THE HONG KONG INSTITUTION OF ENGINEERS
香 港 工 程 師 學 會

Tea Gathering, Veneree Club, HKIE

TRIZ and Design Thinking

17th May 2017

Wednesday

10 am till 12 noon

By Ir Dr. Victor LO
Chairman and Founding Director,
Institute of Systematic Innovation, Hong Kong

講者簡介：

- 盧興猷博士曾任教于香港大學「工業及製造系統工程系」二十多年, 現爲該系的榮譽講師。持有香港工程師學會資深會員資格。盧氏在過去的三十多年對工商界推廣優質管理不遺餘力。除了在國際會議及專業期刊中發表論文及報章專欄外，更特別關注管理方面的應用，以深入淺出之理論與實踐幷重著稱。他特別鑽研世界級企業管理, 所提倡的管理項目包括有：應用中華文化于現代管理，合理化生產，策略管理，優質管理，精益六西格瑪管理，客戶服務及創新方法等。

- 盧博士曾任香港工程師學會理事會成員、製造及工業工程部會長及該部紀律委員會主席、香港大學-工業工程協會會長、香港品質管理會議獎審核委員及香港工業獎(香港政府工業貿易署) - 品質獎評判委員、IRCA注册ISO9000審核員。 現爲英國標準局(太平洋) 認證諮詢委員會主席及技術專家、天祥集團-産品認證計劃委員會主席，香港認可處之技術專家、香港創新學會香港創新學會主席兼創始人、香港耀能協會（前香港痙攣協會）顧問。

创新能力建设已成我国发展的当务之急

- 2007年三月，三位老科学家向温总理写信，温总理批示"自主创新，方法先行。"

三位老科学家提出"自主创新，方法先行"。创新方法是自主创新的根本之源。这一重要观点应高度重视。所提三点建议，请科技部、教育部、发改委结合实际深入研究。有何意见望告。

温家宝
七月三日

P問

K知

I創

R行

National Institute of Standards and Technology (NIST)
美國國家標準與技術研究院

Customer Focus

HOW your organization engages its CUSTOMERS for long-term marketplace success, including HOW your organization listens to the VOICE OF THE CUSTOMER, builds CUSTOMER relationships, and uses CUSTOMER information to improve and to identify opportunities for **INNOVATION**.

Malcolm Baldrige National Quality Award

Malcolm Baldrige National Quality Award

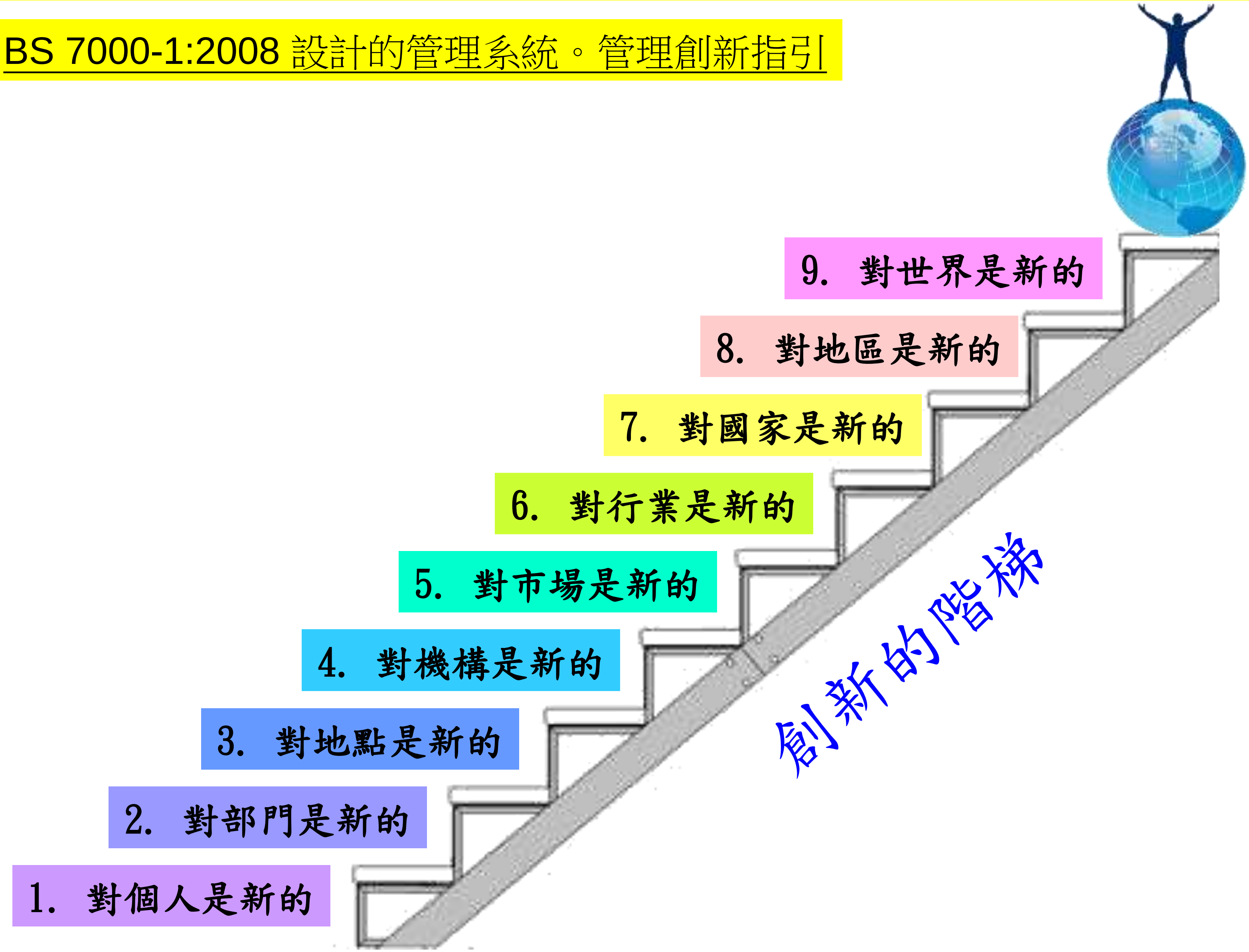
美國 波多里奇 國家質量獎

What is Innovation?

1. **The act of introducing something new (The American Heritage Dictionary)**
2. **The successful exploitation of new ideas (Dept. of Trade and Industry, UK)**
3. **Change that creates a new dimension of performance (Peter Drucker)**
4. **Novel ways to solve problem that bring values(Victor Lo)**

BS 7000-1:2008 Design management systems. Guide to managing innovation

BS 7000-1:2008 設計的管理系統。管理創新指引



Disruptive
Innovation

Smartphone Freedom 251
Launched in India
17 FEBRUARY 2016

Tata Nano XE

Modern innovator

Selling price:
USD 3,500 or HKD 27,000

Are you creative?

1--10

創新想象力隨着年齡減退

與小孩談論工作難題，可能令你有驚喜新意

思維與知識隨着年齡而改變

Thinking ability and knowledge change with age

學而不思則罔；

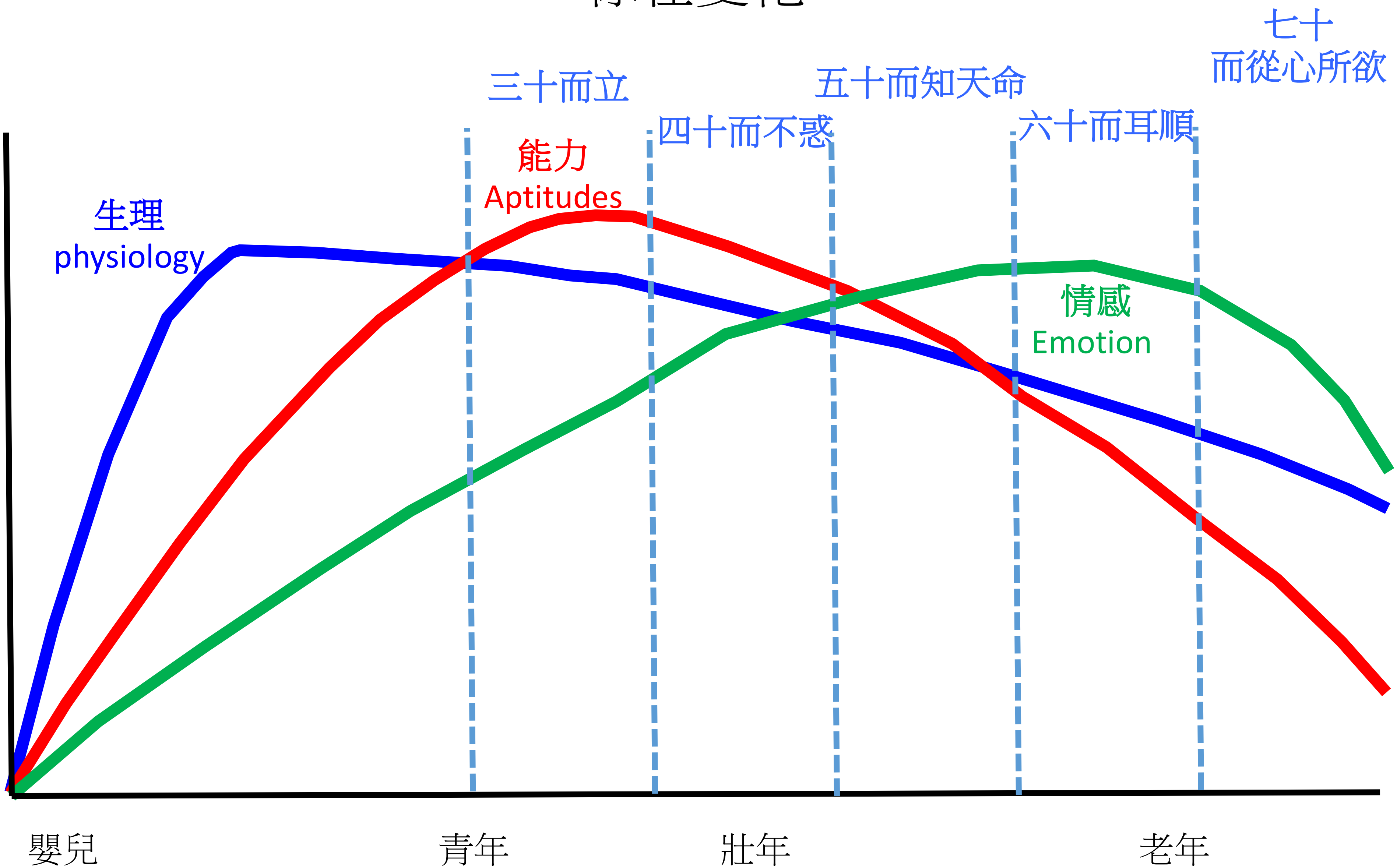
思而不學則殆。

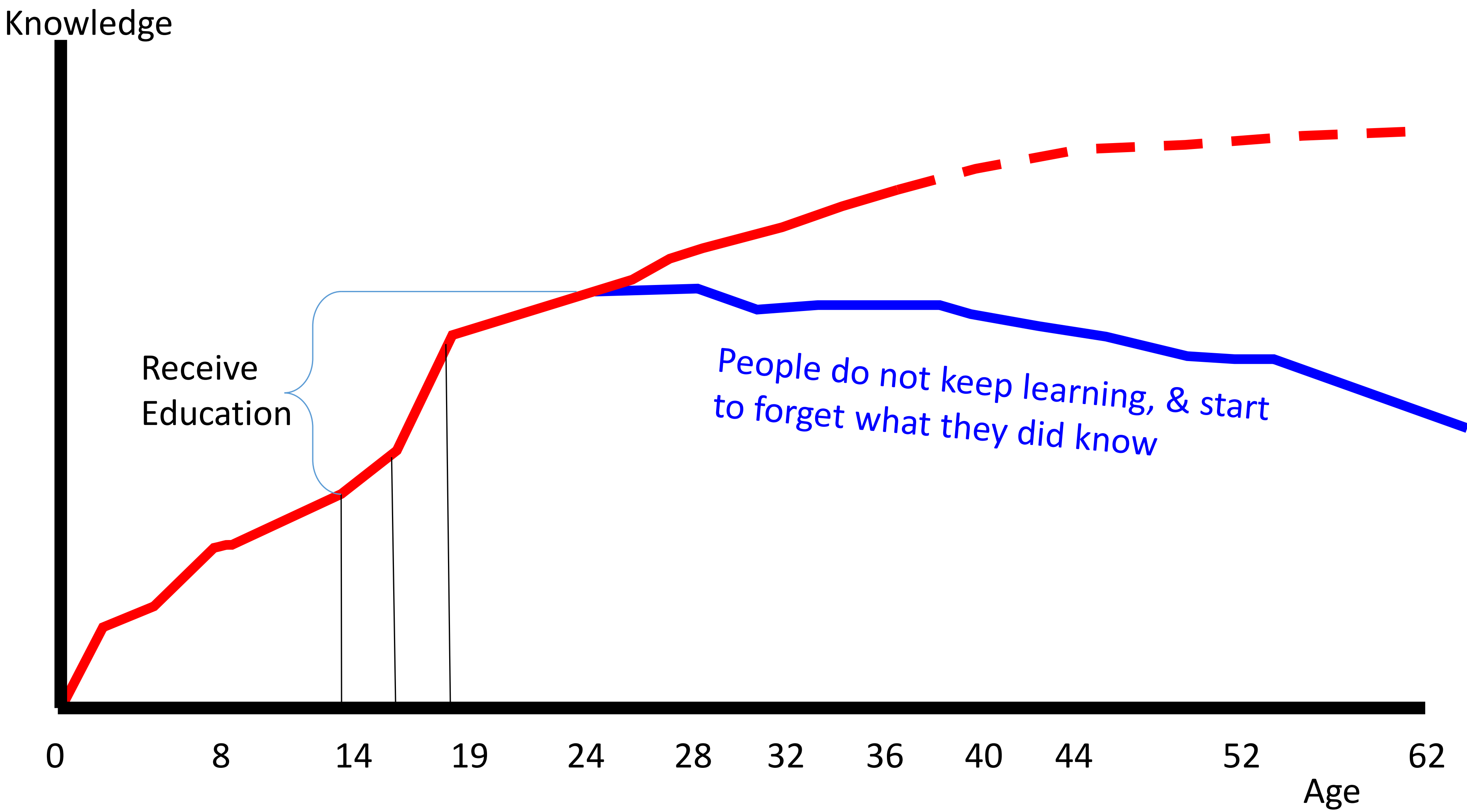
Learning without thought is useless;

thought without learning is dangerous.

三十而立； 三十歲時候能夠自立
四十而不惑；四十歲的時候不再被迷惑
五十而知天命；五十歲的時候明白自己的本份
六十而耳順；六十歲的時候聽到不中聽的話不會氣憤
七十而從心所欲；七十歲的時候能夠心裡怎麼想就怎麼做

你在變化


七十
而從心所欲
三十而立
五十而知天命
四十而不惑
六十而耳順
能力
Aptitudes
生理
physiology
情感
Emotion
嬰兒
青年
壯年
老年



Remarks:- keep learning disregard of age

Source: www.rebootyou.com

香港競爭力...創新主要學派

香港創新時代
The Innovation era
2010 … 2017

TRIZ 通過分析發明專利、解決技術問題

Design Thinking 從人的需求出發，為各種議題尋求創新解決方案

Design Thinking
(People Centered Innovation)

「人本創新」思維法

設計思考

是一種創新方法，而此創新方法的源頭，不是科技的進步，而是回歸到『以人為中心』的思考，以設計師的敏感度和方法，運用可行的科技，以及能轉化成顧客價值，來滿足人們的需求。

“Design Thinkers” create solutions which bring new meanings and which stimulate the various aspects (cognitive, emotional and sensory) involved in the human experience.


Tim Brown


David Kelly


Tom Kelly

沖繩那霸的日航酒店，自助早餐有各種西式補丸供選擇。 Nov 2014

How to do it?

人本創新


CITRUCASA


Minute Maid
PREMIUM
ORANGE
100%
ORIGINAL
PULP FREE
Simply Orange
Florida's Natural
PREMIUM
Squeezed From
Our Fresh
Florida Oranges
USA

TRIZ

俄文：теории решения изобретательских задач

Theory of Inventive Problem Solving (TIPS)

發明家式的解決任務理論

台灣:「萃思」，取其「萃取思考」之義

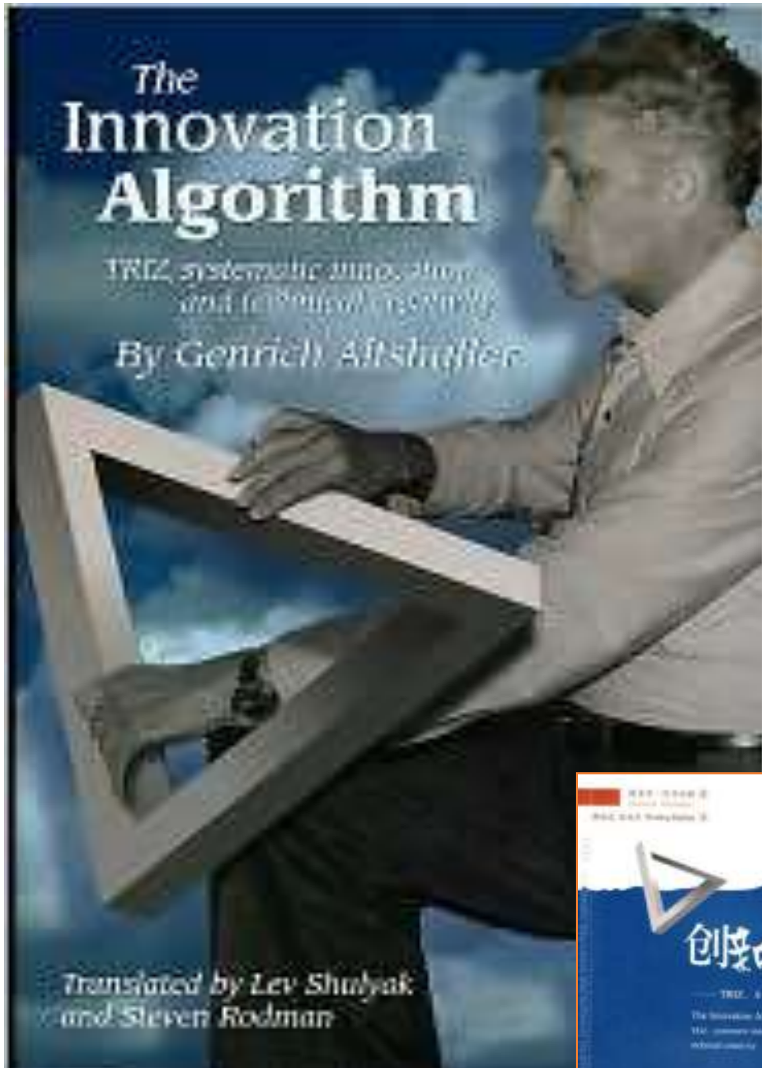
大陸:「萃智」理论

My TRIZ teachers:

Dr. Ikovenko

Prof. Daniel Shu

Dr. Michael YH Li



The Innovation Algorithm - TRIZ, systematic Innovation and technical creativity

Author: Genrich Altshuller

(English)1999

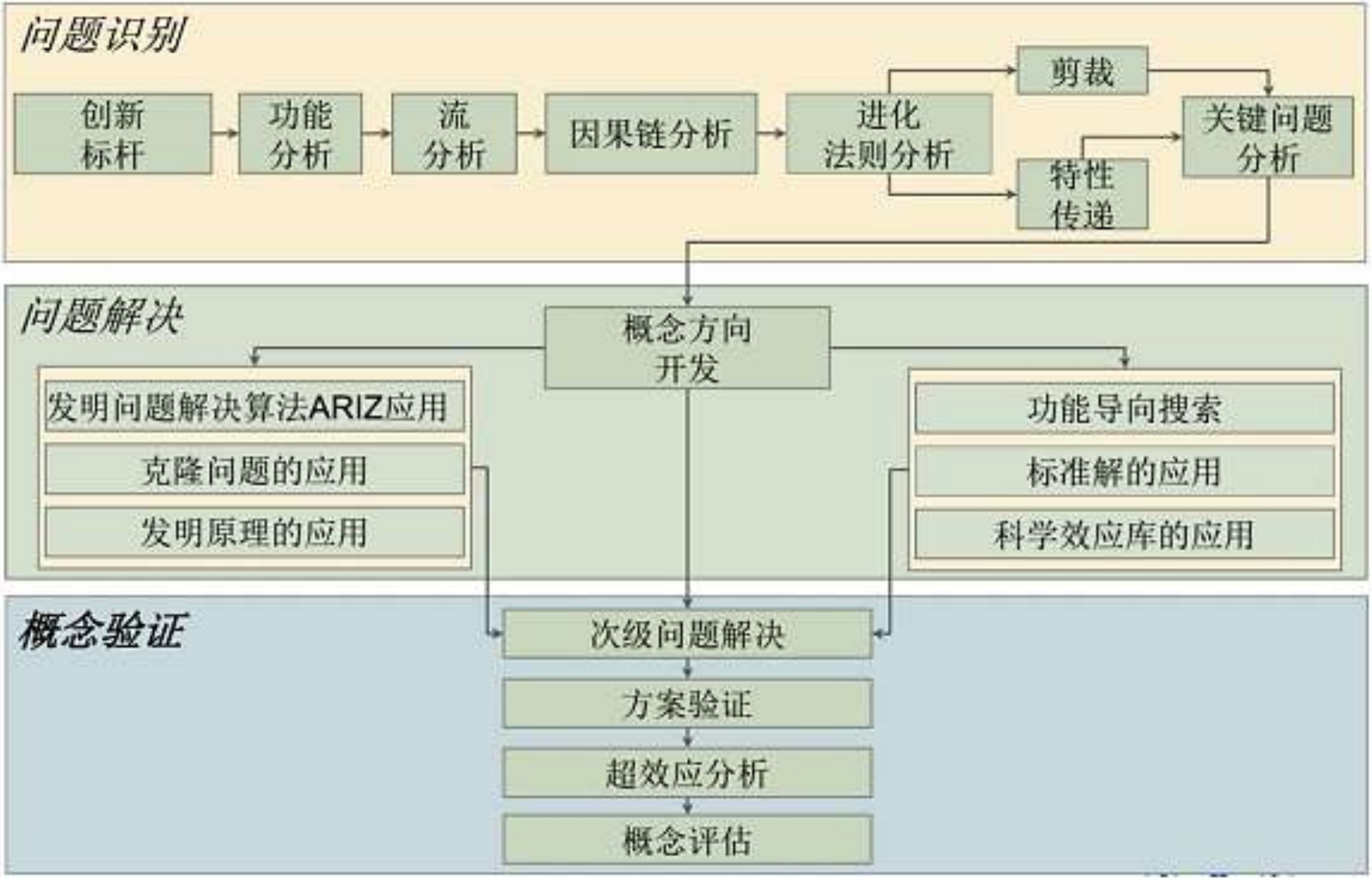
本書是發明問題解決理論（TRIZ）

創新方法發展的里程碑，是二十多年研究與分析的結果。

Altshuller詳細介紹了TRIZ的解決問題的解決方案（ARIZ），可以產生最高級別的創新。 飽含深刻的思想，見解和例子

這本書被許多人視為Altshuller的大作品，他的創作和技術革命手冊。

Chinese translation 2008


问题识别
创新标杆
功能分析
流分析
因果链分析
进化法则分析
剪裁
特性传递
关键问题分析
问题解决
概念方向开发
发明问题解决算法ARIZ应用
克隆问题的应用
发明原理的应用
功能导向搜索
标准解的应用
科学效应库的应用
概念验证
次级问题解决
方案验证
超效应分析
概念评估

5 個 TRIZ 支柱 - 功能，資源，理想，矛盾，演變
5 TRIZ pillars - Functionality, Resources, Ideality, Contradiction, Evolution

顧客買的是 - **功能**
Customers buy - Functions

Not Products
而不是產品

Nor Services
也不是服務

Use Of Resources

Maximization of use of everything contained within a system.

Idle resources

Anything in the system which is not being used.

最大值

$$\text{理想Ideality}=\frac{\text{所有有用的功能}}{\text{所有有害的功能}}$$

Ideal Final Result 最終理想解：

在解決問題之初，拋開各種客觀限制條件，定義出問題的IFR,即解決處於理想狀態， 從而得到解決問題的方向；最終理想解(IFR)提供了創新的目標。

最終理想解特点：

1. 消除缺陷
2. 保留優點
3. 不使更複雜
4. 不使有新的缺陷
5. 利用現有資源

- Resolve **<u>Contradiction</u>**, then problems will gone.
  解決矛盾後，問題就不再出現.

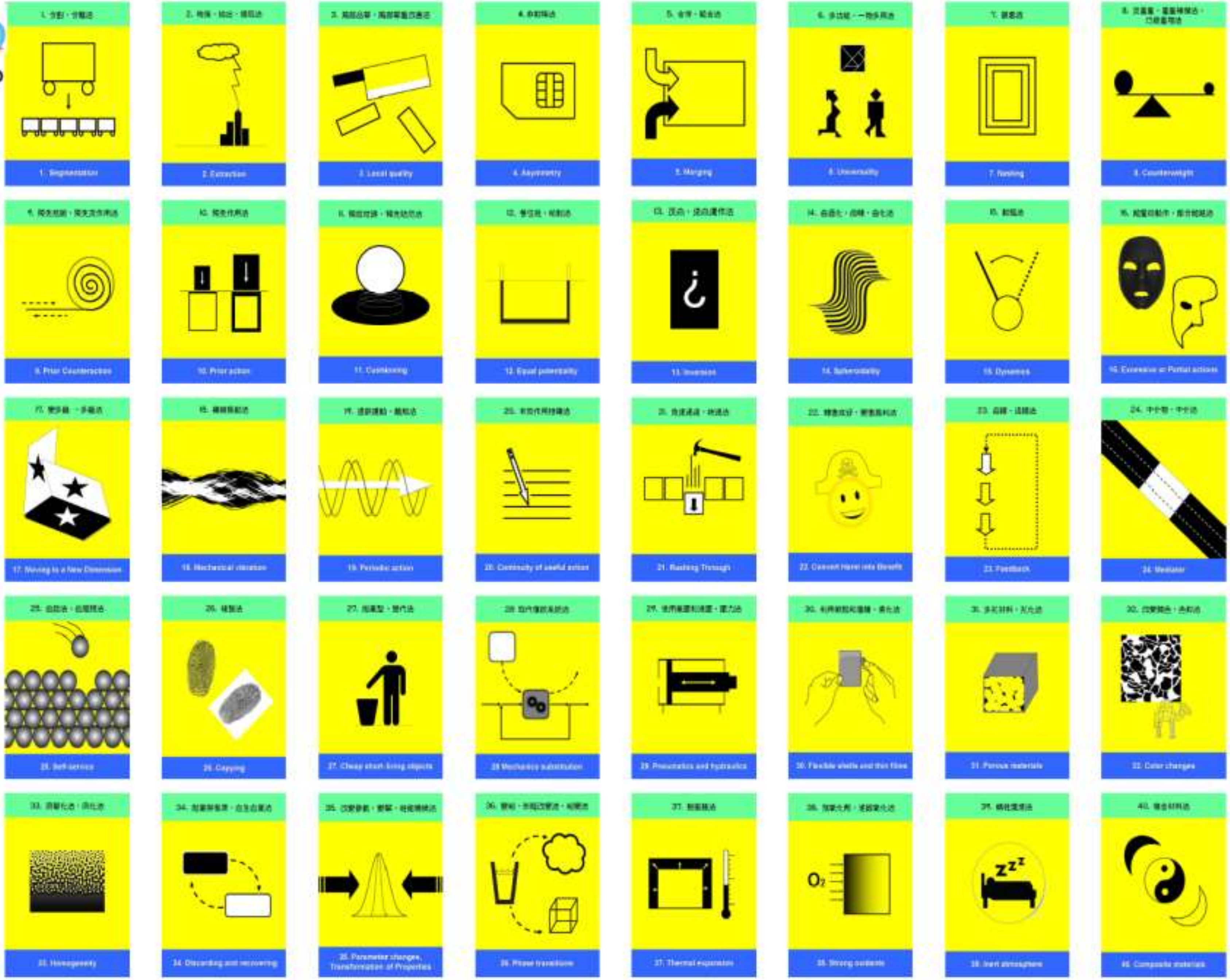
- He found 40 solution concepts to be applied repeatedly and called them inventive principles (40 IPs). 他找出40個重複被應用的解決概念，並稱之為發明原理.

TRIZ 40 innovation principles

1.Segmentation	21. Skipping
2.Taking out	22. "Turn Lemons into Lemonade"
3.Local quality	23 Feedback
4.Asymmetry	24. 'Intermediary'
5.Merging	25. Self-service
6.Universality	26. Copying
7."Nested doll"	27. Cheap short living objects
8.Anti-weight	28. Mechanics substitution
9.Preliminary anti-action	29. Pneumatics and hydraulics
10.Preliminary action	30. Flexible shells and thin films
11.Beforehand cushioning	31. Porous materials
12.Equipotentiality	32. Color changes
13.'The other way round	33. Homogeneity
14.Spheroidality-Curvature	34. Discarding and recovering
15.Dynamics	35. Parameter changes
16.Partial or excessive actions	36. Phase transitions
17.Another dimension	37. Thermal expansion
18.Mechanical vibration	38. Strong oxidants
19.Periodic action	39. Inert atmosphere
20.Continuity of useful action	40. Composite materials

40 Innovation Principle Icons

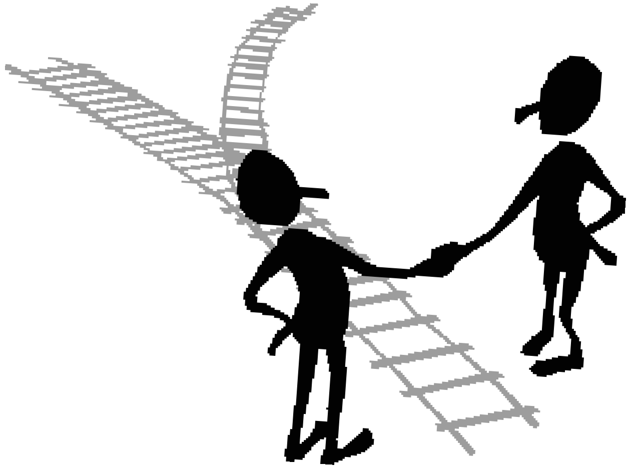
© Victor Lo

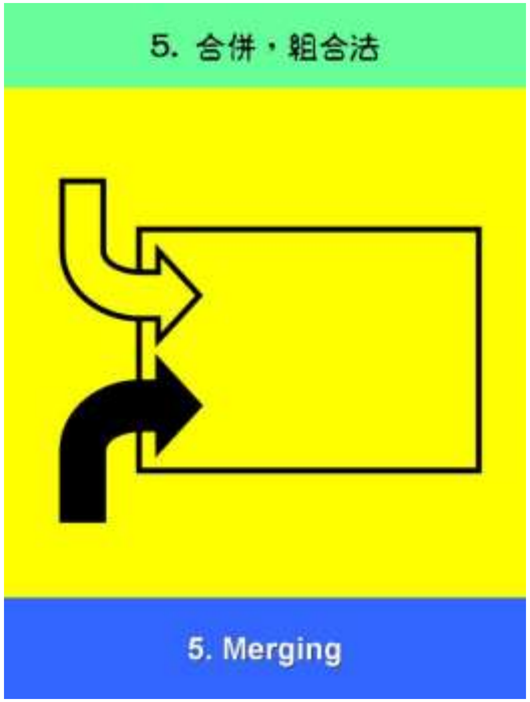


合併 Merging

a. 將相同或相關的物體、作業、或功能實體連接或合併

b. 合併物體、作業、或功能，使其在時間上一起作用



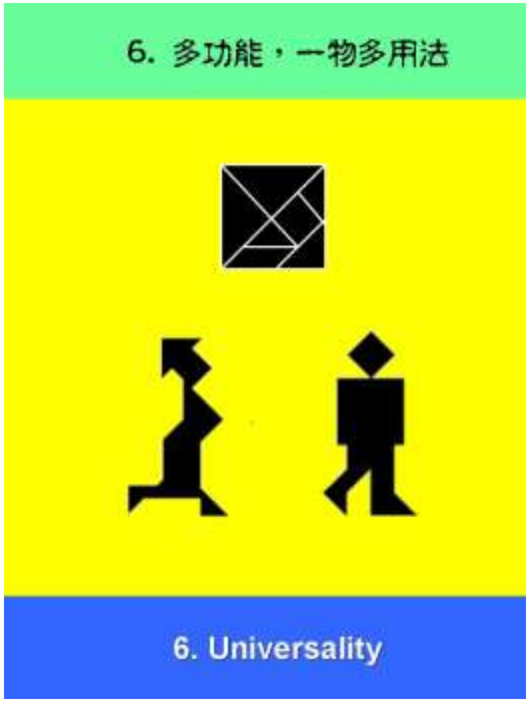


IP 5

多功能 Universality

a. 集多種功能於一身，以消除對其他系統的需求(依賴以完成功能)

b. 使用標準功能

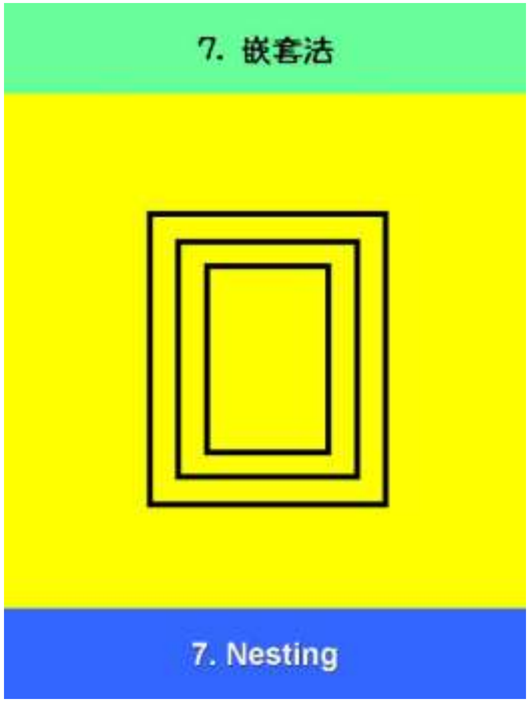


IP 6

嵌套法 Nesting

a. 物體內可放入另一物體

b. 將多數物體或系統放置在其他物體或系統內

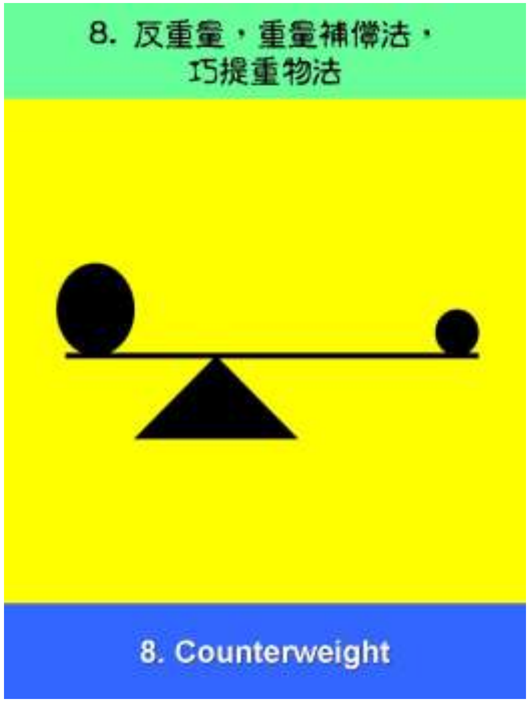


IP 7

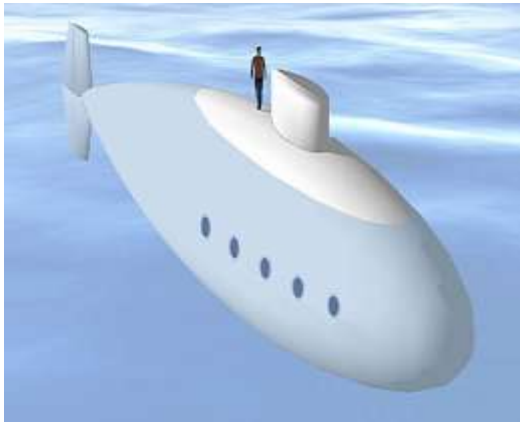
反重量 Counterweight

a. 結合能提供上升力量的物體，平衡物體的重量

b. 利用環境中產生的空氣動力、水動力、浮力等，平衡物體的重量



潛艇的浮潛艇氣缸

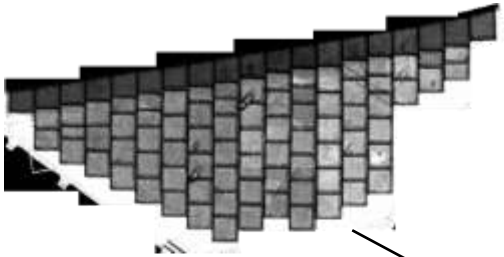


IP 8

預先抵銷 Prior Counteraction

a. 如果一個包含有害與有用的作用，事先進行反作用的行動，以去除或降低有害的效果。

b. 對有害的作用或事件，預先采取相反的作用。



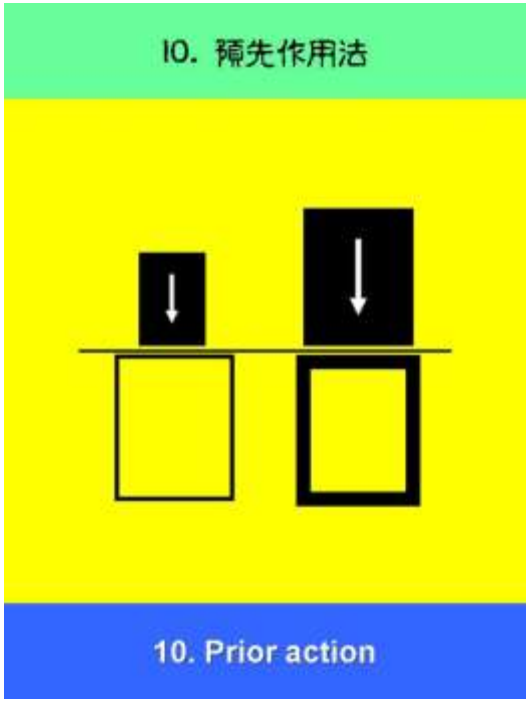
航天飛機使用的耐熱磚，以保護飛船

IP 9

預先作用 Prior action

a. 事先準備使物體可及時並在適當的地方作用

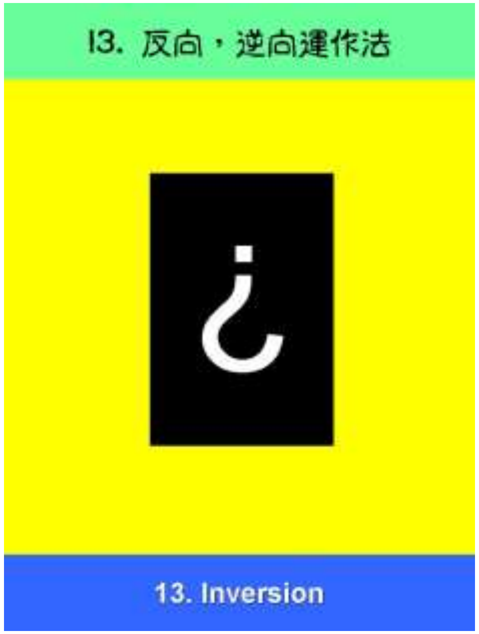
b. 將有用的物體預置，以便使其在必要時能立即在最方便的位置起作用



IP 10

Moving sidewalk with standing people.

移動人行道與站立的人

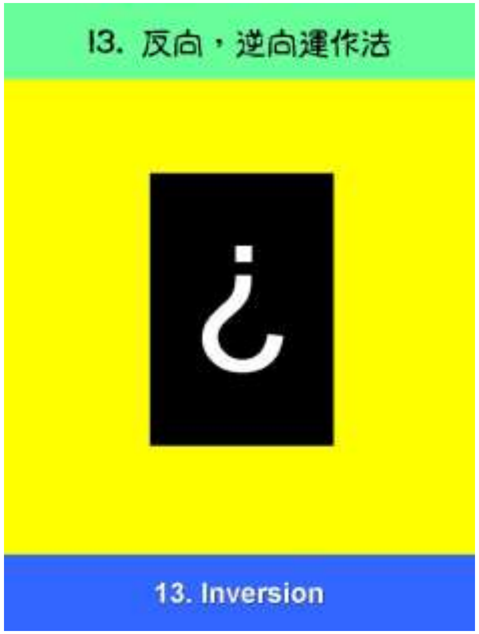


IP 13

13.2) Make movable parts (or the external environment) fixed, and fixed parts movable. 把一個可移動的物體固定，把一個固定的物體讓它變成可移動。

Walking exercise machine

步行運動機



IP 13

13.2) Make movable parts (or the external environment) fixed, and fixed parts movable. 把一個可移動的物體固定，把一個固定的物體讓它變成可移動。

TRIZ 39 System Parameters Quick Reference

1. Weight of moving object	21. Power
2. Weight of nonmoving object	22. Waste of energy
3. Length of moving object	23. Waste of substance
4. Length of nonmoving object	24. Loss of information
5. Area of moving object	25. Waste of time
6. Area of nonmoving object	26. Amount of substance
7. Volume of moving object	27. Reliability
8. Volume of nonmoving object	28. Accuracy of measurement
9. Speed	29. Accuracy of manufacturing
10. Force	30. Harmful factors acting on object
11. Tension, pressure	31. Harmful side effects
12. Shape	32. Manufacturability
13. Stability of object	33. Convenience of use
14. Strength	34. Reparability
15. Durability of moving object	35. Adaptability
16. Nonmoving object Durability	36. Complexity of device
17. Temperature	37. Complexity of control
18. Brightness	38. Level of automation
19. Energy spent by moving object	39. Productivity
20. Energy spent by nonmoving object	

TRIZ 39 System Parameters Quick Reference Cards by Victor Lo

創新 = 問 知 創 行

INNOVATION

Dr Victor Lo

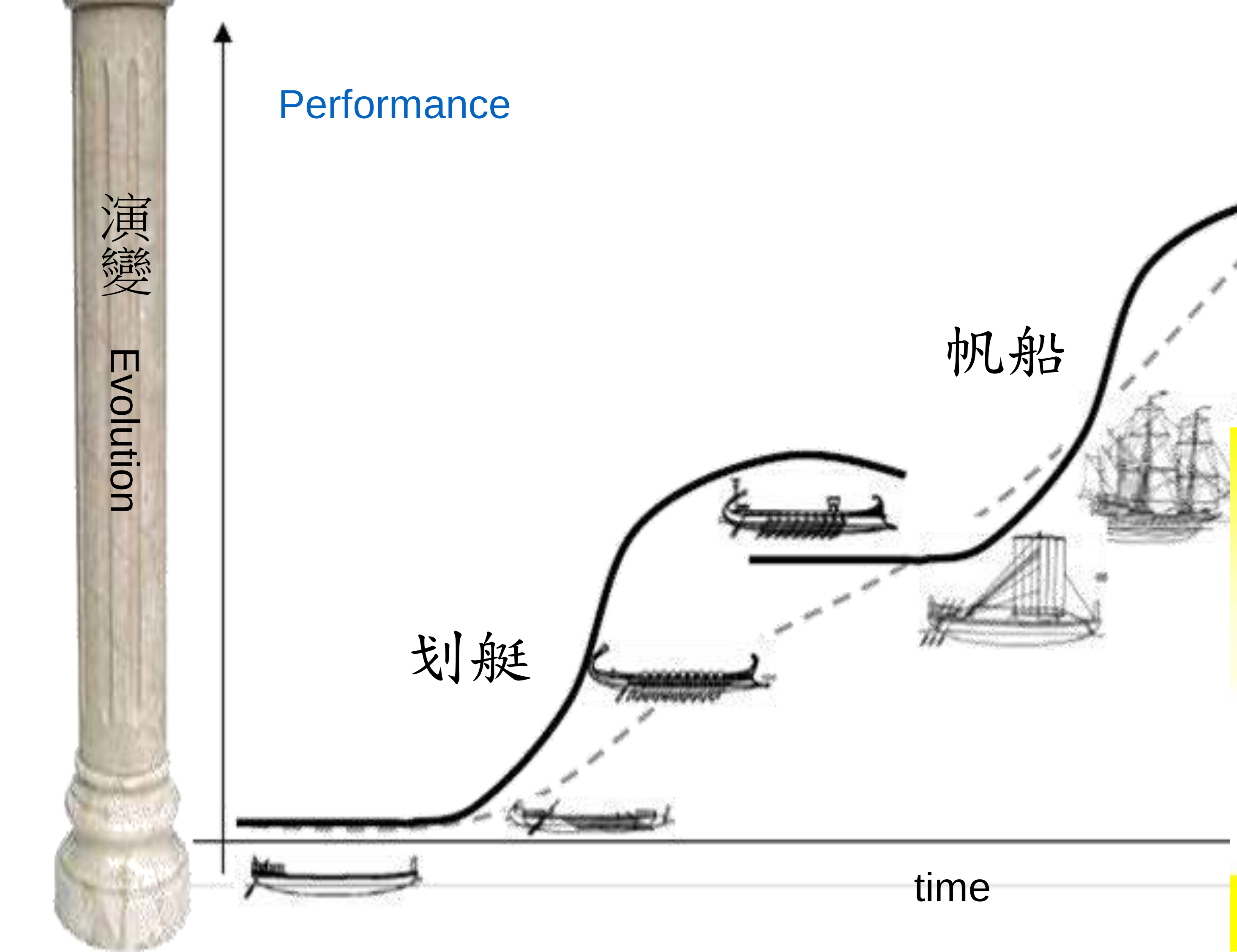
惡化的參數 Worsing Parameters

39 X 39 矛盾矩陣 Contradiction Matrix

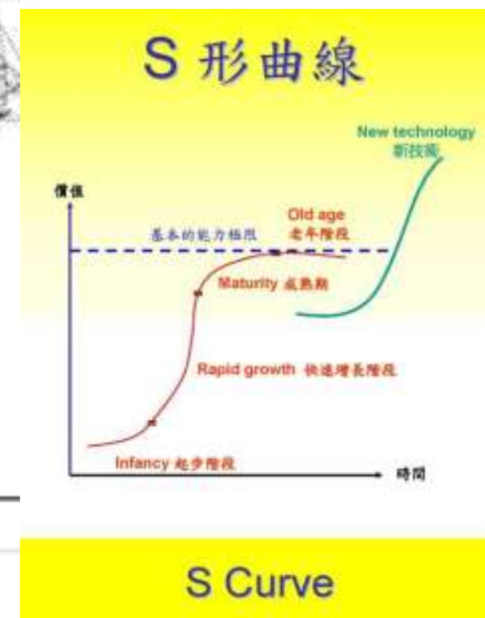
改進的參數 Improving Parameters

改進的參數 Improving Parameters	1 移動件重量	2 固定件重量	3 移動件長度	4 固定件長度	5 移動件面積	6 固定件面積	7 移動件體積	8 固定件體積	9 速度	10 力量	11 張力、壓力	12 形狀	13 物體穩定性	14 強度	15 移動件耐久性	16 固定件重量	17 溫度	18 亮度	19 移動件消耗能量	20 固定件消耗能量	21 動力	22 能量浪費	23 物質浪費	24 資訊損失	25 時間浪費	26 物質數量	27 可靠度	28 量測精確度	29 製造精確度	30 物體上有害因子	31 有害的效應	32 可製造性	33 使用方便性	34 可修理性	35 適合性	36 裝置複雜性	37 控制複雜性	38 自動化程度	39 可生產性
1 移動件重量 Weight of moving object	+		15, 8, 29, 34		29, 17, 38, 34		29, 2, 40, 28		2, 8, 15, 38	8, 10, 18, 37	10, 36, 37, 40	10, 14, 35, 40	1, 35, 19, 39	28, 27, 18, 40	5, 34, 31, 35		6, 29, 4, 38	19, 1, 32	35, 12, 34, 31		12, 36, 18, 31	6, 2, 34, 19	5, 35, 3, 31	10, 24, 35	10, 35, 20, 28	3, 26, 18, 31	1, 3, 11, 27	28, 27, 35, 26	28, 35, 26, 18	22, 21, 18, 27	22, 35, 31, 39	27, 28, 1, 36	35, 3, 2, 24	2, 27, 28, 11	29, 5, 15, 8	26, 30, 36, 34	28, 29, 26, 32	26, 35, 18, 19	35, 3, 24, 37
2 固定件重量 Weight of stationary object		+		10, 1, 29, 35		35, 30, 13, 2		5, 35, 14, 2		8, 10, 19, 35	13, 29, 10, 18	13, 10, 29, 14	26, 39, 1, 40	28, 2, 10, 27		2, 27, 19, 6	28, 19, 32, 22	19, 32, 35		18, 19, 28, 1	15, 19, 18, 22	18, 19, 28, 15	5, 8, 13, 30	10, 15, 35	10, 20, 35, 26	19, 6, 18, 26	10, 28, 8, 3	18, 26, 28	10, 1, 35, 17	2, 19, 22, 37	35, 22, 1, 39	28, 1, 9	6, 13, 1, 32	2, 27, 28, 11	19, 15, 29	1, 10, 26, 39	25, 28, 17, 15	2, 26, 35	1, 28, 15, 35
3 移動件長度 Length of moving object	8, 15, 29, 34		+		15, 17, 4		7, 17, 4, 35		13, 4, 8	17, 10, 4	1, 8, 35	1, 8, 10, 29	1, 8, 15, 34	8, 35, 29, 34	19		10, 15, 19	32	8, 35, 24		1, 35	7, 2, 35, 39	4, 29, 23, 10	1, 24	15, 2, 29	29, 35	10, 14, 29, 40	28, 32, 4	10, 28, 29, 37	1, 15, 17, 24	17, 15	1, 29, 17	15, 29, 35, 4	1, 28, 10	14, 15, 1, 16	1, 19, 26, 24	35, 1, 26, 24	17, 24, 26, 16	14, 4, 28, 29
4 固定件長度 Length of stationary object		35, 28, 40, 29		+		17, 7, 10, 40		35, 8, 2, 14		28, 10	1, 14, 35	13, 14, 15, 7	39, 37, 35	15, 14, 28, 26		1, 10, 35	3, 35, 38, 18	3, 25			12, 8	6, 28	10, 28, 24, 35	24, 26	30, 29, 14		15, 29, 28	32, 28, 3	2, 32, 10	1, 18		15, 17, 27	2, 25	3	1, 35	1, 26	26		30, 14, 7, 26
5 移動件面積 Area of moving object	2, 17, 29, 4		14, 15, 18, 4		+		7, 14, 17, 4		29, 30, 4, 34	19, 30, 35, 2	10, 15, 36, 28	5, 34, 29, 4	11, 2, 13, 39	3, 15, 40, 14	6, 3		2, 15, 16	15, 32, 19, 13	19, 32		19, 10, 32, 18	15, 17, 30, 26	10, 35, 2, 39	30, 26	26, 4	29, 30, 6, 13	29, 9	26, 28, 32, 3	2, 32	22, 33, 28, 1	17, 2, 18, 39	13, 1, 26, 24	15, 17, 13, 16	15, 13, 10, 1	15, 30	14, 1, 13	2, 36, 26, 18	14, 30, 28, 23	10, 26, 34, 2
6 固定件面積 Area of stationary object		30, 2, 14, 18		26, 7, 9, 39		+				1, 18, 35, 36	10, 15, 36, 37		2, 38	40		2, 10, 19, 30	35, 39, 38				17, 32	17, 7, 30	10, 14, 18, 39	30, 16	10, 35, 4, 18	2, 18, 40, 4	32, 35, 40, 4	26, 28, 32, 3	2, 29, 18, 36	27, 2, 39, 35	22, 1, 40	40, 16	16, 4	16	15, 16	1, 18, 36	2, 35, 30, 18	23	10, 15, 17, 7
7 移動件體積 Volume of moving object	2, 26, 29, 40		1, 7, 4, 35		1, 7, 4, 17		+		29, 4, 38, 34	15, 35, 36, 37	6, 35, 36, 37	1, 15, 29, 4	28, 10, 1, 39	9, 14, 15, 7	6, 35, 4		34, 39, 10, 18	2, 13, 10	35		35, 6, 13, 18	7, 15, 13, 16	36, 39, 34, 10	2, 22	2, 6, 34, 10	29, 30, 7	14, 1, 40, 11	25, 26, 28	25, 28, 2, 16	22, 21, 27, 35	17, 2, 40, 1	29, 1, 40	15, 13, 30, 12	10	15, 29	26, 1	29, 26, 4	35, 34, 16, 24	10, 6, 2, 34
8 固定件體積 Volume of stationary object		35, 10, 19, 14	19, 14	35, 8, 2, 14				+		2, 18, 37	24, 35	7, 2, 35	34, 28, 35, 40	9, 14, 17, 15		35, 34, 38	35, 6, 4				30, 6		10, 39, 35, 34		35, 16, 32, 18	35, 3	2, 35, 16		35, 10, 25	34, 39, 19, 27	30, 18, 35, 4	35		1		1, 31	2, 17, 26		35, 37, 10, 2
9 速度 Speed	2, 28, 13, 38		13, 14, 8		29, 30, 34		7, 29, 34		+	13, 28, 15, 19	6, 18, 38, 40	35, 15, 18, 34	28, 33, 1, 18	8, 3, 26, 14	3, 19, 35, 5		28, 30, 36, 2	10, 13, 19	8, 15, 35, 38		19, 35, 38, 2	14, 20, 19, 35	10, 13, 28, 38	13, 26		10, 19, 29, 38	11, 35, 27, 28	28, 32, 1, 24	10, 28, 32, 25	1, 28, 35, 23	2, 24, 35, 21	35, 13, 8, 1	32, 28, 13, 12	34, 2, 28, 27	15, 10, 26	10, 28, 4, 34	3, 34, 27, 16	10, 18	
10 力量 Force	8, 1, 37, 18	18, 13, 1, 28	17, 19, 9, 36	28, 10	19, 10, 15	1, 18, 36, 37	15, 9, 12, 37	2, 36, 18, 37	13, 28, 15, 12	+	18, 21, 11	10, 35, 40, 34	35, 10, 21	35, 10, 14, 27	19, 2		35, 10, 21		19, 17, 10	1, 16, 36, 37	19, 35, 18, 37	14, 15	8, 35, 40, 5		10, 37, 36	14, 29, 18, 36	3, 35, 13, 21	35, 10, 23, 24	28, 29, 37, 36	1, 35, 40, 18	13, 3, 36, 24	15, 37, 18, 1	1, 28, 3, 25	15, 1, 11	15, 17, 18, 20	26, 35, 10, 18	36, 37, 10, 19	2, 35	3, 28, 35, 37
11 張力、壓力 Stress or pressure	10, 36, 37, 40	13, 29, 10, 18	35, 10, 36	35, 1, 14, 16	10, 15, 36, 28	10, 15, 36, 37	6, 35, 10	35, 24	6, 35, 36	36, 35, 21	+	35, 4, 15, 10	35, 33, 2, 40	9, 18, 3, 40	19, 3, 27		35, 39, 19, 2		14, 24, 10, 37		10, 35, 14	2, 36, 25	10, 36, 3, 37		37, 36, 4	10, 14, 36	10, 13, 19, 35	6, 28, 25	3, 35	22, 2, 37	2, 33, 27, 18	1, 35, 16	11	2	35	19, 1, 35	2, 36, 37	35, 24	10, 14, 35, 37
12 形狀 Shape	8, 10, 29, 40	15, 10, 26, 3	29, 34, 5, 4	13, 14, 10, 7	5, 34, 4, 10		14, 4, 15, 22	7, 2, 35	35, 15, 34, 18	35, 10, 37, 40	34, 15, 10, 14	+	33, 1, 18, 4	30, 14, 10, 40	14, 26, 9, 25		22, 14, 19, 32	13, 15, 32	2, 6, 34, 14		4, 6, 2	14	35, 29, 3, 5		14, 10, 34, 17	36, 22	10, 40, 16	28, 32, 1	32, 30, 40	22, 1, 2, 35	35, 1	1, 32, 17, 28	32, 15, 26	2, 13, 1	1, 15, 29	16, 29, 1, 28	15, 13, 39	15, 1, 32	17, 26, 34, 10
13 物體穩定性 Stability of the object's composition	21, 35, 2, 39	26, 39, 1, 40	13, 15, 1, 28	37	2, 11, 13	39	28, 10, 19, 39	34, 28, 35, 40	33, 15, 28, 18	10, 35, 21, 16	2, 35, 40	22, 1, 18, 4	+	17, 9, 15	13, 27, 10, 35	39, 3, 35, 23	35, 1, 32	32, 3, 27, 16	13, 19	27, 4, 29, 18	32, 35, 27, 31	14, 2, 39, 6	2, 14, 30, 40		35, 27	15, 32, 35		13	18	35, 24, 30, 18	35, 40, 27, 39	35, 19	32, 35, 30	2, 35, 10, 16	35, 30, 34, 2	2, 35, 22, 26	35, 22, 39, 23	1, 8, 35	23, 35, 40, 3
14 強度 Strength	1, 8, 40, 15	40, 26, 27, 1	1, 15, 8, 35	15, 14, 28, 26	3, 34, 40, 29	9, 40, 28	10, 15, 14, 7	9, 14, 17, 15	8, 13, 26, 14	10, 18, 3, 14	10, 3, 18, 40	10, 30, 35, 40	13, 17, 35	+	27, 3, 26		30, 10, 40	35, 19	19, 35, 10	35	10, 26, 35, 28	35	35, 28, 31, 40		29, 3, 28, 10	29, 10, 27	11, 3	3, 27, 16	3, 27	18, 35, 37, 1	15, 35, 22, 2	11, 3, 10, 32	32, 40, 25, 2	27, 11, 3	15, 3, 32	2, 13, 25, 28	27, 3, 15, 40	15	29, 35, 10, 14
15 移動件耐久性 Duration of action of moving object	19, 5, 34, 31		2, 19, 9		3, 17, 19		10, 2, 19, 30		3, 35, 5	19, 2, 16	19, 3, 27	14, 26, 28, 25	13, 3, 35	27, 3, 10	+		19, 35, 39	2, 19, 4, 35	28, 6, 35, 18		19, 10, 35, 38		28, 27, 3, 18	10	20, 10, 28, 18	3, 35, 10, 40	11, 2, 13	3	3, 27, 16, 40	22, 15, 33, 28	21, 39, 16, 22	27, 1, 4	12, 27	29, 10, 27	1, 35, 13	10, 4, 29, 15	19, 29, 39, 35	6, 10	35, 17, 14, 19
16 固定件重量 Duration of action by stationary object		6, 27, 19, 16		1, 40, 35				35, 34, 38					39, 3, 35, 23			+	19, 18, 36, 40				16		27, 16, 18, 38	10	28, 20, 10, 16	3, 35, 31	34, 27, 6, 40	10, 26, 24		17, 1, 40, 33	22	35, 10	1	1	2		25, 34, 6, 35	1	20, 10, 16, 38
17 溫度 Temperature	36, 22, 6, 38	22, 35, 32	15, 19, 9	15, 19, 9	3, 35, 39, 18	35, 38	34, 39, 40, 18	35, 6, 4	2, 28, 36, 30	35, 10, 3, 21	35, 39, 19, 2	14, 22, 19, 32	1, 35, 32	10, 30, 22, 40	19, 13, 39	19, 18, 36, 40	+	32, 30, 21, 16	19, 15, 3, 17		2, 14, 17, 25	21, 17, 35, 38	21, 36, 29, 31		35, 28, 21, 18	3, 17, 30, 39	19, 35, 3, 10	32, 19, 24	24	22, 33, 35, 2	22, 35, 2, 24	26, 27	26, 27	4, 10, 16	2, 18, 27	2, 17, 16	3, 27, 35, 31	26, 2, 19, 16	15, 28, 35
18 亮度 Illumination intensity	19, 1, 32	2, 35, 32	19, 32, 16		19, 32, 26		2, 13, 10		10, 13, 19	26, 19, 6		32, 30	32, 3, 27	35, 19	2, 19, 6		32, 35, 19	+	32, 1, 19	32, 35, 1, 15	32	13, 16, 1, 6	13, 1	1, 6	19, 1, 26, 17	1, 19		11, 15, 32	3, 32	15, 19	35, 19, 32, 39	19, 35, 28, 26	28, 26, 19	15, 17, 13, 16	15, 1, 19	6, 32, 13	32, 15	2, 26, 10	2, 25, 16
19 移動件消耗能量 Use of energy by moving object	12, 18, 28, 31		12, 28		15, 19, 25		35, 13, 18		8, 35, 35	16, 26, 21, 2	23, 14, 25	12, 2, 29	19, 13, 17, 24	5, 19, 9, 35	28, 35, 6, 18	-	19, 24, 3, 14	2, 15, 19	+	-	6, 19, 37, 18	12, 22, 15, 24	35, 24, 18, 5		35, 38, 19, 18	34, 23, 16, 18	19, 21, 11, 27	3, 1, 32		1, 35, 6, 27	2, 35, 6	28, 26, 30	19, 35	1, 15, 17, 28	15, 17, 13, 16	2, 29, 27, 28	35, 38	32, 2	12, 28, 35
20 固定件消耗能量 Use of energy by stationary object		19, 9, 6, 27								36, 37			27, 4, 29, 18	35				19, 2, 35, 32	-	+			28, 27, 18, 31			3, 35, 31	10, 36, 23			10, 2, 22, 37	19, 22, 18	1, 4					19, 35, 16, 25		1, 6
21 動力 Power	8, 36, 38, 31	19, 26, 17, 27	1, 10, 35, 37		19, 38	17, 32, 13, 38	35, 6, 38	30, 6, 25	15, 35, 2	26, 2, 36, 35	22, 10, 35	29, 14, 2, 40	35, 32, 15, 31	26, 10, 28	19, 35, 10, 38	16	2, 14, 17, 25	16, 6, 19	16, 6, 19, 37		+	10, 35, 38	28, 27, 18, 38	10, 19	35, 20, 10, 6	4, 34, 19	19, 24, 26, 31	32, 15, 2	32, 2	19, 22, 31, 2	2, 35, 18	26, 10, 34	26, 35, 10	35, 2, 10, 34	19, 17, 34	20, 19, 30, 34	19, 35, 16	28, 2, 17	28, 35, 34
22 能量浪費 Loss of Energy	15, 6, 19, 28	19, 6, 18, 9	7, 2, 6, 13	6, 38, 7	15, 26, 17, 30	17, 7, 30, 18	7, 18, 23	7	16, 35, 38	36, 38			14, 2, 39, 6	26			19, 38, 7	1, 13, 32, 15			3, 38	+	35, 27, 2, 37	19, 10	10, 18, 32, 7	7, 18, 25	11, 10, 35	32		21, 22, 35, 2	21, 35, 2, 22		35, 32, 1	2, 19		7, 23	35, 3, 15, 23	2	28, 10, 29, 35
23 物質浪費 Loss of substance	35, 6, 23, 40	35, 6, 22, 32	14, 29, 10, 39	10, 28, 24	35, 2, 10, 31	10, 18, 39, 31	1, 29, 30, 36	3, 39, 18, 31	10, 13, 28, 38	14, 15, 18, 40	3, 36, 37, 10	29, 35, 3, 5	2, 14, 30, 40	35, 28, 31, 40	28, 27, 3, 18	27, 16, 18, 38	21, 36, 39, 31	1, 6, 13	35, 18, 24, 5	28, 27, 12, 31	28, 27, 18, 38	35, 27, 2, 31	+		15, 18, 35, 10	6, 3, 10, 24	10, 29, 39, 35	16, 34, 31, 28	35, 10, 24, 31	33, 22, 30, 40	10, 1, 34, 29	15, 34, 33	32, 28, 2, 24	2, 35, 34, 27	15, 10, 2	35, 10, 28, 24	35, 18, 10, 13	35, 10, 18	28, 35, 10, 23
24 資訊損失 Loss of Information	10, 24, 35	10, 35, 5	1, 26	26	30, 26	30, 16		2, 22	26, 32						10	10		19			10, 19	19, 10		+	24, 26, 28, 32	24, 28, 35	10, 28, 23			22, 10, 1	10, 21, 22	32	27, 22				35, 33	35	13, 23, 15
25 時間浪費 Loss of Time	10, 20, 37, 35	10, 20, 26, 5	15, 2, 29	30, 24, 14, 5	26, 4, 5, 16	10, 35, 17, 4	2, 5, 34, 10	35, 16, 32, 18		10, 37, 36, 5	37, 36, 4	4, 10, 34, 17	35, 3, 22, 5	29, 3, 28, 18	20, 10, 28, 18	28, 20, 10, 16	35, 29, 21, 18	1, 19, 26, 17	35, 38, 19, 18	1	35, 20, 10, 6	10, 5, 18, 32	35, 18, 10, 39	24, 26, 28, 32	+	35, 38, 18, 16	10, 30, 4	24, 34, 28, 32	24, 26, 28, 18	35, 18, 34	35, 22, 18, 39	35, 28, 34, 4	4, 28, 10, 34	32, 1, 10	35, 28	6, 29	18, 28, 32, 10	24, 28, 35, 30	
26 物質數量 Quantity of substance/the matter	35, 6, 18, 31	27, 26, 18, 35	29, 14, 35, 18		15, 14, 29	2, 18, 40, 4	15, 20, 29		35, 29, 34, 28	35, 14, 3	10, 36, 14, 3	35, 14	15, 2, 17, 40	14, 35, 34, 10	3, 35, 10, 40	3, 35, 31	3, 17, 39		34, 29, 16, 18	3, 35, 31	35	7, 18, 25	6, 3, 10, 24	24, 28, 35	35, 38, 18, 16	+	18, 3, 28, 40	13, 2, 28	33, 30	35, 33, 29, 31	3, 35, 40, 39	29, 1, 35, 27	35, 29, 25, 10	2, 32, 10, 25	15, 3, 29	3, 13, 27, 10	3, 27, 29, 18	8, 35	13, 29, 3, 27
27 可靠度 Reliability	3, 8, 10, 40	3, 10, 8, 28	15, 9, 14, 4	15, 29, 28, 11	17, 10, 14, 16	32, 35, 40, 4	3, 10, 14, 24	2, 35, 24	21, 35, 11, 28	8, 28, 10, 3	10, 24, 35, 19	35, 1, 16, 11		11, 28	2, 35, 3, 25	34, 27, 6, 40	3, 35, 10	11, 32, 13	21, 11, 27, 19	36, 23	21, 11, 26, 31	10, 11, 35	10, 35, 29, 39	10, 28	10, 30, 4	21, 28, 40, 3	+	32, 3, 11, 23	11, 32, 1	27, 35, 2, 40	35, 2, 40, 26		27, 17, 40	1, 11	13, 35, 8, 24	13, 35, 1	27, 40, 28	11, 13, 27	1, 35, 29, 38
28 量測精確度 Measurement accuracy	32, 35, 26, 28	28, 35, 25, 26	28, 26, 5, 16	32, 28, 3, 16	26, 28, 32, 3	26, 28, 32, 3	32, 13, 6		28, 13, 32, 24	32, 2	6, 28, 32	6, 28, 32	32, 35, 13	28, 6, 32	28, 6, 32	10, 26, 24	6, 19, 28, 24	6, 1, 32	3, 6, 32		3, 6, 32	26, 32, 27	10, 16, 31, 28		24, 34, 28, 32	2, 6, 32	5, 11, 1, 23	+		28, 24, 22, 26	3, 33, 39, 10	6, 35, 25, 18	1, 13, 17, 34	1, 32, 13, 11	13, 35, [illegible]	27, 35, 10, 34	26, 24, 32, 28	28, 2, 10, 34	10, 34, 28, 32
29 製造精確度 Manufacturing precision	28, 32, 13, 18	28, 35, 27, 9	10, 28, 29, 37	2, 32, 10	28, 33, 29, 32	2, 29, 18, 36	32, 23, 2	25, 10, 35	10, 28, 32	28, 19, 34, 36	3, 35	32, 30, 40	30, 18	3, 27	3, 27, 40		19, 26	3, 32	32, 2		32, 2	13, 32, 2	35, 31, 10, 24		32, 26, 28, 18	32, 30	11, 32, 1		+	26, 28, 10, 36	4, 17, 34, 26		1, 32, 35, 23	[illegible]	[illegible]	[illegible]	[illegible]	26, 28, 18, 23	10, 18, 32, 39
30 物體上有害因子 Object-affected harmful factors	22, 21, 27, 39	2, 22, 13, 24	17, 1, 39, 4	1, 18	22, 1, 33, 28	27, 2, 39, 35	22, 23, 37, 35	34, 39, 19, 27	21, 22, 35, 28	13, 35, 39, 18	22, 2, 37	22, 1, 3, 35	35, 24, 30, 18	18, 35, 37, 1	22, 15, 33, 28	17, 1, 40, 33	22, 33, 35, 2	1, 19, 32, 13	1, 24, 6, 27	10, 2, 22, 37	19, 22, 31, 2	21, 22, 35, 2	33, 22, 19, 40	22, 10, 2	35, 18, 34	35, 33, 29, 31	27, 24, 2, 40	28, 33, 23, 26	26, 28, 10, 18	+		24, 35, 2	2, 25, 28, 39	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22, 35, [illegible], 24
31 有害的效應 Object-generated harmful factors	19, 22, 15, 39	35, 22, 1, 39	17, 15, 16, 22		17, 2, 18, 39	22, 1, 40	17, 2, 40	30, 18, 35, 4	35, 28, 3, 23	35, 28, 1, 40	2, 33, 27, 18	35, 1	35, 40, 27, 39	15, 35, 22, 2	15, 22, 33, 31	21, 39, 16, 22	22, 35, 2, 24	19, 24, 39, 32	2, 35, 6	19, 22, 18	2, 35, 18	21, 35, 2, 22	10, 1, 34	10, 21, 29	1, 22	3, 24, 39, 1	24, 2, 40, 39	3, 33, 26	4, 17, 34, 26		+			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
32 可製造性 Ease of manufacturing	28, 29, 15, 16	1, 27, 36, 13	1, 29, 13, 17	15, 17, 27	13, 1, 26, 12	16, 40	13, 29, 1, 40	35	35, 13, 8, 1	35, 12	35, 19, 1, 37	1, 28, 13, 27	11, 13, 1	1, 3, 10, 32	27, 1, 4	35, 16	27, 26, 18	28, 24, 27, 1	28, 26, 27, 1	1, 4	27, 1, 12, 24	19, 35	15, 34, 33	32, 24, 18, 16	35, 28, 34, 4	35, 23, 1, 24		1, 35, 12, 18		24, 2		+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	35, 1, 10, 28
33 使用方便性 Ease of operation	25, 2, 13, 15	6, 13, 1, 25	1, 17, 13, 12		1, 17, 13, 16	18, 16, 15, 39	1, 16, 35, 15	4, 18, 39, 31	18, 13, 34	28, 13, 35	2, 32, 12	15, 34, 29, 28	32, 35, 30	32, 40, 3, 28	29, 3, 8, 25	1, 16, 25	26, 27, 13	13, 17, 1, 24	1, 13, 24		35, 34, 2, 10	2, 19, 13	28, 32, 2, 24	4, 10, 27, 22	4, 28, 10, 34	12, 35	17, 27, 8, 40	25, 13, 2, 34	1, 32, 35, 23	2, 25, 28, 39		2, 5, 12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15, 1, 28
34 可修理性 Ease of repair	2, 27, 35, 11	2, 27, 35, 11	1, 28, 10, 25	3, 18, 31	15, 13, 32	16, 25	25, 2, 35, 11	1	34, 9	1, 11, 10	13	1, 13, 2, 4	2, 35	11, 1, 2, 9	11, 29, 28, 27	1	4, 10	15, 1, 13	15, 1, 28, 16		15, 10, 32, 2	15, 1, 32, 19	2, 35, 34, 27		32, 1, 10, 25	2, 28, 10, 25	11, 10, 1, 16	10, 2, 13	25, 10	35, 10, 2, 16		1, 35, 11, 10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1, 32, 10
35 適合性 Adaptability or versatility	1, 6, 15, 8	19, 15, 29, 16	35, 1, 29, 2	1, 35, 16	35, 30, 29, 7	15, 16	15, 35, 29		35, 10, 14	15, 17, 20	35, 16	15, 37, 1, 8	35, 30, 14	35, 3, 32, 6	13, 1, 35	2, 16	27, 2, 3, 35	6, 22, 26, 1	19, 35, 29, 13		19, 1, 29	18, 15, 1	15, 10, 2, 13		35, 28	3, 35, 15	35, 13, 8, 24	35, 5, 1, 10		35, 11, 32, 31		1, 13, 31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	35, 28, 6, 37
36 裝置複雜性 Device complexity	26, 30, 34, 36	2, 26, 35, 39	1, 19, 26, 24	26	14, 1, 13, 16	6, 36	34, 26, 6	1, 16	34, 10, 28	26, 16	19, 1, 35	29, 13, 28, 15	2, 22, 17, 19	2, 13, 28	10, 4, 28, 15		2, 17, 13	24, 17, 13	27, 2, 29, 28		20, 19, 30, 34	10, 35, 13, 2	35, 10, 28, 29		6, 29	13, 3, 27, 10	13, 35, 1	2, 26, 10, 34	26, 24, 32	22, 19, 29, 40	19, 1	27, 26, 1, 13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15, 1, 24	12, 17, 28
37 控制複雜性 Difficulty of detecting and measuring	27, 26, 28, 13	6, 13, 28, 1	16, 17, 26, 24	26	2, 13, 18, 17	2, 39, 30, 16	29, 1, 4, 16	2, 18, 26, 31	3, 4, 16, 35	30, 28, 40, 19	35, 36, 37, 32	27, 13, 1, 39	11, 22, 39, 30	27, 3, 15, 28	19, 29, 39, 25	25, 34, 6, 35	3, 27, 35, 16	2, 24, 26	35, 38	19, 35, 16	18, 1, 16, 10	35, 3, 15, 19	1, 18, 10, 24	35, 33, 27, 22	18, 28, 32, 9	3, 27, 29, 18	27, 40, 28, 8	26, 24, 32, 28		22, 19, 29, 28	2, 21	5, 28, 11, 29	2, 5	12, 26	[illegible]	[illegible]	[illegible]	34, 21	35, 18
38 自動化程度 Extent of automation	28, 26, 18, 35	28, 26, 35, 10	14, 13, 17, 28	23	17, 14, 13		35, 13, 16		28, 10	2, 35	13, 35	15, 32, 1, 13	18, 1	25, 13	6, 9		26, 2, 19	8, 32, 19	2, 32, 13		28, 2, 27	23, 28	35, 10, 18, 5	35, 33	24, 28, 35, 30	35, 13	11, 27, 32	28, 26, 10, 34	28, 26, 18, 23	2, 33	2	1, 26, 13	1, 12, 34, 3	1, 35, 13	27, 4, 1, 35	15, 24, 10	34, 27, 25	+	5, 12, 35, 26
39 可生產性 Productivity	35, 26, 24, 37	28, 27, 15, 3	18, 4, 28, 38	30, 7, 14, 26	10, 26, 34, 31	10, 35, 17, 7	2, 6, 34, 10	35, 37, 10, 2		28, 15, 10, 36	10, 37, 14	14, 10, 34, 40	35, 3, 22, 39	29, 28, 10, 18	35, 10, 2, 18	20, 10, 16, 38	35, 21, 28, 10	26, 17, 19, 1	35, 10, 38, 19	1	35, 20, 10	28, 10, 29, 35	28, 10, 35, 23	13, 15, 23		35, 38	1, 35, 10, 38	1, 10, 34, 28	18, 10, 32, 1	22, 35, 13, 24	35, 22, 18, 39	35, 28, 2, 24	1, 28, 7, 10	1, 32, 10, 25	1, 35, 28, 37	12, 17, 28, 24	35, 18, 27, 2	5, 12, 35, 26	+

S曲線演變趨勢



Performance
演變
Evolution
划艇
帆船
time



S 形曲線
New technology
Old age
Maturity
Rapid growth
Infancy
S Curve

1956 First TRIZ paper published by Altshuller

1980 First TRIZ Conference in USSR

1993 TRIZ becomes known outside of USSR

1993 TRIZ imported in USA

1996 TRIZ Journal founded

1997 International TRIZ Association was founded G. S. Altshulle

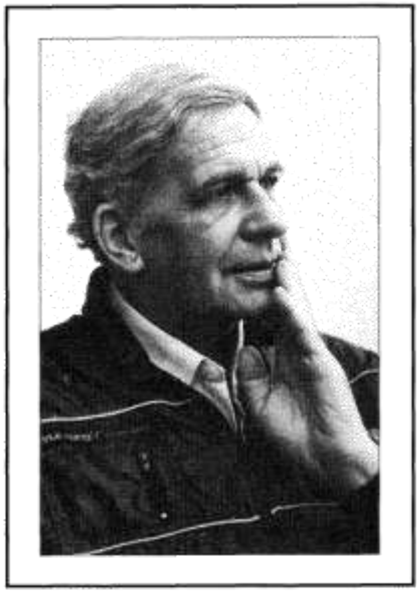
1999 The establishment of Altshuller Institute for TRIZ Studies (USA)

1999 MA TRIZ was officially registered as an international organization

2000 The establishment of European TRIZ Association

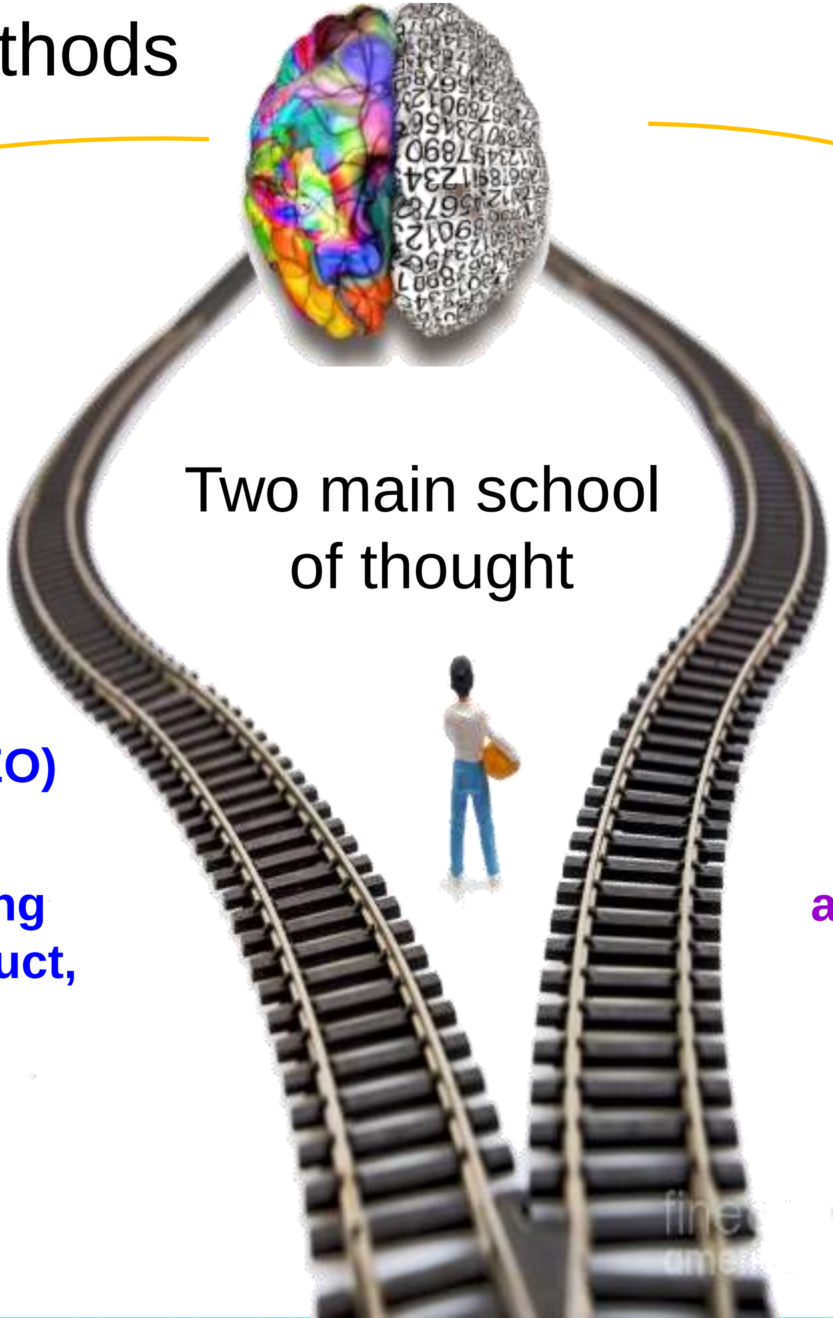
2008 First Chinese translated book published

2010 The establishment of Institute of Systematic Innovation, Hong Kong.



Genrich Saulovich Altshuller
October 15,1926 to September 24, 1998

Innovation methods



People / Empathy

Science / Engineering

Two main school of thought

People centered Innovation
(Design thinking - IDEO)

Suitable for developing new ideas on product, process and customer relationship

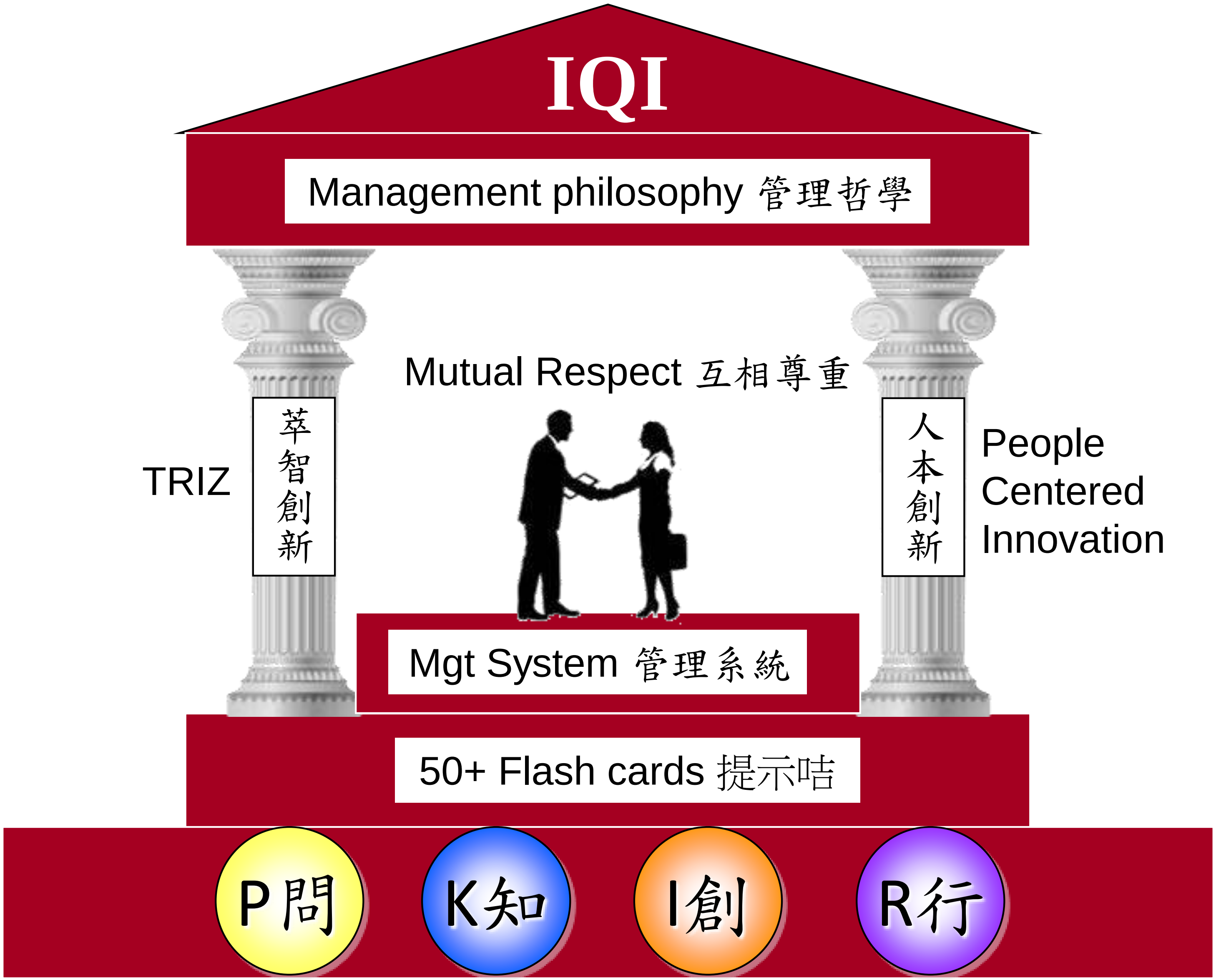
TRIZ
Theory of Inventive Problem Solving (TIPS)

algorithmic approach to solving problems, most suitable for technical system innovation

创新方法
各式其式

取决于用家

集大成？



Problem identification → **K**nowledge acquisition → **I**deation → **R**ealization

Flash cards

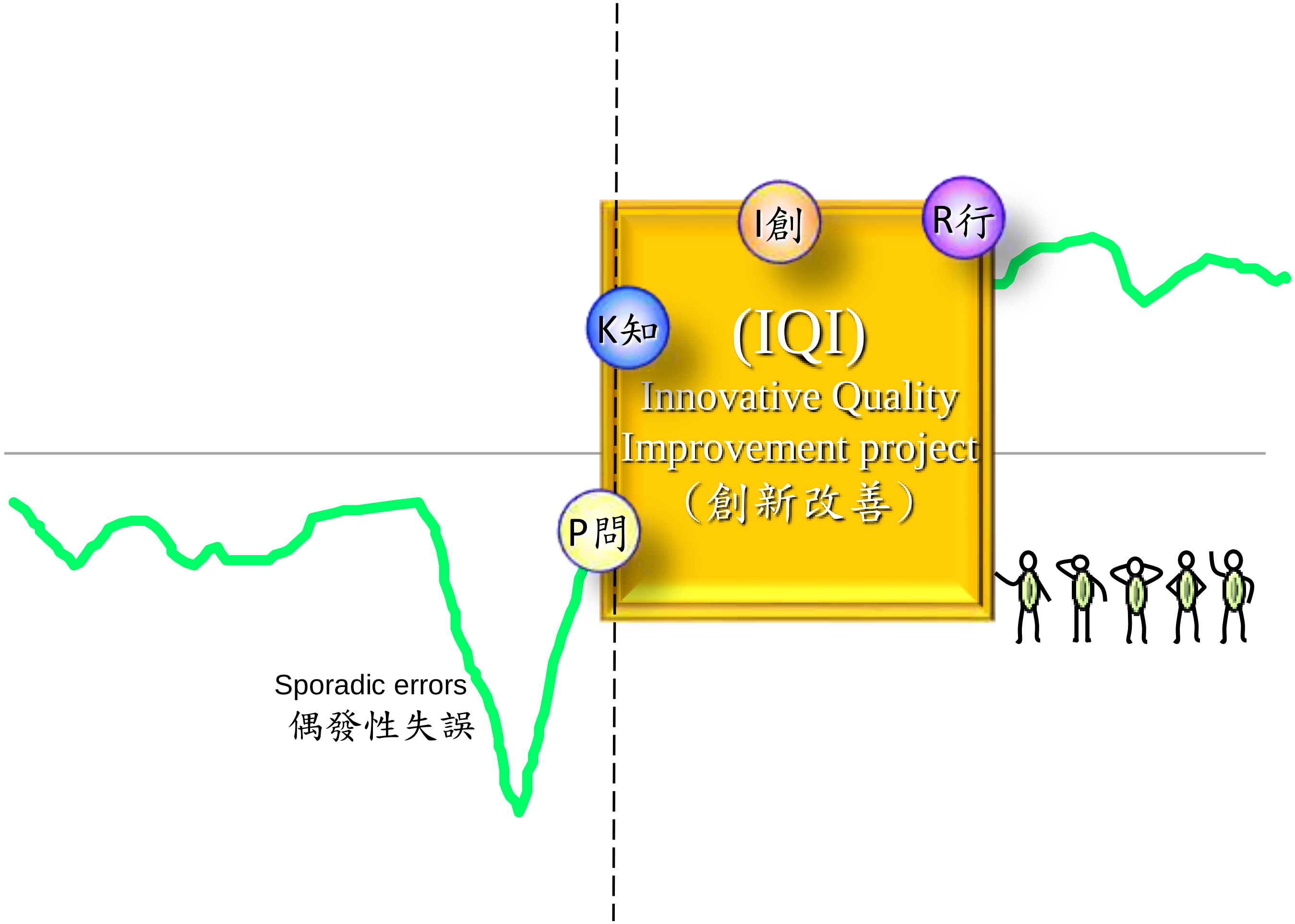

9屏幕法
創
9 Windows Operator
Innovation
Random Word
Voice of Customers
Ideality
Award Scheme
Implementation
Innovation
/ Procedure
Celebration

Innovate with Phronesis
實踐道德創新的智慧

就是在實際處境中，辨別和決定應如何用新方法行事的智慧

以創新的思維去达到目标的智慧

通過 Innovative Quality Improvement (IQI) 項目提升質量水平

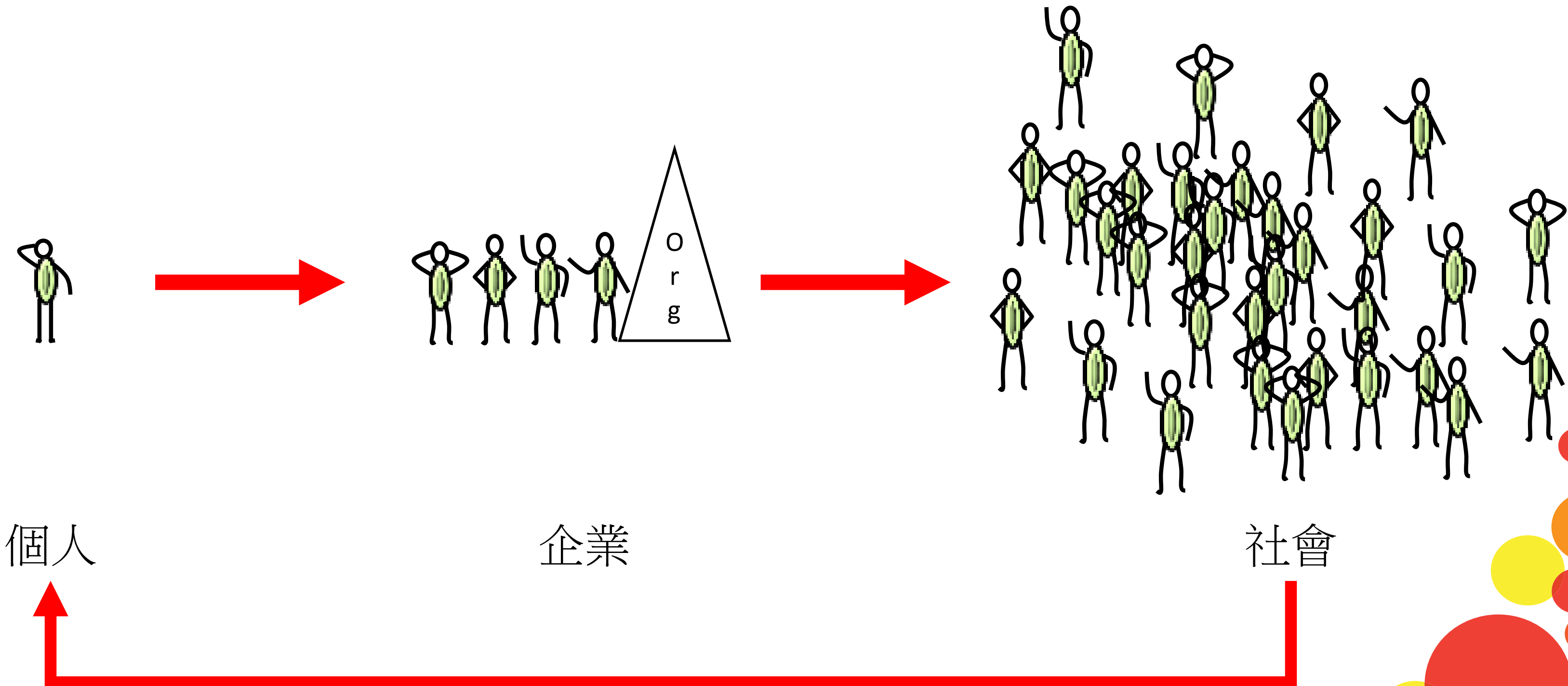


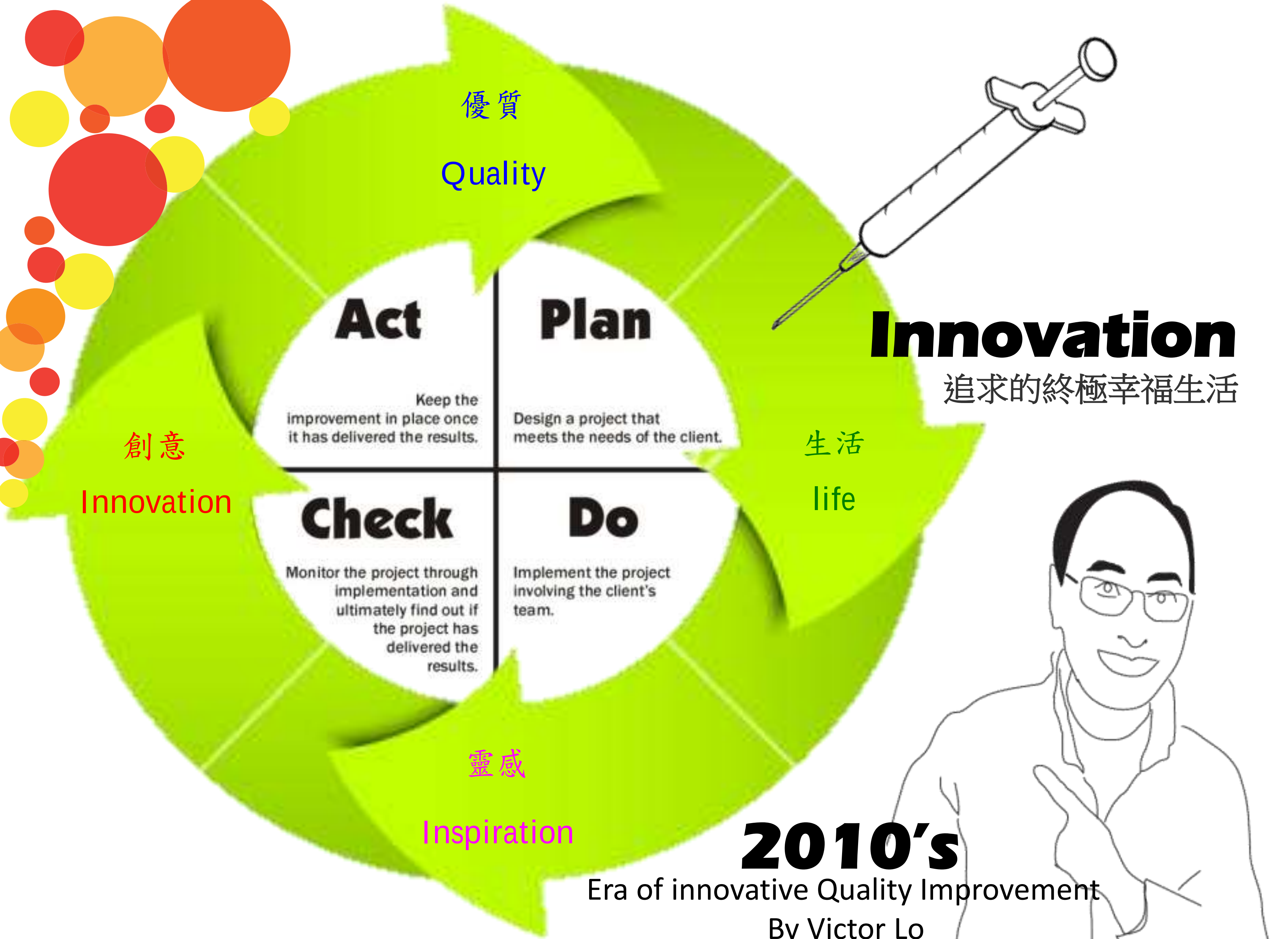
第五屆全球系統創新大賽 (2015)
榮獲 金獎

Gold Medal Award at The 5th Global Competition on Systematic Innovation (2015)

How to do things better (value adding)?

Problem solving





Innovation

追求的終極幸福生活

2010's

Era of innovative Quality Improvement

By Victor Lo

<u>We can change the world by enabling innovation</u>

Make everyone to innovate
Enhance Quality
Decrease risk
Increase engineering success
Make life fun again

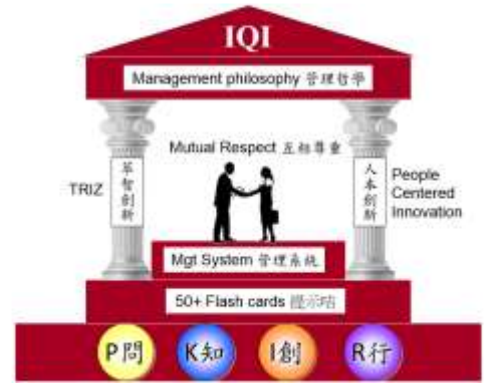
<u>我們可以通過使創新改變世界</u>

讓每個人都能創新
提高產品質量
減少風險
加大工程界成功
再次讓生活樂趣

讓我們一起
推動創新

Victor reminds you !

謝謝大家



V= Visualize your objectives

I = Identify what you want to achieve

C = Cross check with your current practices

T = Target the causes of gaps

O = Organize ‘問知創行’ projects

R = Reiterate these steps

香港創新學會

INSTITUTE OF SYSTEMATIC INNOVATION, H.K.

THE HONG KONG INSTITUTION OF ENGINEERS
香港工程師學會

Tea Gathering, Veneree Club, HKIE

Should do … must do

Restart of what we do by planting innovation in ourselves

學而優則做，做而優則創