



# Application of USIT to Compact Umbrella

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※MPUF (Microsoft Project Users Forum)

NPO aiming at penetrating various methods related to Project Management. Members aim at improving themselves through events, seminars, online community, study group meetings, etc. about various subjects related to project management. The USIT/TRIZ Study Group was launched in April 2007 as a new group among MPUF's nearly 20 study groups, and has currently about 150 members on line.

# USIT Approach



## 1. Problem Definition

Well-defined USIT Problem ( Root causes analysis )

## 2. Closed World Method

Analysis from existing minimum sets of objects  
CW-diagram → O-A-E statements → Qualitative-Change Graph

## 3. Particles Method

Analysis from Ideal Solution Back to its unwanted effect  
Morph cartoon → And/or tree

## 4. Uniqueness

Examine Temporal & Spatial Uniqueness

## 5. Solution Procedures

Pluralization  
(focus on  
Objects)

Dimensionality  
(focus on  
attributes)

Distribution  
(focus on  
function)

Generification-type  
solution

Transduction-type  
solution



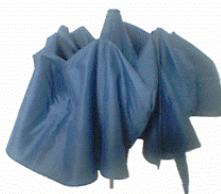


## 6. Idea Concept

Compose of Solution Idea Concept

# 1. Problem Definition



【1-1 : Analysis for Current state】

	<b>C1</b> Before Using Open Action (not yet Wet) <b>Action</b>	<b>C2</b> State of Using <b>Condition</b>	<b>C3</b> 使用直後 Close Action <b>Action</b>	<b>C4</b> After Folding Condition (already gotten Wet) <b>Condition</b>
Current	◆Pull up runner 	◆Polygon(6~8) 	◆Pull Down Action 	◆Rolled up  
Enumeration Desirable Effect (DE)	<ul style="list-style-type: none"> <li>• not necessary to put power.</li> <li>• It doesn't take up space.</li> </ul>	Even if the wind is strong, it easily supports it. strong in the wind. Don't be blown inside out Hands free	<u>Operation is easy</u> <ul style="list-style-type: none"> <li>• fold quickly ⇒Time is not spent.</li> <li>• More Compactly</li> <li>• The hand is not wet.</li> </ul>	<ul style="list-style-type: none"> <li>• Install Compactly.</li> <li>• No Occupations in the bag.</li> <li>• Surroundings are not wet</li> <li>• Losing free bag</li> </ul>
Enumeration Un Desirable Effect (UDE)	Opposite expression above-mentioned		Opposite expression above-mentioned	

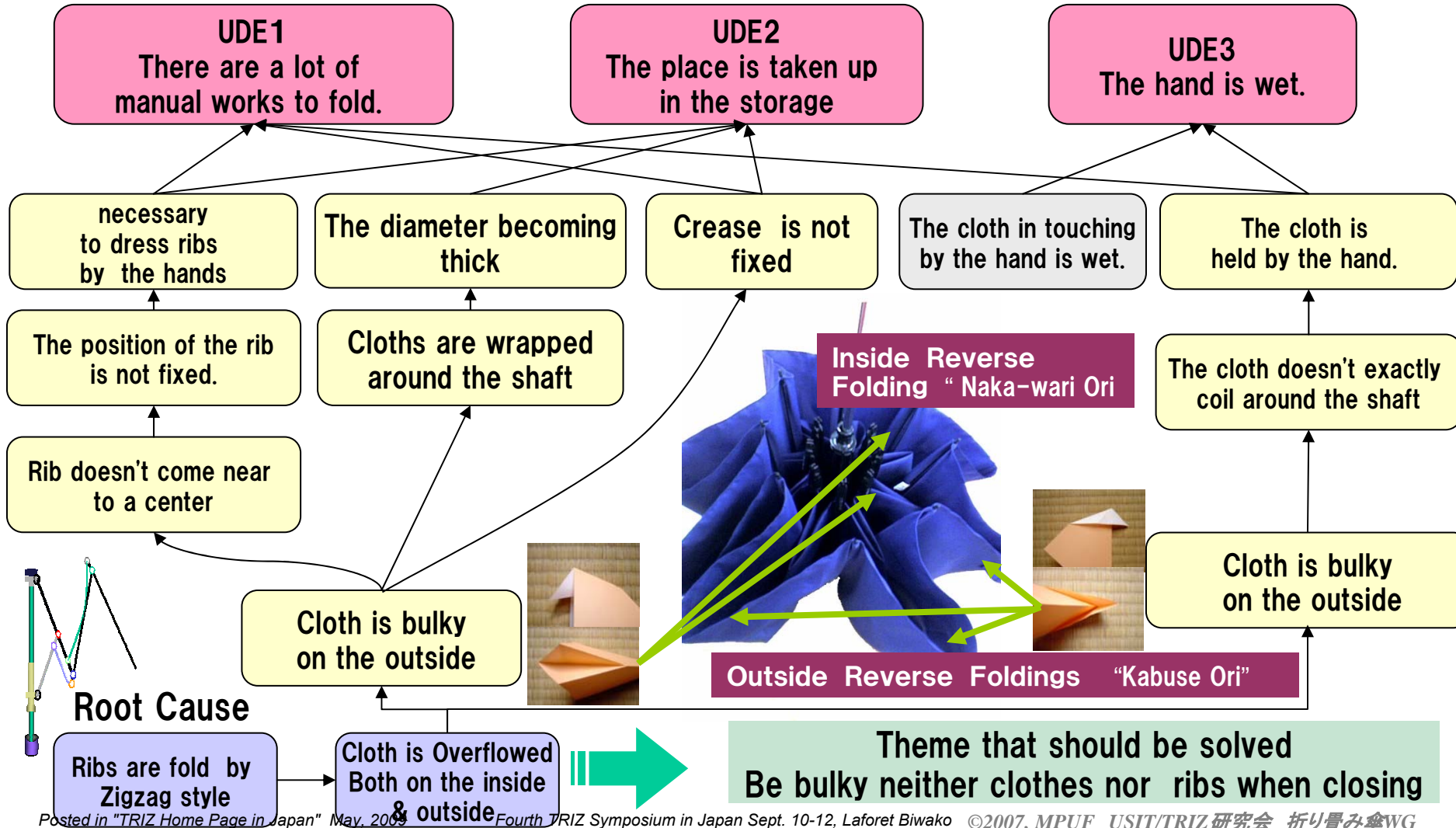
# 1. Problem Definition



## [ 1 – 3 Investigation of Root Cause ]

※Here We've used CRT (Current Reality Tree) using in TOC Thinking Process

※UDE : Undesirable Effect => Current holding Problem

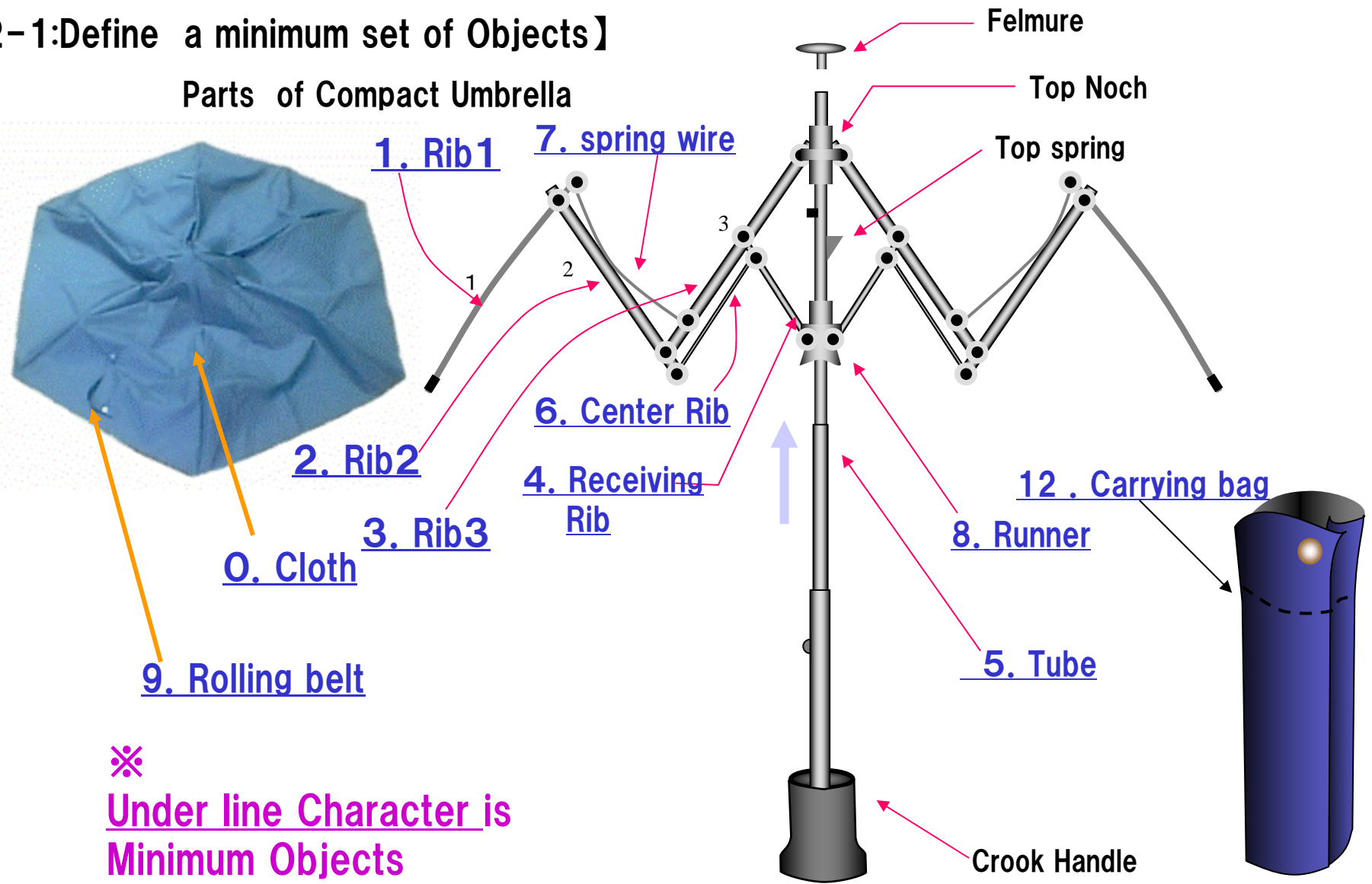


# 2. Closed World Method



## 【2-1:Define a minimum set of Objects】

Parts of Compact Umbrella

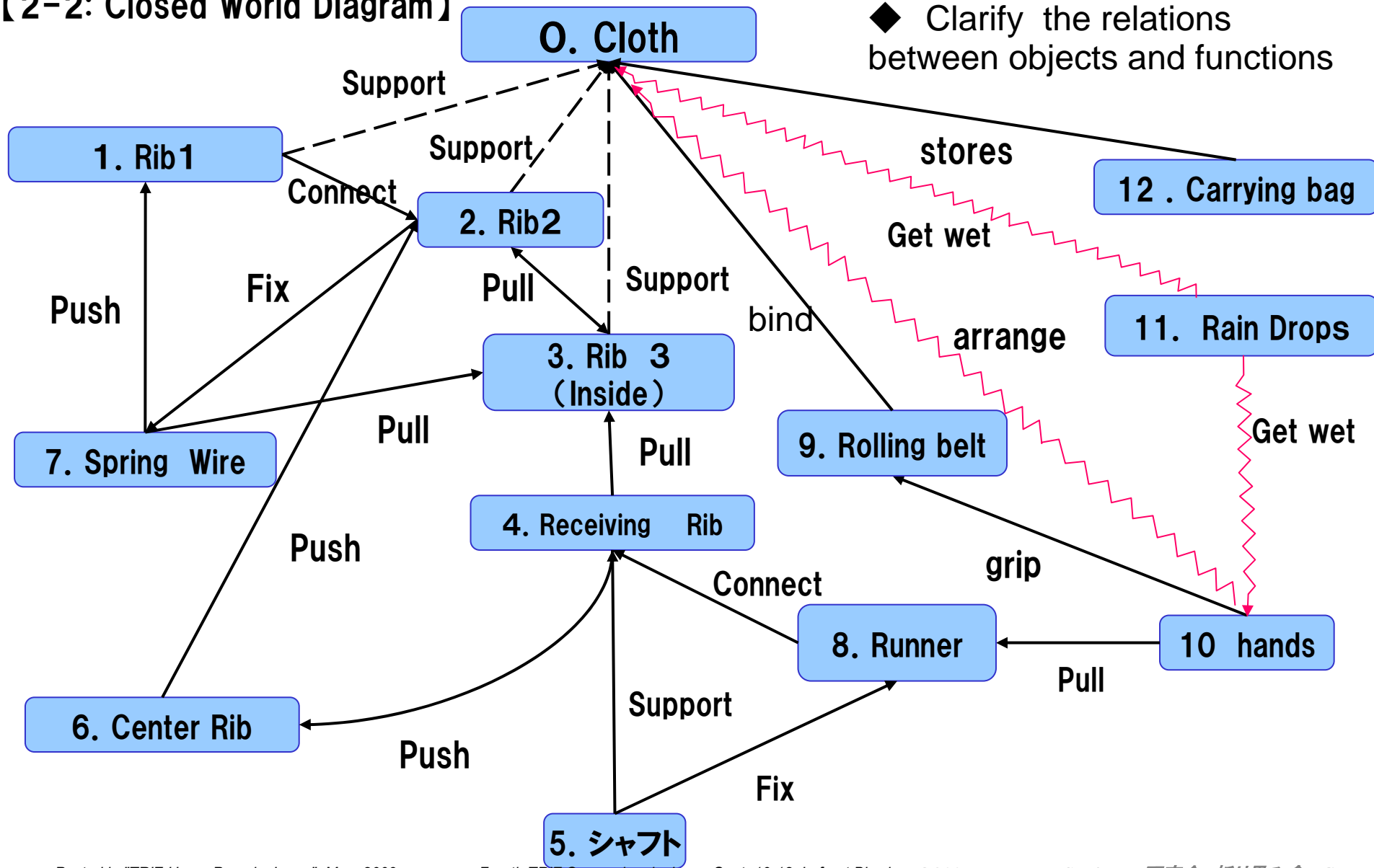


※  
Under line Character is  
Minimum Objects

# 2. Closed World Method

【2-2: Closed World Diagram】

◆ Clarify the relations between objects and functions



# 2. Closed World Method



【2-2:  
List up the Attributes by Objects】

And then  
Select strong effect factor (★)

Show below:  
Selected sample of Ribs & Cloth & Shaft

O Cloth	1, 2, 3, 4, 6, 7 Rib	5 Shaft
Solid ★hardness ★Plural ★shape ★water proof ★easy to crease ★elasticity ★Volatility ★Water-shedding quality ★Easiness to dry ★Water permeability Easiness of wrinkle to adhere Restoration ★Thickness Weight ★Volume ★SealingAbility ★Easiness of wrinkle	Solid ★hardness ★Structure of connection ★shape weight ★Elasticity ★fixable ★Movability ★Length	Solid hardness ★ structure of connection Strength ★length ★surface shape ★spring power of spring ★shape of Top spring ★fixability ★shape of Pole

【2-3:List up】

This time We've used QFD-Chart in place of QC-graph. And Investigate relation between UDE Undesirable Effect & RC (Root Cause) and attribute of each objects

Show below:  
Selected sample of Ribs & Cloth )

	attribute	Objects													
		Rib					Cloth								
		a1	a2	a3	a4	a5	b1	b2	b3	b4	b5	b6	b7	b8	
	X	hardness	Shape	elasticity	number	length	hardness	shape	Waterproof	Easiness to fold	Easiness to dry	Easiness to volume	Thickness	Restoration	elasticity
UDE	There are a lot of manual works to fold	Y1	◎	◎	◎	◎	◎	◎		○				◎	◎
	There are a lot of manual works to fold	Y2	○	○	◎	◎	△	◎	◎		◎			◎	◎
	The hand is wet	Y3							○	◎		◎	◎		
Root Caus	There are a lot of manual works to fold	Y4	△	○		◎	◎	◎	◎		◎		◎	◎	◎

# 3. Particles Method

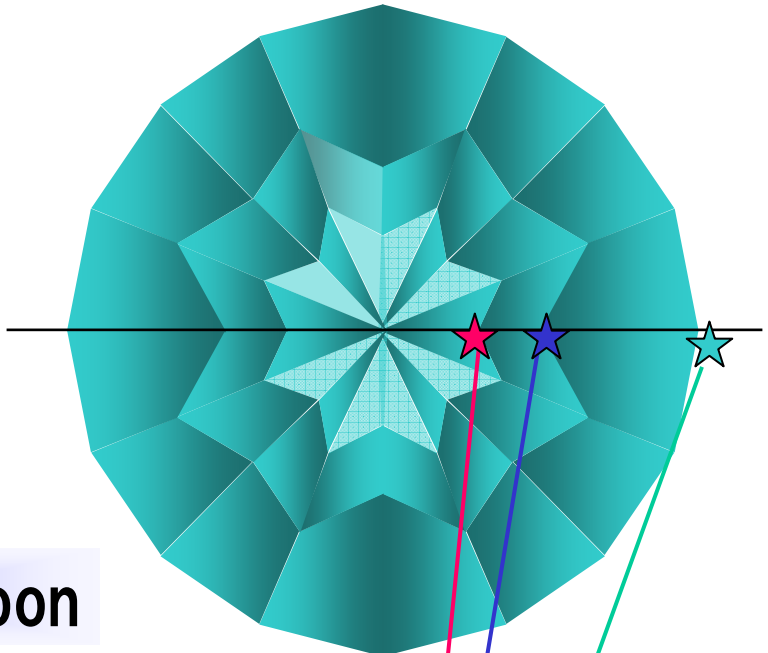
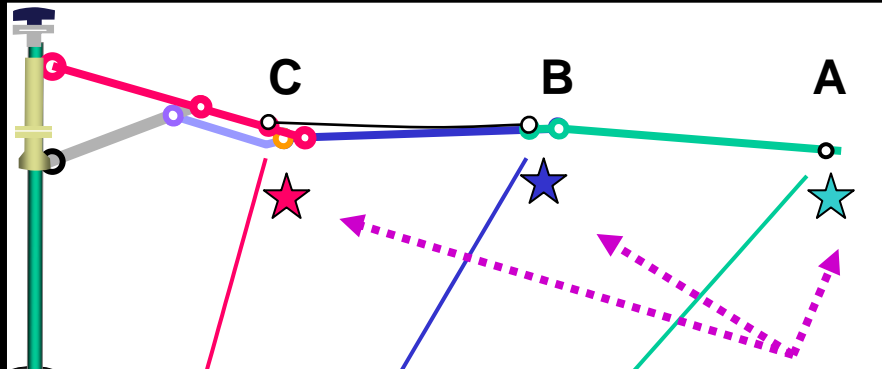
## Analysis from Ideal Solution

Ribs & Shaft Parts

Cloth Parts

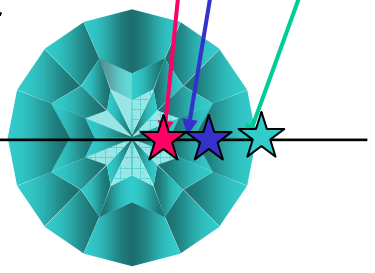
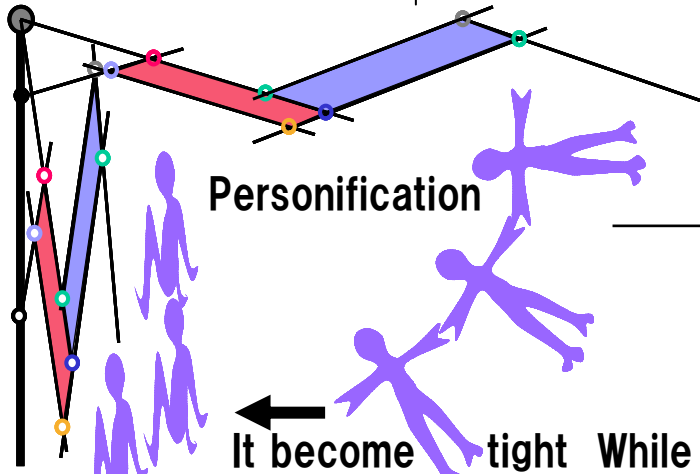
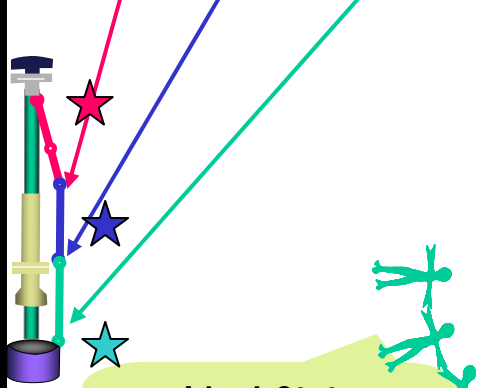
Open State

Close State



Particles

Morph cartoon



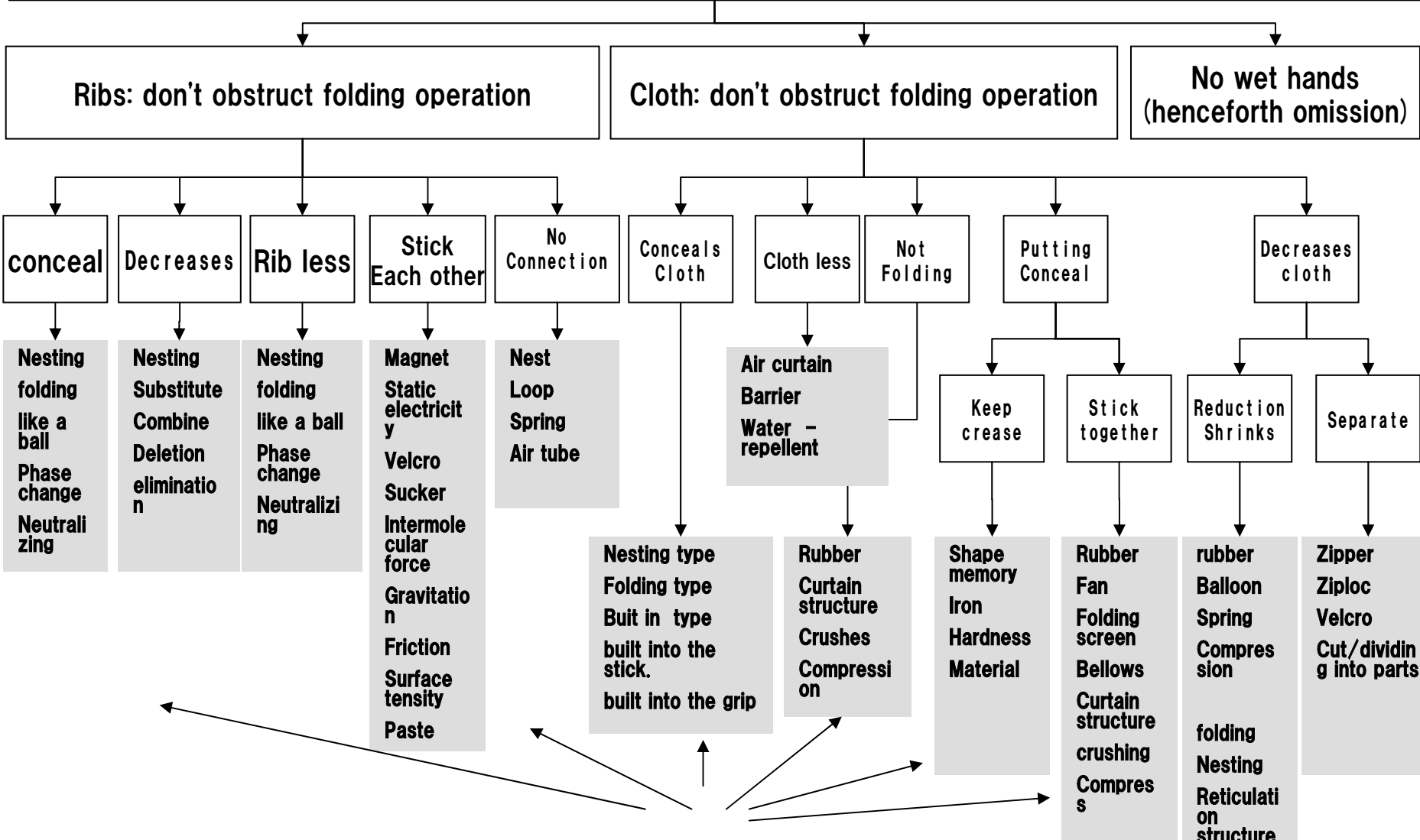
**Ideal State**  
Body itself could be Small!

It become tight While Closing

# 3. Particles Method And/or tree



Desirable Effects : as easy operation in folding & compact as possible & without wetting hands

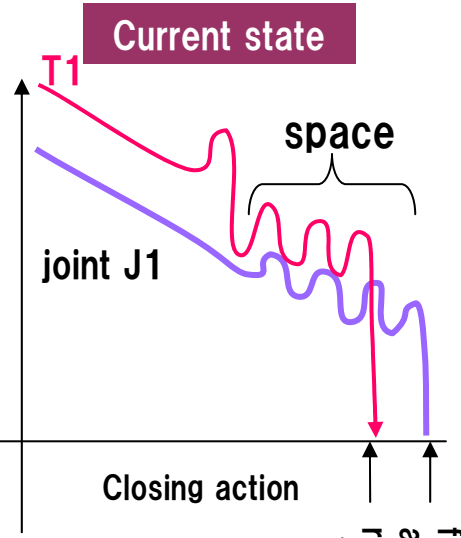
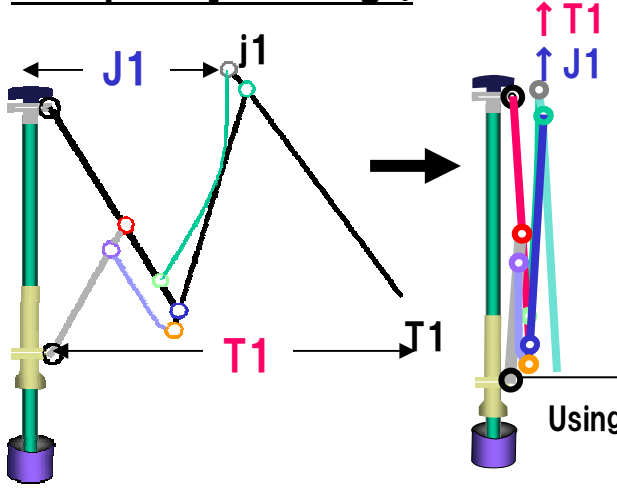


**Key Word**

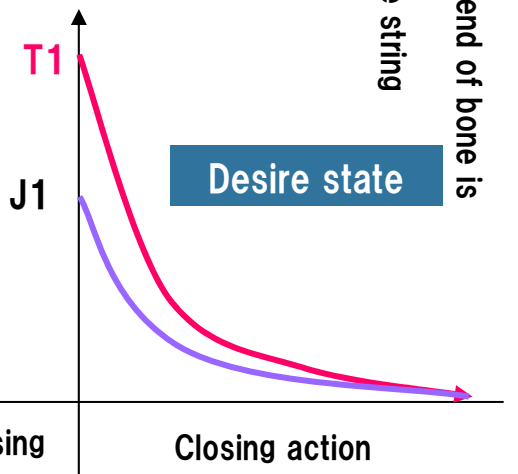
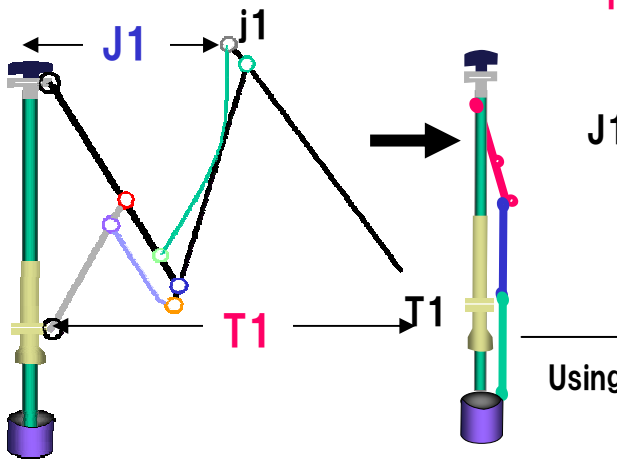
# 4. Uniqueness

## 【4-1 : Examine Temporal & Spatial Uniqueness】

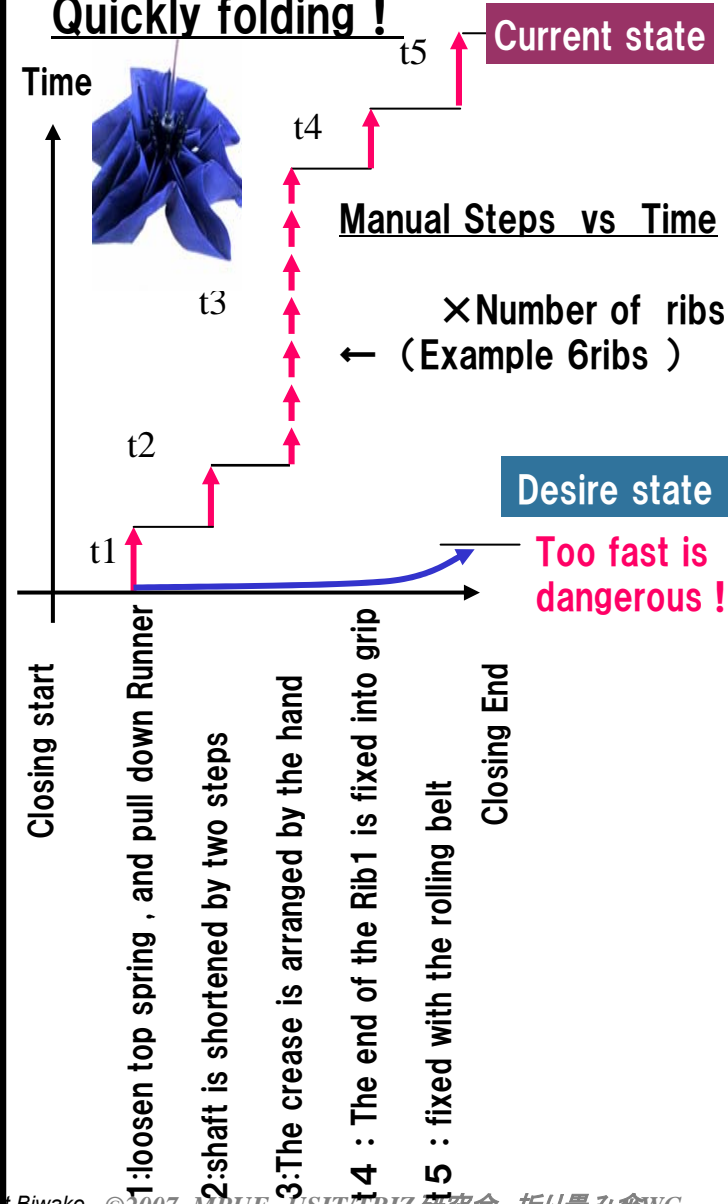
### Compactly folding !



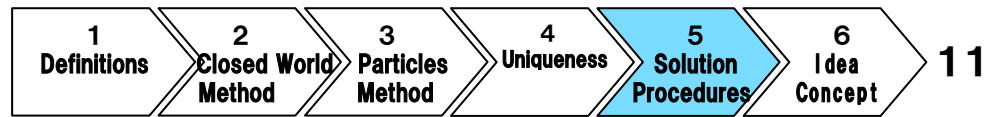
T1:Terminal1:Distance between Center to T1  
 J1:Distance between Center to j1



### Quickly folding !



# 5. Solution Procedures



## 【5-1 : Idea Creation — Primary】

### ① Closed World Method ⇒

- activate useful function or inactivate harmful function
- Add Objects or Activate attributes

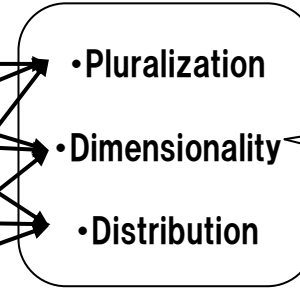
### ② Particles Method ⇒

- activate useful attributes
- increase or decrease objects
- change a function to another

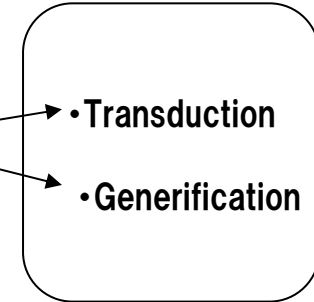
### ③ Uniqueness ⇒

- Change spatial or temporal point of view

### Primary Idea Creation



### Secondary Idea Creation

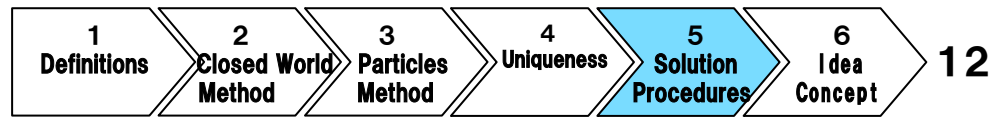


- Air pressured ribs  
← Air Battens of Yacht
- Cloth → Panel Structure
- Joint less → Sea anemone type
- Less ribs & cloth  
→ Thin fiber like a dandelion
- Compound type cloth by a thin fiber.
- Disposable Structure  
like a paper or sponge
- Cloth of thin sponge structure  
to shed water
- Sponge that doesn't inhale water

- Air inflate structure.
- Fold machine of umbrella
- Mechanism that turn out the surface side of cloth by one operation
- Board umbrella like fan
- Good retractility for direction of radiation
- The bone persists in magnetism.
- The cloth adhere by magnetism each other.
- Multiple ribs
- Pinwheel structure
- Material that extends while water gets wet
- Cloth like paper folding
- Walking stick of jugglery
- Window shade that opens radially

- Not folded by pull action  
but folded by pushing.  
but folded by rotate  
but folded like Acordeon  
but folded like the fan
- It is possible to fold to the A4 panel size.
- Horizontal structure of window shade  
(Form with a multiple panel.)
- Umbrella of fan type
- Air curtain structure
- Cover that have function to squeeze
- Water-shedding quality to the cover.
- After use water disappears.

# 5. Solution Procedures



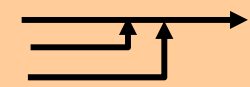
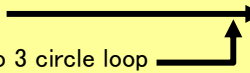

## 【5-1 : Idea Creation – Secondary】

Categorize (Grouping )

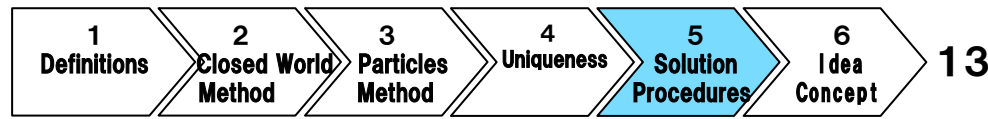
⇒ Generification ⇒

Transduction

Shaw below one part. (Actually we generate about 100 ideas)

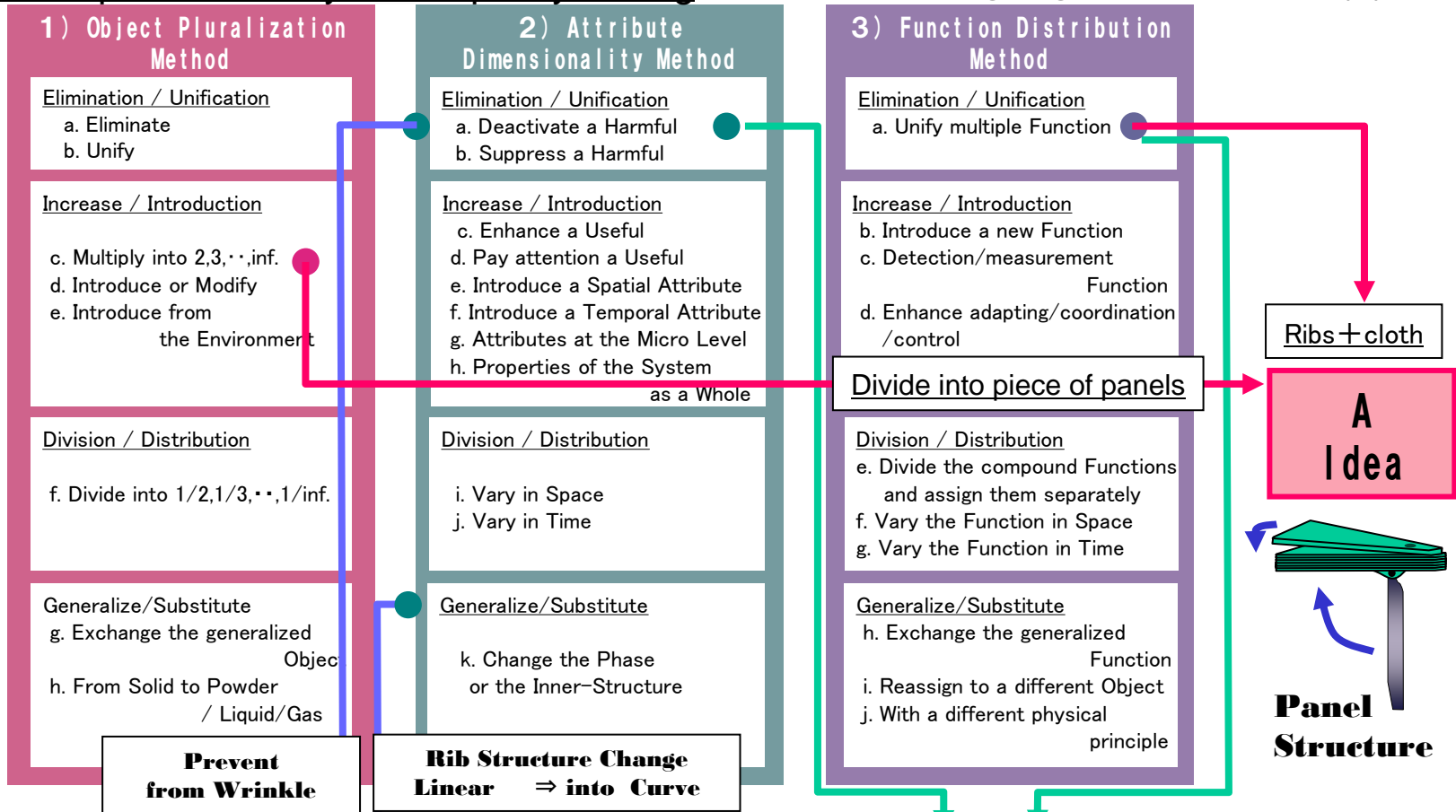
Category Large	Category Middle	Category Small	Generification Add ★	Transduction Add ★
Close Not be bulky Gp	Creaseless Gp	Panel Gp		★Panel cloth ☆Not Cloth but Board ☆A celluloid board Rib in the sale of yacht that hardens the cloth Air Battens of Yacht The outside of the cloth is hard. Cloth is soft when shutting and hard when using . Panel style fan likea chinese folding fan  Idea A-1  Idea A-2
		Soft Rib Gp		★1 Loop Rib ☆When twisted becomes to 3 circle loop Air born Type ★ Bone that rolled coil (like bone of lantern)  Idea B
	Fixing Crease Gp	Folding Gp		★Miura Or bamboo hat type umbrella ☆Miura ori with wire spring power ★ Like a japanese folding fan  Idea C
		Bellows Gp		★ Acordeon Folding in pleats japanese lantern like bellows
Ribs Not be bulky Gp	Junction Connecting Gp		↓ Omission As follows	
	No JunctionGp			

# 5. Solution Procedures



## 5 : Solution Procedures – Summary

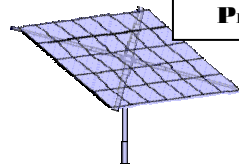
Idea Concept for Quickly & Compactly folding (※ The idea of not getting wet is omitted in this paper)



### Loop Rib Structure



Posted in "TRIZ Home Page in Japan" May, 2009



Prevent from Wrinkle

Closing time is shortened to one time

### Folding Fan Structure

# 6. Solution Concept

Idea Concept: Quick folding & Compactly storing

## A: Panel Gp

Combine the functions of Ribs & Cloth ,then devise

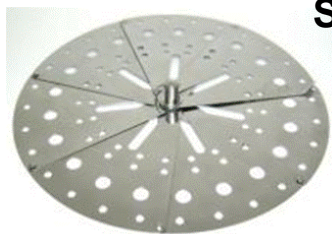
### 3. Function Distribution Method 3a: Unify multiple Function

Ribs (Support cloth function )+cloth (protected from getting wet.)

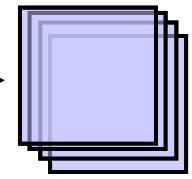
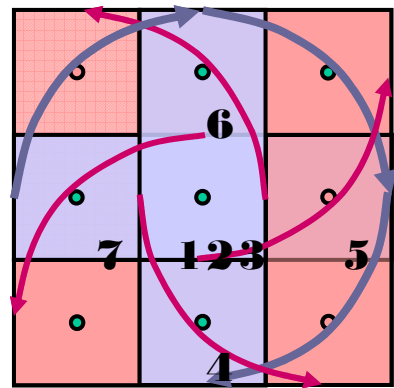
#### 1. Object Pluralization Method

1 f : Divide object into 1/2,1/3, • • ,1/inf  
Divide into piece of panels

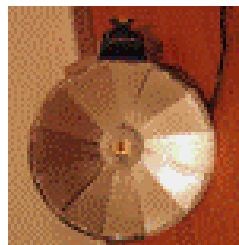
#### ◆ Idea Concept A-1



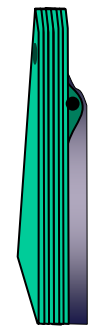
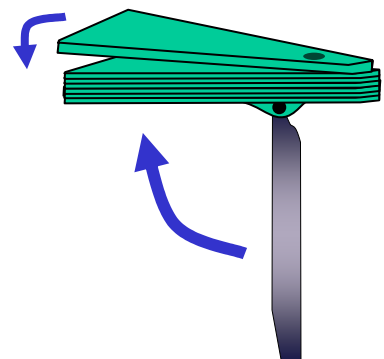
Size Changeable Lid



#### ◆ Idea Concept A-2



Flash Type



# 6. Solution Concept

Idea Concept: Quick folding & Compactly storing

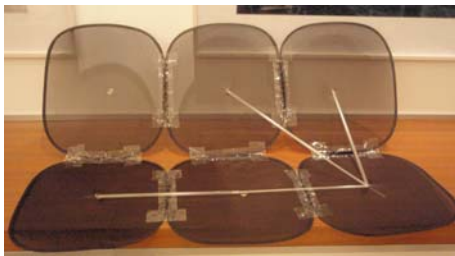
## C: Loop Rib Gp

2k : Change the Phase or the Inner-Structure

◆ Change the structure of Object ( Ribs ) Linear into Curve

2a : a. Deactivate a Harmful Attributes ◆ prevents from wrinkle of cloth

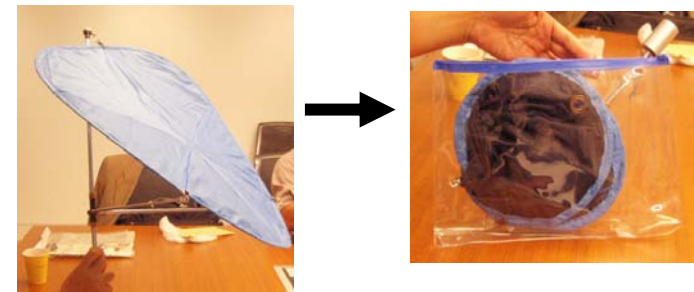
Sample1



Sample2

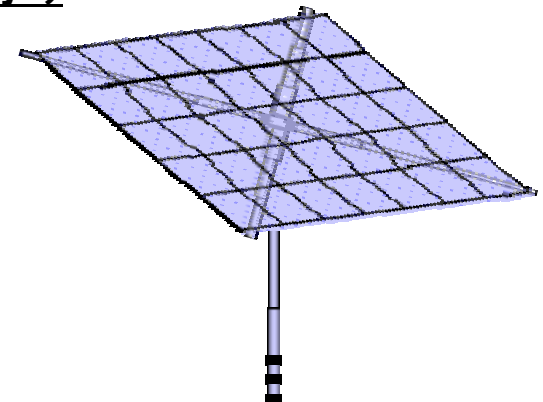
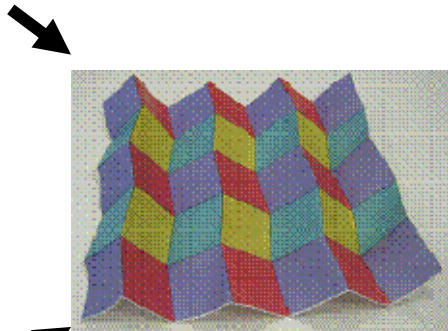


Sample3



## C: Folding Gp Miura Ori ( ← Open quickly fold quickly )

3a : Unify multiple Function ◆ Fold & Unfold at one action



## 1. Introduction of the USIT Approach for the Problem of Compact Umbrella

◆ We could have experienced USIT technique by a familiar theme, and have found the effectiveness at the same time. The excellent point of the USIT is to arise naturally the solving point of the problem while focusing there **object, attribute, and function** and combine them with unique feature of spatial or temporal side.

## 2. Various solution ideas and conceptual prototypes.

◆ Though it was not a purpose to output the Best solution but after adopting USIT approach, We could output various solution ideas of Compact Umbrella ie: Panel Style, Loop-rib Style, Folding Fan shape and so on.

## 3. New devices for USIT approach

◆ Various devices for improving USIT method are born and the effectiveness was able to be shared among members

- ★ Root cause analysis enhanced by a TOC thinking process
- ★ practical use of QFD in Quality—Change graph
- ★ personification for Object, and (d) template of the USIT process