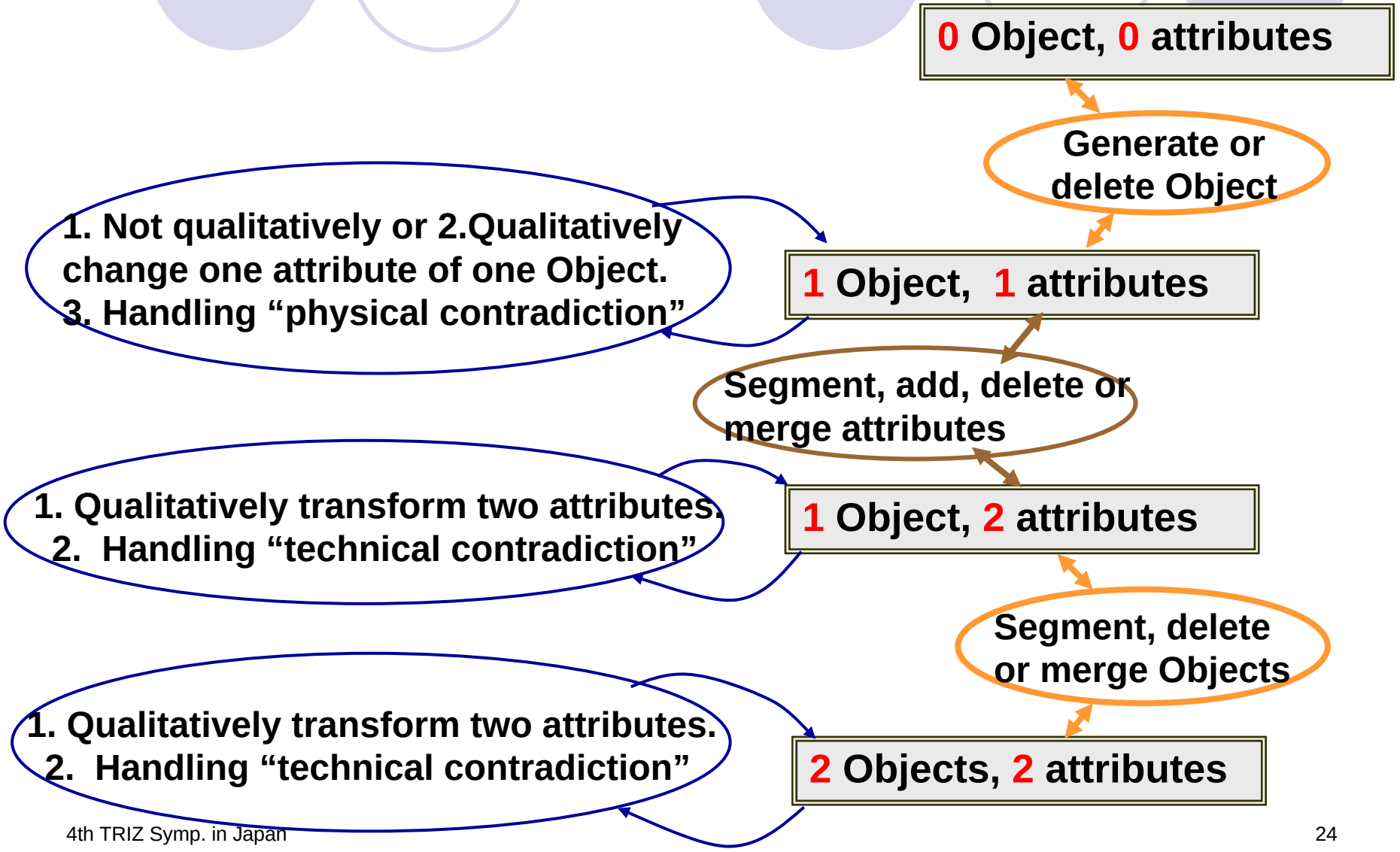
- **Opposites: 2 values in 1 attributes, 2 attributes in 1 Object, 2 attributes in each Object**

- **A. "Allow contradiction to go on" type** ("Develop a form in which opposites can exist side by side")
- Type 1: Mutually exclusive conditions of two values in one attribute lead to movement or change
- type X: (no change of two values of two attributes)
- **B. "Improvement of attributes" type**
- type 2: Meet two values of requirements of two attributes simultaneously
- type 3: Transformation of two attributes to the other attributes
- **C. Type of Segmentation of Object**
- type 4: Segmentation of Object

4.1.3 Types of Objects Change and TRIZ Preparation : Types of Resolving Contradiction



4.2.1. Types of Objects Change within Two Attributes and Objects and TRIZ



4.2.2. Types of Objects Change within Two Attributes and Objects and TRIZ 1

Types of Objects Changes		Means to realize in TRIZ
1) Change number of Object 0/ 1, 1/ 0	11) Generate Object	Principle 24. Intermediary
	12) Delete Object	Principle 34. Discarding
2) Handling one attribute **: two values in case of 22), 23): to be studied*	21) No change of attribute 211) Mutually exclusive conditions of two values in one attribute lead to movement	"Physical Contradiction" in TRIZ: Type 1
	212) Two values can be separated	Separation of P.C: Type X
	22) Not qualitative change of attributes	Many Principles in TRIZ
	23) Qualitative change of attributes 231) Delete attributes	Principle 34. Discarding
	232) Transformation of attribute to the other attributes	(Transformation of attribute to be studied)
3) Change number of attributes 1/ 2, 2/ 1	31) One attribute to two attributes 311) Add attribute	Principle 6. Universality
	312) Segmentation of attribute	Principle 1. Segmentation
	32) Two attributes to one attribute 321) Delete one of the two	Principle 34. Discarding
	322) Two merge into one	Principle 5. Merging

4.2.3. Types of Objects Change within Two Attributes and Objects and TRIZ 2

4) Handling two attributes	41) No change of attributes	—
	42) Not qualitative change of attributes Meet two values of requirements simultaneously	"Technical Contradiction" in TRIZ
	43) Qualitative change of attributes Transformation of attribute to the other attributes	(Transformation of two attribute to be studied)
5) Change number of Object 1/ 2, 2/ 1	51) Segmentation of Objects	Principle 1. Segmentation
	52) Two Objects to one Object 521) One of the two extinguishes	Principle 34. Discarding
	522) Two merge into one Dissolve contradiction by merging opponents	Principle 5. Merging
6) Handling two attributes	Same as 4)	

5.1. Rearrange Existing 40 Principles 1

numbers of Principles the number of Principle

31, 32, 37 are not included

- **Structure Principles Super Groups**
- **a) Basic Principles Group 5**: 1, 5, 6, 24, 34

- **b) Dynamic Principles Group 18**: (3, 4, 6, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 35, 40)
- **c) Structure Principles Group 7**: (1, 2, 5, 7, 13, 24, 40)
- **d) Replace Principles Groups 9**:
- **Replace Element Principles Group** (26, 27, 28)
- **Replace Environment Principles Group** (29, 38, 39)
- **Replace by Attributes Change Principles Group** (14, 30, 40)

5.2. Rearrange Existing 40 Principles 2

- **Function and Attributes Principles Super Groups 1**
- **e) Plus Principles Groups 18:**
- **Basic Plus Principles Group** (1, 24, 35)
- **Function Plus Principles Group** (6, 9, 10, 11, 15, 16, 17, 18, 19, 20, 21, 23, 25, 36)
- **Attributes Plus Principles Group** (17, 35, 40)
- **f) Minus Principles Groups 12:**
- **Basic Minus Principles Group** (2, 5, 34, 35)
- **Function Minus Principles Group** (16)
- **Replace Minus Principles Group** (26, 27, 28, 29, 30, 31, 33)
- **Attributes Minus Principles Group** (33, 35)

5.3. Rearrange Existing 40 Principles 3

- **Function and Attributes Principles Super Groups 2**
- **g) Equal Principles Groups 9:**
- **Equal Problem Solving Principles Group** (8, 11, 12, 34)
- **Equal Movement Principles Group** (9, 10, 16, 23, 34)
- **Equal Attributes Principles Group** (33)
- **h) "Anti" Principles Groups 8:**
- **Basic "Anti" Principles Group** (13)
- **"Anti" Function Principles Group** (13)
- **"Anti" Attributes Principles Group** (4, 13, 39)
- **"Anti- Anti" Function Principles Group** (8, 9, 16, 34)
- **"Anti- Anti" Meaning of Function Principles Group** (22)

6.1. Conclusion

- Types of Object changes within two attributes and two Objects
- TRIZ is an assemblage of process elements
- attributes change
- solving “physical contradiction” and “technical contradiction”
- segmentation and merging of attributes
- segmentation and merging of Objects
- We can apply TRIZ to institutional area with some modification

6.2. Further Study Needed

- How inner structure of Object decide attributes, Structure of contradiction in Institution
- Solution is to decide 1. how types of purposes and situation decide types of Object changes (where in 4.1 or 4.2) and 2. how types of Objects change select Principle U, P, D and decide how to use them
- “40 Principles” in the area of Institution

1.4./2.4.5./6.3. Total Picture of Types