

# **AATRIZINVENTOR SOLUTION FOR INNOVATION BASED ON NATURE'S L.I. Working Document to Build a Specific Solution.**

**INNOVATION CHALLENGE: Improve Design of the best toy for children affected by designer paradigms that do not fit with children's desires**

**APPLICATION OF NATURE'S LANGUAGE OF INNOVATION / Nature's L.I.**

Web site: [www.aatrizinventor.com](http://www.aatrizinventor.com)

Reference book: The Nature's Language of Innovation, José Roberto Espinoza, Amazon, Kindle.

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## **FACTORS OF INNOVATION:**

**FUNCTION AFFECTED:** Design of the best toy for children affected by designer paradigms that do not fit with children's desires

**PHYSICAL VARIABLE OR CHARACTERISTIC:** Less Empathy with children

**S1 OBJECT: DESIGNER** Type: Moving

**S2 OBJECT: CHILDREN** Type: Moving

**DESIRED ACTION VERB:** Improve

## **INNOVATION CHALLENGE:**

**CHALLENGE:** Improve Design of the best toy for children affected by designer paradigms that do not fit with children's desires

**DESIRED GOAL:** More Empathy with children

**EVALUATED OBJECT:** DESIGNER

**NEED TO SATISFY > 32. Ease of achieving desired outcome**

## **SELECTED INNOVATION PARAMETERS TO EVALUATE:**

### **A. UNDESIRABLE EFFECTS CAUSES OF DISSATISFACTION (UDEs)**

There are More difficulty to Improve Design of the best toy for children affected by designer paradigms that do not fit with children's desires because:

DESIGNER Has More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2

DESIGNER Has Less Achievement of desired outcome interacting with S2

DESIGNER Has Less Adaptability or versatility to interaction variability of S2

DESIGNER Has More Difficulty in detection and measurement interacting with S2

There are undesirable effects that cause dissatisfaction because:

There is Less Empathy with children

### **B. DESIRED EFFECT FOR NEED TO SATISFY**

There is More ease to Improve Design of the best toy for children affected by designer paradigms that do not fit with children's desires because:

DESIGNER Has More Ease of achieving desired outcome interacting with S2

There is desirable effect for need to satisfy because:

There is More Empathy with children

**Table I. RELATIONSHIP WITH UNIVERSAL TRIZ INNOVATION PARAMETERS ( maximum of 7 undesirable effects)**

**CHALLENGE:** Improve Design of the best toy for children affected by designer paradigms that do not fit with children's desires

This table presents the selected innovation parameters to evaluate the challenge that must be resolved for the interaction between an Object S1 and an Object S2, and no others. The choice of undesirable effects must be based on a thorough review of the current situation, identifying them based on the objective evidence present within the predefined space and time of evaluation. Fulfilling this requirement is crucial: If you do not connect the dots of the current situation properly, the algorithm will deliver a disconnected solution.

The selection of the need to satisfy should reflect the best estimation of the innovation-evolution state of the object S1 being evaluated.

Recognizing the criticality of this selection process, the Aatrizinventor algorithm provides flexibility to change parameters and conducts a sensitivity analysis in order to offer alternative solutions. These alternatives are based on different combinations of the entered parameters, also including a different need to satisfy from the one originally posed.

<b>Parameters to evaluate(s)</b>	<b>It is understood as DESIGNER has:</b>
<b>Parámetros of undesirable effects (UDE):</b>	<b>Undesirable effects causes of dissatisfaction:</b>
(+) 1. Heaviness of moving object	More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2
(-) 29. Fulfillment of desired outcome	Less Achievement of desired outcome interacting with S2
(-) 35. Adaptability or versatility	Less Adaptability or versatility to interaction variability of S2
(+) 37. Difficulty of detecting and measuring	More Difficulty in detection and measurement interacting with S2
<b>Desirable parameter (DE):</b>	<b>Desirable Effect for Need to satisfy:</b>
(+) 32. Ease of achieving desired outcome	More Ease of achieving desired outcome interacting with S2
<b>TRIZ undesirables parameters for sensitivity analysis</b>	<b>It is understood as DESIGNER has:</b>
(+) 24. Loss of Information	More Loss of information or lack of communication interacting with S2
(-) 12. Shape / composition / configuration	Less Appropriate shape, composition, or configuration interacting with S2
n/a	
n/a	

n/a

## EVALUTION RESULTS TABLES

**TABLE II. SPECIFIC CONTRADICTION MATRIX FOR UNDESIRABLE EFFECTS AND NEED TO SATISFY. FOR EVALUATED OBJECT: DESIGNER AND NEED TO BE SATISFIED > 32. Ease of achieving desired outcome**

CHALLENGE: Improve Design of the best toy for children affected by designer paradigms that do not fit with children's desires

(\*) Preferred parameters: Improve 32. Ease of achieving desired outcome & Attenuate or preserve 37.

Difficulty of detecting and measuring.

Contradictions/ E.C: Essential, Comp.:Complementary, Top 5: Up to the major fifth, noted if outside the preferred parameters.

Parameters in the first row are the same as those in the first column.

Parameter to attenuate or preserve => Parameter to improve	Var.	(+) Par.1	(-) Par.29	(-) Par.35	(+) Par.37 <b>PREF.</b>	(+) Par.32	Sum wt
(+) 1. Heaviness of moving object	wt		wt.14	wt.11	<b>wt.5 Compl.</b>	<b>wt.4 Top 5</b>	71%
	IP(s)	0,0,0,0	28,35,26,18	29,5,15,8	28,29,26,32	27,28,1,36	
(-) 29. Fulfillment of desired outcome	wt	wt.12		-	-	-	10%
	IP(s)	28,32,13,18	0,0,0,0	0,0,0,0	0,0,0,0	0,0,0,0	
(-) 35. Adaptability or versatility	wt	wt.8	-		<b>wt.6 Compl.</b>	wt.13	42%
	IP(s)	1,6,15,8	0,0,0,0	0,0,0,0	1,0,0,0	1,13,31,0	
(+) 37. Difficulty of detecting and measuring	wt	<b>wt.2 Top 5</b>	-	wt.7		<b>wt.3 Top 5</b>	91%
	IP(s)	27,26,28,13	0,0,0,0	1,15,0,0	0,0,0,0	5,28,11,29	
(+) 32. Ease of achieving desired outcome <b>PREF.</b>	wt	<b>wt.9 Compl.</b>	-	<b>wt.10 Compl.</b>	<b>wt.1 E.C.</b>		78%
	IP(s)	28,29,15,16	0,0,0,0	2,13,15,0	6,28,11,1	0,0,0,0	
Sum wt		79%	8%	36%	100%	67%	

This table shows the essential contradiction (E.C.) that determines the solution strategy. Additionally, preferred parameters are established where complementary contradictions (Compl.) are found, allowing the definition of the Base Solution shown in Table III.

As a complement to the Base Solution, Table II also provides the following information that could be

relevant to obtain an optimal solution:

- a) The algorithm identifies the top 5 contradictions from the entire Table II and highlights those that are outside the preferred parameters for further review.
- b) There are inventive principles present in Table II that are not part of the Recommended Solution proposed in Table V. In the latter, the top three most relevant ones are highlighted, and the contradictions they involve are presented to evaluate whether they contribute significant aspects to the desired solution. For further details, Table VIII provides a prioritization of the inventive principles from Table II, and those not included in the Recommended Solution in Table V are marked with \*\*\*.

**TABLE III. BASE SOLUTION FOR THE EVALUATED OBJECT: DESIGNER**

**NEED TO SATISFY > 32. Ease of achieving desired outcome**

CHALLENGE: Improve Design of the best toy for children affected by designer paradigms that do not fit with children's desires

<b>Table II Selection: Essential Contradiction wt.1 y Complementary contradictions with preferred parameters (*) wt.5/wt.6/wt.9/wt.10</b>							
Parameter to improve	Parameter to attenuate or preserve	Contradict.	Wt.n	IP. Ord.1	IP Ord 2	IP Ord 3	IP Ord 4
(+) 32. Ease of achieving desired outcome	(+) 37. Difficulty of detecting and measuring	Essential	wt.1	<b>6 Es.</b>	<b>28 Es.</b>	<b>11 Es.</b>	<b>1 Es.</b>
(+) 1. Heaviness of moving object	(+) 37. Difficulty of detecting and measuring	Compl. 1	wt.5	<b>28 Es.</b>	29	26	32
(-) 35. Adaptability or versatility	(+) 37. Difficulty of detecting and measuring	Compl. 2	wt.6	<b>1 Es.</b>	0	0	0
(+) 32. Ease of achieving desired outcome	(+) 1. Heaviness of moving object	Compl. 3	wt.9	<b>28 Es.</b>	29	15	16
(+) 32. Ease of achieving desired outcome	(-) 35. Adaptability or versatility	Compl. 4	wt.10	2	13	15	0

**Inventive Principles (IP) selected for the Base Solution**

- IP.6. Universality - tactical type
- IP.28. Mechanics Substitution - strategic type
- IP.11. Beforehand Cushioning - tactical type
- IP.1. Segmenting/ Integrating - strategic type
- IP.29. Controllable Soft Variables - tactical type
- IP.26. Copying/ Replicating - strategic type
- IP.32. Perception/ Appearance/ Color Changes - strategic type
- IP.15. Dynamics - strategic type
- IP.16. Partial or Excessive Actions - **operative type**
- IP.2. Taking out/ Adding - strategic type
- IP.13. Reverse or Indirect Action - strategic type

Table III shows the essential contradiction, the one with the highest weight, plus the following 4 complementary contradictions in weight, which are located in the row and column of the preferred parameters selected in Table II. These contradictions are considered relevant for the solution and are described as the Base Solution in Table IX.

Keep in mind that all inventive principles selected for a solution must be evaluated according to the specific context of the contradictions in which they participate.

Inventive principles marked with 'Es.' correspond to inventive principles that belong to the essential contradiction.

**TABLE IV. CONTRADICTION MATRIX COVERAGE FOR SOLUTION AMONG NEEDS TO SATISFY FOR EVALUATED OBJECT: DESIGNER, NEED TO BE SATISFY: 32. Ease of achieving desired outcome**

Coverage is defined as the extent to which the inventive principles from Table II encompass the inventive principles from Table IV. If weighted coverage is higher, it has been observed that the obtained solution is more likely to have the lowest cost and the maximum benefit-to-cost ratio.

Parameter to improve	Parameter to preserve	IP. Ord.1	IP Ord 2	IP Ord 3	IP Ord 4
32. Ease of achieving desired outcome	39. Productivity	35	1	<b>10</b> nT2	28
32. Ease of achieving desired outcome	15. Duration of action of moving object	27	1	<b>4</b> nT2	0
32. Ease of achieving desired outcome	34. Ease of change, repair or maintain	35	1	11	<b>9</b> nT2
32. Ease of achieving desired outcome	33. Ease of operation	2	5 nT3	13	16
32. Ease of achieving desired outcome	32. Ease of achieving desired outcome	0	0	0	0
32. Ease of achieving desired outcome	19. Use of energy by moving object	28	26	27	1
32. Ease of achieving desired outcome	27. Reliability	0	0	0	0
32. Ease of achieving desired outcome	38. Extent of automation/ autonomy	8 nT3	28	1	0
32. Ease of achieving desired outcome	35. Adaptability or versatility	2	13	15	0
32. Ease of achieving desired outcome	13. Stability	11	13	1	0

**Inventive Principles (IP) selected for the Solution of relevant Contradictions between Needs to Satisfy**

IP.35. Transformation / Parameter Changes - strategic tpe

IP.1. Segmenting/ Integrating - strategic tpe

IP.10. Preliminary Action - strategic tpe

IP.28. Mechanics Substitution - strategic tpe

IP.27. Cheap Short-Living Objects - strategic tpe

IP.4. Asymmetry/ Symmetry - **operative type**

IP.11. Beforehand Cushioning - tactical type

IP.9. Preliminary Anti-action - **operative type**

96.56 % weighted coverage of the inventive principles (IP) included in Table IV. of Contradictions between Needs to Satisfy (NS), in relation to the IP included in Table II Specific Contradiction Matrix.

The inventive principles labeled with nT2 are not found in Table II. Due to this condition, the first three contradictions in Table IV containing principles marked with nT2 are described as a Solution among Needs to Satisfy in Table IX. This solution, combined with the previously mentioned Base Solution, forms the Recommended Solution by the Aatrizinventor Algorithm, shown in Table V.

**From practical experience, if Table IV contains more than 3 contradictions with inventive principles not included in Table II, then it is likely to be more challenging to construct a specific solution. In that case, it is recommended to look for an alternative combination of parameters in Table VI of sensitivity analysis. It is also an option to select another need to satisfy, which is shown in Table VII Essential Contradictions of Needs to Satisfy (NS) for the same undesirable effects already evaluated for DESIGNER.**

To evaluate the recommended inventive principles here and the corresponding contradictions in which they participate, it is necessary for the Base Solution to guide an initial context for the solution, as the contradictions between Needs to Satisfy do not identify which variable of the evaluated object S1 should be operated.

Inventive principles labeled with nT3 are included in Table II, but do not participate in the Recommended Solution shown in Table V. The Innovation Team must review the contradictions where they participate, to determine if there were other specific aspects that could be significant for the solution.

Unmarked inventive principles are included in Table II Specific Contradiction Matrix and in Table V Recommended Solution.

**TABLE V. RECOMMENDED SOLUTION FOR INNOVATION CHALLENGE FOR EVALUATED OBJECT DESIGNER**

CHALLENGE: Improve Design of the best toy for children affected by designer paradigms that do not fit with children's desires

Evaluated need to satisfy in this report: **32. Ease of achieving desired outcome**

UDEs: (+) 1. Heaviness of moving object// (-) 29. Fulfillment of desired outcome// (-) 35. Adaptability or versatility// (+) 37. Difficulty of detecting and measuring

Parameter to improve	Parameter to attenuate or preserve	Contradict.	Wt.n	IP. Ord.1	IP Ord 2	IP Ord 3	IP Ord 4
(+) 32. Ease of achieving desired outcome	(+) 37. Difficulty of detecting and measuring	Essential	wt.1	6 Es.	28 Es.	11 Es.	1 Es.

(+) 1. Heaviness of moving object	(+) 37. Difficulty of detecting and measuring	Compl. 1	wt.5	<b>28 Es.</b>	29	26	32
(-) 35. Adaptability or versatility	(+) 37. Difficulty of detecting and measuring	Compl. 2	wt.6	<b>1 Es.</b>	0	0	0
(+) 32. Ease of achieving desired outcome	(+) 1. Heaviness of moving object	Compl. 3	wt.9	<b>28 Es.</b>	29	15	16
(+) 32. Ease of achieving desired outcome	(-) 35. Adaptability or versatility	Compl. 4	wt.10	2	13	15	0
32. Ease of achieving desired outcome	39. Productivity	NS.1	wns.1	35	<b>1 Es.</b>	10	<b>28 Es.</b>
32. Ease of achieving desired outcome	15. Duration of action of moving object	NS.2	wns.2	27	<b>1 Es.</b>	4	0
32. Ease of achieving desired outcome	34. Ease of change, repair or maintain	NS.3	wns.3	35	<b>1 Es.</b>	<b>11 Es.</b>	9

### Relevant inventive principles from Table II not included in Recommended Solution

Before deciding on the solution, make sure you have previously reviewed the contradictions with relevant Inventive Principles from Table II, not included in the Recommended Solution. The 3 most relevant are shown below.

IP.5. Merging/ Separating (Pos.6) ***	<b>IP. Oper.</b>	[Par.1][Par.35][ IP(s) : 29,5,15,8] - [Par.37][Par.32][ IP(s) : 5,28,11,29] -
IP.31. Using/ Removing Unused Parts (Pos.14) ***	<b>IP. Oper.</b>	[Par.35][Par.32][ IP(s) : 1,13,31,0] -
IP.18. Mechanical Vibrations/ Energy Variations (Pos.15) ***	<b>IP. Tac.</b>	[Par.29][Par.1][ IP(s) : 28,32,13,18] - [Par.1][Par.29][ IP(s) : 28,35,26,18] -

### Inventive Principles (IP) selected for Recommended Solution:

To develop a Specific Solution based on the contradictions provided in Table V, where S1: DESIGNER interacts with S2: CHILDREN, the Innovation Team must analyze the recommended innovation concepts for each selected inventive principle listed below. At least one concept from each principle that is applicable to the challenge under evaluation should be chosen.

Once the concepts are selected per inventive principle, it is essential to conduct an 'integrated reading' of the contradictions indicated in Table V. If this 'integrated reading' can demonstrate a coherent logical thread for each selected contradiction and as a whole, then it can be considered that there is a potential innovation solution.

To complete the definition of the specific solution, it is necessary to review the relevant inventive principles from Table II that were not included in the Recommended Solution in Table V, which are

presented above.

For more details on the selected contradictions, you can review the complete descriptions of the inventive principles by contradiction, as shown in Table IX.

In the Starting Manual, Fundamentals of Aatrizinventor, Point 11, an example is provided for developing the Specific Solution based on the Recommended Solution by the Aatrizinventor algorithm, based on the 'Language of Nature Innovation.' The identification of a specific solution is a systematic and iterative process involving multiple concepts, aiming to determine a comprehensive solution with minimal implementation costs and maximum benefit-to-cost ratio.

It's important noting that an asterisk (\*) has been added to the name of the object under evaluation to remind that the descriptions of the inventive principles may consider that DESIGNER can be in its current physical and functional state, or in a modified state, or even in a new state, as needed to achieve the desired objective. Please, make the most of your relational thinking skills.

**Summary description of the Inventive Principles included in the Recommended Solution shown above, applicable to the challenge under evaluation for the defined space and time:**

**N°1 Improve: (+) 32. Ease of achieving desired outcome and Attenuate or Preserve: (+) 37. Difficulty of detecting and measuring**

**IP.6. Universality - tactical type (1)**

- a. Make a part or the whole of DESIGNER\* perform multiple functions.
- b. Eliminate the need of DESIGNER\* for others parts.

**IP.28. Mechanics Substitution - strategic type (2)**

- a. Replace a direct or manual action in, or for, DESIGNER\*, with a mechanical action or a tool.
- b. Replace a mechanical means in, or for, DESIGNER\*, with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.
- c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological, psychological or other fields to improve action of DESIGNER\*.
- d. Change from static fields in, or for, DESIGNER\* to moving fields, from unstructured fields to those with structure, or vice versa.
- e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, DESIGNER\*.

**IP.11. Beforehand Cushioning - tactical type (3)**

- a. Prepare emergency means, beforehand, to compensate for the relatively low reliability of DESIGNER\*.

**IP.1. Segmenting/ Integrating - strategic type (4)**

- a. Divide DESIGNER\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different existing or new parts, forms, phases, states or conditions of DESIGNER\* in a single entity.
- c. Make DESIGNER\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of DESIGNER\*.

**N°2 Improve: (+) 1. Heaviness of moving object and Attenuate or Preserve: (+) 37. Difficulty of detecting and measuring**

**IP.28. Mechanics Substitution - strategic type (5)**

- a. Replace a direct or manual action in, or for, DESIGNER\*, with a mechanical action or a tool.

- b. Replace a mechanical means in, or for, DESIGNER\*, with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.
- c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological, psychological or other fields to improve action of DESIGNER\*.
- d. Change from static fields in, or for, DESIGNER\* to moving fields, from unstructured fields to those with structure, or vice versa.
- e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, DESIGNER\*.

**IP.29. Controllable Soft Variables - tactical type (6)**

- a. Use external, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological, etc.) to interact with DESIGNER\* facilitating goal fulfillment of the function performed with Object S2.
- b. Make easier DESIGNER\* interact with Object S2 using internal, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological, etc.) available in S1 and / or S2, facilitating goal fulfillment.

**IP.26. Copying/ Replicating - strategic type (7)**

- a. Instead of using DESIGNER\*, or any of its unavailable, expensive, fragile parts or properties, use simpler and inexpensive copies or replicates to perform the desired function and, if possible, do so with improved characteristics and properties, while disregarding the harmful, undesirable, or unnecessary ones.
- b. Imitate DESIGNER\*, or any of its parts or properties, leveraging the relevant available environment.
- c. If simple copies, or replicates are already being used, apply copies, or replicates of a higher level or technical

**IP.32. Perception/ Appearance/ Color Changes - strategic type (8)**

- a. Change how is perceived, the appearance or shape of DESIGNER\* in relation to the object S2 with which it interacts.
- b. Change the color, or appearance, of DESIGNER\* or its external environment.
- c. Change the transparency of DESIGNER\* or its external environment.

**N°3 Improve: (-) 35. Adaptability or versatility and Attenuate or Preserve: (+) 37. Difficulty of detecting and measuring**

**IP.1. Segmenting/ Integrating - strategic type (9)**

- a. Divide DESIGNER\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different existing or new parts, forms, phases, states or conditions of DESIGNER\* in a single entity.
- c. Make DESIGNER\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of DESIGNER\*.

**N°4 Improve: (+) 32. Ease of achieving desired outcome and Attenuate or Preserve: (+) 1. Heaviness of moving object**

**IP.28. Mechanics Substitution - strategic type (10)**

- a. Replace a direct or manual action in, or for, DESIGNER\*, with a mechanical action or a tool.
- b. Replace a mechanical means in, or for, DESIGNER\*, with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.
- c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological, psychological or other fields to improve action of DESIGNER\*.

d. Change from static fields in, or for, DESIGNER\* to moving fields, from unstructured fields to those with structure, or vice versa.

e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, DESIGNER\*.

**IP.29. Controllable Soft Variables - tactical type** (11)

a. Use external, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological, etc.) to interact with DESIGNER\* facilitating goal fulfillment of the function performed with Object S2.

b. Make easier DESIGNER\* interact with Object S2 using internal, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological, etc.) available in S1 and / or S2, facilitating goal fulfillment.

**IP.15. Dynamics - strategic type** (12)

a. Allow (or design) the characteristics of DESIGNER\*, external environment, or process to change to an optimal, or to find an optimal, operating condition.

b. Divide DESIGNER\* into parts that are capable of relative movement between each other.

c. If DESIGNER\* (or process) is rigid or inflexible, make it flexible or adaptive.

d. To enhance the dynamics of DESIGNER\* or the process, use feature(s) or object(s) available in the nearby environment.

**IP.16. Partial or Excessive Actions - operative type** (13)

a. If the objective of DESIGNER\* in its interaction with CHILDREN is difficult to fully achieve using a given solution, then use 'a little less' or 'a little more' of the same solution.

**N°5 Improve: (+) 32. Ease of achieving desired outcome and Attenuate or Preserve: (-) 35. Adaptability or versatility**

**IP.2. Taking out/ Adding - strategic type** (14)

a. Separate an interfering part or a property from DESIGNER\*, or single out the only necessary part (or property) of DESIGNER\*. b. Add new parts or properties to DESIGNER\*.

**IP.13. Reverse or Indirect Action - strategic type** (15)

a. Inverse the applied action or apply an indirect action to perform the current function of DESIGNER\* to interact with object S2 It should be identified how DESIGNER\* currently performs an action with Object S2 and from there evaluate an inverse or indirect action.

b. Make moving parts of DESIGNER\* (or the external environment) fixed, and fixed parts moving.

c. Turn DESIGNER\* (or process) 'upside down', 'change the position', 'change the condition'.

**IP.15. Dynamics - strategic type** (16)

a. Allow (or design) the characteristics of DESIGNER\*, external environment, or process to change to an optimal, or to find an optimal, operating condition.

b. Divide DESIGNER\* into parts that are capable of relative movement between each other.

c. If DESIGNER\* (or process) is rigid or inflexible, make it flexible or adaptive.

d. To enhance the dynamics of DESIGNER\* or the process, use feature(s) or object(s) available in the nearby environment.

**N°6 Improve: 32. Ease of achieving desired outcome and Preserve: 39. Productivity**

**IP.35. Transformation / Parameter Changes - strategic type** (17)

a. Change DESIGNER\*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).

- b. Change the composition or condition of DESIGNER\* by adding or removing components.
- c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of DESIGNER\*.

**IP.1. Segmenting/ Integrating - strategic type** (18)

- a. Divide DESIGNER\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different existing or new parts, forms, phases, states or conditions of DESIGNER\* in a single entity.
- c. Make DESIGNER\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of DESIGNER\*.

**IP.10. Preliminary Action - strategic type** (19)

- a. Perform the required change in, or for, DESIGNER\*, before it is needed (either fully or partially).
- b. Pre-arrange DESIGNER\* and other objects, if necessary, in such a way that they can come into action from the most convenient place and without losing time for their delivery.

**IP.28. Mechanics Substitution - strategic type** (20)

- a. Replace a direct or manual action in, or for, DESIGNER\*, with a mechanical action or a tool.
- b. Replace a mechanical means in, or for, DESIGNER\*, with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.
- c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological, psychological or other fields to improve action of DESIGNER\*.
- d. Change from static fields in, or for, DESIGNER\* to moving fields, from unstructured fields to those with structure, or vice versa.
- e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, DESIGNER\*.

**N°7 Improve: 32. Ease of achieving desired outcome and Preserve: 15. Duration of action of moving object**

**IP.27. Cheap Short-Living Objects - strategic type** (21)

- a. Replace or divide (either fully or partially) DESIGNER\* or its action with multiple inexpensive or short-living objects, actions, or sub-parts, which compress or simplify its characteristics and properties, and/or are limited but sufficient to achieve the desired objective.
- b. Compress certain qualities of DESIGNER\* (e.g., the degree of participation, complexity, or lifetime), with no loss of functionality, to achieve the desired objective.

**IP.1. Segmenting/ Integrating - strategic type** (22)

- a. Divide DESIGNER\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different existing or new parts, forms, phases, states or conditions of DESIGNER\* in a single entity.
- c. Make DESIGNER\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of DESIGNER\*.

**IP.4. Asymmetry/ Symmetry - operative type** (23)

- a. Change the shape of DESIGNER\* from symmetrical to asymmetrical, permanent, or variable in time, or vice versa.
- b. If DESIGNER\* is asymmetrical, increase its degree of asymmetry, or vice versa.

**N°8 Improve: 32. Ease of achieving desired outcome and Preserve: 34. Ease of change, repair or maintain**



#	1	29	35	37	32. Ease of achieving desired outcome	96.56	98.46	97.04
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Table VI presents the 10 most favorable parameter combinations recommended by the Aatrizinventor algorithm. It is suggested to evaluate the 2 or 3 most relevant ones. Practice teaches that they often contain the best solution for the evaluated challenge.

(E) Combination of TRIZ innovation parameters evaluated in this Aatrizinventor Solution is prioritized here

#### A. PRIORITISED CONTRADICTIONS BY GLOBAL COVERAGE (Cob.GL)

Par.5 is automatically selected

Order	Par.1	Par.2	Par.3	Par.4	Par.5	Cob. NS (%)	Cob. EC (%)	Cob. GL (%)
I.a	1	12	35	37	13. Stability	98.22	100	98.66
II.a	1	29	35	37	32. Ease of achieving desired outcome (E)	96.56	98.46	97.04
III.a	1	12	29	35	19. Use of energy by moving object	94.61	100	95.96
IV.a	1	24	29	35	19. Use of energy by moving object	94.26	100	95.7
V.a	1	12	35	37	19. Use of energy by moving object	94.26	100	95.7

#### B. PRIORITIZATION OF CONTRADICTIONS BY COVERAGE OF NEEDS TO SATISFY (Cob.NS)

Par.5 is automatically selected

Order	Par.1	Par.2	Par.3	Par.4	Par.5	Cob. NS (%)	Cob. EC (%)	Cob. GL (%)	Table VI.A
I.b	1	12	35	37	13. Stability	98.22	100	98.66	I.a
II.b	1	12	35	37	32. Ease of achieving desired outcome	97.84	65.14	89.66	-
III.b	1	24	35	37	32. Ease of achieving desired outcome	97.84	7.97	75.37	-
IV.b	1	12	37	0	13. Stability	96.93	23.52	78.58	-
V.b	1	24	12	37	13. Stability	96.93	20.72	77.88	-

**TABLE VII ESSENTIAL CONTRADICTIONS MATRIX FOR NEEDS TO SATISFY (NS) FOR THE SAME UNDESIRABLE EFFECTS EVALUATED OF: DESIGNER**

CHALLENGE: Improve Design of the best toy for children affected by designer paradigms that do not fit with children's desires

Evaluated need to satisfy in this report: **32. Ease of achieving desired outcome**

UDEs: (+) 1. Heaviness of moving object// (-) 29. Fulfillment of desired outcome// (-) 35. Adaptability or versatility// (+) 37. Difficulty of detecting and measuring

This table allows the Innovation Team to compare the coverages obtained for the evaluated need to satisfy with those of the other defined needs, for the same undesirable effects. This way, they can decide whether to choose any of the suggested innovation parameter combinations here that offer better coverage.

Need to Satisfy	Parameter to improve	Parameter to attenuate or preserve	Contradict. Essential	Cob. NS (%)	Cob. between EC (%)	Cob. GL (%) 3/1
<b>32. Ease of achieving desired outcome</b>	(+) 32. Ease of achieving desired outcome	(+) 37. Difficulty of detecting and measuring	[6,28,11,1]	96.56	98.46	97.04
19. Use of energy by moving object	(+) 1. Heaviness of moving object	(+) 37. Difficulty of detecting and measuring	[28,29,26,32]	94.26	100	95.7
34. Ease of change, repair or maintain	(+) 1. Heaviness of moving object	(+) 37. Difficulty of detecting and measuring	[28,29,26,32]	93.29	100	94.96
33. Ease of operation	(+) 1. Heaviness of moving object	(+) 37. Difficulty of detecting and measuring	[28,29,26,32]	82.1	100	86.58
38. Extent of automation/ autonomy	(+) 1. Heaviness of moving object	(+) 37. Difficulty of detecting and measuring	[28,29,26,32]	78.18	100	83.63
35. Adaptability or versatility	(+) 1. Heaviness of moving object	(+) 37. Difficulty of detecting and measuring	[28,29,26,32]	76.56	100	82.42
13. Stability	(+) 1. Heaviness of moving object	(-) 29. Fulfillment of desired outcome	[28,35,26,18]	94.37	39.62	80.68
39. Productivity	(+) 1. Heaviness of moving object	(-) 29. Fulfillment of desired outcome	[28,35,26,18]	91.4	39.62	78.45
15. Duration of action of moving object	(+) 37. Difficulty of detecting and measuring	(+) 1. Heaviness of moving object	[27,26,28,13]	74.12	38	65.09

27. Reliability	(+) 1. Heaviness of moving object	(+) 27. Reliability	[1,3,11,27]	77.36	24.15	64.06
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Table VII shows the essential contradictions obtained for each of the defined Needs to Satisfy, taking into account the same undesirable effects that have been evaluated. This table is based on the calculation of a global coverage (Cob.GL), which is determined by combining two values: the coverage from Table IV (Cob.NS) already explained, and a relative coverage (Cob. between EC) that is obtained in this table VII, when each other comparing the essential contradictions identified for the 10 parameters of Needs to Satisfy.

This global coverage (GL) is based on expert weighting criteria to prioritize the solutions for the different Needs to Satisfy. Experience with aatrizinventor indicates that the most effective solutions are those with higher global coverage, preferably exceeding 90%, if possible.

**The Innovation Team may decide if it is appropriate to carry out a new evaluation with another Need to Satisfy, selected from the results provided in Table VII. This decision will be primarily made when the evaluated Need to Satisfy is not ranked in the first position of Table VII. In this table, the position of the evaluated Need to Satisfy is highlighted: 32. Ease of achieving desired outcome.**

#### TABLE VIII. ORDER OF INCIDENCE OF INVENTIVE PRINCIPLES (POS.n)

CHALLENGE: Improve Design of the best toy for children affected by designer paradigms that do not fit with children's desires

Participation analysis of inventive principles in TABLE II SPECIFIC CONTRADICTION MATRIX.

Evaluated parameters for Object DESIGNER:

Par. UDEs:

(+) 1. Heaviness of moving object

(-) 29. Fulfillment of desired outcome

(-) 35. Adaptability or versatility

(+) 37. Difficulty of detecting and measuring

Par. NS: (+) 32. Ease of achieving desired outcome

\*\*\*: Inventive Principles from the Specific Contradiction Matrix (Table II) not described in the Recommend Solution (Table IX). It is recommended to perform an additional review following the order of position.

Inventive principles of Table II	IP type	Tables	Contradictions
IP.28. Mechanics Substitution (Pos.1)	IP. Str.	II / III / IV	[Par.29][Par.1][ IP(s) : 28,32,13,18] - [Par.37][Par.1][ IP(s) : 27,26,28,13] - [Par.32][Par.1][ IP(s) : 28,29,15,16] - [Par.1][Par.29][ IP(s) : 28,35,26,18] - [Par.1][Par.37][ IP(s) : 28,29,26,32] - [Par.32][Par.37][ IP(s) : 6,28,11,1] - [Par.1][Par.32][ IP(s) : 27,28,1,36] - [Par.37][Par.32][ IP(s) : 5,28,11,29] -

IP.1. Segmenting/ Integrating (Pos.2)	IP. Str.	II / III / IV	[Par.35][Par.1][ IP(s) : 1,6,15,8] - [Par.37][Par.35][ IP(s) : 1,15,0,0] - [Par.35][Par.37][ IP(s) : 1,0,0,0] - [Par.32][Par.37][ IP(s) : 6,28,11,1] - [Par.1][Par.32][ IP(s) : 27,28,1,36] - [Par.35][Par.32][ IP(s) : 1,13,31,0] -
IP.27. Cheap Short- Living Objects (Pos.3)	IP. Str.	II / IV	[Par.37][Par.1][ IP(s) : 27,26,28,13] - [Par.1][Par.32][ IP(s) : 27,28,1,36] -
IP.29. Controllable Soft Variables (Pos.4)	IP. Tac.	II / III /	[Par.32][Par.1][ IP(s) : 28,29,15,16] - [Par.1][Par.35][ IP(s) : 29,5,15,8] - [Par.1][Par.37][ IP(s) : 28,29,26,32] - [Par.37][Par.32][ IP(s) : 5,28,11,29] -
IP.6. Universality (Pos.5)	IP. Tac.	II / III /	[Par.35][Par.1][ IP(s) : 1,6,15,8] - [Par.32][Par.37][ IP(s) : 6,28,11,1] -
IP.5. Merging/ Separating (Pos.6) ***	<b>IP. Oper.</b>	II / IV	[Par.1][Par.35][ IP(s) : 29,5,15,8] - [Par.37][Par.32][ IP(s) : 5,28,11,29] -
IP.2. Taking out/ Adding (Pos.7)	IP. Str.	II / III / IV	[Par.32][Par.35][ IP(s) : 2,13,15,0] -
IP.13. Reverse or Indirect Action (Pos.8)	IP. Str.	II / III / IV	[Par.29][Par.1][ IP(s) : 28,32,13,18] - [Par.37][Par.1][ IP(s) : 27,26,28,13] - [Par.32][Par.35][ IP(s) : 2,13,15,0] - [Par.35][Par.32][ IP(s) : 1,13,31,0] -
IP.15. Dynamics (Pos.9)	IP. Str.	II / III / IV	[Par.35][Par.1][ IP(s) : 1,6,15,8] - [Par.32][Par.1][ IP(s) : 28,29,15,16] - [Par.1][Par.35][ IP(s) : 29,5,15,8] - [Par.37][Par.35][ IP(s) : 1,15,0,0] - [Par.32][Par.35][ IP(s) : 2,13,15,0] -
IP.26. Copying/ Replicating (Pos.10)	IP. Str.	II / III / IV	[Par.37][Par.1][ IP(s) : 27,26,28,13] - [Par.1][Par.29][ IP(s) : 28,35,26,18] - [Par.1][Par.37][ IP(s) : 28,29,26,32] -
IP.32. Perception/ Appearance/ Color Changes (Pos.11)	IP. Str.	II / III /	[Par.29][Par.1][ IP(s) : 28,32,13,18] - [Par.1][Par.37][ IP(s) : 28,29,26,32] -
IP.35. Transformation / Parameter Changes (Pos.12)	IP. Str.	II / IV	[Par.1][Par.29][ IP(s) : 28,35,26,18] -
IP.11. Beforehand Cushioning (Pos.13)	IP. Tac.	II / III / IV	[Par.32][Par.37][ IP(s) : 6,28,11,1] - [Par.37][Par.32][ IP(s) : 5,28,11,29] -
IP.31. Using/ Removing Unused Parts (Pos.14) ***	<b>IP. Oper.</b>	II /	[Par.35][Par.32][ IP(s) : 1,13,31,0] -
IP.18. Mechanical Vibrations/ Energy Variations (Pos.15) ***	IP. Tac.	II /	[Par.29][Par.1][ IP(s) : 28,32,13,18] - [Par.1][Par.29][ IP(s) : 28,35,26,18] -

IP.8. Anti-Weight/ Compensation (Pos.16) ***	IP. Tac.	II / IV	[Par.35][Par.1][ IP(s) : 1,6,15,8] - [Par.1][Par.35][ IP(s) : 29,5,15,8] -
IP.36. Phase, State or Condition Transitions (Pos.17) ***	IP. Oper.	II /	[Par.1][Par.32][ IP(s) : 27,28,1,36] -
IP.16. Partial or Excessive Actions (Pos.18)	IP. Oper.	II / III / IV	[Par.32][Par.1][ IP(s) : 28,29,15,16] -

### TABLE IX. RECOMMENDED SOLUTION ACCORDING TO THE MOST RELEVANT CONTRADICTIONS IDENTIFIED FOR THE EVALUATED OBJECT: DESIGNER

CHALLENGE: Improve Design of the best toy for children affected by designer paradigms that do not fit with children's desires

This table displays the relevant contradictions identified by the algorithm, which are crucial for determining the direction and scope of the solution to the innovation challenge under evaluation. The specific solution will be obtained by applying the updated inventive principles detailed below.

It is essential to bear in mind that we are evaluating DESIGNER when it interacts with CHILDREN and there is an affected function: Design of the best toy for children affected by designer paradigms that do not fit with children's desires, in a specific space and time. DESIGNER may require changes in space, time, its physical composition, or its functional characteristic, as well as partial or total replacement with another object or other recommended changes. To emphasize this concept, we mark DESIGNER with an asterisk. Do not read the name of the evaluated object literally; associate it with a possible solution for DESIGNER\*.

Each inventive principle described here may contain more than one innovation concept recommended by TRIZ, identified as a, b, c, ..., not all of which are applicable to a specific case under evaluation. The Innovation Team must select those innovation concepts that best relate to the evaluated innovation challenge, based on their own knowledge and the analysis of relational thinking that they must carry out.

Additionally, technological research may be necessary for its solution, as the specific solution recommended by the inventive principles described here likely already exists somewhere in the world. The interpretation of the inventive principles, to apply them specifically to the evaluated case, is a recursive process that generally ranges from strategic to tactical and operational levels. We recommend completing the reading of the inventive principles described below to envision a possible solution and then rereading the principles to reinforce the coherence of the emerging solution. As a result of the finally determined innovation solution, there will be a change in DESIGNER, in a new context guided by the inventive principles, probably not previously imagined.

The Language of Nature's Innovation provides speed and focus for guided and systematic innovation thinking for individuals. The foundation for innovation is a profound understanding of the current

situation.

## **IX.A BASE SOLUTION FOR INNOVATION CHALLENGE FOR THE EVALUATED OBJECT DESIGNER**

### **NEED TO SATISFY: 32. Ease of achieving desired outcome**

Strategic inventive principles: Str. IP

Tactical inventive principles: Tac. IP

Operative inventive principles: Oper. IP

Pos.n : Order of importance n of an inventive principle included in Table II.

## **ESSENTIAL CONTRADICTION**

### **Contradiction order wt.1**

#### **Parameter to improve: (+) 32. Ease of achieving desired outcome**

TO IMPROVE (DE): DESIGNER has More Ease of achieving desired outcome interacting with S2

#### **Parameter to attenuate or preserve: (+) 37. Difficulty of detecting and measuring**

TO ATTENUATE OR PRESERVE (UDE): DESIGNER has More Difficulty in detection and measurement interacting with S2

**Inventive principles IP(s) : [6,28,11,1]**

#### **6. Universality, Tac. IP (Pos.5):**

- a. Make a part or the whole of DESIGNER\* perform multiple functions.
- b. Eliminate the need of DESIGNER\* for others parts.

Separation principle for DESIGNER\* : Separation alternative

Solution strategy for DESIGNER\* : Improving if a solution has not yet emerged

#### **28. Mechanics Substitution, Str. IP (Pos.1):**

- a. Replace a direct or manual action in, or for, DESIGNER\* , with a mechanical action or a tool.
- b. Replace a mechanical means in, or for, DESIGNER\* , with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.
- c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological, psychological or other fields to improve action of DESIGNER\* .
- d. Change from static fields in, or for, DESIGNER\* to moving fields, from unstructured fields to those with structure, or vice versa.
- e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, DESIGNER\* .

Separation principle for DESIGNER\* : Separation by condition

Solution strategy for DESIGNER\* : Improving attributes

#### **11. Beforehand Cushioning, Tac. IP (Pos.13):**

- a. Prepare emergency means, beforehand, to compensate for the relatively low reliability of DESIGNER\* .

Separation principle for DESIGNER\* : Separation in time

Solution strategy for DESIGNER\* : Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

#### **1. Segmenting/ Integrating, Str. IP (Pos.2):**

- a. Divide DESIGNER\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different parts, shapes, phases, states, or existing or new conditions of a DESIGNER\* into a single entity..

c. Make DESIGNER\* easy to disassemble or assemble.

d. Increase or reduce the degree of fragmentation or segmentation of DESIGNER\*.

Separation principle for DESIGNER\* : Separation in space / Separation in subsystem

Solution strategy for DESIGNER\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

## COMPLEMENTARY CONTRADICTION 1

### Contradiction order wt.5

#### Parameter to improve: (+) 1. Heaviness of moving object

TO IMPROVE (UDE): DESIGNER has More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2

#### Parameter to attenuate or preserve: (+) 37. Difficulty of detecting and measuring

TO ATTENUATE OR PRESERVE (UDE): DESIGNER has More Difficulty in detection and measurement interacting with S2

Inventive principles IP(s) : [28,29,26,32]

#### 28. Mechanics Substitution, Str. IP (Pos.1):

- a. Replace a direct or manual action in, or for, DESIGNER\*, with a mechanical action or a tool.
- b. Replace a mechanical means in, or for, DESIGNER\*, with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.
- c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological, psychological or other fields to improve action of DESIGNER\*.
- d. Change from static fields in, or for, DESIGNER\* to moving fields, from unstructured fields to those with structure, or vice versa.
- e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, DESIGNER\*.

Separation principle for DESIGNER\* : Separation by condition

Solution strategy for DESIGNER\* : Improving attributes

#### 29. Controllable Soft Variables, Tac. IP (Pos.4):

- a. Use external, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) to interact with DESIGNER\* facilitating goal fulfillment of the function performed with S2 Object.
- b. Make easier DESIGNER\* interact with S2 Object using internal, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) available in S1 and / or S2, facilitating goal fulfillment.

Separation principle for DESIGNER\* : Separation in time

Solution strategy for DESIGNER\* : Improving if a solution has not yet emerged

#### 26. Copying/ Replicating, Str. IP (Pos.10):

- a. Instead of using DESIGNER\*, or any of its unavailable, expensive, fragile parts or properties, use simpler and inexpensive copies or replicates to perform the desired function and, if possible, do so with improved characteristics and properties, while disregarding the harmful, undesirable, or unnecessary ones.
- b. Imitate or replicate DESIGNER\*, or any of its parts or properties, leveraging the relevant available environment.
- c. If simple copies, or replicates are already being used, apply copies, or replicates of a higher level or

technical complexity.

Separation principle for DESIGNER\* : Separation in space

Solution strategy for DESIGNER\* : Improving if a solution has not yet emerged

### **32. Perception/ Appearance/ Color Changes, Str. IP (Pos.11):**

a. Change how is perceived, the appearance or shape of DESIGNER\* in relation to the object (S2) with which it interacts.

b. Change the color, or appearance, of DESIGNER\* or its external environment.

c. Change the transparency of DESIGNER\* or its external environment.

Separation principle for DESIGNER\* : Separation by condition

Solution strategy for DESIGNER\* : Improving if a solution has not yet emerged

## **COMPLEMENTARY CONTRADICTION 2**

**Contradiction order wt.6**

### **Parameter to improve: (-) 35. Adaptability or versatility**

TO IMPROVE (UDE): DESIGNER has Less Adaptability or versatility to interaction variability of S2

### **Parameter to attenuate or preserve: (+) 37. Difficulty of detecting and measuring**

TO ATTENUATE OR PRESERVE (UDE): DESIGNER has More Difficulty in detection and measurement interacting with S2

**Inventive principles IP(s) : [1,0,0,0]**

#### **1. Segmenting/ Integrating, Str. IP (Pos.2):**

a. Divide DESIGNER\* into existing and/or new parts, shapes, phases, states, or conditions.

b. Integrate different parts, shapes, phases, states, or existing or new conditions of a DESIGNER\* into a single entity..

c. Make DESIGNER\* easy to disassemble or assemble.

d. Increase or reduce the degree of fragmentation or segmentation of DESIGNER\*.

Separation principle for DESIGNER\* : Separation in space / Separation in subsystem

Solution strategy for DESIGNER\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

## **COMPLEMENTARY CONTRADICTION 3**

**Contradiction order wt.9**

### **Parameter to improve: (+) 32. Ease of achieving desired outcome**

TO IMPROVE (DE): DESIGNER has More Ease of achieving desired outcome interacting with S2

### **Parameter to attenuate or preserve: (+) 1. Heaviness of moving object**

TO ATTENUATE OR PRESERVE (UDE): DESIGNER has More Heaviness, value, cost, or restriction, whether physical or figurative interacting with S2

**Inventive principles IP(s) : [28,29,15,16]**

#### **28. Mechanics Substitution, Str. IP (Pos.1):**

a. Replace a direct or manual action in, or for, DESIGNER\* , with a mechanical action or a tool.

b. Replace a mechanical means in, or for, DESIGNER\* , with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.

c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological,

psychological or other fields to improve action of DESIGNER\*.

d. Change from static fields in, or for, DESIGNER\* to moving fields, from unstructured fields to those with structure, or vice versa.

e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, DESIGNER\*.

Separation principle for DESIGNER\* : Separation by condition

Solution strategy for DESIGNER\* : Improving attributes

#### **29. Controllable Soft Variables, Tac. IP (Pos.4):**

a. Use external, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) to interact with DESIGNER\* facilitating goal fulfillment of the function performed with S2 Object.

b. Make easier DESIGNER\* interact with S2 Object using internal, controllable soft variables (manual, physical, mechanical, pneumatic, hydraulic, electrical, magnetic, electromagnetic, digital, chemical, biological, social, psychological, physiological , etc.) available in S1 and / or S2, facilitating goal fulfillment.

Separation principle for DESIGNER\* : Separation in time

Solution strategy for DESIGNER\* : Improving if a solution has not yet emerged

#### **15. Dynamics, Str. IP (Pos.9):**

a. Allow (or design) the characteristics of DESIGNER\*, external environment, or process to change to an optimal, or to find an optimal, operating condition.

b. Divide DESIGNER\* into parts that are capable of relative movement between each other.

c. If DESIGNER\* (or process) is rigid or inflexible, make it flexible or adaptive.

d. To enhance the dynamics of DESIGNER\* or the process, use feature(s) or object(s) available in the nearby environment.

Separation principle for DESIGNER\* : Separation in time

Solution strategy for DESIGNER\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

#### **16. Partial or Excessive Actions, Oper. IP (Pos.18):**

a. If the goal of DESIGNER\* is hard to achieve fully, using a given solution's method; then the problem may be considerably easier to solve, using "slightly less" or "slightly more" of the same method.

Separation principle for DESIGNER\* : Separation in time

Solution strategy for DESIGNER\* : Improving performance

### **COMPLEMENTARY CONTRADICTION 4**

#### **Contradiction order wt.10**

#### **Parameter to improve: (+) 32. Ease of achieving desired outcome**

TO IMPROVE (DE): DESIGNER has More Ease of achieving desired outcome interacting with S2

#### **Parameter to attenuate or preserve: (-) 35. Adaptability or versatility**

TO ATTENUATE OR PRESERVE (UDE): DESIGNER has Less Adaptability or versatility to interaction variability of S2

**Inventive principles IP(s) : [2,13,15,0]**

#### **2. Taking Out/ Adding, Str. IP (Pos.7):**

a. Separate an interfering part or a property from DESIGNER\*, or single out the only necessary part (or property) of DESIGNER\*.

**b.** Add new parts or properties to DESIGNER\*.

Separation principle for DESIGNER\* : Separation in space

Solution strategy for DESIGNER\* : Improving attributes

**13. Inverse or Indirect Action, Str. IP (Pos.8):**

**a.** Inverse the applied action or apply an indirect action to perform the current function of DESIGNER\* to interact with object (S2)

It should be identified how DESIGNER\* currently performs an action with S2 Object and from there evaluate an inverse or indirect action.

**b.** Make moving parts of DESIGNER\* (or the external environment) fixed, and fixed parts moving.

**c.** Turn DESIGNER\* (or process) “upside down”, “change the position”, “change the condition”.

Separation principle for DESIGNER\* : Separation in space / Separation inverse

Solution strategy for DESIGNER\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

**15. Dynamics, Str. IP (Pos.9):**

**a.** Allow (or design) the characteristics of DESIGNER\*, external environment, or process to change to an optimal, or to find an optimal, operating condition.

**b.** Divide DESIGNER\* into parts that are capable of relative movement between each other.

**c.** If DESIGNER\* (or process) is rigid or inflexible, make it flexible or adaptive.

**d.** To enhance the dynamics of DESIGNER\* or the process, use feature(s) or object(s) available in the nearby environment.

Separation principle for DESIGNER\* : Separation in time

Solution strategy for DESIGNER\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

**IX.B SOLUTION TO MORE RELEVANT CONTRADICTIONS BETWEEN NEEDS TO SATISFY (Cob.NS)**

Included in each inventive principle described below is the incidence level or position number it occupies in Table II. If it is not shown, it means that it only appears in Table IV. and requires attention.

**CONTRADICTION BETWEEN NEEDS TO SATISFY N° 1**

**Parameter to improve 32. Ease of achieving desired outcome**

MEJORAR > DESIGNER tiene More Ease of achieving desired outcome interacting with S2

**Parameter to preserve 39. Productivity**

PRESERVAR > DESIGNER tiene más efecto deseable por párametro 39. Productivity

**Inventive principles IP(s) : [35,1,10,28]**

**35. Transformation/ Parameter Changes, Str. IP (Pos.12):**

**a.** Change DESIGNER\*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).

**b.** Change the composition or condition of DESIGNER\* by adding or removing components.

**c.** Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of DESIGNER\*.

Separation principle for DESIGNER\* : Separation by condition / Separation alternative

Solution strategy for DESIGNER\* : Improving attributes; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

**1. Segmenting/ Integrating, Str. IP (Pos.2):**

- a. Divide DESIGNER\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different parts, shapes, phases, states, or existing or new conditions of a DESIGNER\* into a single entity..
- c. Make DESIGNER\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of DESIGNER\*.

Separation principle for DESIGNER\* : Separation in space / Separation in subsystem

Solution strategy for DESIGNER\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

#### **10. Preliminary Action, Str. IP (Pos.):**

- a. Perform the required change in, or for, DESIGNER\*, before it is needed (either fully or partially).
- b. Pre-arrange DESIGNER\* and other objects, if necessary, in such a way that they can come into action from the most convenient place and without losing time for their delivery.

Separation principle for DESIGNER\* : Separation in time

Solution strategy for DESIGNER\* : Improving attributes; Improving performance

#### **28. Mechanics Substitution, Str. IP (Pos.1):**

- a. Replace a direct or manual action in, or for, DESIGNER\*, with a mechanical action or a tool.
- b. Replace a mechanical means in, or for, DESIGNER\*, with sensory (optical, acoustic, vibration, taste, smell, feelings or other sensory fields) means.
- c. Use mechanical, pneumatic, hydraulic, electric, magnetic, and electromagnetic, chemical, biological, psychological or other fields to improve action of DESIGNER\*.
- d. Change from static fields in, or for, DESIGNER\* to moving fields, from unstructured fields to those with structure, or vice versa.
- e. Use fields in conjunction with field-activated parts, components, or particles (e.g., magnetic field and ferromagnetic particles) in, or for, DESIGNER\*.

Separation principle for DESIGNER\* : Separation by condition

Solution strategy for DESIGNER\* : Improving attributes

### **CONTRADICTION BETWEEN NEEDS TO SATISFY N° 2**

#### **Parameter to improve 32. Ease of achieving desired outcome**

MEJORAR > DESIGNER tiene More Ease of achieving desired outcome interacting with S2

#### **Parameter to preserve 15. Duration of action of moving object**

PRESERVAR > DESIGNER tiene más efecto deseable por párametro 15. Duration of action of moving object

**Inventive principles IP(s) : [27,1,4,0]**

#### **27. Cheap Short-Living Objects, Str. IP (Pos.3):**

- a. Replace or divide (either fully or partially) DESIGNER\* or its action with multiple inexpensive or short-living objects, actions, or sub-parts, which compress or simplify its characteristics and properties, and/or are limited but sufficient to achieve the desired objective.
- b. Comprising certain qualities of DESIGNER\* (e.g., the degree of participation, complexity, or lifetime), with no loss of functionality, to achieve the desired objective.

Separation principle for DESIGNER\* : Separation in subsystem

Solution strategy for DESIGNER\* : Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

#### **1. Segmenting/ Integrating, Str. IP (Pos.2):**

- a. Divide DESIGNER\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different parts, shapes, phases, states, or existing or new conditions of a DESIGNER\* into a single entity..
- c. Make DESIGNER\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of DESIGNER\*.

Separation principle for DESIGNER\* : Separation in space / Separation in subsystem

Solution strategy for DESIGNER\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

#### **4. Asymmetry/ Symmetry, Str. IP (Pos.):**

- a. Change the shape of DESIGNER\* from symmetrical to asymmetrical, permanent, or variable in time, or vice versa.
- b. If DESIGNER\* is asymmetrical, increase its degree of asymmetry, or vice versa.

Separation principle for DESIGNER\* : Separation in space

Solution strategy for DESIGNER\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

### **CONTRADICTION BETWEEN NEEDS TO SATISFY N° 3**

#### **Parameter to improve 32. Ease of achieving desired outcome**

MEJORAR > DESIGNER tiene More Ease of achieving desired outcome interacting with S2

#### **Parameter to preserve 34. Ease of change, repair or maintain**

PRESERVAR > DESIGNER tiene más efecto deseable por párametro 34. Ease of change, repair or maintain

**Inventive principles IP(s) : [35,1,11,9]**

#### **35. Transformation/ Parameter Changes, Str. IP (Pos.12):**

- a. Change DESIGNER\*'s physical or chemical state (e.g., in shape, in composition, to a gas, liquid, solid or plasma).
- b. Change the composition or condition of DESIGNER\* by adding or removing components.
- c. Change the concentration or consistency; change the degree of flexibility; change the temperature or the level of internal activity of DESIGNER\*.

Separation principle for DESIGNER\* : Separation by condition / Separation alternative

Solution strategy for DESIGNER\* : Improving attributes; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

#### **1. Segmenting/ Integrating, Str. IP (Pos.2):**

- a. Divide DESIGNER\* into existing and/or new parts, shapes, phases, states, or conditions.
- b. Integrate different parts, shapes, phases, states, or existing or new conditions of a DESIGNER\* into a single entity..
- c. Make DESIGNER\* easy to disassemble or assemble.
- d. Increase or reduce the degree of fragmentation or segmentation of DESIGNER\*.

Separation principle for DESIGNER\* : Separation in space / Separation in subsystem

Solution strategy for DESIGNER\* : Improving attributes; Improving performance; Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security); Improving if a solution has not yet emerged

### 11. Beforehand Cushioning, Tac. IP (Pos.13):

a. Prepare emergency means, beforehand, to compensate for the relatively low reliability of DESIGNER\*.

Separation principle for DESIGNER\* : Separation in time

Solution strategy for DESIGNER\* : Improving 7 quality factors (Quality, Reliability, Maintainability, Supportability, Human Factors, Safety, Security)

### 9. Preliminary Anti-action, Oper. IP (Pos.):

a. If DESIGNER\* needs to perform an action with harmful and useful effects, this action should be replaced with anti-actions to control harmful effect.

b. Create beforehand actions in DESIGNER\* that will oppose known undesirable working stresses later.

Separation principle for DESIGNER\* : Separation in time

Solution strategy for DESIGNER\* : Improving performance

## Anexo

### List of applicable Inventive Principles for Innovation Solutions

IP.1. Segmenting/ Integrating	IP.21. Skipping/ Avoiding
IP.2. Taking out/ Adding	IP.22. Convert harm in benefit
IP.3. Local Quality	IP.23. Feedback
IP.4. Asymmetry/ Symmetry	IP.24. Intermediary
IP.5. Merging/ Separating	IP.25. Self-service
IP.6. Universality	IP.26. Copying/ Replicating
IP.7. Nesting/ Dispersing	IP.27. Cheap Short-Living Objects
IP.8. Anti-Weight/ Compensation	IP.28. Mechanics Substitution
IP.9. Preliminary Anti-action	IP.29. Controllable Soft Variables
IP.10. Preliminary Action	IP.30. Simple Shapes/ Ways to Interact
IP.11. Beforehand Cushioning	IP.31. 31.Using/ Removing Unused Parts
IP.12. Equipotentiality	IP.32. Perception/ Appearance/ Color Changes
IP.13. Reverse or Indirect Action	IP.33. Homogeneity / Compatibility
IP.14. Spheroidality - Curvature - Angle	IP.34. Discarding and Recovering
IP.15. Dynamics	P.35. Transformation / Parameter Changes
IP.16. Partial or Excessive Actions	IP.36. Phase, State or Condition Transitions
IP.17. Another Dimension or Field	IP.37. Useful Perceptible Change
IP.18. Mechanical Vibrations/ Energy Variations	IP.38. Strong or Quick Reactions
IP.19. Time-Varying Action/ Periodic or Pulsating	IP.39. Inert Atmosphere / Environment
IP.20. Continuity of Useful Action	IP.40. Composite Materials/ Conditions

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