



# Equivalent Transforming Thinking

Thinking Process for Creation and  
Innovation and Its Application

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# Equivalent Transforming Thinking

- A theory about creation and innovation advocated by Dr. Kikuya Ichikawa (Kyoto Univ. and moved to Doshisya Univ,) in 1955.
- Practiced and proven by those of Ichikawa school who were the professional engineers of R&D sectors and producing sectors in manufactures.
  - 🌐 Dr. Ichikawa directed the school from 60's to 80's.
  - 🌐 Continuously studied in the academic meeting formed by Ichikawas school students.

# The History of ET Thinking

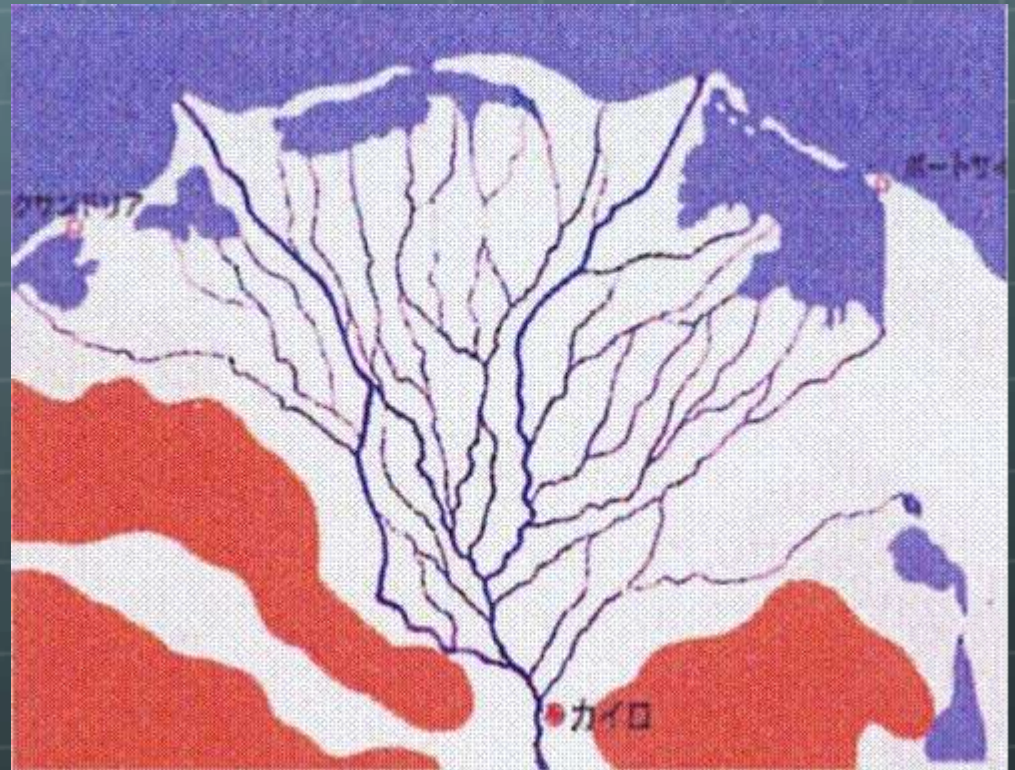
- 1955 The theory was developed and advocated
- 1964“ Creativity Development for Business Professionals” course opened at Osaka Science and Technology Center
- R&D engineers studied the theory and learned the application for 7 months
- The course lasted for 14 years
- The theory has been taken up by the students of the course.
- 1966 The Study group of Creativity development was formed
- 1967 The Society for Equivalent Transformation was established
- 2006 NPO Japan Creativity Development Center was established



# The Basic Concept

**When a man creates a new thing or concept he has pierced something common in a different thing; he was searching and catching an “Equivalent Relation” in it.**

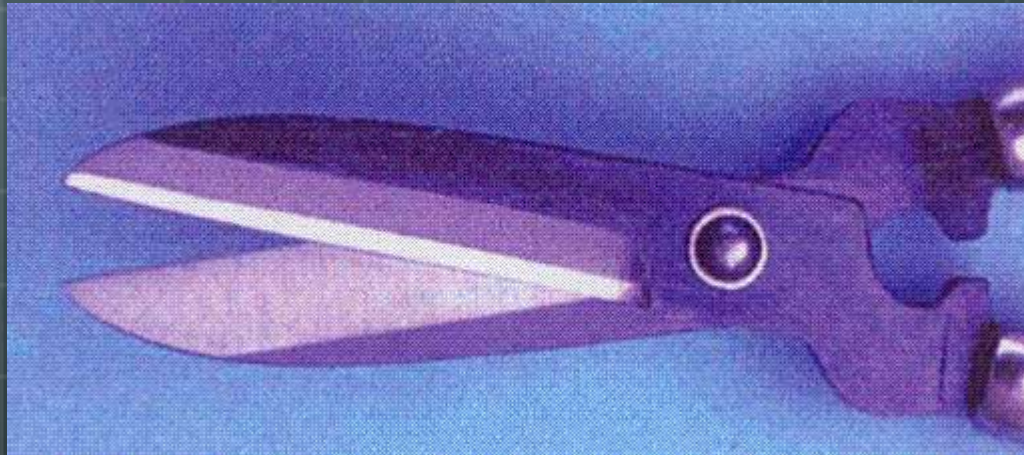
# Equivalent Relation in Figure



# Equivalent Relation in Function

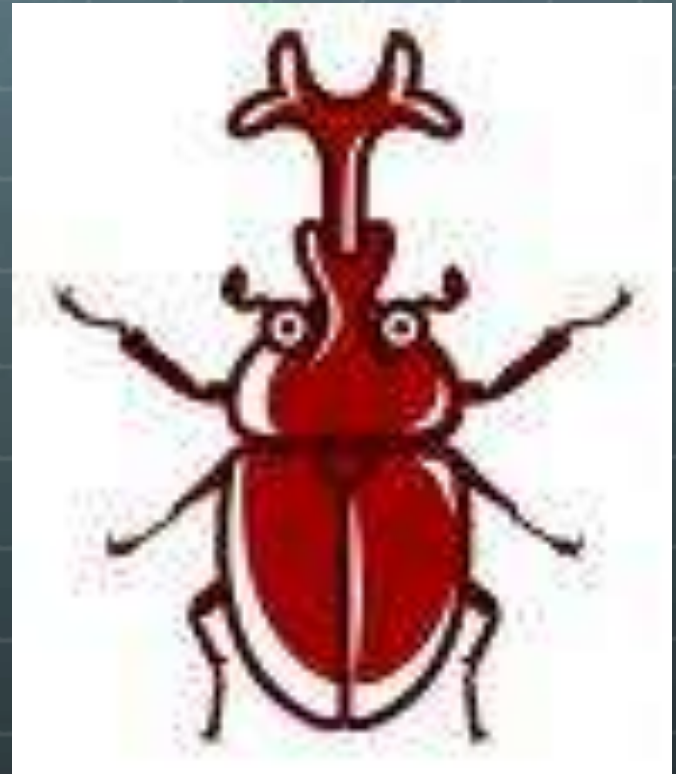


**Ramphastidae**



**Gardening  
Scissors**

# Searching an Equivalence



# Searching an Equivalence





# Searching an Equivalence



# Exercise: Sort them by Equivalent Pairs

Hermit Crab



ANA

# What does Equivalent Transforming = Evolution or Creation mean?

To Change a form (=Transform) from A to B by

- Keeping the Equivalent factor
- Removing all of unnecessary factors
- Adding on newly needed factors

# Overview of a Creating Activity Through Equivalent Transforming Perspective

Intrinsic Factors in the Departure



Essence

The Departure:  
Existing Thing  
or Hint



The Arrival:  
Solved Issue or  
Developped Ting

Viewpoint 



Unique/Original  
Factors in the  
Arrival

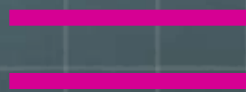
# Example 1: From Tablet Chocolate to Cutterknife

- Cocoa,
- Sugar



Fold it along  
the Crack

Tablet  
Chocolate



Cutterknife

Fold and split  
something  
neatly and  
easily



- Steal
- Appropriate  
depth and angle  
of the crack

## Example 2

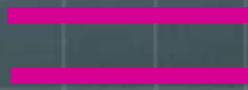
# From a Five Story Pagoda to Flexible Structured Skyscraper; Kasumigaseki Building

- Wood
- Religion



Spreading and  
Absorbing Seismic  
Energy

Five Story  
Pagoda



Kasumigaseki  
Building

Antiseismic  
Structure



- Iron Frame
- Concrete Panel

# Example 3: Rice Polishing Machine w/o Water

Any intrinsic factors of a Gum as a food

Sticky things can be removed by pressing same same substance

Chewing Gum  
adhes on a Cloth

Rice Polishing  
Machine w/o  
Water

Remove  
Bice Bran

Rice Milling  
Technologies

# The Formula of Equivalent Transforming

Intrinsic Factors in the  
Departure ( $\Sigma a$ )


Conditioned  
Essence ( $C\varepsilon$ )

The Departure:  
Existing Thing or  
Hint ( $Ao$ )

=

The Arrival: Solved  
Issue or Developed  
Thing ( $B\tau$ )

Viewpoint ( $Vi$ ) 

 Unique/Original  
Factors in the Arrival  
( $\Sigma b$ )



# Explaining Past Developments with ET Thinking

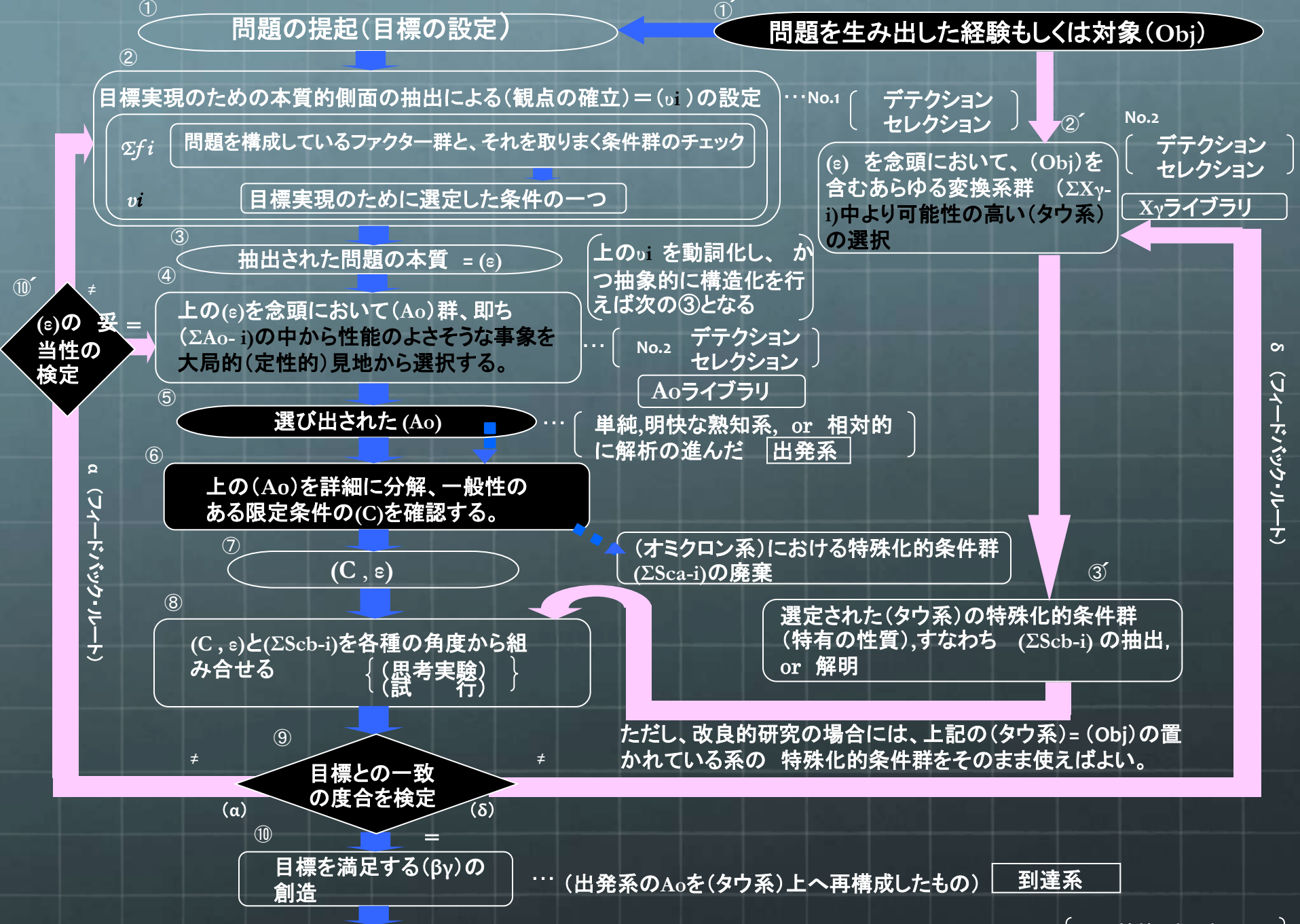
Ao: Hint	B <sub>T</sub> Developed Thing	C <sub>ε</sub> essence Equivalence
Electric <i>Kotatsu</i>	Smoke Free Fish BBQ Cooker	Put the heat source above
Blood circulation	Takuma Boiler	Separate the flow and valve function
A leaf floating on a river surface	Automatic ticket gate	A sheet piece can be trimmed its position when it hits a projection
Poured detergent on a water	Manufacturing process of sheet glass (Pilkington Method)	Lighter gravity liquid spreads out when it poured on heavier liquid
Pawn Shop	<i>Echigoya</i>	Fixed price, no discount, Prompt clearance by cash

# ET Thinking Process

1. Identify the issue/ scope / objectives
2. Define the viewpoint that can solve the issue and abstract the essence ( $V_i, \epsilon$ )
3. Search a hint example that contains the essence ( $A_o$ )
4. Establish conceptual new model identifying how the hint satisfy the essence explaining with what condition(s). ( $C\epsilon$ )
5. Complete the whole product idea realizing new conceptual model ( $-\Sigma a, +\Sigma b, B\tau$ )

# Automatic Production of Liquid Crystal Panel

- 🌐 Mica Spacers were placed by man (with Vacuum tweezers)  
=> The process should be automated.
- 🌐 Vi: Allocate tons of granularity materials efficiently. Each piece must be placed evenly.
- 🌐 Ao: Seeding sods. Mix up seeds with soil first, then place the soil.
- 🌐 Cε: Mix up micro granularity materials with medium first, then place the medium
- 🌐 Bτ: Mix up mica spacer with medium and print the media on a plate by roll.





注) また以上のフローチャートは、多人数協業体制(研究所、企業など)の組織構成原則にもあてはまるものである。

# Identify the Issue/Scope/Objective

-  **Negative Search = Shortage, Constrain, Problem, inconvenience etc.**
-  **Positive Search = Desire, Vision**


# Define the viewpoint ( $V_i$ ) and Abstract the essence ( $\epsilon$ )


-  What is the basic approach to resolve the Issue? ( $V_i$ )
-  How do you redefine the Viewpoint with more abstract expression? ( $\epsilon$ )

# Extract Conditioned Essence (Cε)

- 🌐 Define or draw simply how the Ao, the hint you found, meet the Vision in what condition.  
(What condition(C) is required to prove that Ao include the essence.(ε))
- 🌐 Describe the logic abstractly
  - 🌐 Replace proper name to general noun
  - 🌐 Think by verb, rather than adjective or noun
- 🌐 When you express it visually, simplify the structure excluding detail decoration

# Complete the whole product idea realizing new conceptual model (Bτ)

 The new concept is expressed with Cε To make it real thing, exclude all unnecessary factors of the hint example and add on all other necessary factors to complete the object/new thing.

 (To objectivise Cε, exclude Σα, unneeded factors of Aο, add B τ, newly needed factors to complete the Bτ)



# Apply A Thinking Process to R&D Activity

- **Thinking process = program in a brain**
  - **Strengthen your thinking ability**
  - **With low cost**
  
- **Thinking Process as a common language**
  - **When everyone understands it, because of simple thinking process, you can pinpoint which step your colleague is facing the challenging, and which step he/she should go back. Communication (discussion, coaching) become more efficient and effective.**

# The Advantage of ET Thinking as A Thinking Technique

- **Generate hypothesis and testing in faster time cycle**
  - Try identification of issue and defining the viewpoint many times
  - Test by stepping back to the thinking process
- **Abstracting the essence**
  - The basic of thinking technique to avoid the influence of precedence , common examples
  - Enhancing the degree of abstractness, options of hints become more available from various field.

# Some Challenging of Individual's Capability When ET Thinking is Applied to Organization

- Ability to search and identify the issue
  - Negative Search: Appraise the situation, Breakdown issues or concerns, and Solve each problem
  - Positive Search: The capability is dependent on his creativity. Can everyone set-up higher standards? Can he/she imagine higher ideal or goal?
- Combining linguistic ability and imaginative skill. Sometimes they are contradictive.
- Constructing ability to complete the new product

# How to Boost Your Creativity Based on ET Thinking

 **Strengthen the ability to find out Equivalence**



 **Multiple Perspective**

 **Strengthen Abstract Thinking**