Innovazione e sviluppo prodotto
&
Innovation Management & New Product Development

LIUC
Università Cattaneo

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

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Implementing TRIZ a proposed framework

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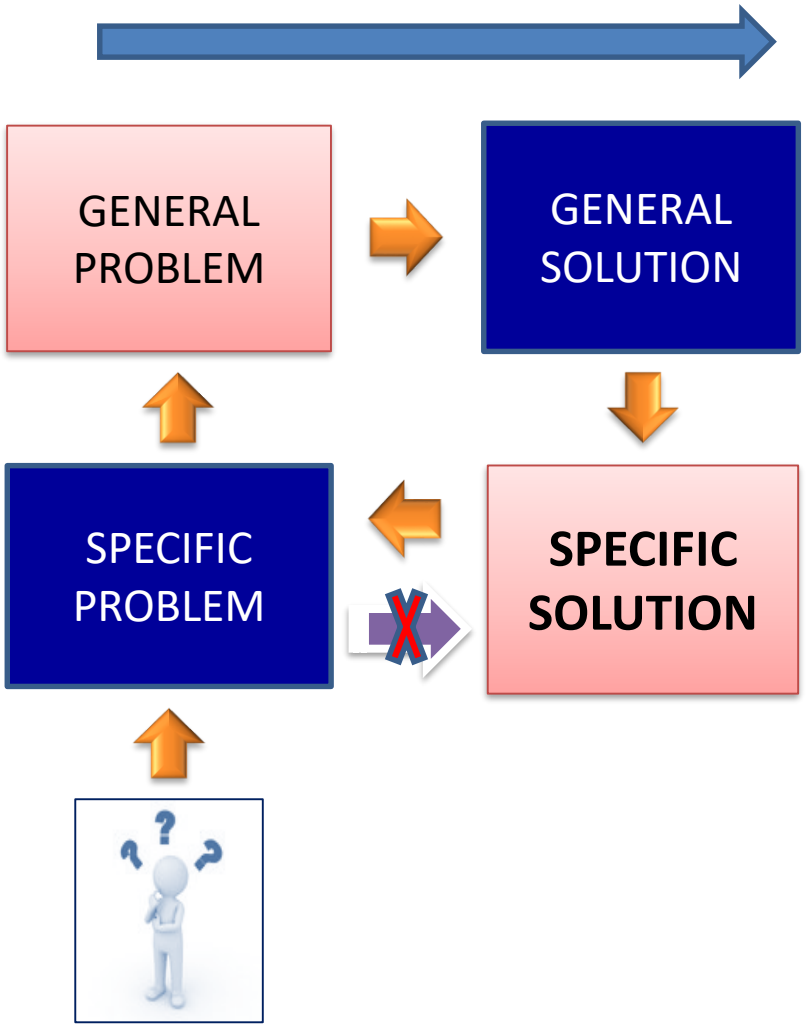
UNDERSTAND THE «HEARTH» OF THE PROBLEM
• PHYSICAL / TECHNICAL CONTRADICTIONS

PROBLEM ABSTRACTION (building a model)
•SU-FIELD ANALYSIS

HOW «MATURE» IS MY SYSTEM?
- Distance from IFR
- ITEMS

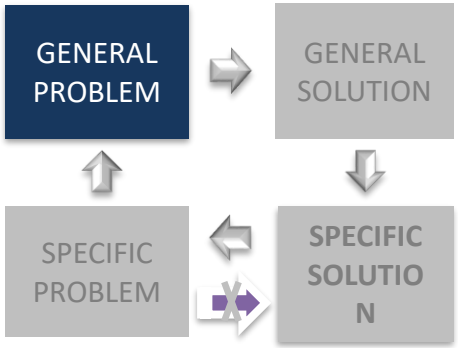
HOW DOES MY SYSTEM WORK?
- Describe your system/ products in the most objective way as possible ("film maker")
- Describe functions, value proposition, tangible and intangible features (product specifrications)



FINDING A SOLUTION
• FUNCTIONAL ANALYSIS
• 40 PRINCIPLES
• SEPARATION PRINCIPLE

APPLYING THE SOLUTION TO THE SPECIFIC PROBLEM
• PATENT ANALYSIS
•Understanding evolutionary trends

Problem generalisation



PROBLEM ABSTRACTION (building a model)

•SU-FIELD ANALYSIS

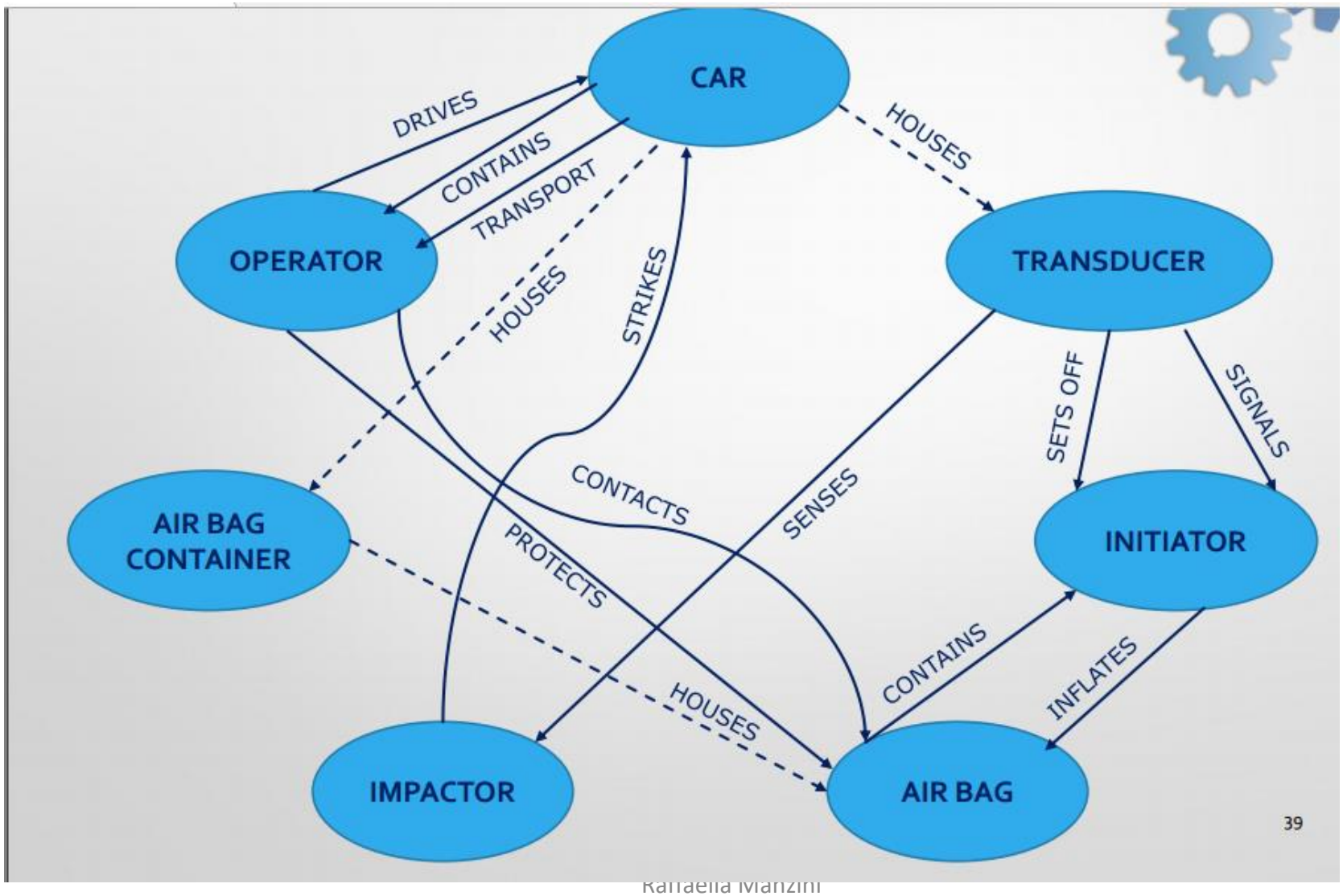
UNDERSTAND THE «HEARTH» OF THE PROBLEM

• PHYSICAL / TECHNICAL CONTRADDICTIONS

Applying su-field analysis

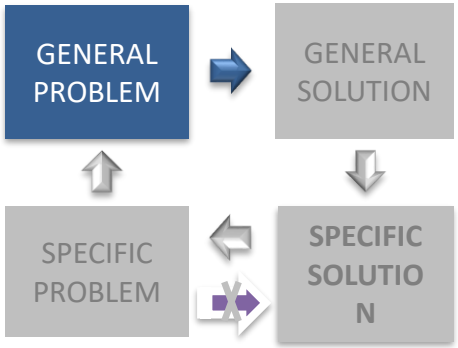
- Identify the elements of a system.
- Identify The fields.
- Construct the model.
- After completing these steps, stop to evaluate the completeness and effectiveness of the system. Bring into evidence if some element is missing, some effect is harmful, or not necessary, try to identify what it is.

Su-field analysis example: the airbag

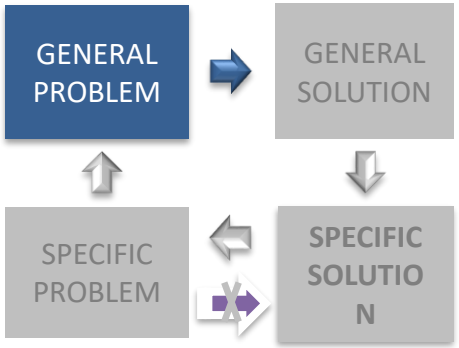


The general problem

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



Contradictions



- Physical contradictions: a same object might be in mutually exclusive physical states (to perform the necessary function, the object should posses / should not possess some properties)

- Technical contradictions: a same object might possess contrasting technical parameters

Technical parameters

ALTSHULLER'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

Technical contradictions

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

Rows = feature to improve

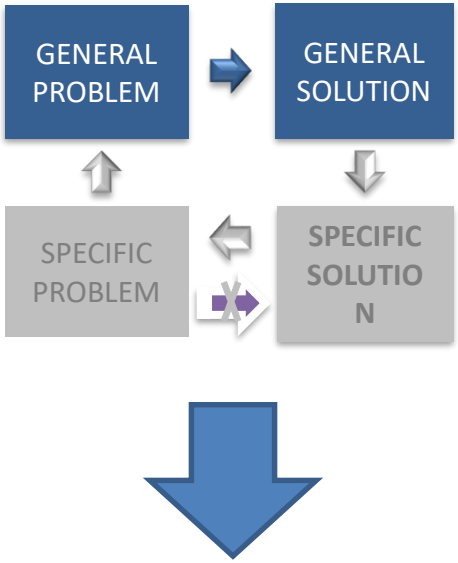
Columns = undesired results

Each cell represents a contradiction.

APPENDIX 2 — Contradiction Matrix

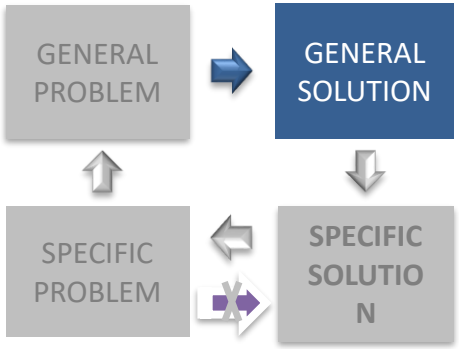
Feature to Improve \ Undesired Result (Conflict)		1 Weight of moving object	2 Weight of stationary object	3 Length of moving object	4 Length of stationary object	5 Area of moving object	6 Area of stationary object	7 Volume of moving object	8 Volume of stationary object	9 Speed	10 Force
1	Weight of moving 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, 1
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	

From the general problem to the general solution



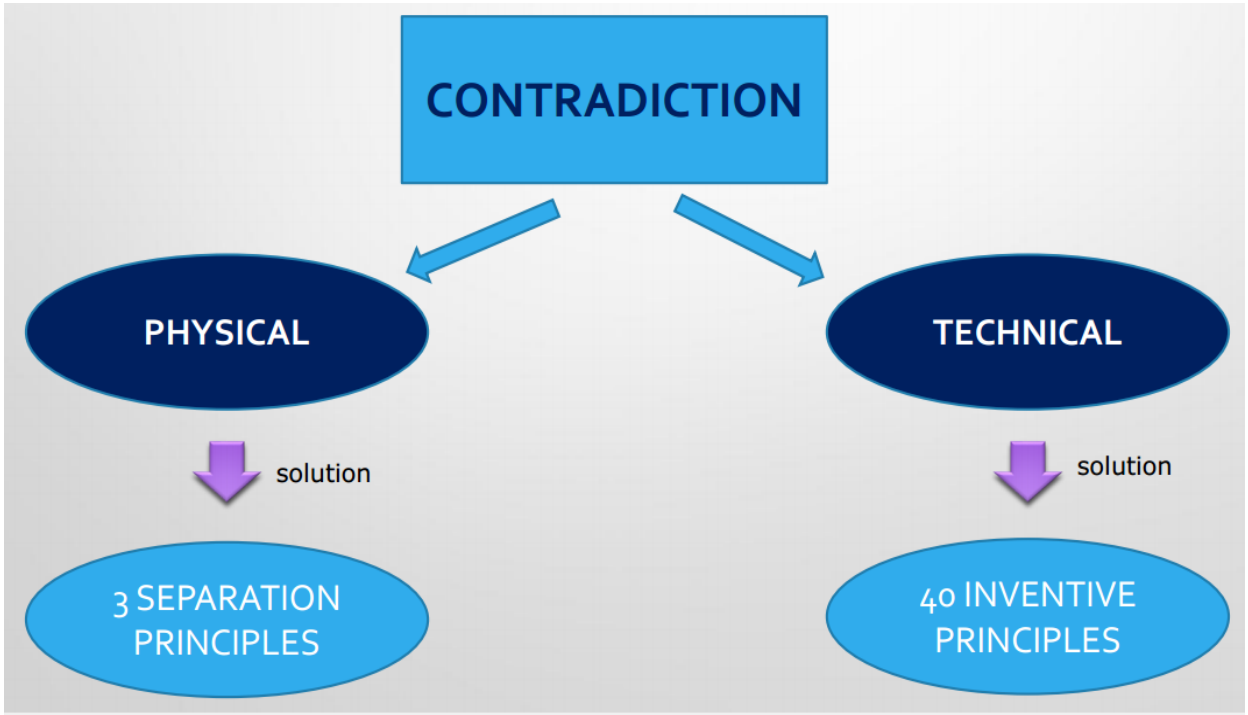
Solving contradictions means moving towards a general solution for the general problem

General solution



FINDING A SOLUTION

- SEPARATION PRINCIPLES
- 40 PRINCIPLES

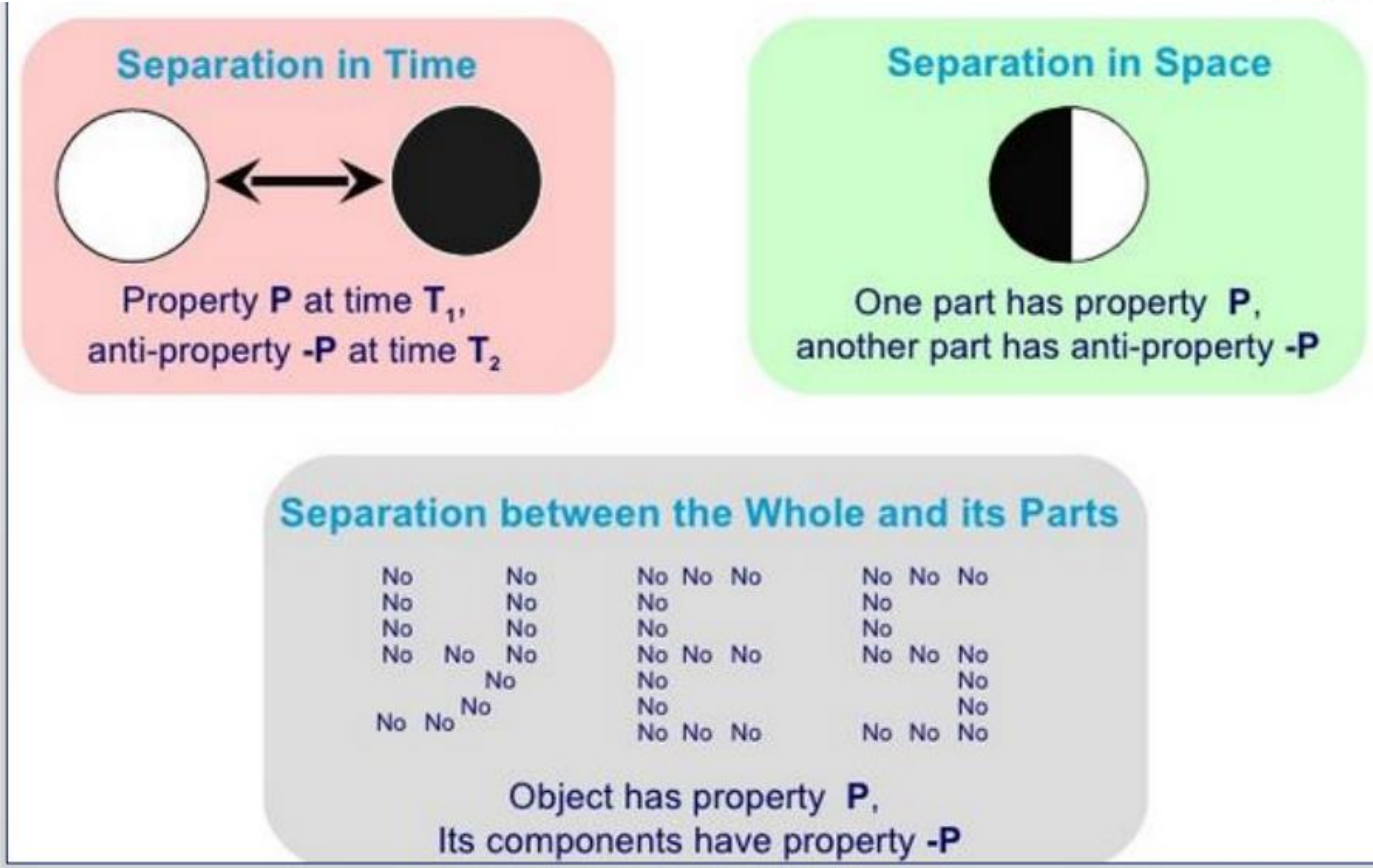


Separation principles

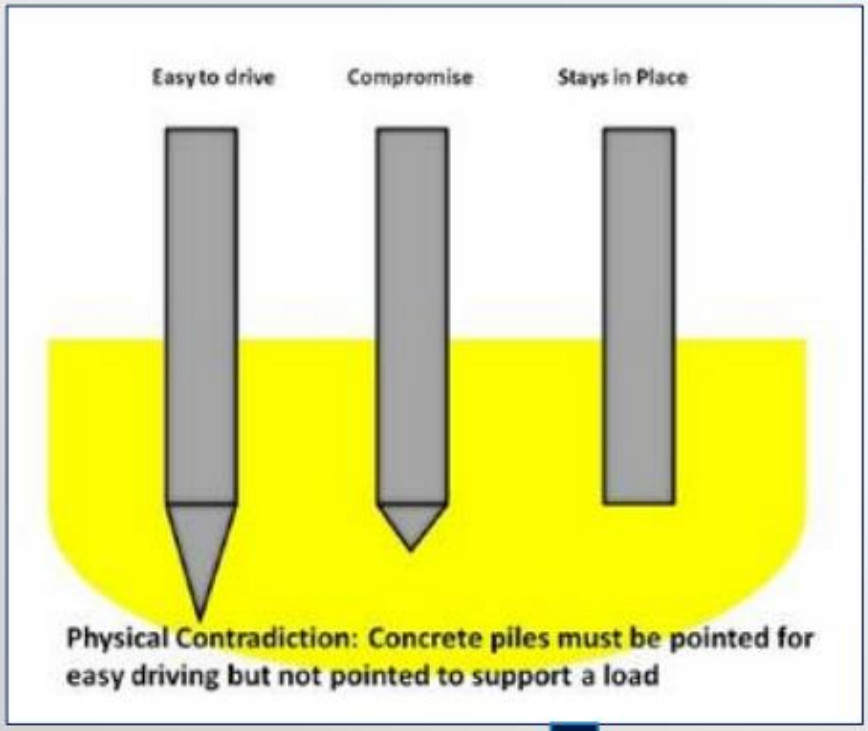
The separation principles to be used in order to solve physical contradictions are:

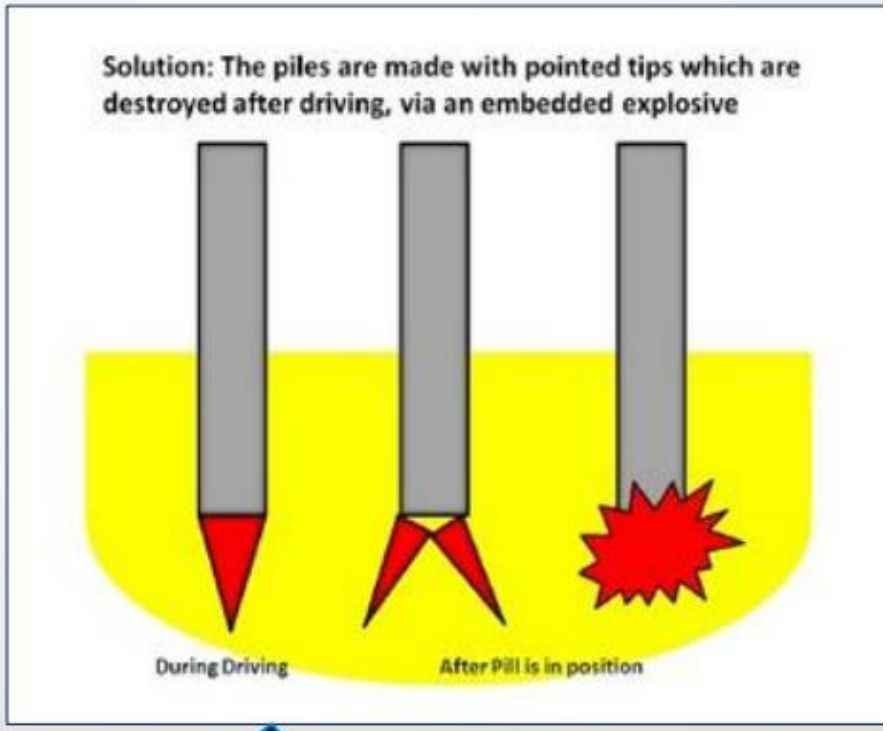
- Separation in space
- Separation in time
- Separation between the parts and the whole
- Separation upon conditions

Separation principles



PHYSICAL CONTRADICTIONS: EXAMPLE





Separation in...TIME!

PHYSICAL CONTRADICTIONS: EXAMPLE

Physical Contradiction

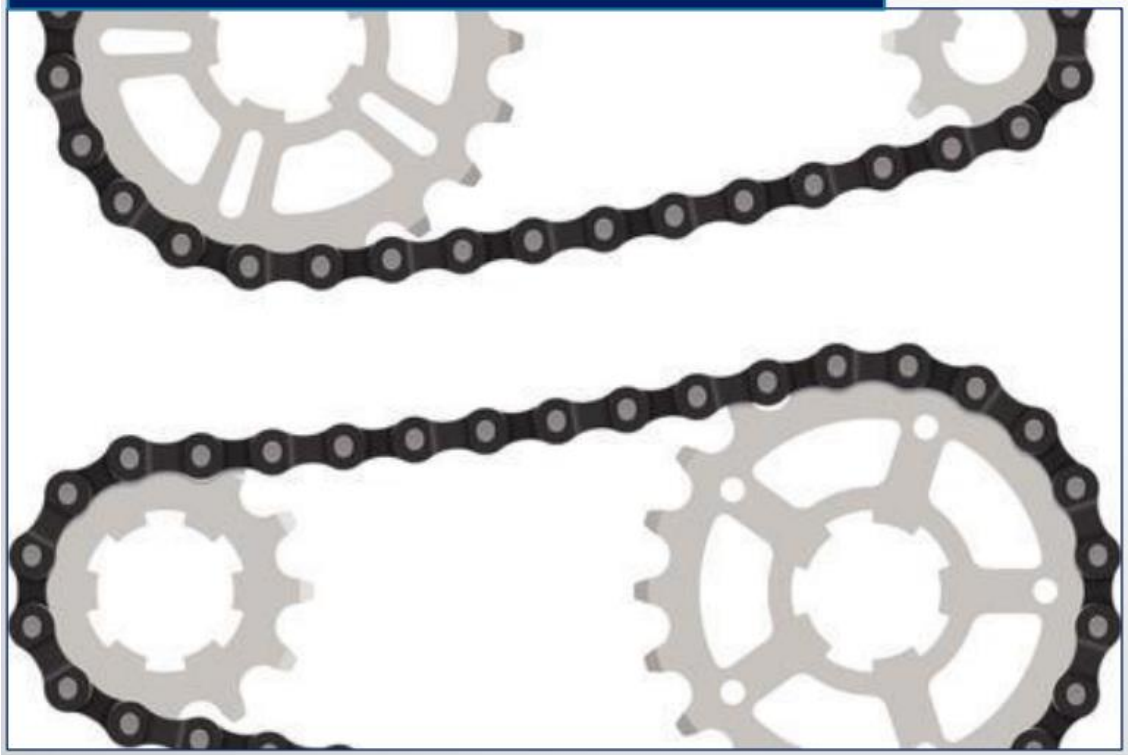
Car should have a large space to accommodate people and should not have large space to get parked easily

Solution

Flexible space depending on requirements

Separation in...SPACE!

PHYSICAL CONTRADICTIONS: EXAMPLE



Separation between the parts and the whole!

40 principles

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, that is for each contradiction

APPENDIX 2 — Contradiction Matrix

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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

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