

# Introduction to TRIZ

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# Introduction to TRIZ

After analysing:

- 50000 patents
- 40 ways to resolve contradictions- the 40 Inventive Principles- were uncovered.

TRIZ thinking is achieved by considering two questions:

- What do I want?
- How can I get all the things I want without changing anything?

# Solving Contradictions with the 40 Principles

- ① Finding and defining contradictions
- ② Understanding the two types of contradictions
- ③ Solving contradictions by applying the 40 Inventive Principles

# Spotting Contradictions

A contradiction is when you have conflicts in what you want:  
either

- you want opposites of the same thing or
- as you improve something, something else gets worse.

Examples of contradictions:

- I want a more powerful engine for my car but I don't want it to get heavier
- I want a cup that keeps my coffee hot but doesn't burn my hand
- ...

# Two types of contradictions

- A Technical Contradiction:** as you improve something, something else gets worse.  
⇒ Making a car safer by adding more material but it makes the car more heavier
- A Physical Contradiction:** when you want opposites of the same thing.  
⇒ An umbrella needing to be both big and small.

# The 39 contradictions

**Moving objects:** Objects which can easily change position in space, either on their own, or as a result of external forces. Vehicles and objects designed to be portable are the basic members of this class

**Stationary objects:** Objects which do not change position in space, either on their own, or as a result of external forces. Consider the conditions under which the object is being used.

## The 39 contradictions (cont.)

- ① Weight of moving object
- ② Weight of stationary object
- ③ Length of moving object
- ④ Length of stationary object
- ⑤ Area of moving object
- ⑥ Area of stationary object
- ⑦ Volume of moving object
- ⑧ Volume of stationary object
- ⑨ Speed
- ⑩ Force



## The 39 contradictions (cont.)

- 11 Stress or pressure
- 12 Shape
- 13 Stability of the object's composition
- 14 Strength
- 15 Duration of action by a moving object
- 16 Duration of action by a stationary object
- 17 Temperature
- 18 Illumination intensity
- 19 Use of energy by moving object
- 20 Use of energy by stationary object

## The 39 contradictions (cont.)

- 21 Power
- 22 Loss of Energy
- 23 Loss of substance
- 24 Loss of Information
- 25 Loss of Time
- 26 Quantity of substance/the matter
- 27 Reliability
- 28 Measurement accuracy
- 29 Manufacturing precision
- 30 External harm affects the object

## The 39 contradictions (cont.)

- 31 Object-generated harmful factors
- 32 Ease of manufacture
- 33 Ease of operation
- 34 Ease of repair
- 35 Adaptability or versatility
- 36 Device complexity
- 37 Difficulty of detecting and measuring
- 38 Extent of automation
- 39 Productivity

# Traditional approach versus TRIZ to contradictions.

Traditional:

- compromise or
- give up

Triz: reapply other people's genius solutions.

How: the 40 Inventive Principles

# Resolving Physical Contradictions

In TRIZ you can separate in four ways:

**In Time:** Having opposite things at the same time.

**In Space:** Wanting opposite things at the same time but in different places

**On Condition:** Sometimes you want opposite things at the same time, in the same place - but for different features of your system.

**By System:** Understanding that you want opposite things at different levels, for example in the broader context and in the detail.

## Separation Principles table

### Separate in Time:

- One solution at one time, the opposite solution at another.

### Separate in Space:

- One solution in one place, the opposite solution at another.

### Separate on Condition:

- Opposite solutions in the same place and at the same time.
- One solution for one element- the opposite for another.

### Separate by System:

- Separate by Scale (to Sub-system or Super-system).
- Switch to Inverse System.
- Switch to Another System

# The 40 Inventive Principles, 1-20

- |                       |                               |
|-----------------------|-------------------------------|
| ① Segmentation        | ⑪ Cushion                     |
| ② Taking out          | ⑫ Equal Potential             |
| ③ Local Quality       | ⑬ The Other Way Round         |
| ④ Asymmetry           | ⑭ Spheres and Curves          |
| ⑤ Merging             | ⑮ Dynanism                    |
| ⑥ Multi-Function      | ⑯ Partial or Excessive Action |
| ⑦ Nested Doll         | ⑰ Another Dimension           |
| ⑧ Counterweight       | ⑱ Mechanical Vibration        |
| ⑨ Prior Counteraction | ⑲ Periodic Action             |
| ⑩ Prior Action        | ⑳ Continous Useful Action     |

# The 40 Inventive Principles, 21-40

- 21 Rushing Through
- 22 Blessing in Disguise
- 23 Feedback
- 24 Intermediary
- 25 Self-service
- 26 Copying
- 27 Cheap, Short-Living Objects
- 28 Replace Mechanical System
- 29 Pneumatics and Hydraulics
- 30 Flexible Membranes and Thin Films
- 31 Porous Materials
- 32 Colour Change
- 33 Uniform Material
- 34 Discarding and Recovering
- 35 Parameter Change
- 36 Phase Changes
- 37 Thermal Expansion
- 38 Boosted Interactions
- 39 Inert Atmosphere
- 40 Composite Structures

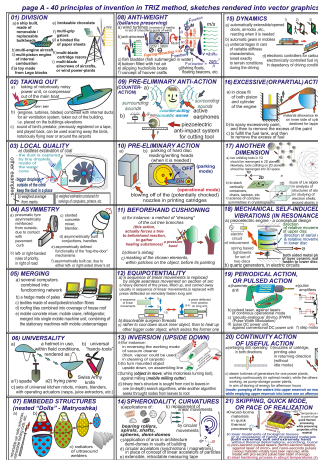


- Outline
- Introduction
- Contradictions
- Intuitive Principles

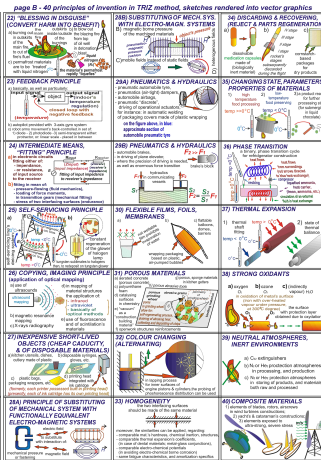
## Introducing the 40 Inventive Principles

### Applying the 40 Inventive Principles to Contradictions

# The 40 Inventive Principles in one image

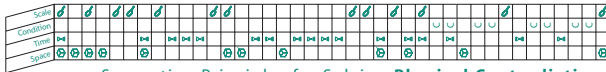


*A technique of Engineering Creativity and Inventive Thinking in Problem Solving*



*A technique of Engineering Creativity and Inventive Thinking in Problem Solving*

# The Contradiction Matrix



## Separation Principles for Solving **Physical Contradictions**

40	Inventive Principles	1	Suppression	25	Self Service	39	Copying	53	Intermediary	67	Periodic Action	81	Periodic Action	95	Periodic Action	109	Periodic Action	123	Periodic Action	137	Periodic Action	151	Periodic Action	165	Periodic Action	179	Periodic Action	193	Periodic Action	207	Periodic Action	221	Periodic Action	235	Periodic Action	249	Periodic Action	263	Periodic Action	277	Periodic Action	291	Periodic Action	305	Periodic Action	319	Periodic Action	333	Periodic Action	347	Periodic Action	361	Periodic Action	375	Periodic Action	389	Periodic Action	403	Periodic Action	417	Periodic Action	431	Periodic Action	445	Periodic Action	459	Periodic Action	473	Periodic Action	487	Periodic Action	501	Periodic Action	515	Periodic Action	529	Periodic Action	543	Periodic Action	557	Periodic Action	571	Periodic Action	585	Periodic Action	599	Periodic Action	613	Periodic Action	627	Periodic Action	641	Periodic Action	655	Periodic Action	669	Periodic Action	683	Periodic Action	697	Periodic Action	711	Periodic Action	725	Periodic Action	739	Periodic Action	753	Periodic Action	767	Periodic Action	781	Periodic Action	795	Periodic Action	809	Periodic Action	823	Periodic Action	837	Periodic Action	851	Periodic Action	865	Periodic Action	879	Periodic Action	893	Periodic Action	907	Periodic Action	921	Periodic Action	935	Periodic Action	949	Periodic Action	963	Periodic Action	977	Periodic Action	991	Periodic Action	1005	Periodic Action	1019	Periodic Action	1033	Periodic Action	1047	Periodic Action	1061	Periodic Action	1075	Periodic Action	1089	Periodic Action	1103	Periodic Action	1117	Periodic Action	1131	Periodic Action	1145	Periodic Action	1159	Periodic Action	1173	Periodic Action	1187	Periodic Action	1201	Periodic Action	1215	Periodic Action	1229	Periodic Action	1243	Periodic Action	1257	Periodic Action	1271	Periodic Action	1285	Periodic Action	1299	Periodic Action	1313	Periodic Action	1327	Periodic Action	1341	Periodic Action	1355	Periodic Action	1369	Periodic Action	1383	Periodic Action	1397	Periodic Action	1411	Periodic Action	1425	Periodic Action	1439	Periodic Action	1453	Periodic Action	1467	Periodic Action	1481	Periodic Action	1495	Periodic Action	1509	Periodic Action	1523	Periodic Action	1537	Periodic Action	1551	Periodic Action	1565	Periodic Action	1579	Periodic Action	1593	Periodic Action	1607	Periodic Action	1621	Periodic Action	1635	Periodic Action	1649	Periodic Action	1663	Periodic Action	1677	Periodic Action	1691	Periodic Action	1705	Periodic Action	1719	Periodic Action	1733	Periodic Action	1747	Periodic Action	1761	Periodic Action	1775	Periodic Action	1789	Periodic Action	1803	Periodic Action	1817	Periodic Action	1831	Periodic Action	1845	Periodic Action	1859	Periodic Action	1873	Periodic Action	1887	Periodic Action	1901	Periodic Action	1915	Periodic Action	1929	Periodic Action	1943	Periodic Action	1957	Periodic Action	1971	Periodic Action	1985	Periodic Action	1999	Periodic Action	2013	Periodic Action	2027	Periodic 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Action	9937	Periodic Action	9951	Periodic Action	9965	Periodic Action	9979	Periodic Action	9993	Periodic Action	10007	Periodic Action	10021	Periodic Action	10035	Periodic Action	10049	Periodic Action	10063	Periodic Action	10077	Periodic Action	10091	Periodic Action	10105	Periodic Action	10119	Periodic Action	10133	Periodic Action	10147	Periodic Action	10161	Periodic Action	10175	Periodic Action	10189	Periodic Action	10203	Periodic Action	10217	Periodic Action	10231	Periodic Action
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# The Contradiction Matrix (cont.)

Improve this one  
↓  
without  
making this  
one worse  
→

**39 Technical Parameters**

		Weight of moving object	Weight of Stationary Object
		1	2
1	Weight of moving object	-	1
2	Weight of stationary object	-	2
3	Length of moving object	8 15 29 34	-
4	Length of stationary object	-	35 37 40 49
5	Area of moving object	2 17 29 4	-
6	Area of stationary object	-	30 2 14 8
7	Volume of moving object	2 26 29 40	-
8	Volume of stationary object	-	35 0 19 4
9	Speed	8 28 13 38	-
10	Force (Intensity)	8 1 37 18	18 3 1 1 8 6
11	Stress or pressure	10 36 37 40	13 19 3 10 8
12	Shape	8 10 29 40	15 0 2 20 3
13	Stability of the object's composition	21 35 2 39	26 19 1 2 1
14	Strength	1 8 40 15	40 26 27 1
15	Duration of action by moving object	19 5 34 34	-

Solving Technical Contradictions by using the matrix shows us how to break the link and *separate* the two parameters – the Inventive Principles suggest ways of improving/changing one without also affecting the other one or making it worse.

The matrix offers these Inventive Principles 40, 26, 27, 40 – Composite Materials

26 – Copying

27 – Cheap Short-Living Objects

1 – Segmentation

# Literature

- ① Haines-Gadd, L., TRIZ For Dummies, John Wiley & Sons Ltd., 2016
- ② Gadd, K., TRIZ for Engineers: Enabling Inventive Problem Solving, John Wiley & Sons, Ltd. , 2011.
- ③ Oxford Creativity, [www.triz.co.uk](http://www.triz.co.uk)