

**Innovazione e sviluppo prodotto
&
Innovation Management & New Product
Development**



**New Product Development:
New concept generation and the use of
TRIZ**

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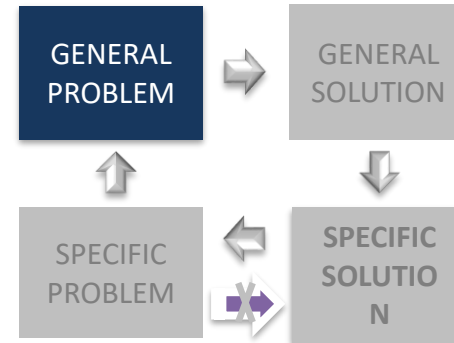
Problem generalisation

PROBLEM ABSTRACTION (building a model)

- SU-FIELD ANALYSIS

UNDERSTAND THE «HEARTH» OF THE PROBLEM

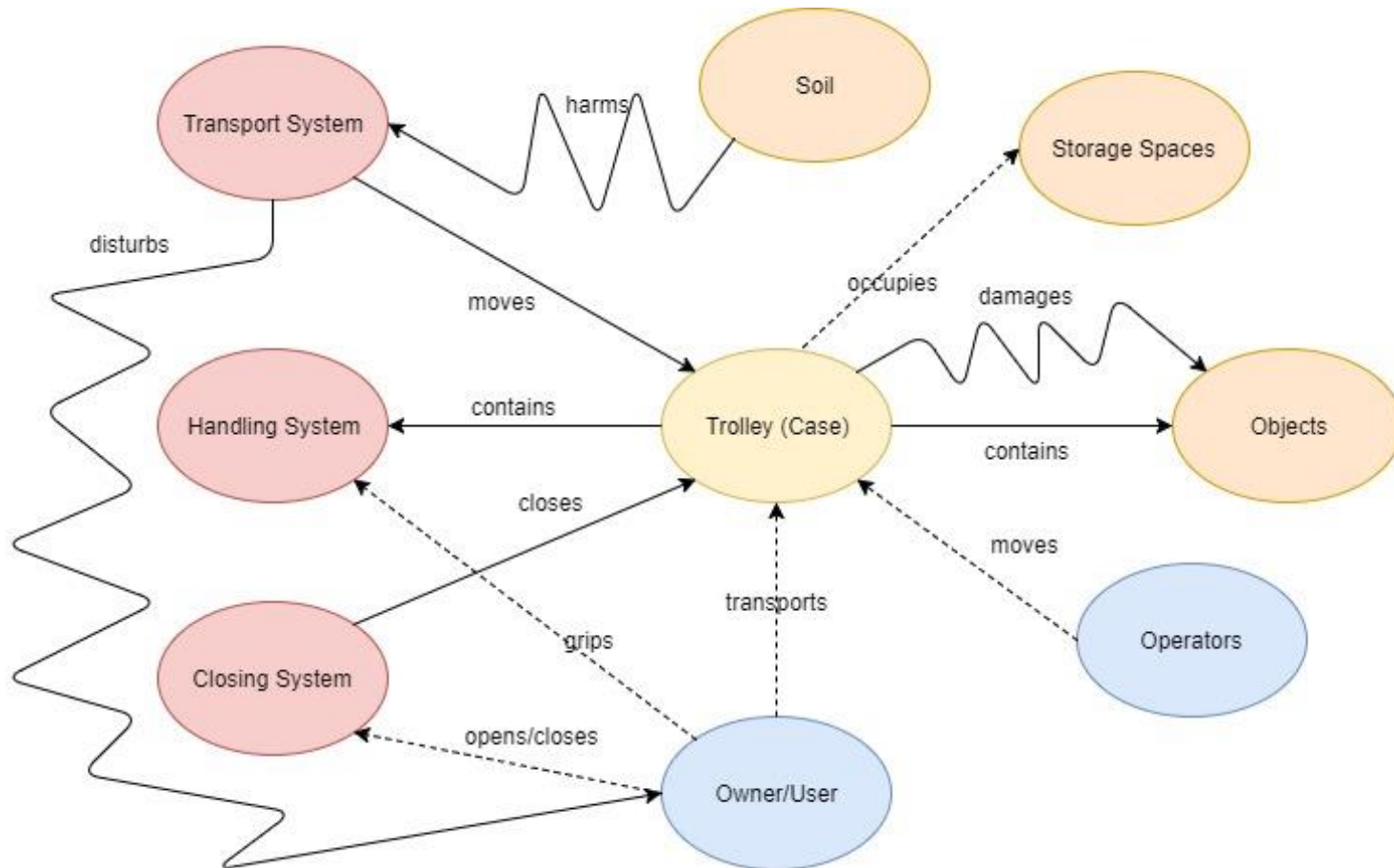
- PHYSICAL / TECHNICAL
CONTRADICTIONS



Applying su-field analysis

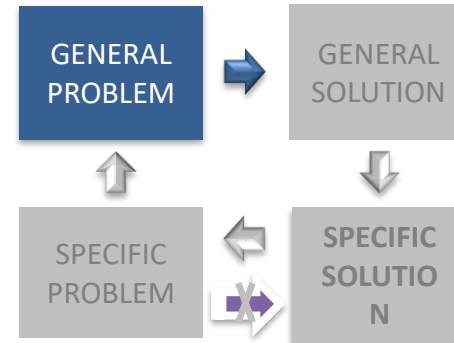
- Identify the elements of a system.
- Identify The fields.
- Construct the model.
- After completing these steps, stop to evaluate the completeness and effectiveness of the system. Bring into evidence if some element is missing, some effect is harmful, or not necessary, try to identify what it is.

Su-field analysis example: the airbag



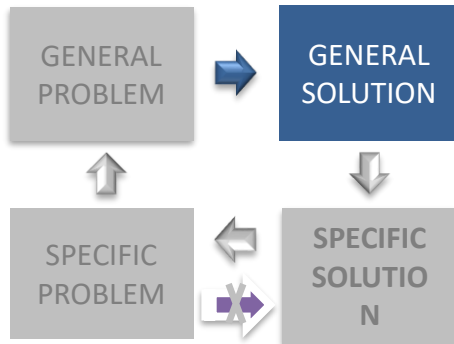
From the general problem to the general solution

Undesired effects, inefficient effects are often generated by **CONTRADICTIONS** (conflicts in a system); they represent the general problem



Solving contradictions means moving towards a general solution for the general problem

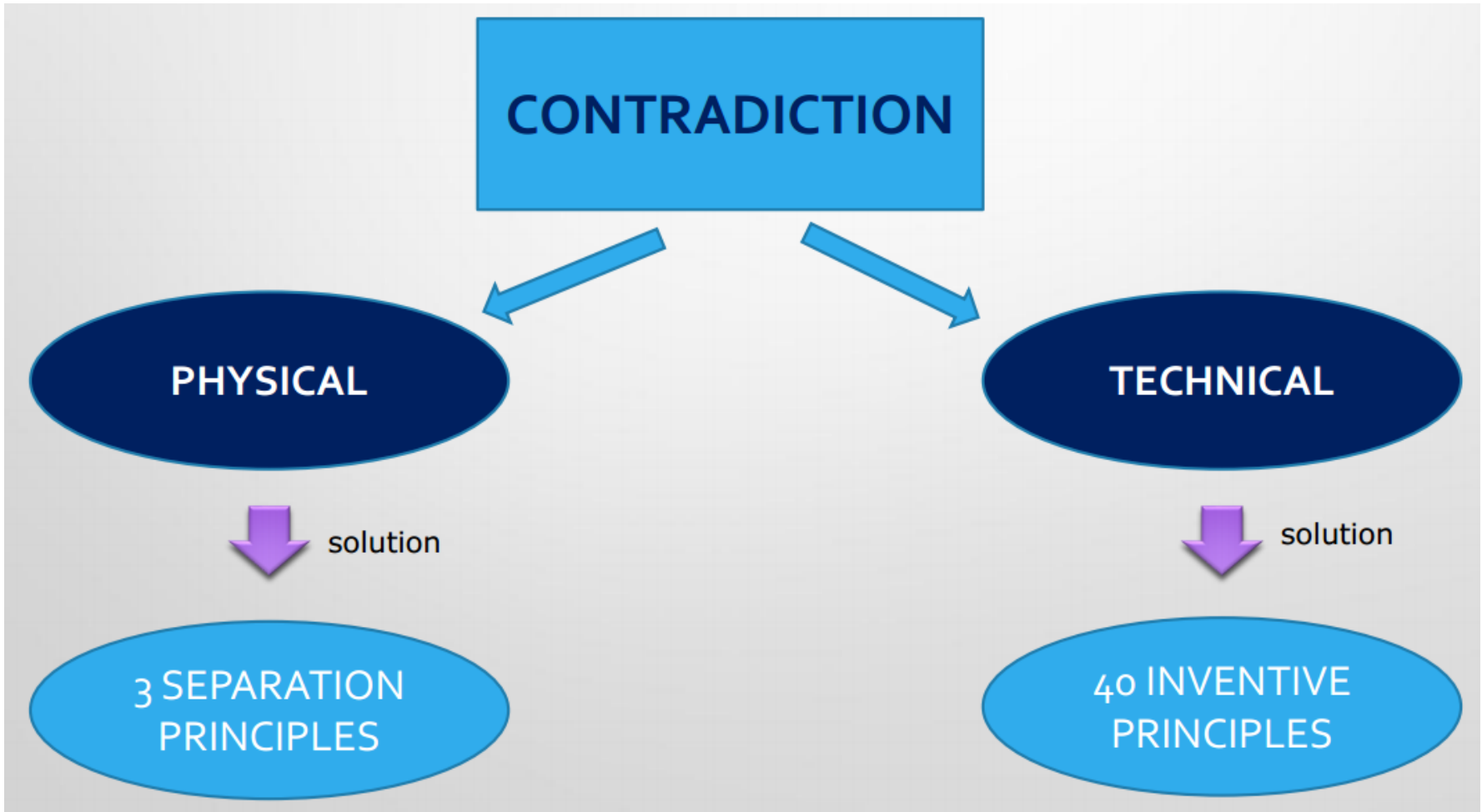
General solution



FINDING A SOLUTION

- 40 PRINCIPLES
- SEPARATION PRINCIPLES
- PATENT ANALYSIS

Finding a solution for contradictions



Physical contradictions

Physical Contradiction = A same object might be in mutually exclusive physical states

To perform the necessary function, the same area/ object:

- should possess some properties and
- should not possess some properties

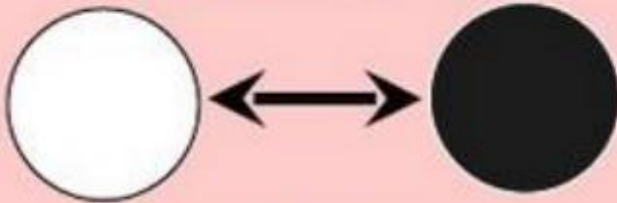
TRIZ tries to eliminate the physical contradiction by separating the two contradictory requirements through 4 SEPARATION

PRINCIPLES:

1. **Separation in space**
2. **Separation in time**
3. **Separation between the parts and the whole**
4. **Separation upon conditions**

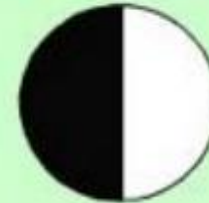
Separation principles

Separation in Time



Property **P** at time T_1 ,
anti-property **-P** at time T_2

Separation in Space



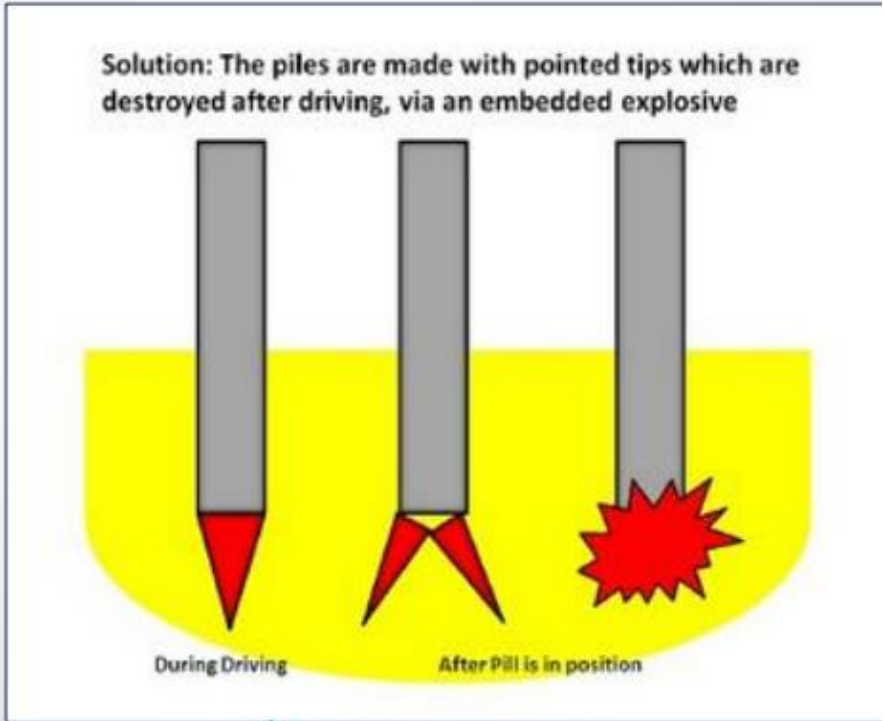
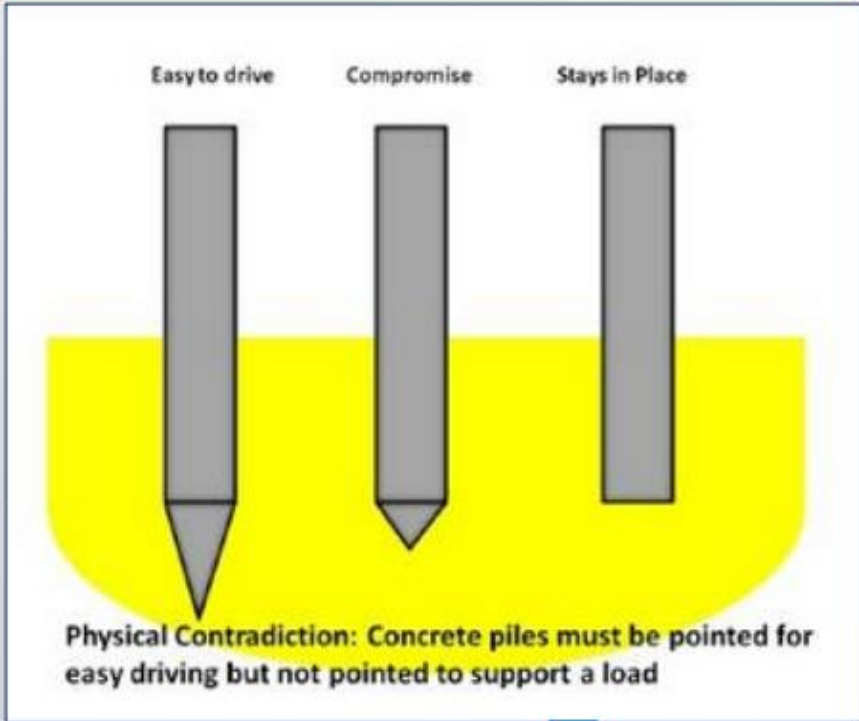
One part has property **P**,
another part has anti-property **-P**

Separation between the Whole and its Parts

No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No

Object has property **P**,
Its components have property **-P**

PHYSICAL CONTRADICTIONS: EXAMPLE



Separation in...TIME!

PHYSICAL CONTRADICTIONS: EXAMPLE



Physical Contradiction

Car should have a large space to accommodate people and should not have large space to get parked easily

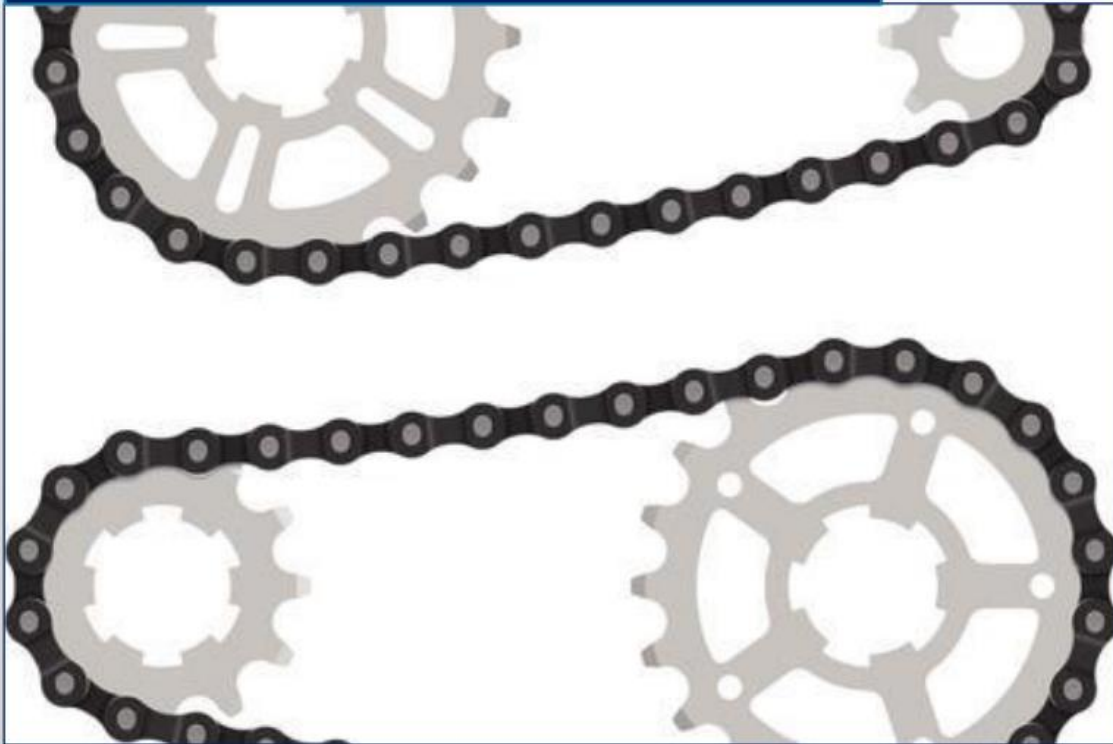


Solution

Flexible space depending on requirements

Separation in...SPACE!

PHYSICAL CONTRADICTIONS: EXAMPLE



Separation between the parts and the whole!

Technical contradictions

Technical contradictions are in a **39 X 39 contradiction matrix**

APPENDIX 2 — Contradiction Matrix

Columns = undesired characteristics

Rows = desired characteristics

Undesired Result (Conflict) / Feature to Improve		1	2	3	4	5	6	7	8	9	10
		Weight of moving object	Weight of stationary object	Length of moving object	Length of stationary object	Area of moving object	Area of stationary object	Volume of moving object	Volume of stationary object	Speed	Force
1	Weight of moving object			15, 8, 29, 34		29, 17, 38, 34		29, 2, 40, 28		2, 8, 15, 38	8, 10, 18, 37
2	Weight of stationary object				10, 1, 29, 35		35, 30, 13, 2		5, 35, 14, 2		8, 10, 19, 35
3	Length of moving object	8, 15, 29, 34				15, 17, 4		7, 17, 4, 35		13, 4, 8	17, 10, 4
4	Length of stationary object		35, 28, 40, 29				17, 7, 10, 40		35, 8, 2, 14		28, 10
5	Area of moving object	2, 17, 29, 4		14, 15, 18, 4				7, 14, 17, 4		29, 30, 4, 34	19, 30, 35, 2
6	Area of stationary object		30, 2, 14, 18		26, 7, 9, 39						1, 18, 35, 36
7	Volume of moving object	2, 26, 29, 40		1, 7, 4, 35		1, 7, 4, 17				29, 4, 38, 34	15, 35, 36, 37
8	Volume of stationary object		35, 10, 19, 14	19, 14	35, 8, 2, 14						2, 18, 37
9	Speed	2, 28, 13, 38		13, 14, 8		29, 30, 34		7, 29, 34			13, 28, 15, 19
10	Force	8, 1, 37, 18	18, 13, 1, 28	17, 19, 6, 36	28, 10	19, 10, 15	1, 18, 36, 37	15, 9, 12, 37	2, 36, 18, 37	13, 28, 15, 12	

Each cell represents a contradiction;

Contradictions can be solved by applying the **40 inventive principles**;

the contradiction matrix specifies the principles to be used for each cell



Technical parameters

ALTSULLER'S PARAMETERS

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
11. Tension, pressure
12. Shape
13. Stability of object
14. Strength
15. Durability of moving object
16. Durability of stationary object
17. Temperature
18. Brightness
19. Energy spent by moving object
20. Energy spent by stationary object
21. Power
22. Waste of energy
23. Waste of substance
24. Loss of information
25. Waste of time
26. Amount of substance
27. Reliability
28. Measurement accuracy
29. Manufacturing accuracy
30. Harmful factors acting on an object
31. Harmful side effects
32. Manufacturability
33. Convenience of use
34. Repairability
35. Adaptability
36. Device complexity
37. Complexity of control
38. Level of automation
39. Productivity

The 40 inventive principles

- The 40 inventive principles represent general solutions drawn from previous inventions
- They represent the principles already used by inventors in their innovation process

Example:

1. Segmentation

- Divide an object into independent parts
- Make an object easy to disassemble
- Increase the degree of an object segmentation



Link for the 40 inventive principles

- http://www.triz40.com/TRIZ_GB.php
- <https://triz-journal.com/40-inventive-principles-examples/>