



The 40 Principles of TRIZ illustrated up to 104 case by using 85 kinds of sub principles

Results of trying to the universality of Principles of the smart phone



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TRIZ | Support differentiated technological development <http://www.proengineer-institute.com/>

First, confirm the keyword

What's universality

Principles of Universal Design (Ronald Mace)

1. **Equitable** use
2. **Flexibility** in Use
3. Simple and **.....ly** Use
4. **Perceptible** Information
5. Tolerance for Error
6. Low Physical Effort
7. **Size and Space** for Approach and Use ➔ Smartphone size

1.1 Conclusion : Obvious and latent needs

◆ Main needs for 40 principles from seminar etc. questionnaire

Obvious needs

- Do you understand semiconductor cases?
- Can I get ideas without using a contradiction matrix?
- Can you differentiate your ideas with only 40 principles?

latent needs

- Can I use smartphones?
- Can I make an idea intuitively?
- How to improve abstraction?

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1.2 Conclusion : Responses

◆ 40 principles that can intuitively conceive ideas using smartphones

40 Principles (pro-engineer) What's TRIZ (pro-engineer)

Click

Set the contradiction to solve

Articles that can be read in multilingual on Monodukuri.com

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2 Background and aims of the issue

Conclusion Issues Responses Effects

Background

Until now, we have tried to create TRIZ tools that can be used by universities and small and medium enterprises. In that process, I was keenly aware that "**engineers who are not good at abstraction thinking**" are very numerous. Therefore, I thought that I could break through by **deepening the original one of the 40 principles** for a technician with a clear problem.

About 1 year ago I wrote this commentary on "Monozukuri .com". There is a request for its tool conversion, and it was published to HP of "proengineer-institute".

Aims

1. **Abstraction** (enlargement) and **implementation** (reduction) can be processed unconsciously
2. Increase the **trigger of the idea**
3. Brush up **universality**

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3 Specific responses

Conclusion Issues Responses Effects

1. Unconsciously abstract (enlarge) / realize (reduce)
 - ⇒ Suggest ideas from the **5 viewpoints** of principles name of the 2 languages, the meaning of each principles, principles image diagram, sub principles all realistic illustration, and the application example of different fields
2. Increase the trigger of the idea
 - ⇒ New 40 principles of 104 illustrative examples including **85 sub principles** that respect original principles
3. Brush up universality
 - ⇒ **Mobile Friendly** matrix of 40 principles and contradiction Matrix

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3.4 Concrete illustration of all sub principles

Conclusion Issues Responses Effects

◆ Expand trigger of **intuitive** idea by concrete illustration of all sub

発明原理	1. 分割原理 (Segmentation) 2つ以上に分ける。組立性・分解性向上 15. 結合せ原理の反対の原理。物体やシステムを細かく単位に分割して処理をスムーズにしようとする考え方。分割のレベルは、原子、分子レベルまで考える。例えば、化粧品は粉体粒子を、細分化すれば肌への浸透速度や割合を高められる。	発明原理	17. 他次元移行原理 (Another dimension) 立体的な変える。多面的に変える 点や面積から、2次元、3次元と自由度を増やす考え方。また、物理的矛盾の解決策の分離原理の一つともほぼ同じ。そして、13の発想原理もこの考え方に依っている。例えば、多層のフィルムを貼り合わせた窓ガラスは、数十倍の強度となり、防犯機能も向上させることができる。
サマリー & イメージ		サマリー & イメージ	
サブ原理 & 図解	<p>a. 物体やシステムをその部分あるいは区分に分割する考え方</p> <p>バックアップ容量の肥大化を防ぐため、PC等のHDDやSSDを、OSやアプリケーションとドキュメントデータに分割する。</p> <p>b. 組立と分解が容易なようなシステムを作る考え方</p> <p>廃棄時に分別が容易にできるはさみ。廃棄時は、ハンドル部分の隙間にマイクドライバーの先端を押し当てることで、ハンドルも部から刃部を容易に取り外し可能である。</p> <p>c. 分割の度合いを増加させる考え方</p> <p>毛穴やシワの奥へ入り込み、皮脂や汚れを吸着させるため、シャワーからマイクロナノメートルに分割した超微細な気泡を発生させる。</p>	<p>a. 物体やシステムを、2次元または3次元空間で移動する考え方</p> <p>らせん階段は、3次元空間を効率よく利用したもので、床面積を小さくできる。</p> <p>b. 物体やシステムを単層だけではなく多層に配列する考え方</p> <p>立体駐車場は、駐車場を多層階層に配置している。</p> <p>c. 物体やシステムの向きを変える考え方</p> <p>スマートフォンの自撮り鏡は、ほぼ全ての方向に、スマートフォンの向きを変えられる。</p> <p>d. 物体やシステムの「反対側」を使用する考え方</p> <p>両面実装基板は、両面に電子部品を載せています(チューナー基板の例)。</p>	
異分野事例	HW: 自動車エンジンの複数のピストン SW: パケット通信方式 ビジネス: 機能別、事業部門等の組織の分割	HW: ロボット用等の螺旋状にした配線や配管 SW: Webの階層別表示 ビジネス: 出前用の共等多層に運搬できるオカモチ	

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4.1 Google search ranking

Conclusion Issues Responses Effects

◆ Contents of "40 Principles - all deputy principles" will continue to be displayed at the top of Google Search.

Google Ranking

Ranking of other tools

Tools	Ranking
40 Principles	1
Contradiction matrix	1
Evolution trend	1
S-Field Analysis	1
Inventive Standards	2
Effects	2
9 windows method	1
Ideal Final Result	1
Resources	1
Self-X	1
Smart-Little-People	1

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4.2 Impressions and overall satisfaction of seminar students

Conclusion
Issues
Responses
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Impressions (2016)

1. Compared to other seminars, tools are evolving.
2. Compared to past teaching materials, it is very easy to understand.
3. New 40 principles can be used immediately for work.

Overall satisfaction

Question: Overall, were you satisfied with the seminar

Year	Students (n)	Strongly agree (5)	Somewhat agree (4)	Natural (3)	Somewhat disagree (2)	Strongly disagree (1)
2007	20	15%	65%	15%	5%	0%
2009	17	12%	78%	10%	0%	0%
2010	16	45%	45%	10%	0%	0%
2014	18	35%	55%	10%	0%	0%
2016	22	45%	45%	10%	0%	0%

Legend:

- Strongly disagree (1)
- Somewhat disagree (2)
- Natural (3)
- Somewhat agree (4)
- Strongly agree (5)

Precondition:

- ※1. Program: Lecture & exercise of 7 hour
(Purposes principle, 5 whys analysis, 40 principles, Evolution trend, Effects, Ideal Final Result, 9 windows, Self-X, Resources)
- ※2. Students: Active participants + Top manager's recommendation (10~20%)

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4.3 Future prospects

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◆ Only 40% of the idea factor can be supported by the idea method
 ➔ The remaining issues is motivation

Factors thinking ideas

Mental factors

- Challenge (5%)
- + Trial and error (10%)
- + Patience (25%)
- + Change viewpoint (5%)
- + Flexibility (5%)

Personal factors

- Experience (5%)
- + Idea (20%)
- + Sense (10%)
- + New knowledge (10%)
- + Realization (5%)

Supportable factor of idea method

Motivation method

1. Interest to work (Curiosity)
2. Challenge to work
3. Communication
4. To be recognized from your superiors, members and customers
5. Contribution to organization or significance of work

Source: '87 Nikkei Mechanical (Miura)

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