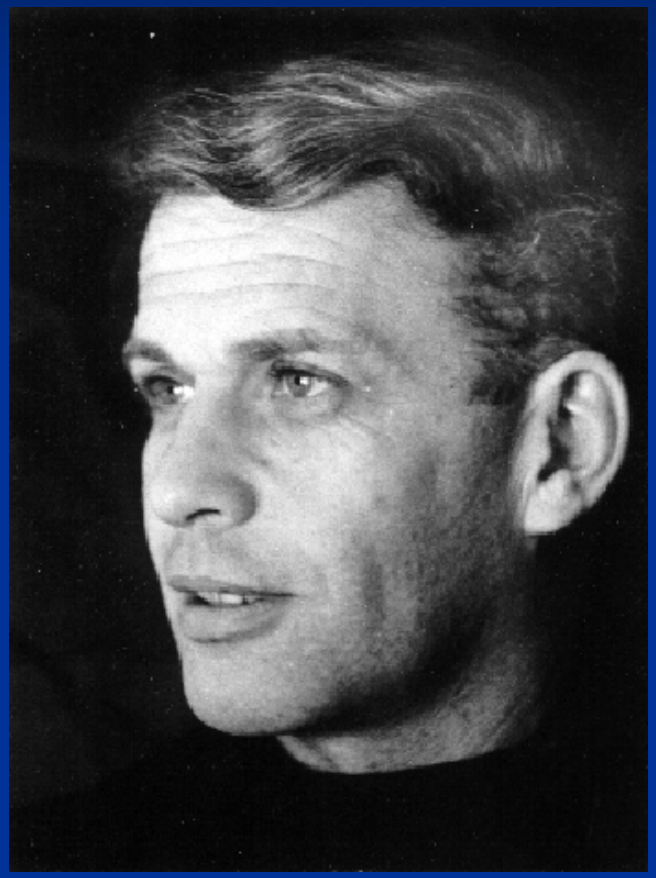
Effective Education and Problem Management Tools based on OTSM-TRIZ

(First Acquaintance Level)

TA Group
contacts@thinking-approach.org

Author of Classical TRIZ



Genrich
ALTSHULLER,

October 15, 1926
September 24, 1998

Start to develop TRIZ in 1946 (20 years old) and dedicate for this
rest of his life.

Before we start

NON LINEAR EDUCATION

A few words about
Non Linear Education Technology
(how we will learn things during the program)

This technology was developed for teaching Classical TRIZ and OTSM to adults.

Now the same principles are used for children education.

Application for children education provides useful feedback for the development of instruments for adult education and vise versa.

Why do adults have difficulties learning TRIZ & OTSM while children do not?

Making knowledge workers productive requires changes in basic attitude - whereas making the manual worker more productive only required telling the worker how to do the job.

Peter Drucker, “Management Challenges for the 21-st century 1999”.

Modern education system appeared for teaching Manual Workers. As a result adults who went through this education have problems learning TRIZ and OTSM as the system does not develop some important thinking skills.

The educational approach developed in framework of the JL-Project aims at the development of a set of skills necessary to handle non-typical problems efficiently.

Linear Education (Options)

1. ENV Model-Contradiction-IFR-Standards.
2. Contradiction-Standards-IFR-ENV model.
3. Contradiction-IFR-ENV model Standards.

Objective law: Individuals prefer start with the subject most closer to their personal ZPD (Zone of Proximal Development, by Lev Vygotsky).

Social demand: education must be a mass product, thus aimed at the average learner.

As a result many students who are above or below the average suffer. This leads to a decrease in quality of education.

Problem of Traditional (Linear) Education

- Rigid and not adjustable for the individuality of a particular learner.
- Zone of Proximal Development (ZPD) is neglected for the individual by respecting just the average.
- Non-linear structure of knowledge is neglected.
- Interdisciplinary application of obtained knowledge is widely ignored.
- Reflection skills - extremely important for non-typical problem solving - mostly ignored.

Non linear education approach is aimed at fixing these problems, at least partially.

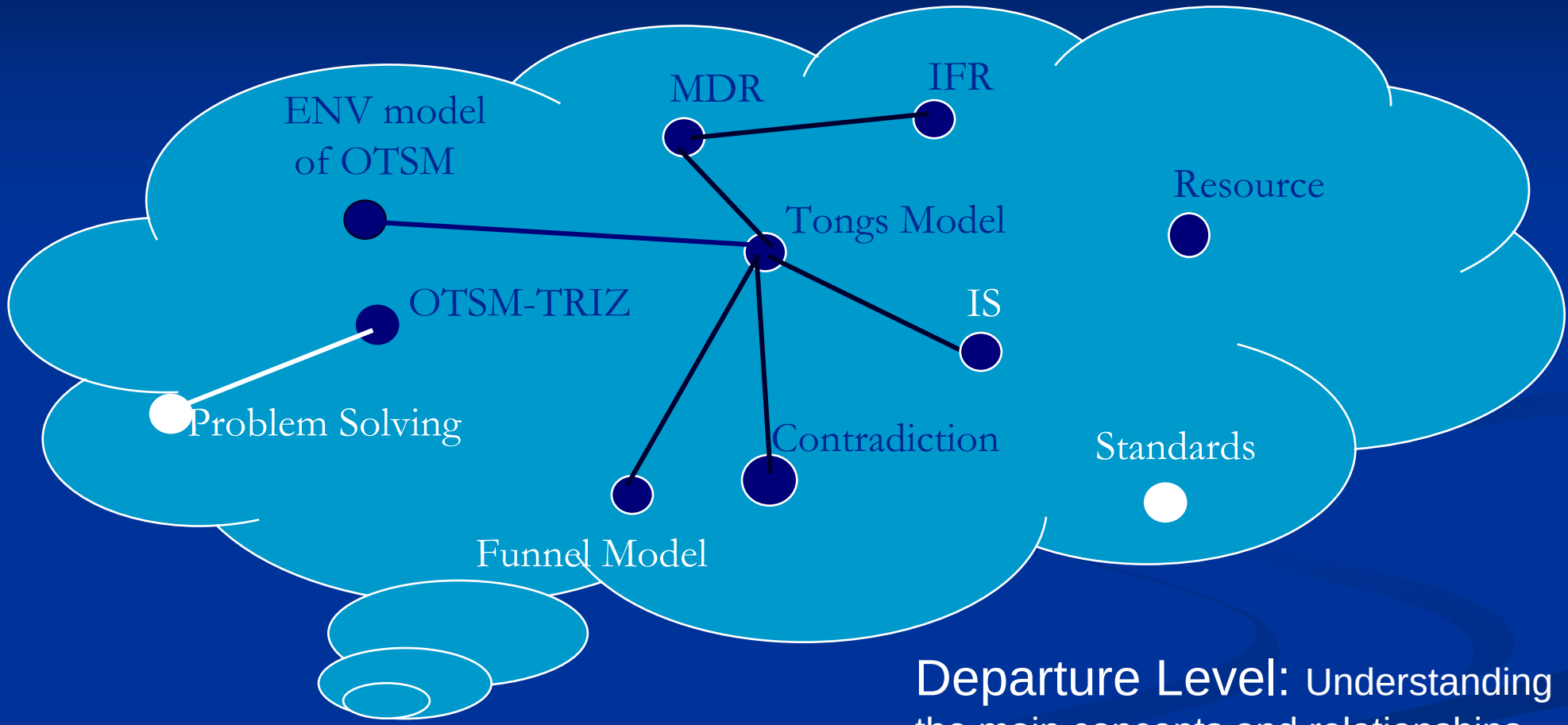
Problems Adults Face When First Dealing with Non-Linear Education

- Stereotypes of linear education are very strong. The student tries to force the teacher to change his/her way of education. As a result, the efficiency of education decreases.
- Individual success orientation should be replaced by team success orientation. Students should become teachers for each other and by this provide feedback to the teacher.
- Students expect achievement from the very first hours of education. However, valuable achievement appears in the end of the programme, often as an avalanche of understanding.

The best way to overcome the problems:

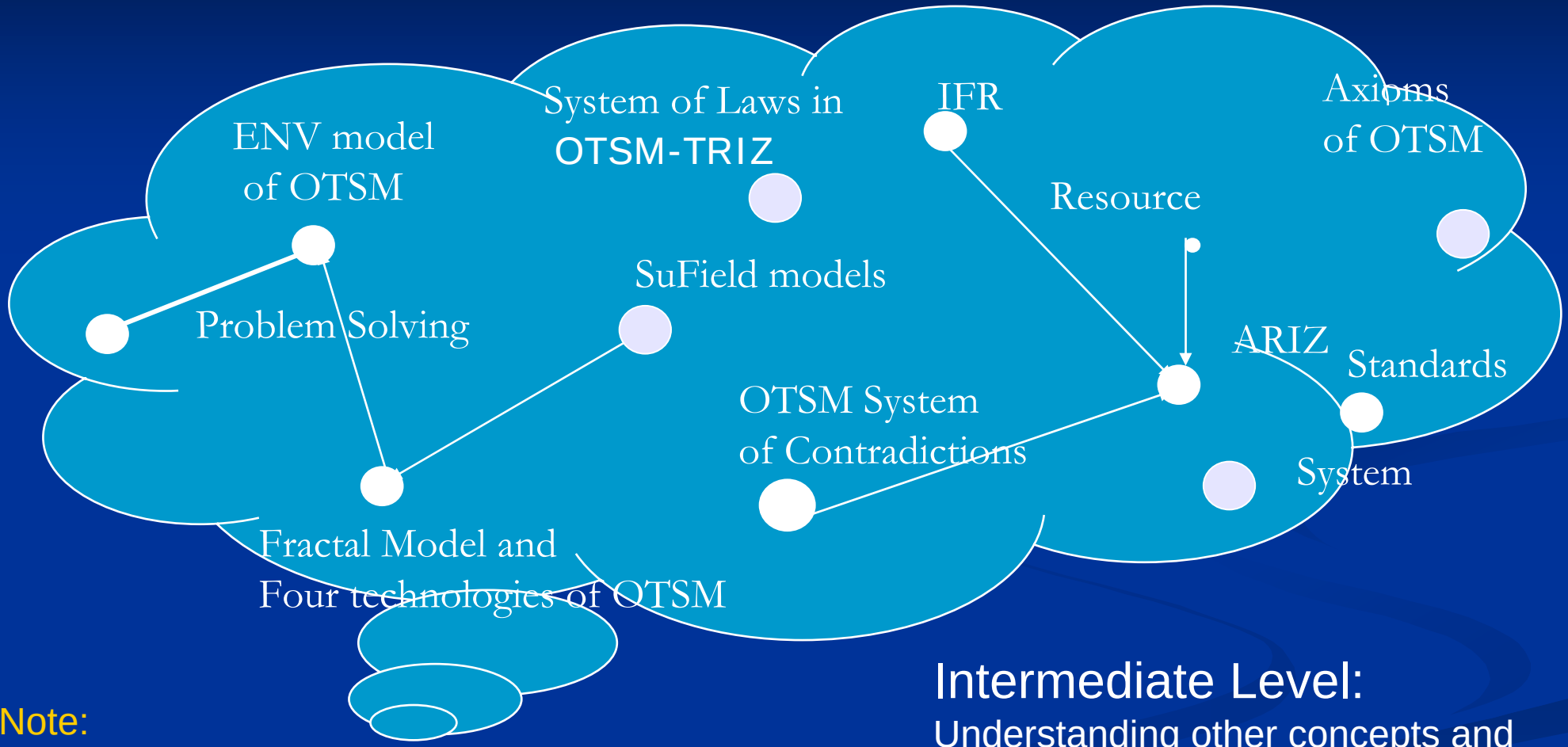
- open your mind and follow the assignment
- share your achievement with others as much as you can;
- teamwork and cooperation for mutual benefits;
- do not try to remember everything at once, focus on understanding of deep relationships between various components.

OTSM-TRIZ: Non-Linear Education



Departure Level: Understanding the main concepts and relationships between them

OTSM-TRIZ: Non-Linear Education

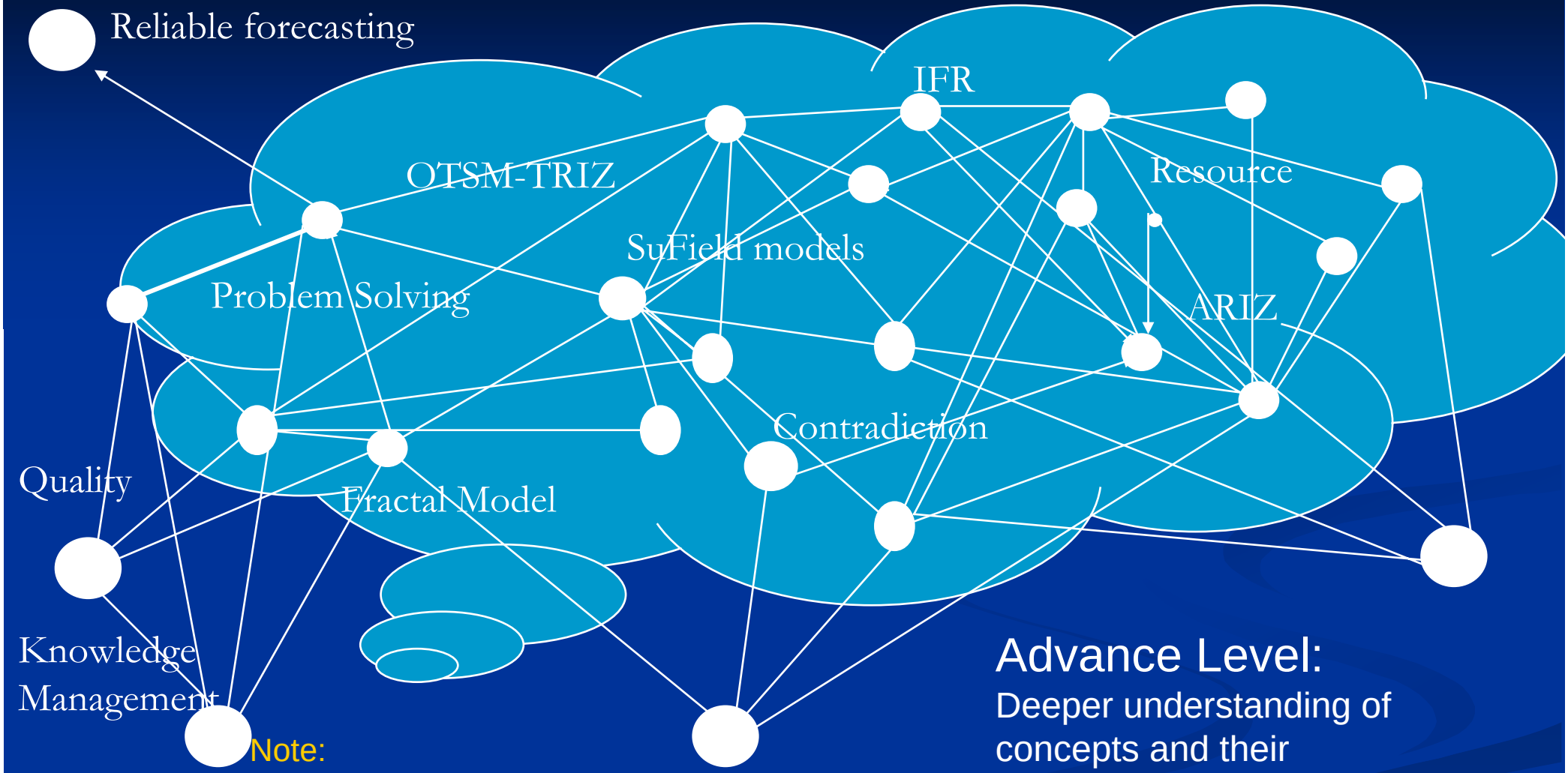


Note:
This is not a complete list of TRIZ and OTSM components

Intermediate Level:

Understanding other concepts and their relationships

OTSM-TRIZ: not linear education



Note:

This is not a complete list of potential applications OTSM-TRIZ and its components

Advance Level:

Deeper understanding of concepts and their relationship with internal and external world

Some Helpful Advice

- Do not try to remember and understand everything at once. It is impossible in non-linear problem-centered education.
- Try to find the relationship between theoretical notions and practical instruments and understand how all of them work together to solve problems.
- The same knowledge will be will be dealt with many times during classes in different contexts and combinations. Use it to obtain and improve your individual understanding of the Knowledge Network, share your understanding with others both in the classroom and beyond it. Discuss and learn from other students as well as from the trainers.
- Useful Model: Consider that all of us are members of the same OTSM team that work for a large world-wide company which delivers a large spectrum of products and services. Participate in all discussions. Do not hesitate to share your point of view and don't be afraid to make a mistake. The more mistakes you make in the classroom, the fewer will be made in real life.

Instruments to create instruments…

THEORY OR METHOD?

What is different?

Method

- If your method does not work, then you must look for another method or switch to a very inefficient Trials and Errors method.
- Example:
  Creative Problem Solving – Morphological Analysis: intensification of Trials and Errors method – thousands of ideas per unit of time.

Theory

- If you have a theory that underlies your methods, then for many cases you can improve the existing method or create a new one.
- Example
  An applied Scientific Theory: decrease the amount of trials and errors as much as possible and increase the probability of obtaining a desirable result, ideally without any trials.

What is behind the Russian acronyms: TRIZ and OTSM?

Classical TRIZ
(! do not mix with TRIZ!)

- The Theory of Solving Inventive (i.e. Non Typical) Problems (**T**eoria **R**eshenia **I**zobretatelskikh **Z**adach).
- Classical TRIZ provides fundamentals *for developing instruments for solving Non Typical problematic situations* whenever we need them.
- Classical TRIZ deals with relatively simple Non Typical problematic situations that could be re-framed as a set of a few contradictions or could be transformed into Typical Problems.

OTSM

- The General Theory of Powerful Thinking (**O**bschaya **T**eoria **S**ilnogo **M**ishlenia). OTSM - could be pronounced as **T**i-e**S**-e**M**
- OTSM provides fundamentals for *developing instruments for managing complex interdisciplinary problematic situations* that consist of dozens and hundreds problems and contradictions that are linked to each other.

What is Classical TRIZ and OTSM?

- Classical TRIZ is a Theory for developing Instruments for solving problems that are difficult even for professionals, i.e. Non Typical or creative Problems).

- OTSM is a further development of Classical TRIZ aimed to widen the domain of its application and develop instruments for managing complex interdisciplinary problematic situations.

!!! Important !!!
to understand and remember

- Classical TRIZ and OTSM are applied scientific theories about developing very practical instruments for managing various Non Typical problematic situations in many domains of human activities.
- Both theories have sets of interrelated instruments.
- Whenever necessary, new instruments could be developed by OTSM-TRIZ experts or existing instruments could be adjusted for a specific problematic situation.
- To achieve this top level of OTSM-TRIZ level of competence it is necessary to be a fluent user of the existing Instruments and understand deep roots of the existing instruments i.e. theoretical fundamentals.

Why we have to learn the fundamentals?

- Each component of theoretical fundamentals could be used as an independent general and therefore universal tool for solving problems when more precise instruments could be difficult to apply.
- Deep understanding of the theoretical background could help you formulate problems you face with the application of certain instruments in your particular case and resolve these problems in order to adjust general instruments for your particular case (Part 9 of Altshuller's ARIZ-85-C is dedicated for this purpose in Classical TRIZ).
- OTSM Axiom of Reflection: when doing something, think:
  - what you do and why;
  - how precisely you use particular instruments and if you follow the rules;
  - what is difficult for you in using a particular rule or instruments;
  - what theoretical background is behind each rule or instrument;
  - how the theoretical background appears out of the real life practical experience
- Try to answer all of these questions and you will dramatically increase your level of competence in OTSM-TRIZ practical applications.

Exercises: decrease the amount of trials and errors by developing your own method.

- 1,2,3 dimensional Yes-No games.
- “Guess what is in my mind”
- “Detective Situation”

Hint:

Think of a good method instead of a solution to the problem… Create your own way to decrease useless trials and errors. Think of evaluation criteria for what is a good step and what is not…

When we start to think hard of something?

WHAT FOR DO WE NEED POWERFUL THINKING?

When do you start thinking really hard?

- 1. When you just dream about something.
- 2. When you do something to achieve your dreams and use typical solutions like “If you have …. then do ….”
- 3. When you face the barriers that prevent you from achieving your dreams (ultimate goal, etc.)
- 4. When you face a Non-Typical problematic situation and all of your own experience cannot help you.
- 5. When you face a difficult problem that no one around you can help you with and you cannot find a solution neither in books nor in the internet?

Problem or not a problem?

This is a question…

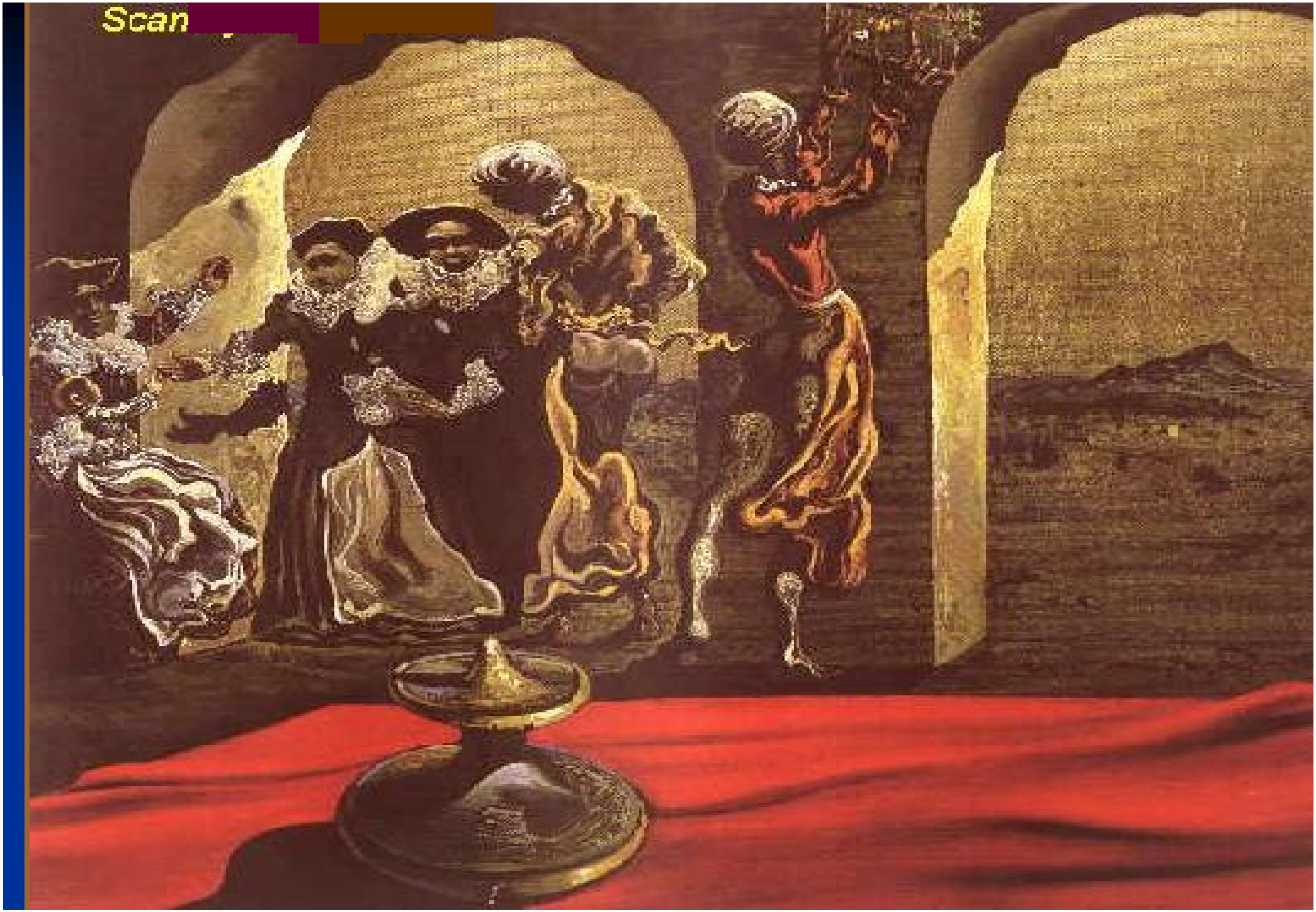
WHAT MAKES A PROBLEM DIFFICULT?

What Makes a Problem Difficult?

...The problems that exist in the world today
cannot be solved
by the level of thinking
that created them...

attributed to Albert Einstein

"Making knowledge workers productive
requires changes in basic attitude"
Peter Drucker
Management Challenges
for the 21-st century
1999.


Scan

Dilemma. Which mind is better: well-filled in or well-organized?

- Modern education system produces professionals with the mind well filled in with typical solutions from the past.
- The current situation demands regular and quick innovation which cannot be provided by previous typical solutions. Cross disciplinary problem solving instruments are needed to produce new typical solutions quicker and more effectively than Trials and Errors Method that was used in the past.
- Dynamic and well-organized mind is a new challenge for education, industry and research.
  This mind should able to handle difficult non-typical problems. These problems are often complex and cross-disciplinary. Collaborative negotiation between different professionals is necessary. This also requires efficient organization of the mind.

What makes a Problem Difficult?

...The problems that exist in the world today
cannot be solved
by the level of thinking
that created them...

attributed to Albert Einstein

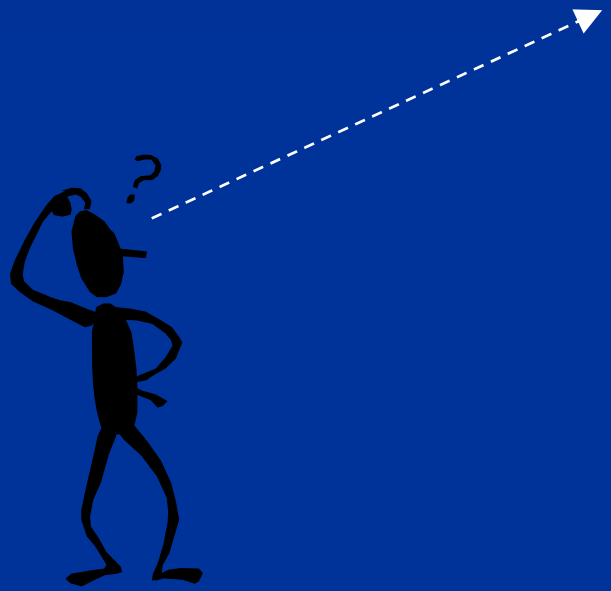
Conclusion:
in the world of rapid changes we have to handle effectively Non-Typical problematic situations, i.e. we must increase our thinking capabilities and change the basic attitude all the time.

How can we discover
WHAT, WHERE and HOW
should we change our mind in order to solve a non-typical problem?

WHY ARE OTSM-TRIZ INSTRUMENTS FOR INNOVATIVE THINKING SO EFFICIENT?

How can OTSM-TRIZ help us overcome mental inertia in order to change our mind properly?

Solution



Problem

Mental inertia

OTSM -TRIZ provides us with stairs:

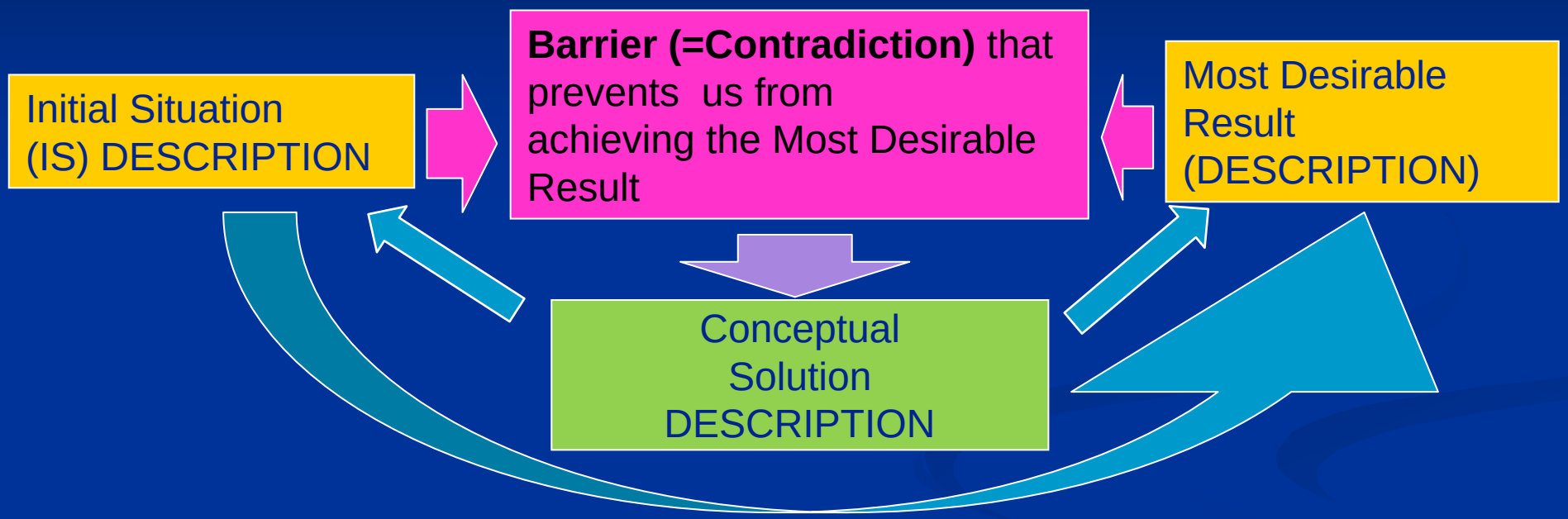
It is easy to overcome mental inertia making small steps in the RIGHT DIRECTION.

"There is no tail wind for the ship that doesn't have destination point"

. *Attributed to Seneca*

How can OTSM help discover the right direction for solving Non-Typical Problems?

“Tongs” Model of the Problem Solving Process



A specific barrier we should overcome is the root of a specific problem.
The root of the barrier is a hidden CONTRADICTION.

What is the root of a contradiction?

Why are OTSM-TRIZ instruments so efficient?

Typical stereotype of problem solving:
Generate as many different ideas as possible!!!

Acceptable solution

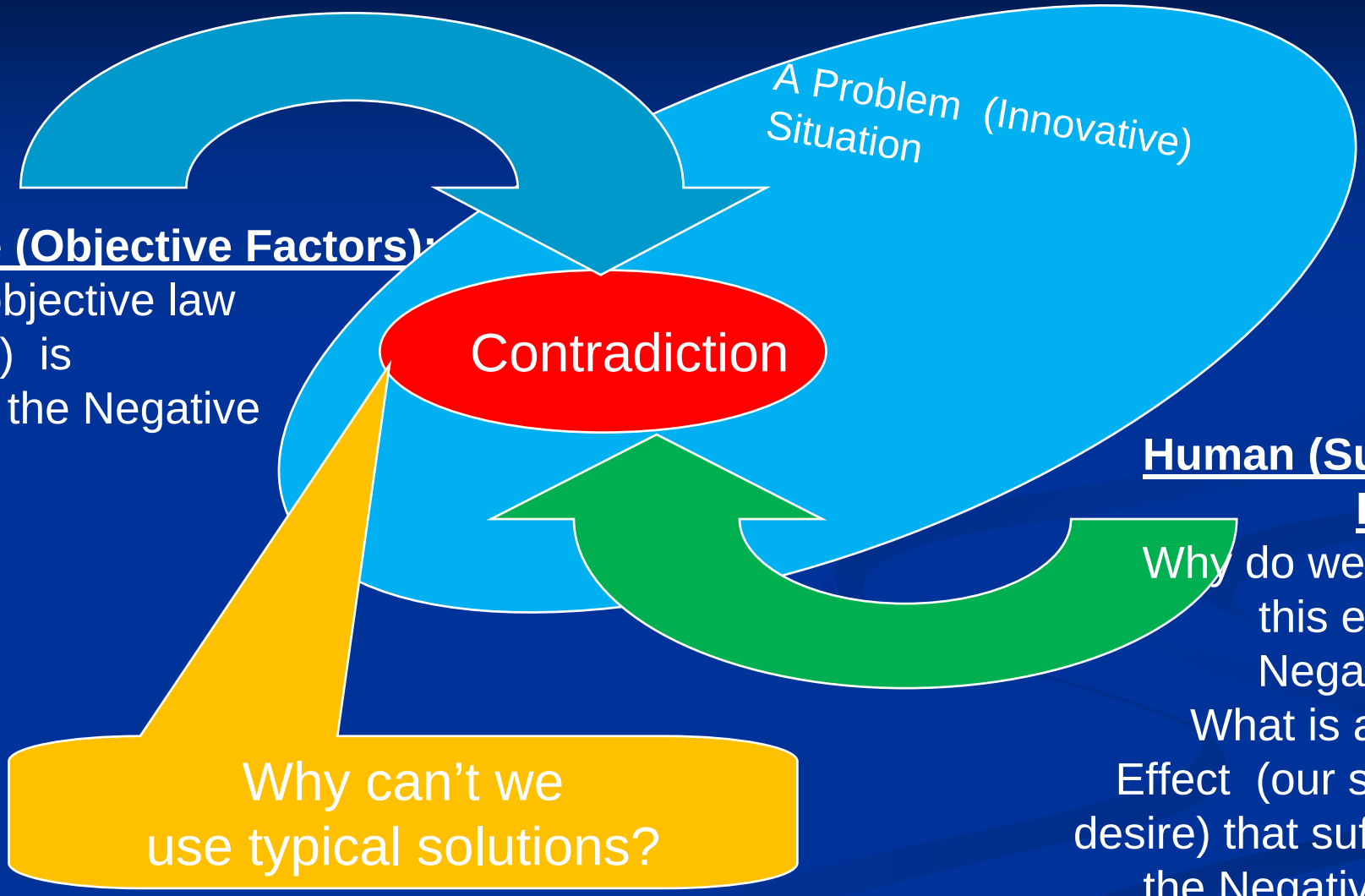
OTSM-TRIZ Problem solving process:
(oversimplified)

Initial Situation (IS) Description: Negative Effect

Satisfactory Solution Description

Most Desirable Result (MDR) Description: Positive Effect

Art of Victory:
OTSM Axiom of the Core of Any Problem



Nature (Objective Factors):
What objective law (factor) is behind the Negative Effect?

Human (Subjective Factors):
Why do we consider this effect as a Negative one? What is a Positive Effect (our subjective desire) that suffers from the Negative Effect?

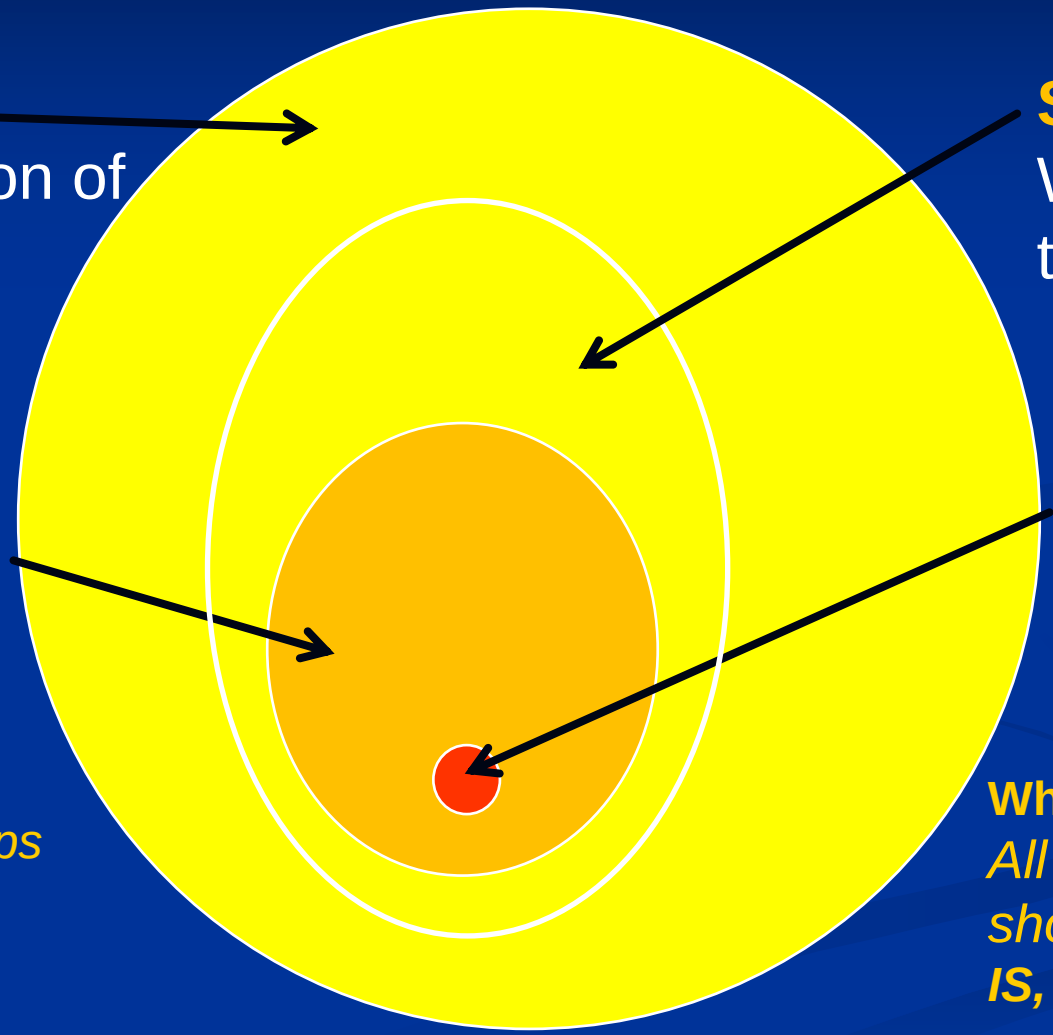
The Axiom and the “Tongs” help us discover the core of a specific problematic situation

First step
Initial description of problematic Situation

Second step.
What we would like to change (IS)

Third step.
What we would like achieve (MDR)

Fourth step.
Barrier = Contradiction that underlies the problem



Last but not least:
The sequence of steps (from 2 to 4) does NOT matter.

What matters?
All three components should be in harmony:
IS, MDR, Contradiction

How does OTSM help Regular and Sustainable Innovation

- OTSM-TRIZ instruments allow us to decrease the randomness and obtain solutions of Innovative Problems regularly and deliberately.
- We can pose Innovative Problems and solve them better and more often.
- The OTSM Problem Flow Network (PFN) Approach allows us to see the line of evolution of our products or services.
- We can plan the chain of Innovation in advance, manage it properly and be prepared for the next innovation better than our competitors.

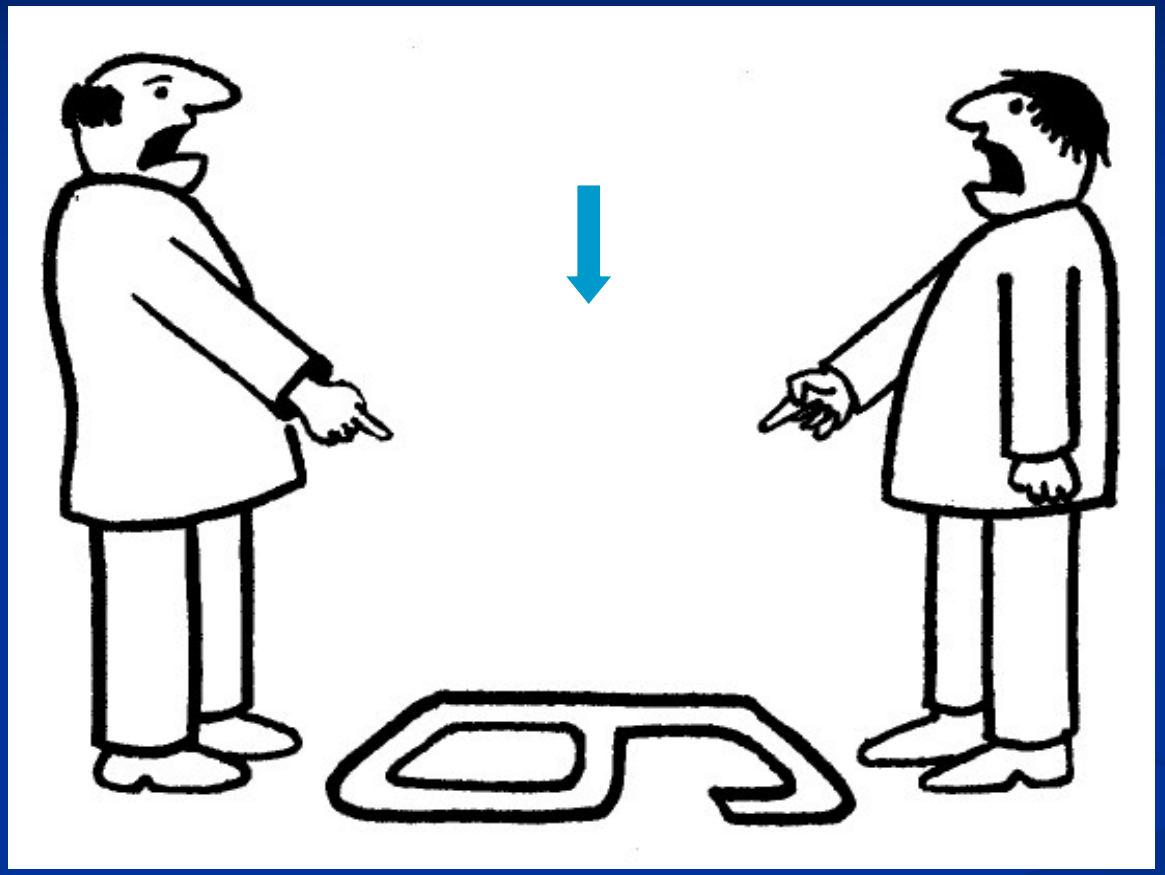
How can we follow Albert Einstein's advice?

Models (descriptions) are not reality…. by definition…

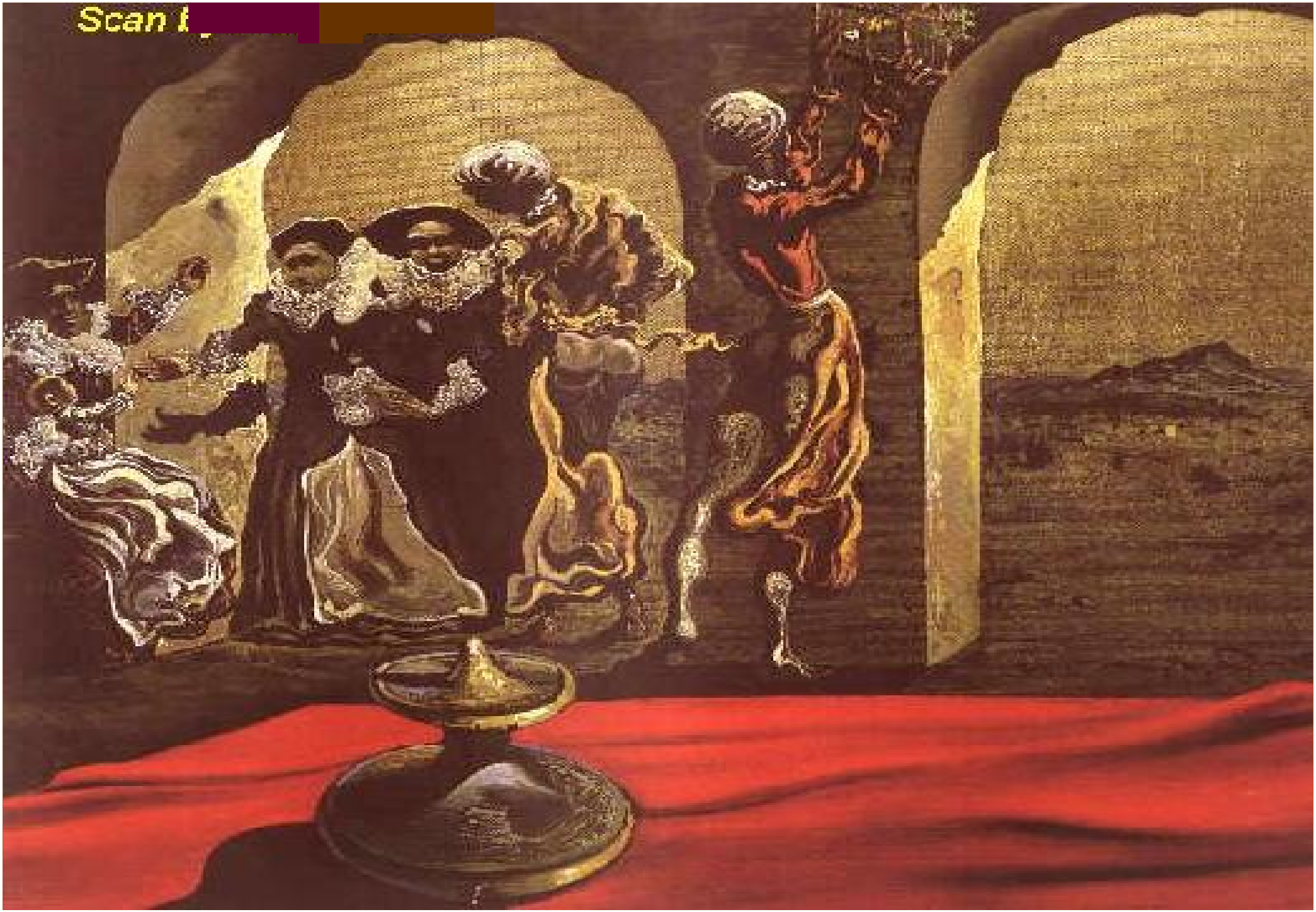
OTSM AXIOM OF DESCRIPTIONS

OTSM Axiom of Descriptions (Models)

Root-Cause of many Disagreements:



Everybody describe their perception about something from their own standing point.


Scan

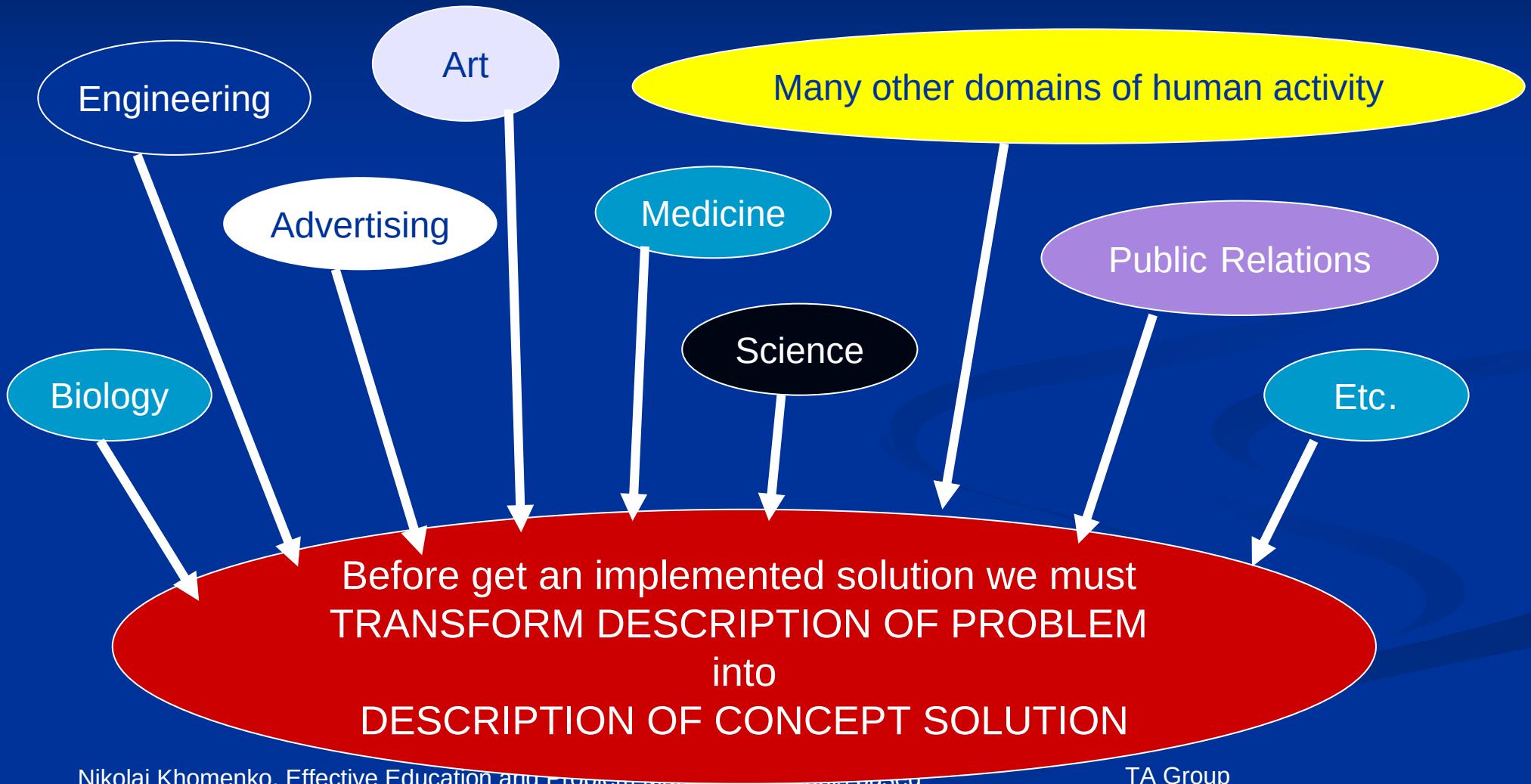
Features of Difficult Problems:

Summary of several years research: several hundreds people of various occupations, ages, cultures and nationalities around the World.

- Lack of methodology of
  - problem understanding,
  - problem identification,
  - getting concept solutions
  - objective evaluation of the concepts.
- Lack of recourses: money, people, equipment etc.
- Complicated problem arise as a set of problems linked to each other.
- Research is necessary to clarify root of problem.
- Different demands contradict to each others
- Mental Inertia
- Social aspects

Important: *the features* ***DO NOT DEPEND ON the problem nature****: engineering, management, art, social, politics, economy etc .*

What do various problem solving processes have in common?



Conclusion

- In order to understand What, Where and How we should change in our perception of a non typical problematic situation, we should re-frame the Initial Situation with the help of OTSM instruments.
- OTSM instruments help us repeat this re-framing until the the Initial Situation Description (Model) is transformed into the Description (Model) of a satisfactory solution. However, this process also requires knowledge of the domain.

Comment:

OTSM instruments can help us understand what knowledge is required for solving a problem, however they cannot replace the knowledge from a certain specific domain.

The "Tongs" model is one of the most general but useful OTSM instruments to understand what and where we should change.

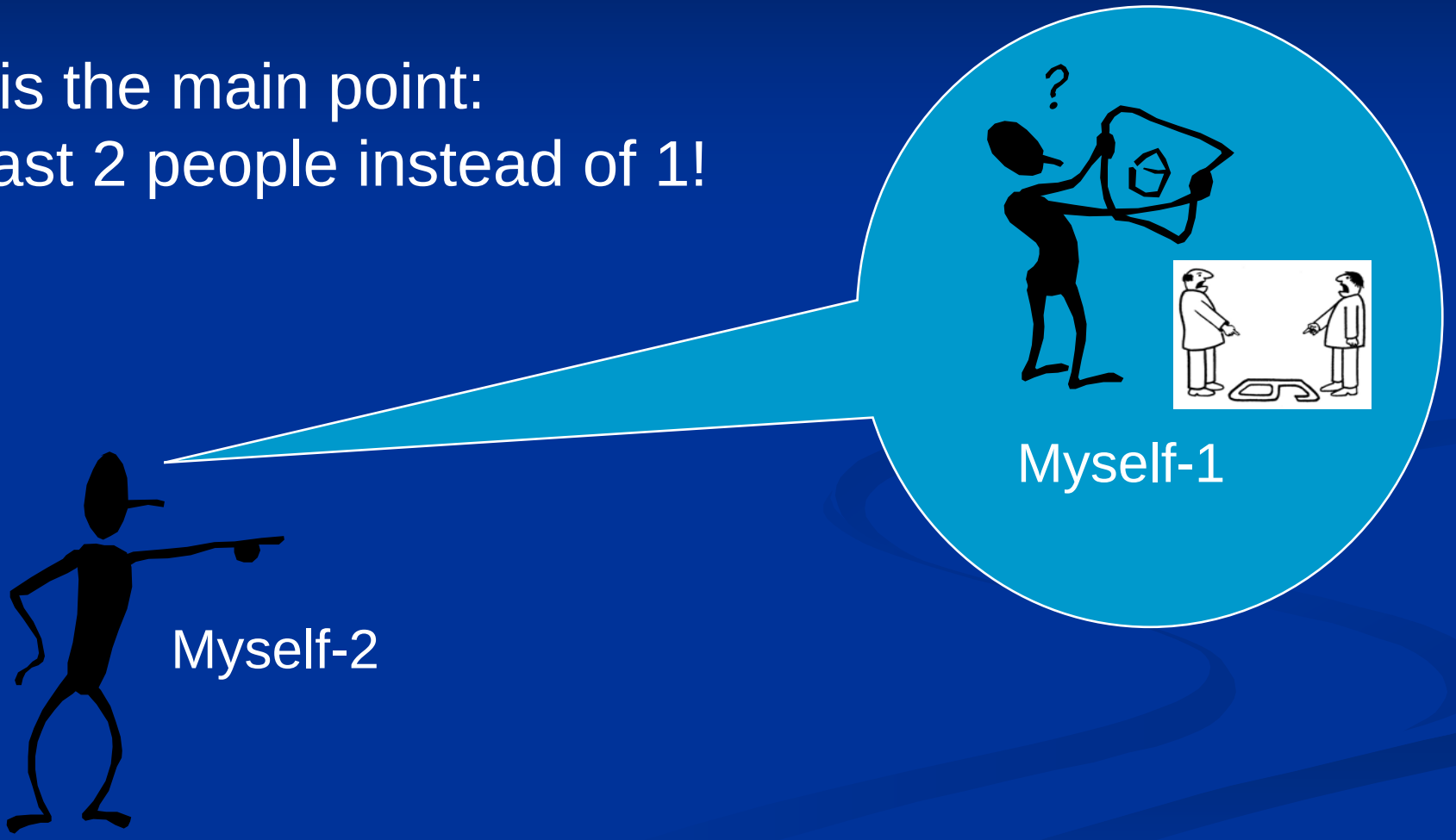
Other models could help us understand How.

To follow the advice of Einstein we should think how we think about something…

OTSM AXIOM OF REFLECTION

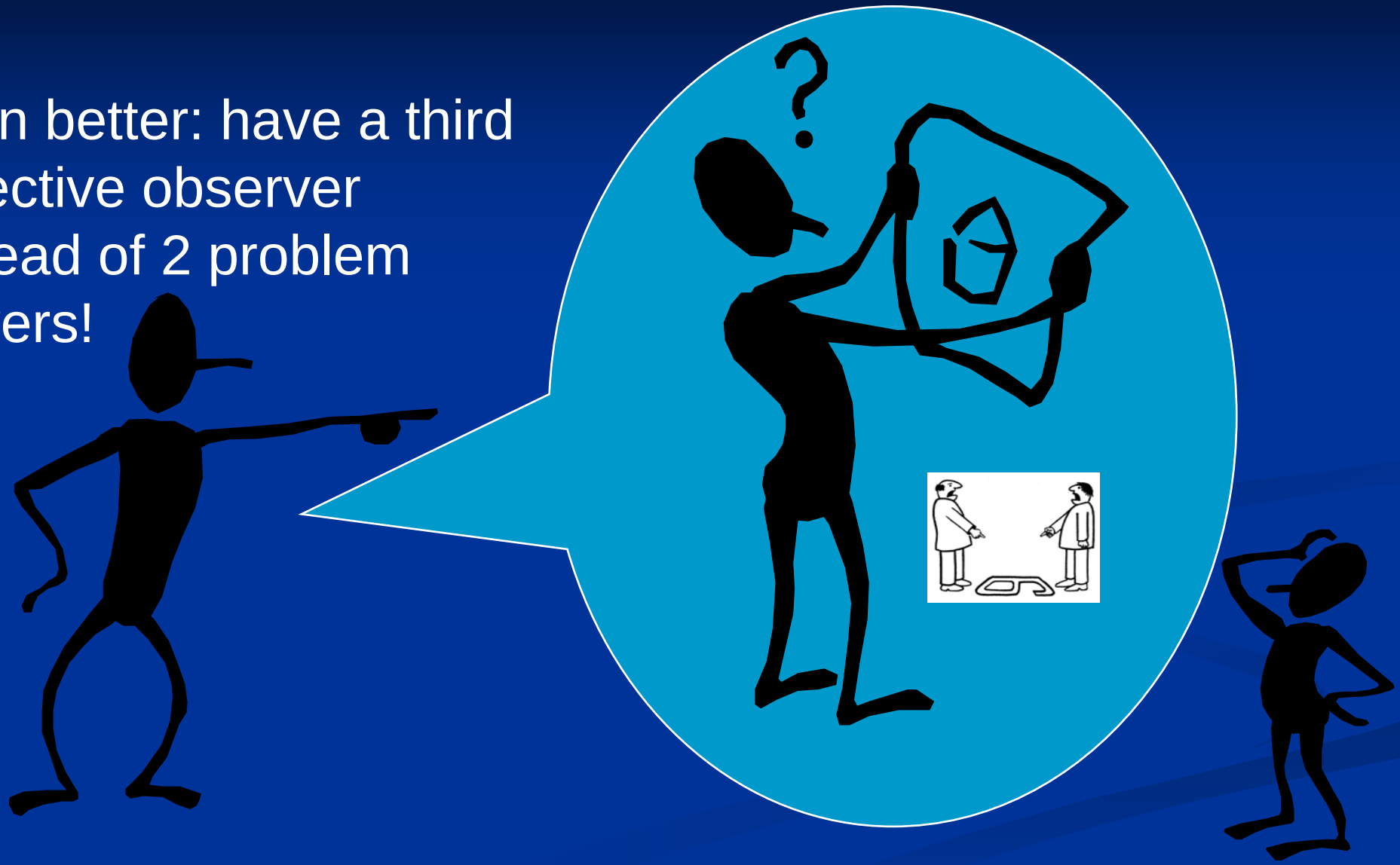
OTSM Axiom of Reflection

This is the main point:
At least 2 people instead of 1!

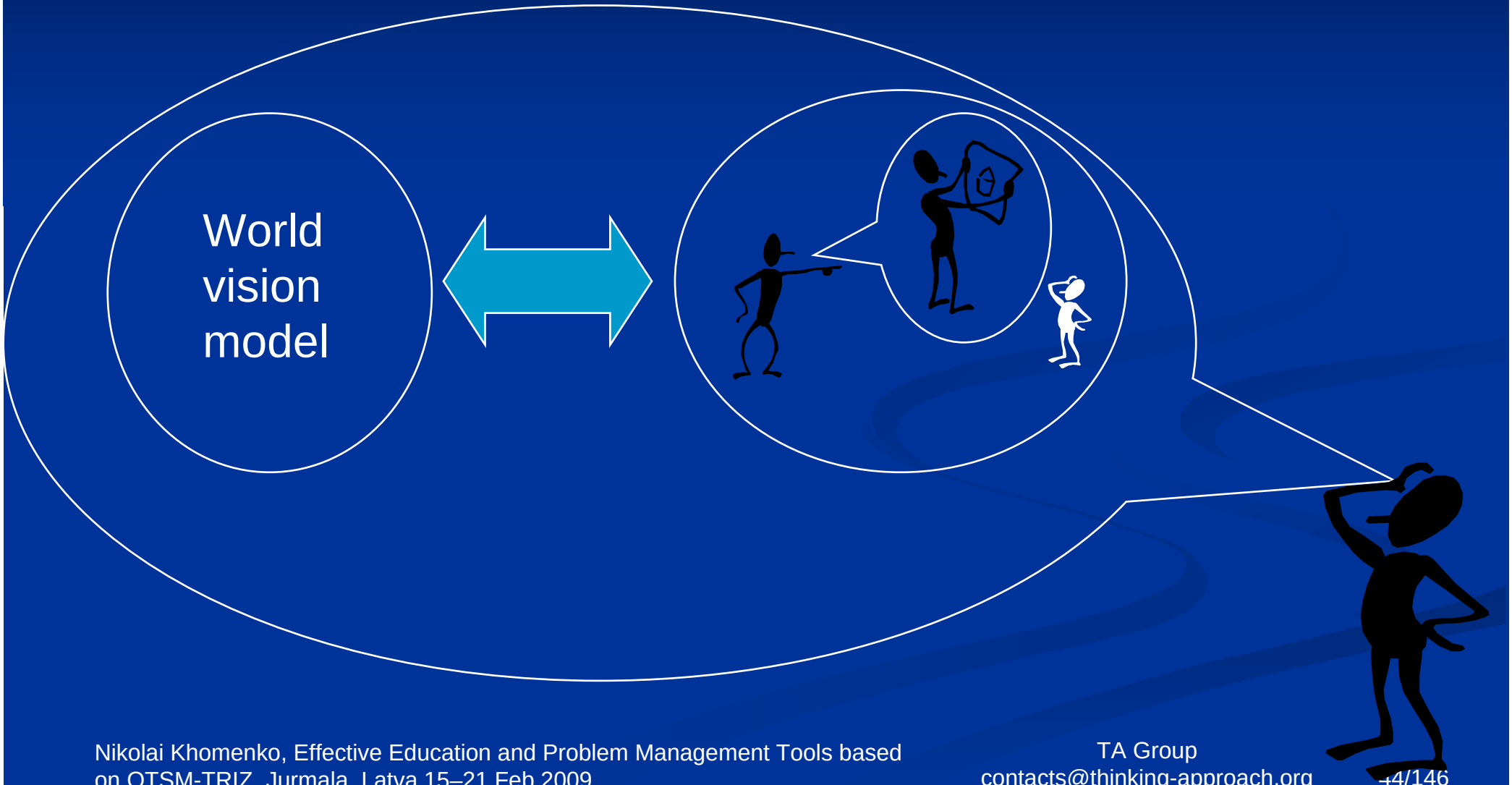


Art of Victory: OTSM Axiom of Reflection

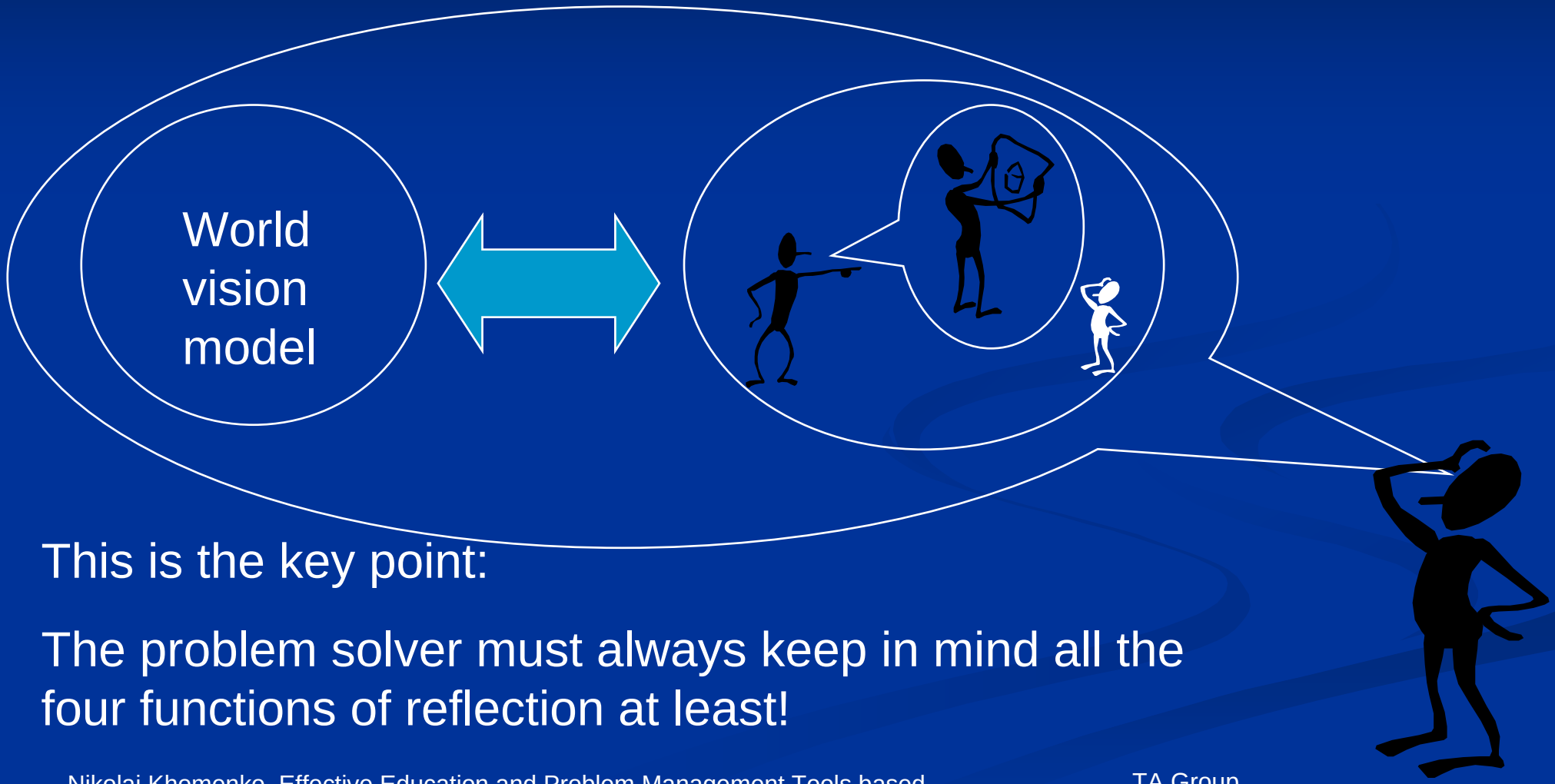
Even better: have a third reflective observer instead of 2 problem solvers!



To follow Einstein's advice we need even more: the fourth reflective person should observe changes in our world vision.



Axiom of Reflection



This is the key point:

The problem solver must always keep in mind all the four functions of reflection at least!

Conclusion for Our Educational Process

- Our main interest is NOT a solution to a problem.
- The most important activity of our training is understanding how we use OTSM instruments, follow OTSM-TRIZ rules and where and how we change our perception of a problematic situation.
- “Tongs” model can be used for these reflections as well as for the problem solving process itself.

Comment:

Modern education system does not develop reflective skills of students. That is why many adults have a problem learning OTSM-TRIZ but preschool children don’t.

There is nothing more practical than a good theory

FUNDAMENTALS OF CLASSICAL TRIZ AND OTSM

General Structure of Applied Scientific Theory

- **Main problems to be solved by the theory**
- **Postulates as the scope of the theory and as general instruments and directions.**
- **Main models of the theory.**
- **Practical Instruments of the applied Theory.**

Comment:

Applied theory often appears as a result of a deep analysis of real life experience, generalisation of the experience and developing practical instruments on the basis of this generalisation.

Main Problems to be Solved by Classical TRIZ and OTSM

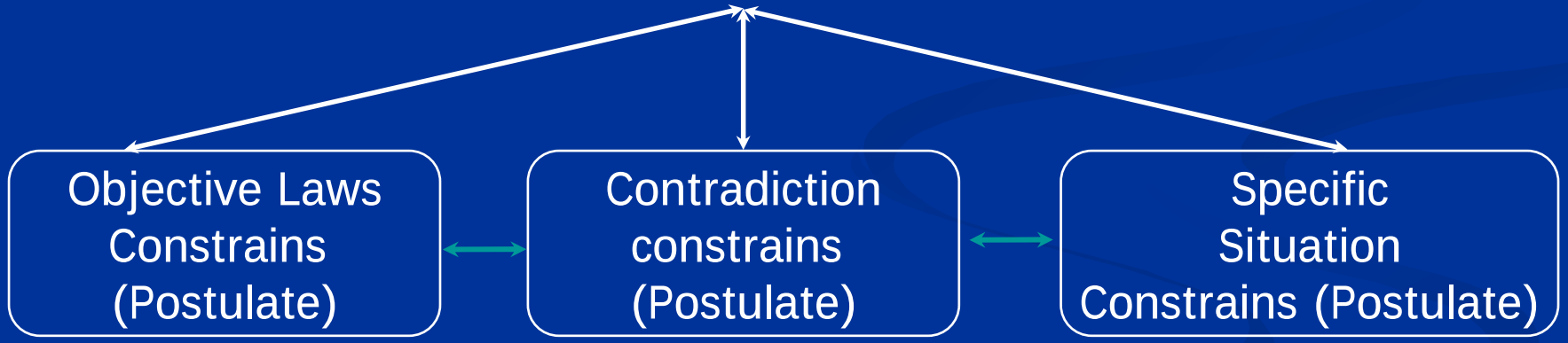
- Applied theories usually have a key question they should give an answer to.
- The goal of an applied theory is to increase the predictability of results and decrease the amount of useless trials and errors.
- Classical TRIZ and OTSM should answer the following question (exaggerated):

  How can a satisfactory solution be obtained without useless trials and errors?

The First Question to Be Asked When Facing a Non-Typical Problem:

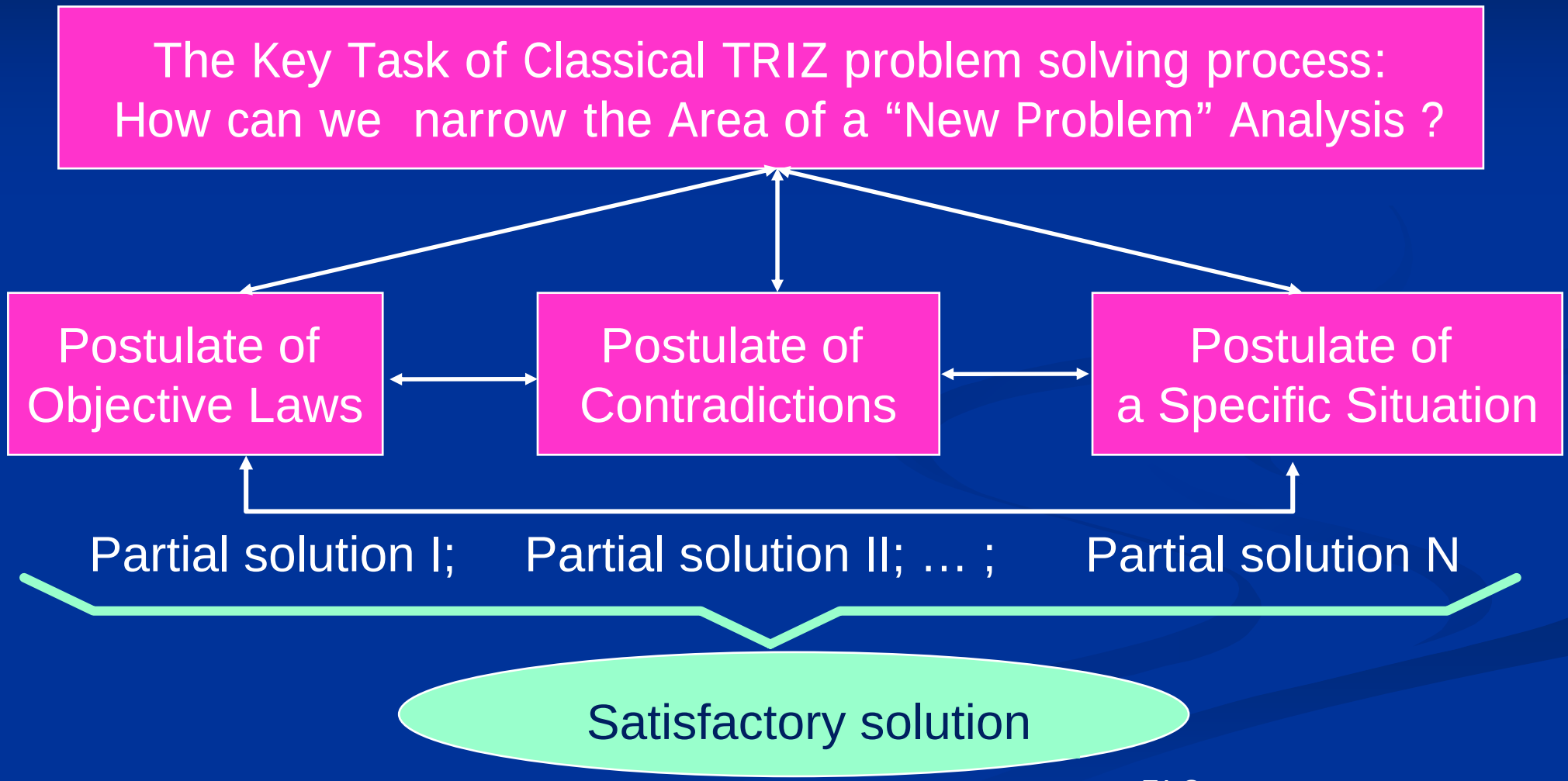
How can I organize my knowledge to narrow the area of analysis?
What constraints should I apply?

Typical ways to narrow the area of analysis



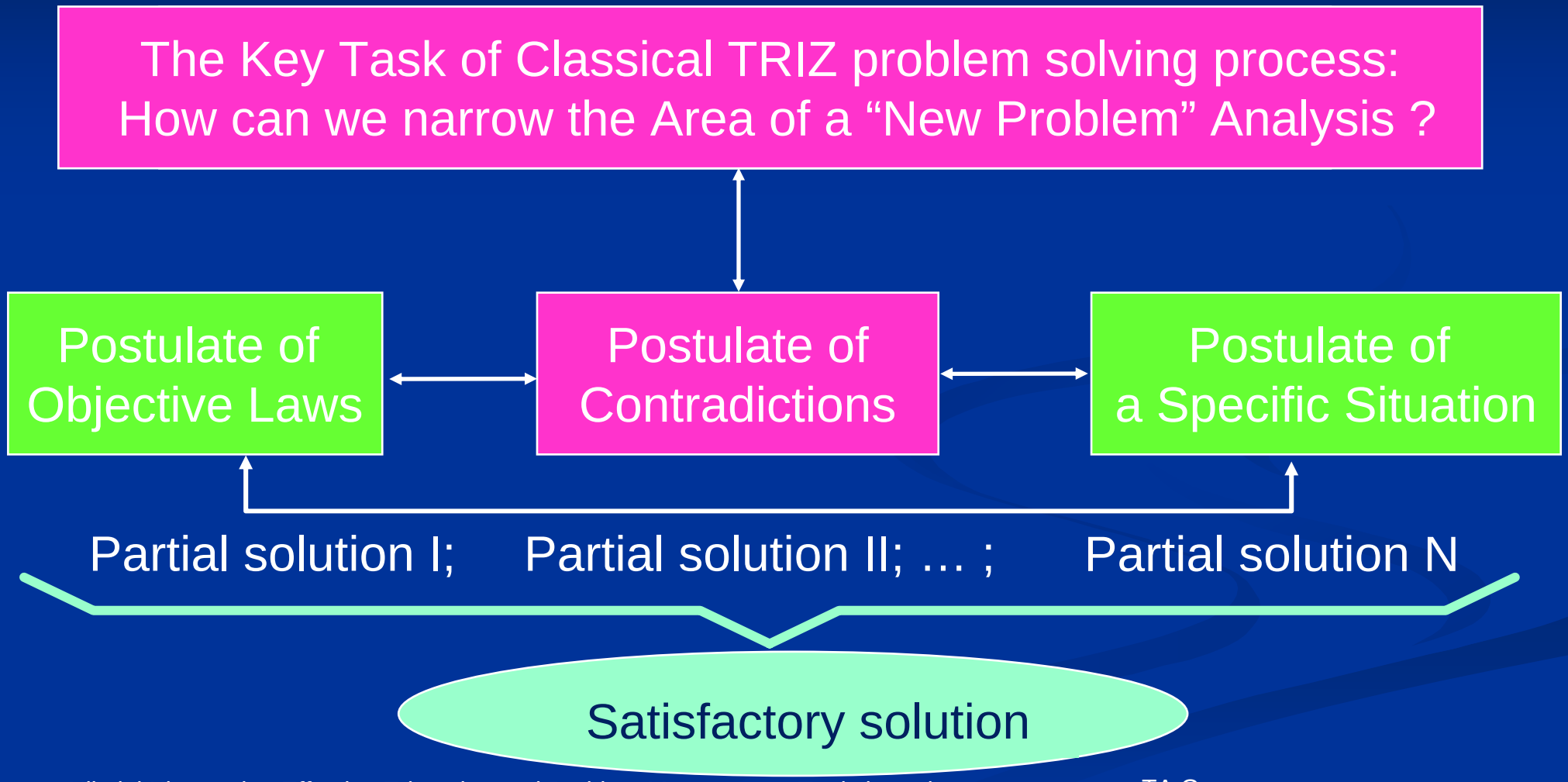
Classical TRIZ and OTSM provide us with efficient tools to implement these general theoretical ideas for specific practical tasks.

System of Rules for Understanding a "New Problem"



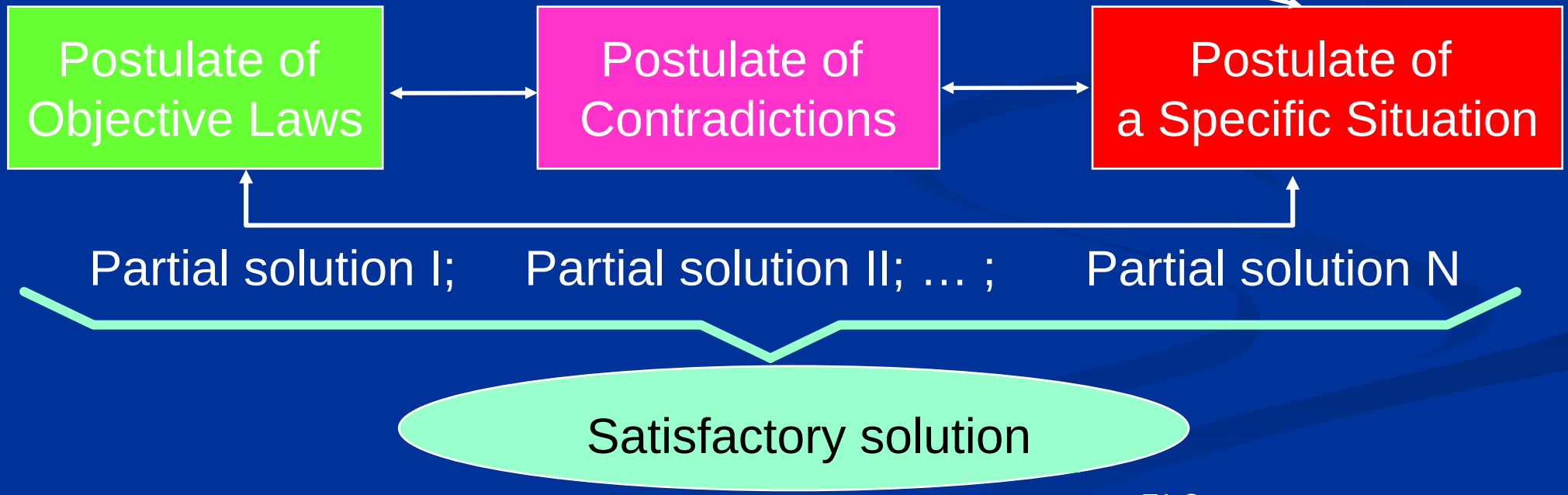
Variant 1 ("Good R&D: OTSM ready"):

Information on LAWS and SPECIFIC SITUATION



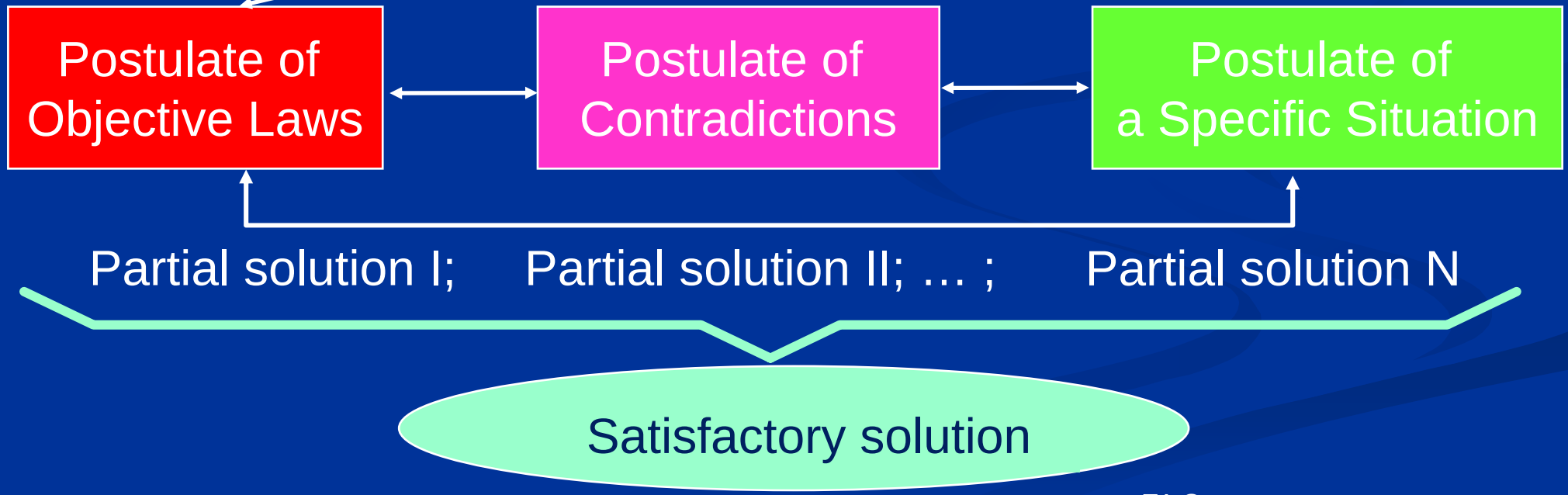
Variant 2 ("Scientist"):
Information on objective LAWS only

The Key Task of Classical TRIZ problem solving process:
How can we narrow an Area of a "New Problem" Analysis ?



Variant 3 (“Industry”):
Information on SITUATION only

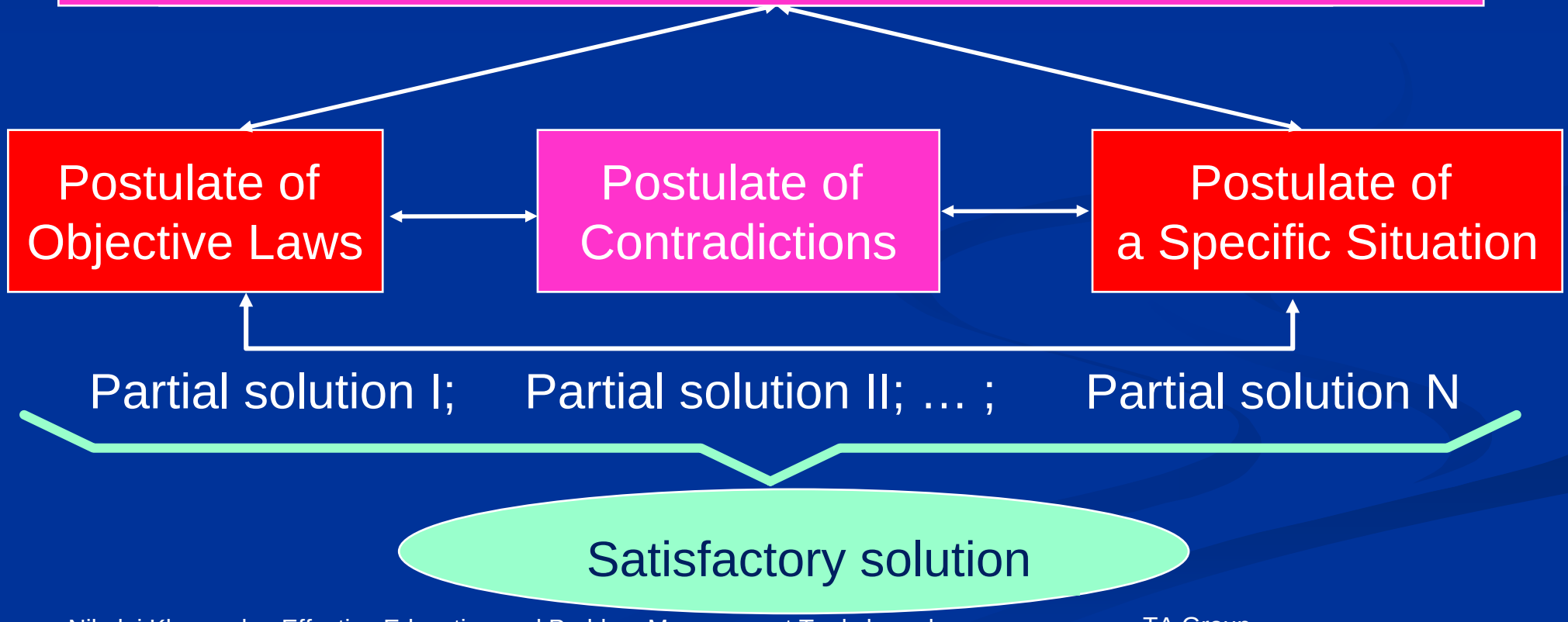
The Key Task of Classical TRIZ problem solving process:
How can we narrow the Area of a “New Problem” Analysis ?



Variant 3 (“Problem Solver”):

NO INFORMATION on either laws or situation

The Key Task of Classical TRIZ problem solving process:
How can we narrow the Area of a “New Problem” Analysis ?



Postulates as General Instruments for Solving Specific Problems

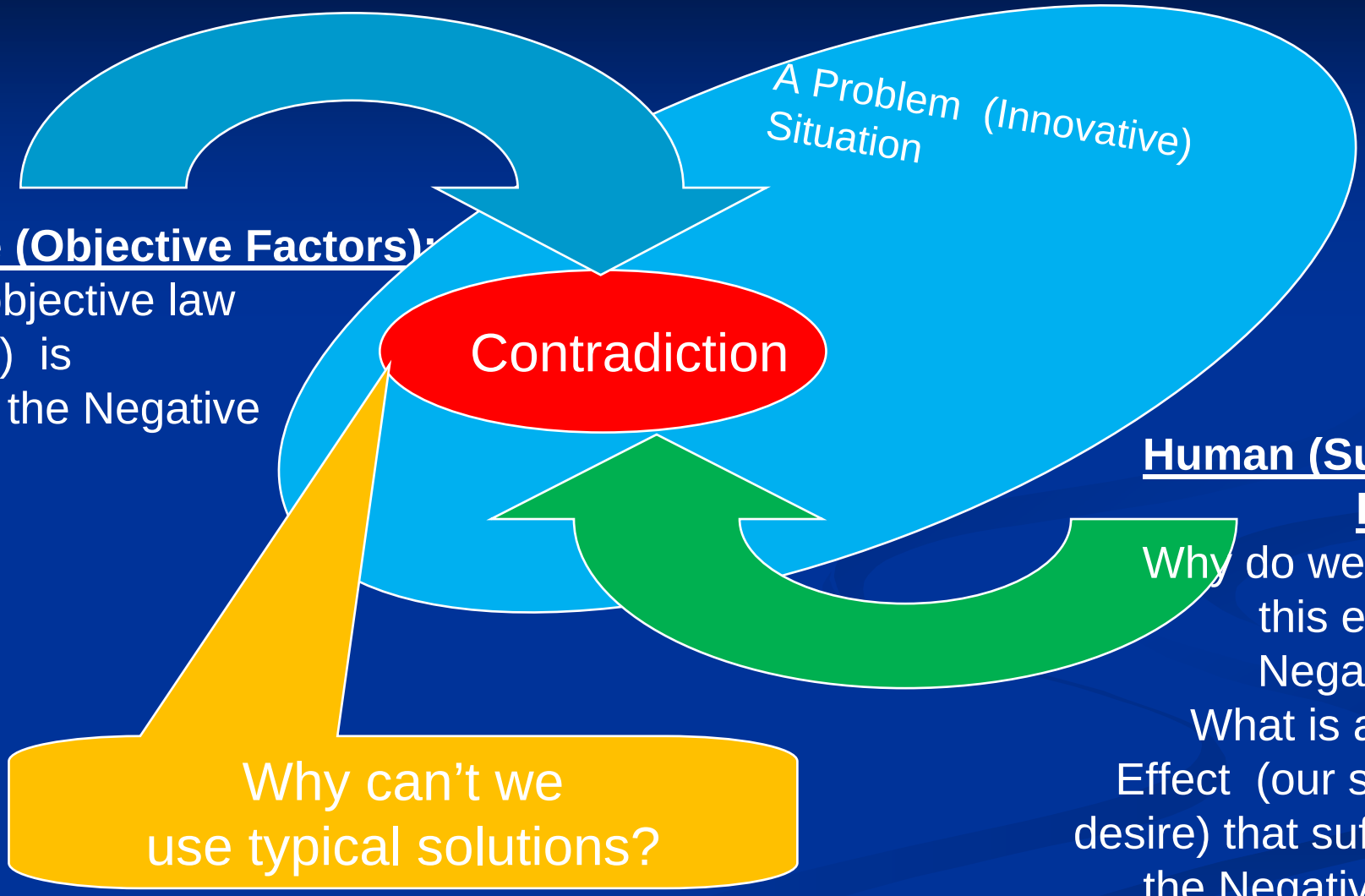
- Postulate of Objective laws of system evolution:
  While solving a problem we should follow and respect the objective laws of system evolution.
- Postulate of Contradictions:
  In oreder to develop an effective solution we must discover and resolve contradictions that underlie the problematic situation.
- Postulate of a Specific Situation:
  In order to obtain an effective solution we must respect the context of a specific problematic situation and use resources available in the context.

Comment: Classical TRIZ and OTSM evolve in the direction of developing useful models and efficient instruments for a particular application of these general fundamental ideas. Fundamentals of Classical TRIZ and OTSM help us create new instruments whenever we need them.

The very Core of every single problem

OTSM AXIOM OF ROOT OF PROBLEMS

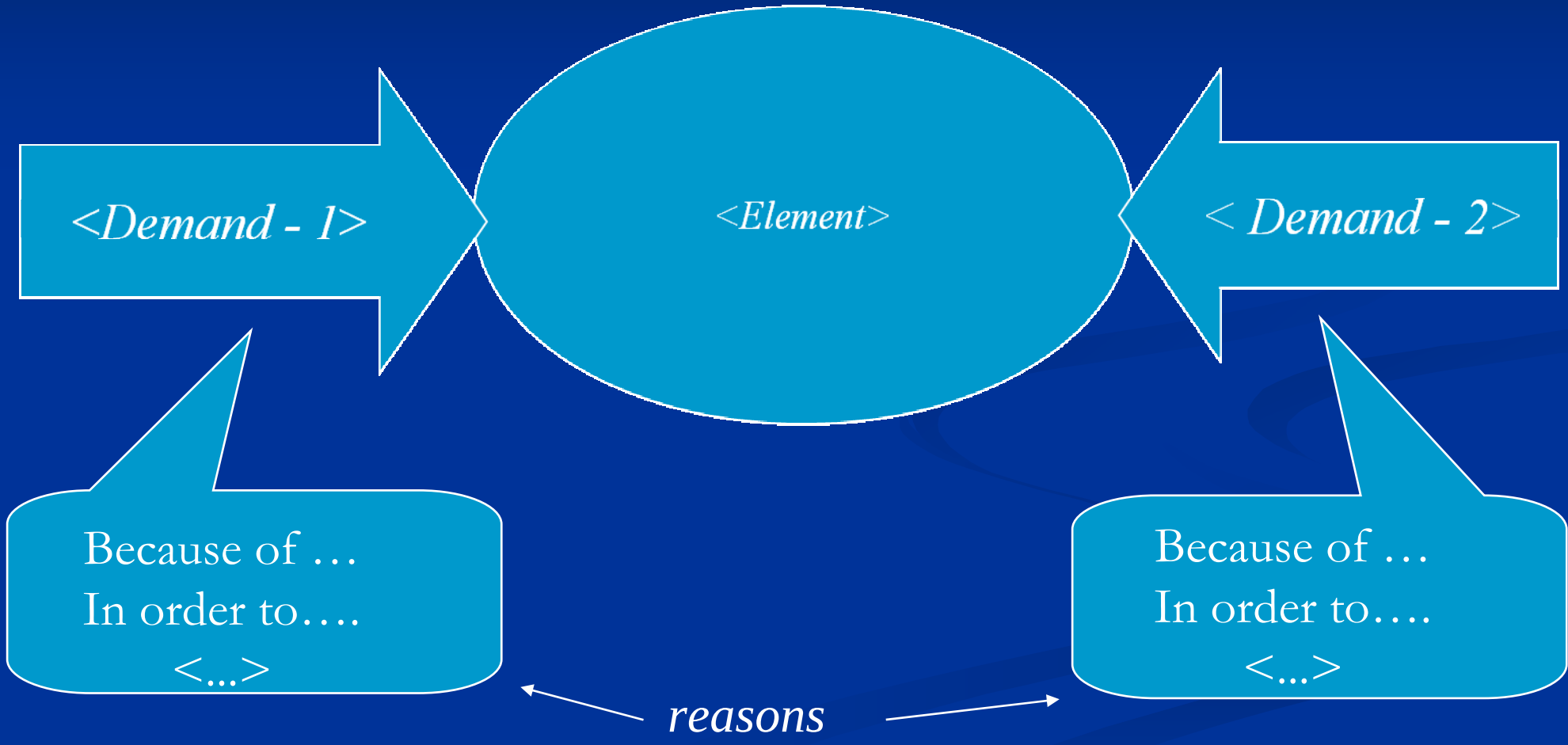
Art of Victory:
OTSM Axiom of the Core of Any Problem



Nature (Objective Factors):
What objective law (factor) is behind the Negative Effect?

Human (Subjective Factors):
Why do we consider this effect as a Negative one?
What is a Positive Effect (our subjective desire) that suffers from the Negative Effect?

Complete Form of a Contradiction

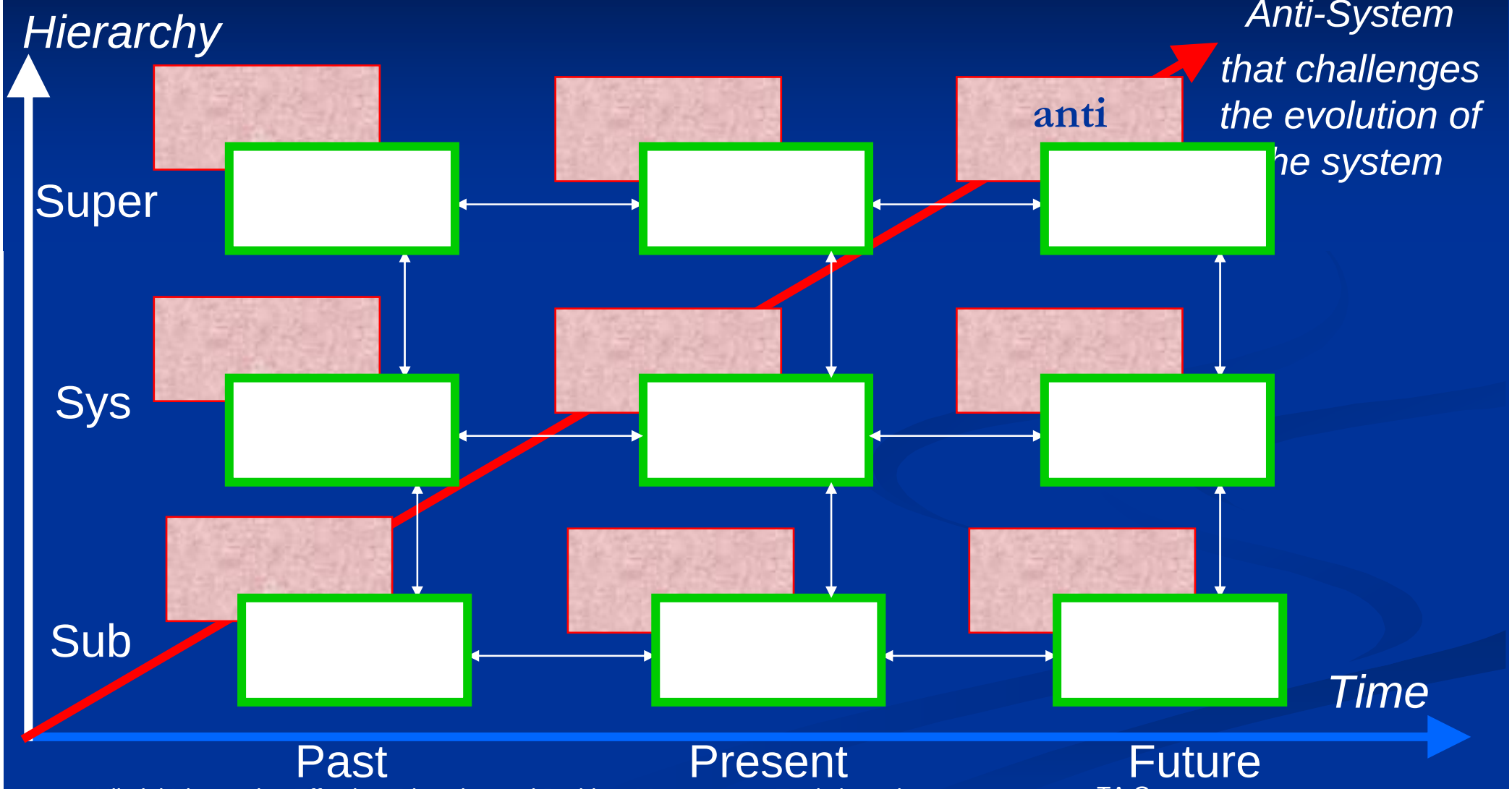


Main models of Classical TRIZ and OTSM

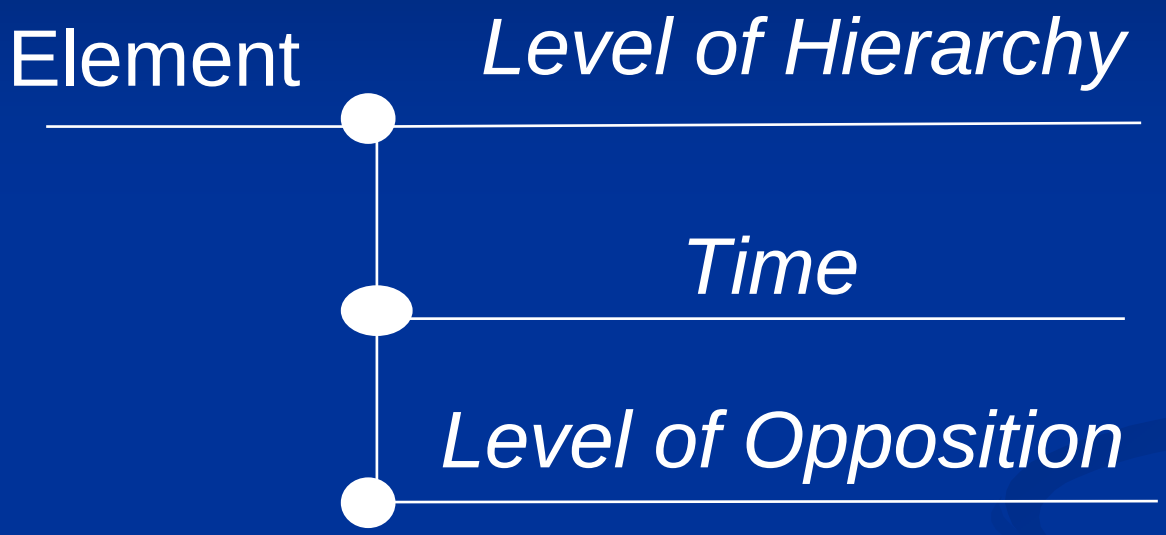
Models to Describe Elements of Problem Situations

- Classical Multi-screen scheme of powerful thinking (System Operator)
- OTSM ENV model

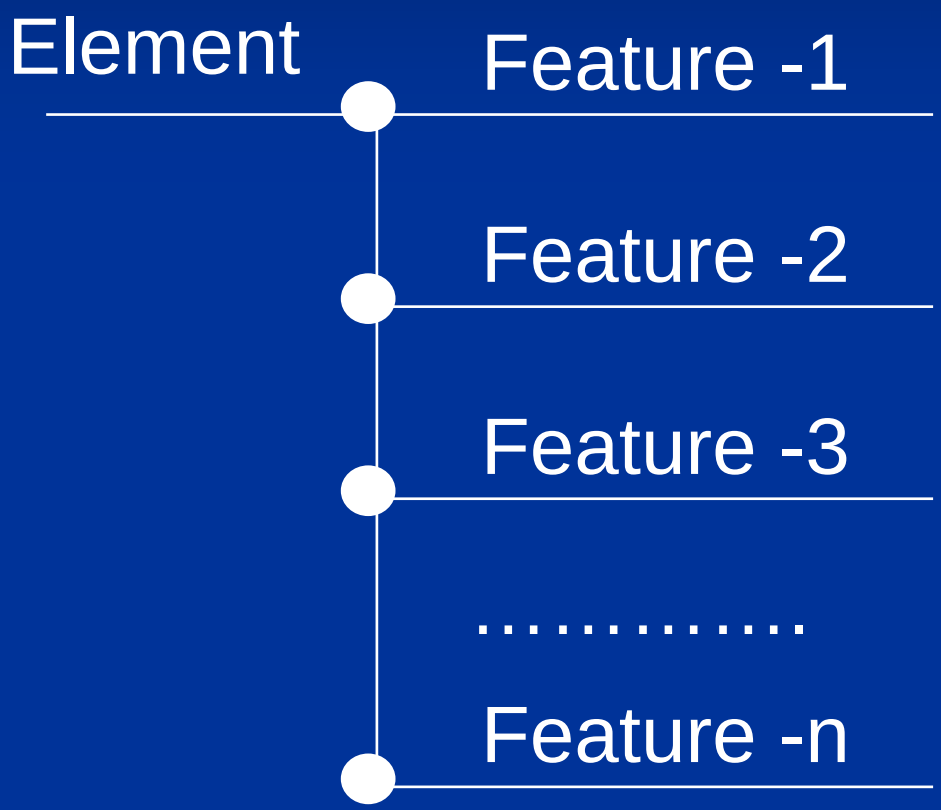
Classical TRIZ: Scheme of Powerful Thinking



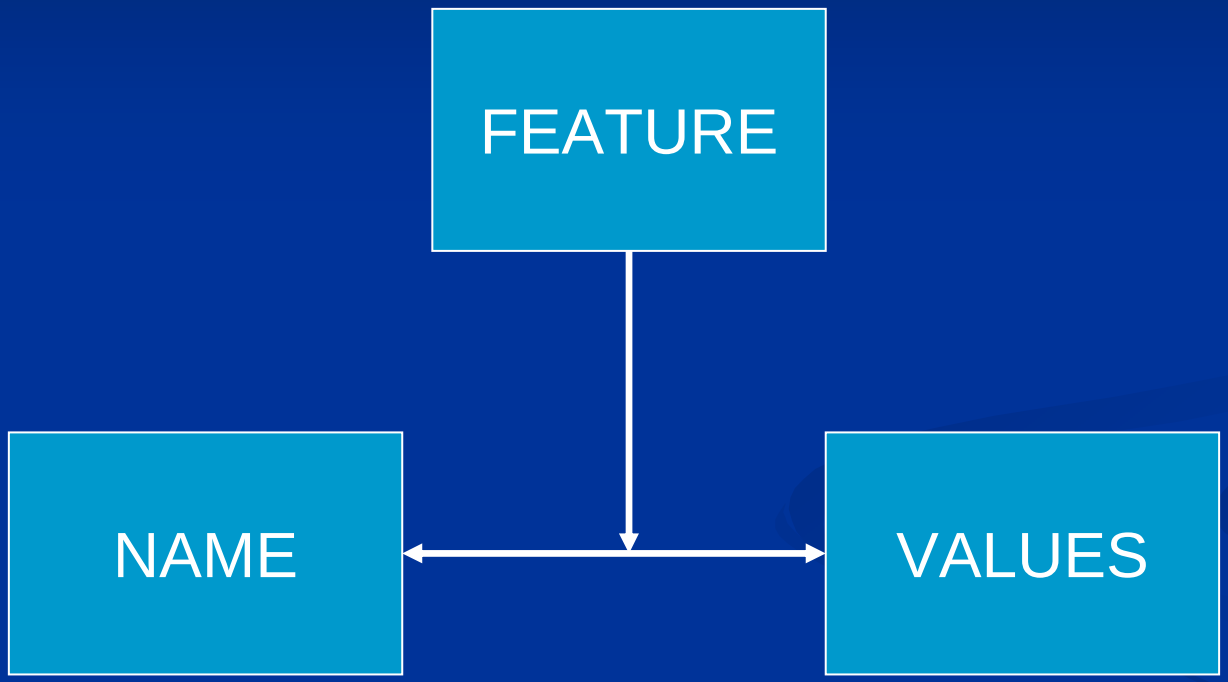
ENV Representation of Classical TRIZ System Operator



Name of Element and List of Its Features

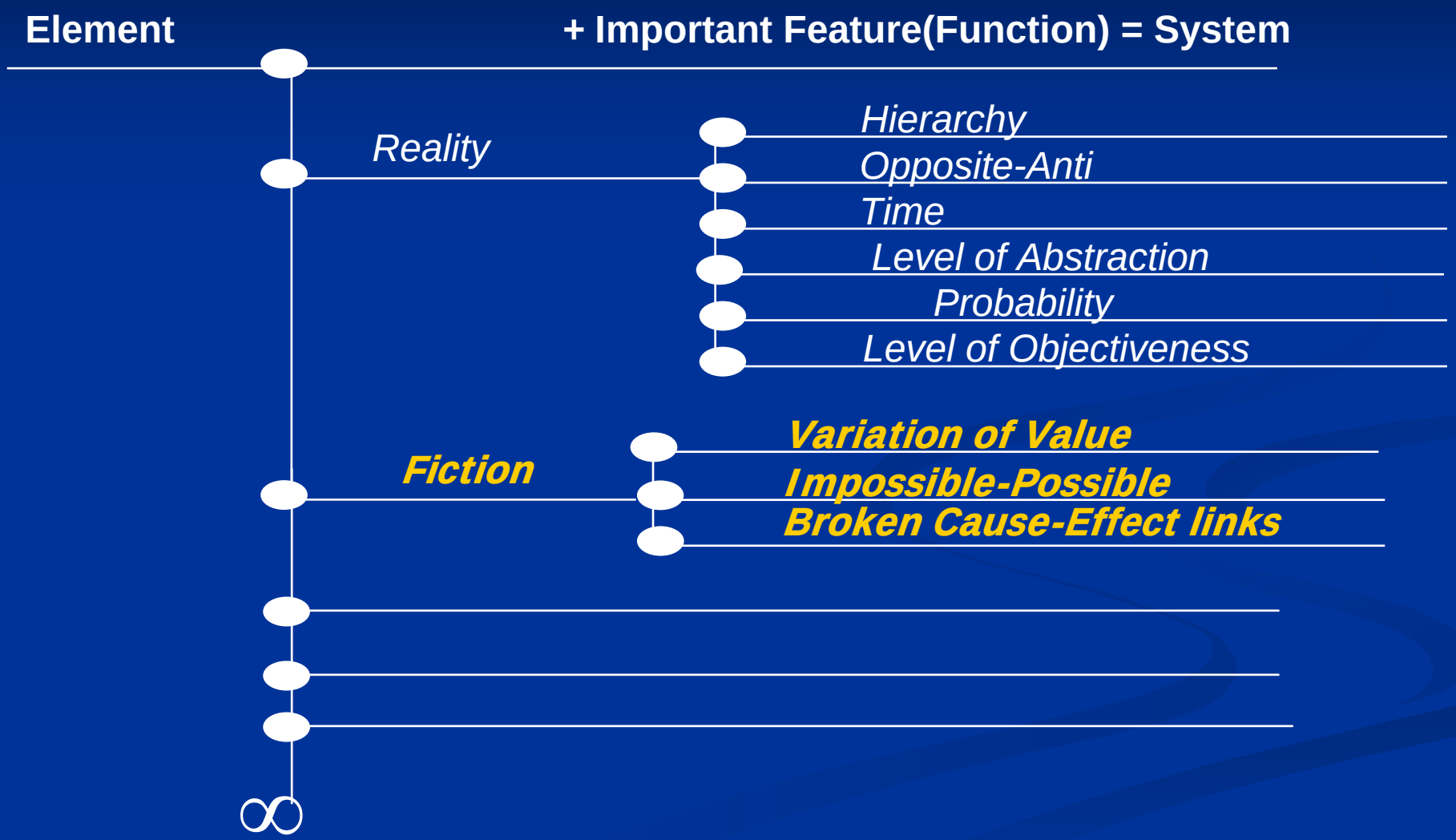


Element - Feature
Element - Name - Value



Model: Element - Name – Value (ENV)

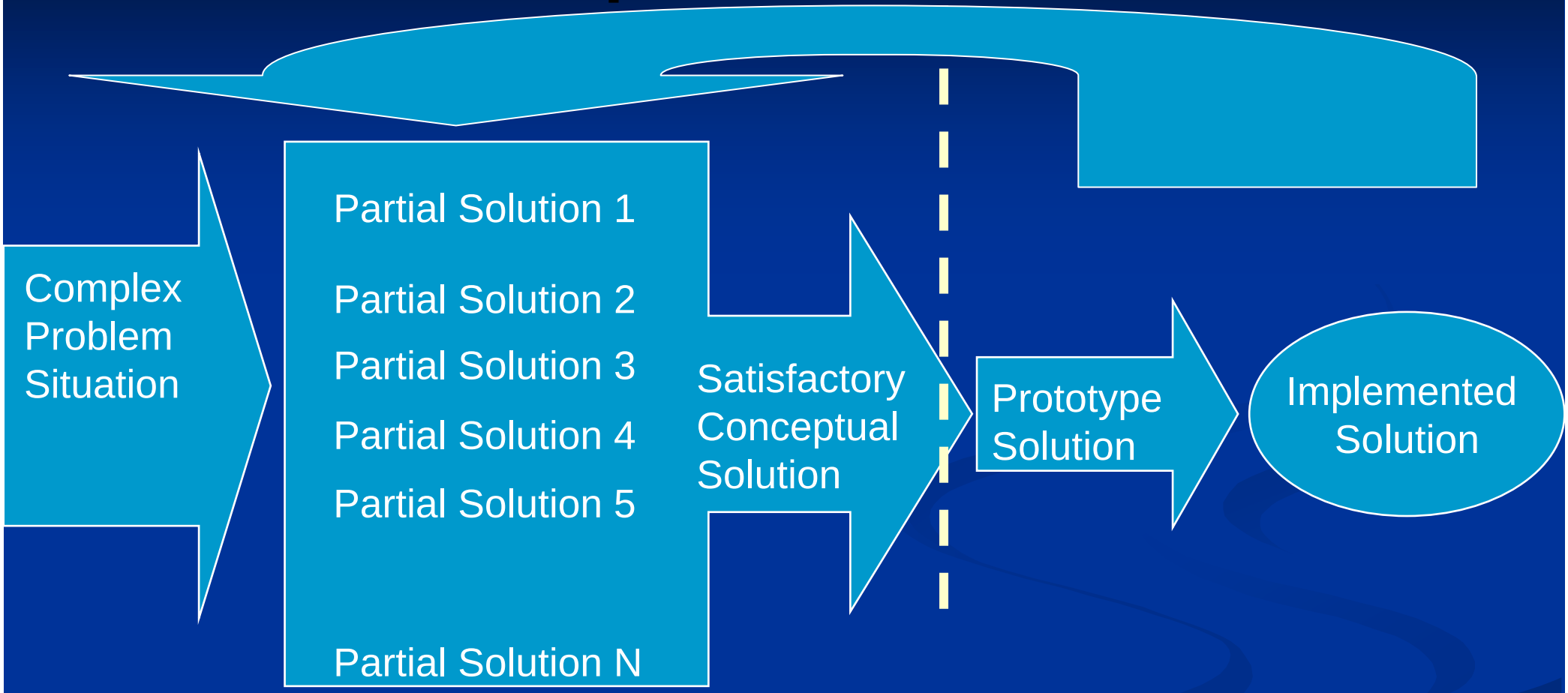
Complete ENV model
(multi-dimension fractal space of parameters)



Models of OTSM-TRIZ based problem solving processes :

- ***Line of Solutions:***
  - ***(1) partial conceptual solutions;***
  - ***(2) satisfactory conceptual solution;***
  - ***(3) Prototype solution;***
  - ***(4) Implemented solutions.***
- ***"Funnel" Model.***
- ***"Tongs" Model (MDR as a convergency of DRs and IFRs).***
- ***"Hill" Model.***
- ***Problem Flow Model.***
- ***Fractal model of the problem solving process.***

Commonly Accepted Way to Solve Complex Problems

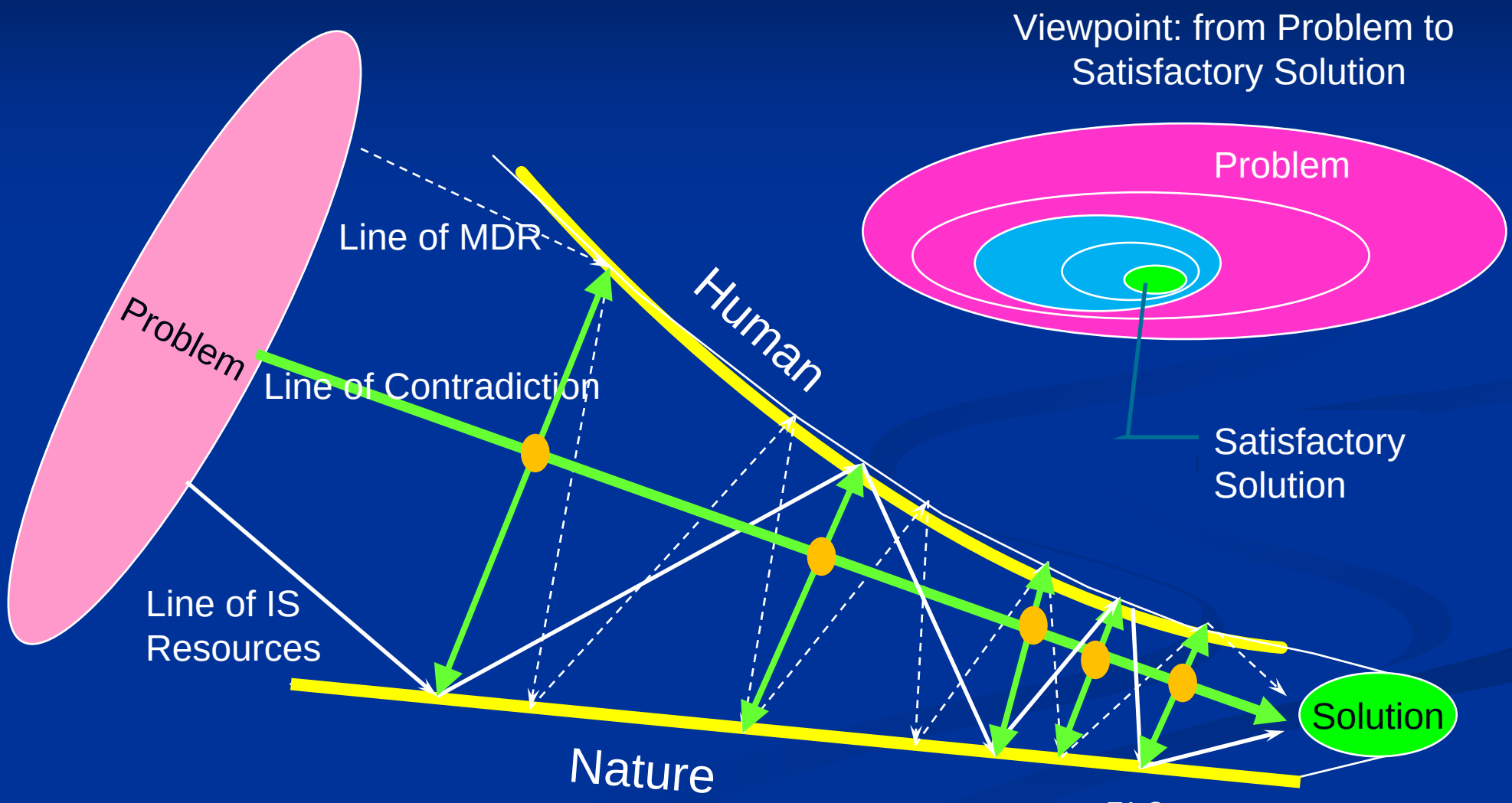


OTSM-TRIZ provides us with instruments to generate effective partial solutions (PS); converge those PS into a Satisfactory Conceptual Solution and evaluate those solutions objectively. Combination of Models: “Funnel”, “Tongs”, “Hill” and “Problem flow”.

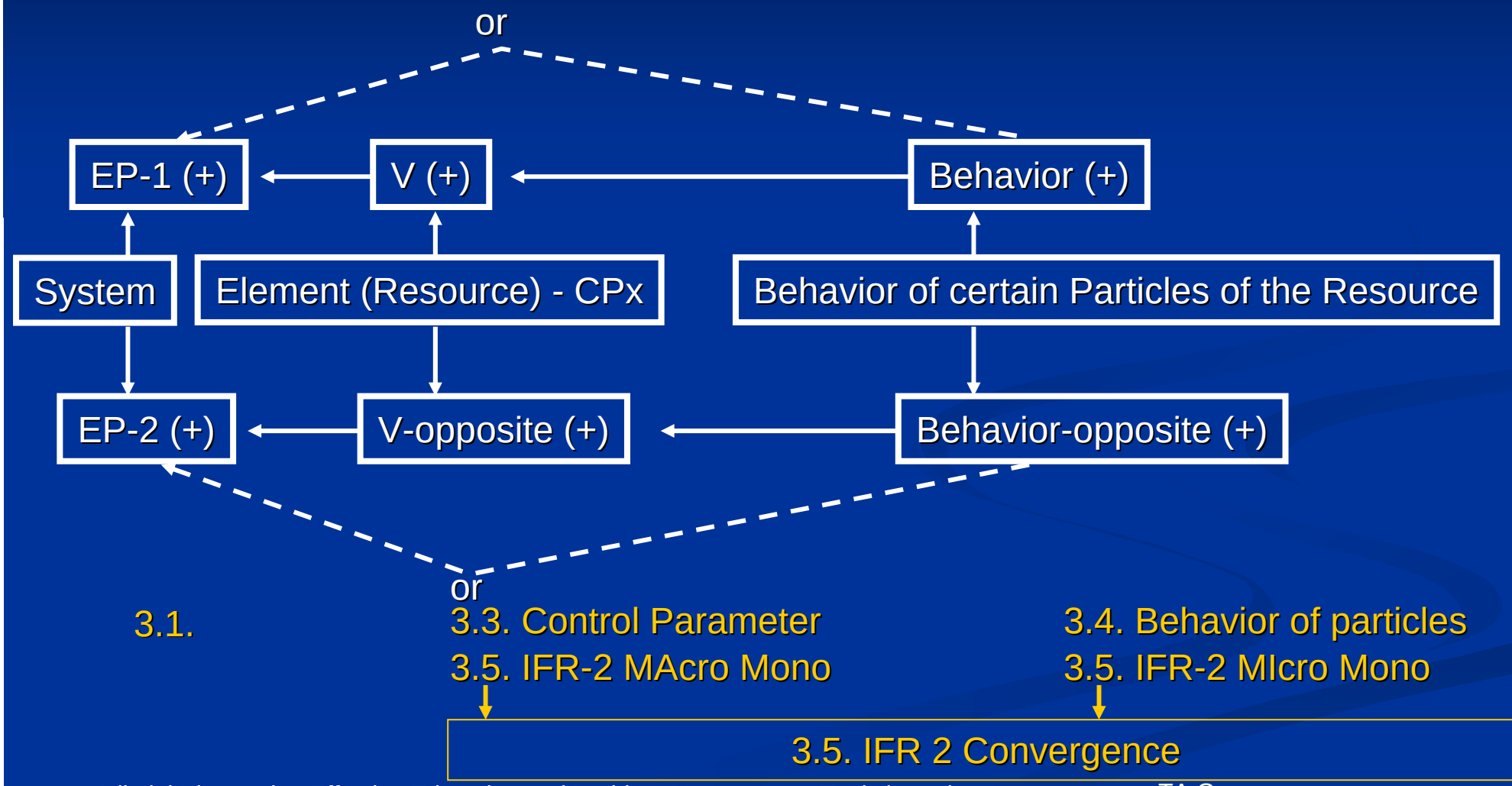
Most general Model of TRIZ based problem solving process

“FUNNEL” MODEL OF THE PROBLEM SOLVING PROCESS

“Funnel” Model of the Problem Solving Process



“Tongs” and “Funnel” Models in ARIZ and OTSM Contradiction Technology



So let us reflect on why OTSM-TRIZ instruments are so effective?

EXAGGERATION AND INTENSIFICATION – ONE OF MAIN TRIZ TRICKS IN PROBLEM SOLVING PROCESS

Why are OTSM-TRIZ instruments so efficient?

Typical stereotype of problem solving:
Generate as many different ideas as possible!!!

More or less acceptable solution

Advancement

OTSM-TRIZ Problem solving process:
(oversimplified)

Initial Situation (IS) Description: Negative Effect

Maximum possible Satisfactory Solution

Most Desirable Result (MDR) Description: Positive Effect

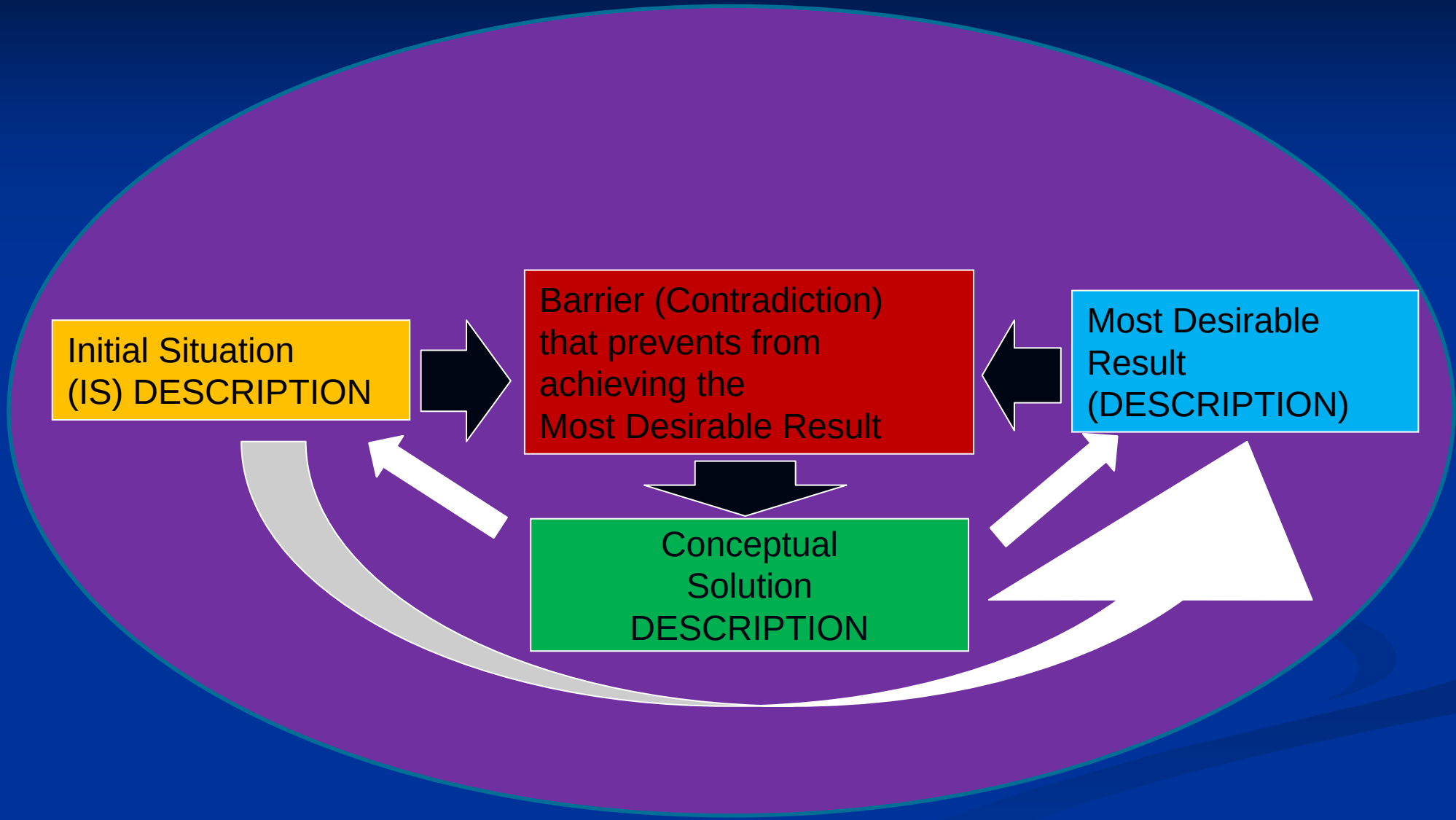
How do we exaggerate effectively?

- Choose an Evaluation Parameter that should be improved.
- Step by step exaggerate the value of the parameter in a different way up to “Zero” and below it. Up to the maximum and even more.
- Use OTSM Axiom of impossibility (“Gold Fish” and “Sword Fish” Methods) to overcome mental inertia and obtain unusual ideas.
- Do this with both Initial Situation and MDR.

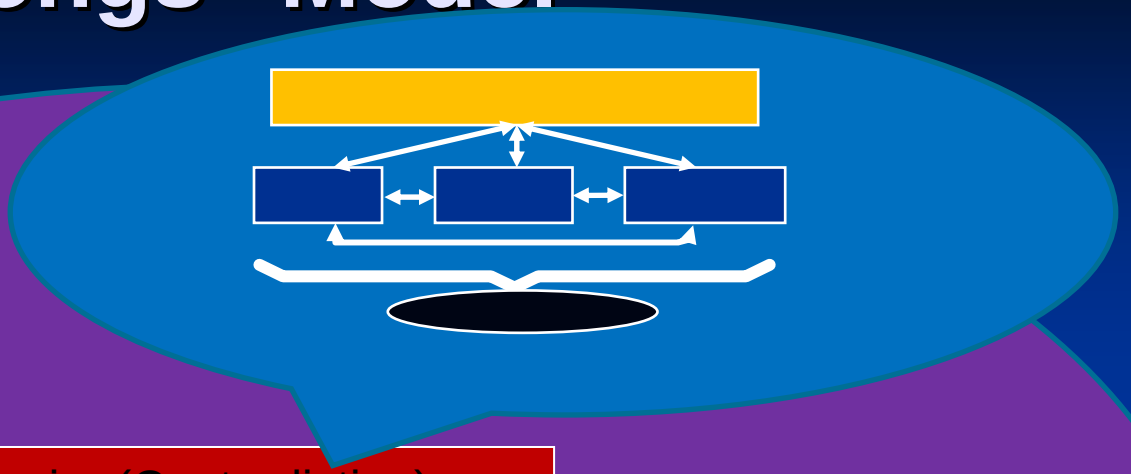
Some more details on using the “Funnel” Model

“TONGS” MODEL OF THE PROBLEM SOLVING PROCESS

“Tongs” Model


Initial Situation
(IS) DESCRIPTION
Barrier (Contradiction)
that prevents from
achieving the
Most Desirable Result
Most Desirable
Result
(DESCRIPTION)
Conceptual
Solution
DESCRIPTION

“Tongs” Model



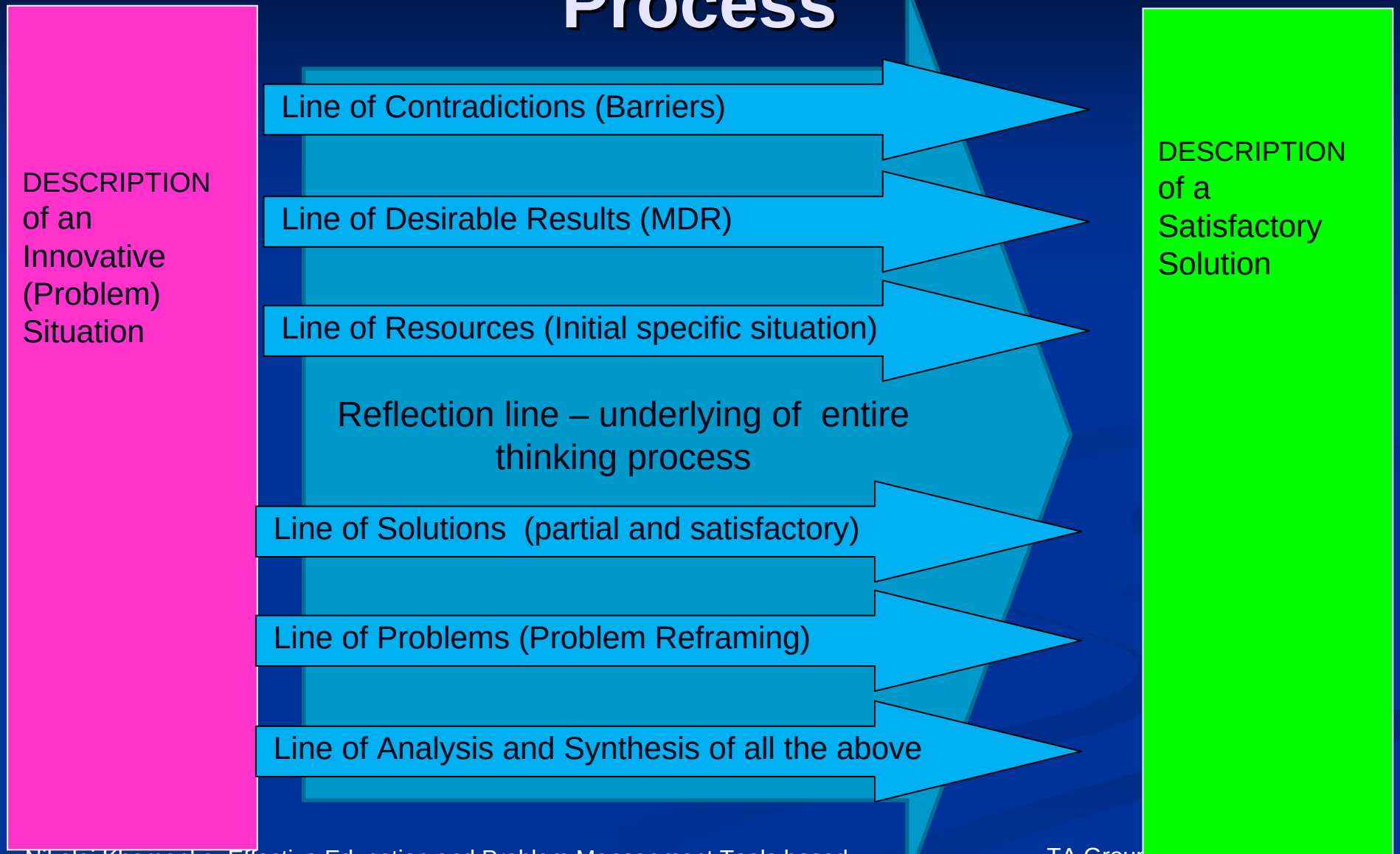
Initial Situation (IS) DESCRIPTION

Barrier (Contradiction) that prevents from achieving the Most Desirable Result

Most Desirable Result (DESCRIPTION)

Conceptual Solution DESCRIPTION

Analytical Lines of OTSM Problem Solving Process



Example: The Treasures of Surcouf

A famous French corsair Surcouf wanted to keep the treasure on the ship rather than hide it somewhere in the ground.
But...

Template for Application of “Tongs” Model

IS – Initial Situation description: Undesirable (negative) situation.
What would we like to change?:

MDR - Most Desirable Result.
Imagine that magic wand is in your hand:

Barrier (OTSM Axiom of root of problems) that prevents us form overcoming the negative effect and obtain the MDR :

List of collected Partial Solutions that should be integrated into Satisfactory solution description:

New Problem (New Initial situation):

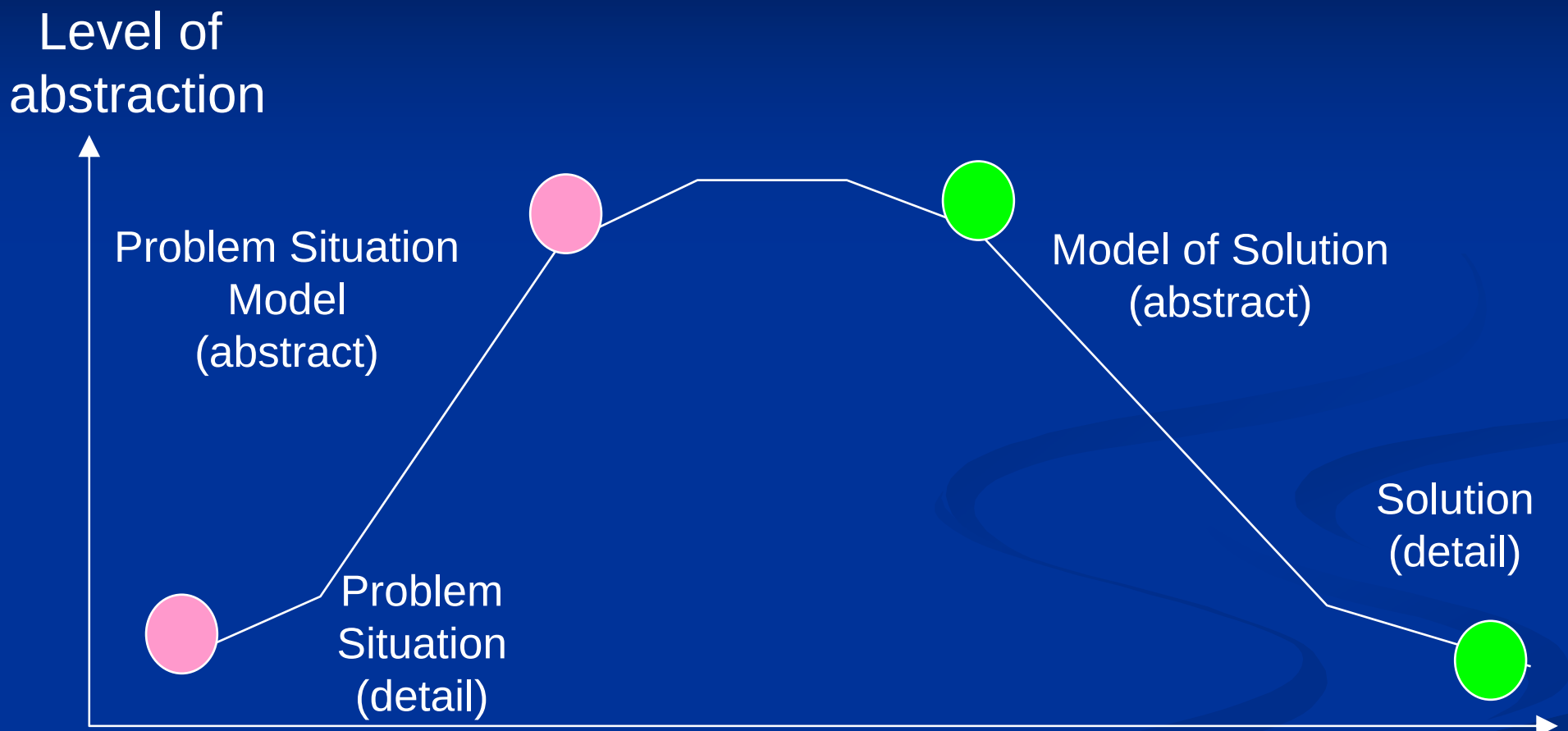
Some More Problems for Training:

- Moving books of local library to a new facility.
- Money and the old Mom whose memory is not good any more.
- Research problem:
  A bug that protects itself by the high temperature liquid.

Further development of the “Funnel” Model: transition from a Non-Typical problem to a Typical one.

“HILL” MODEL OF THE PROBLEM SOLVING PROCESS

The “Hill” model of Problem Solving (oversimplified)



King's Problem (1)

Once upon a time there was a country whose old king died. The king who replaced him, right away wanted to show people how kind and trustworthy he is, and the first thing he decided to do was to give all the inmates in the country's prisons a half amnesty. All the prison terms were to become two times shorter. However, there appeared a difficulty that the king hadn't noticed before. What about those inmates who had life-time sentences? What was he to do with them?

King's Problem (2)

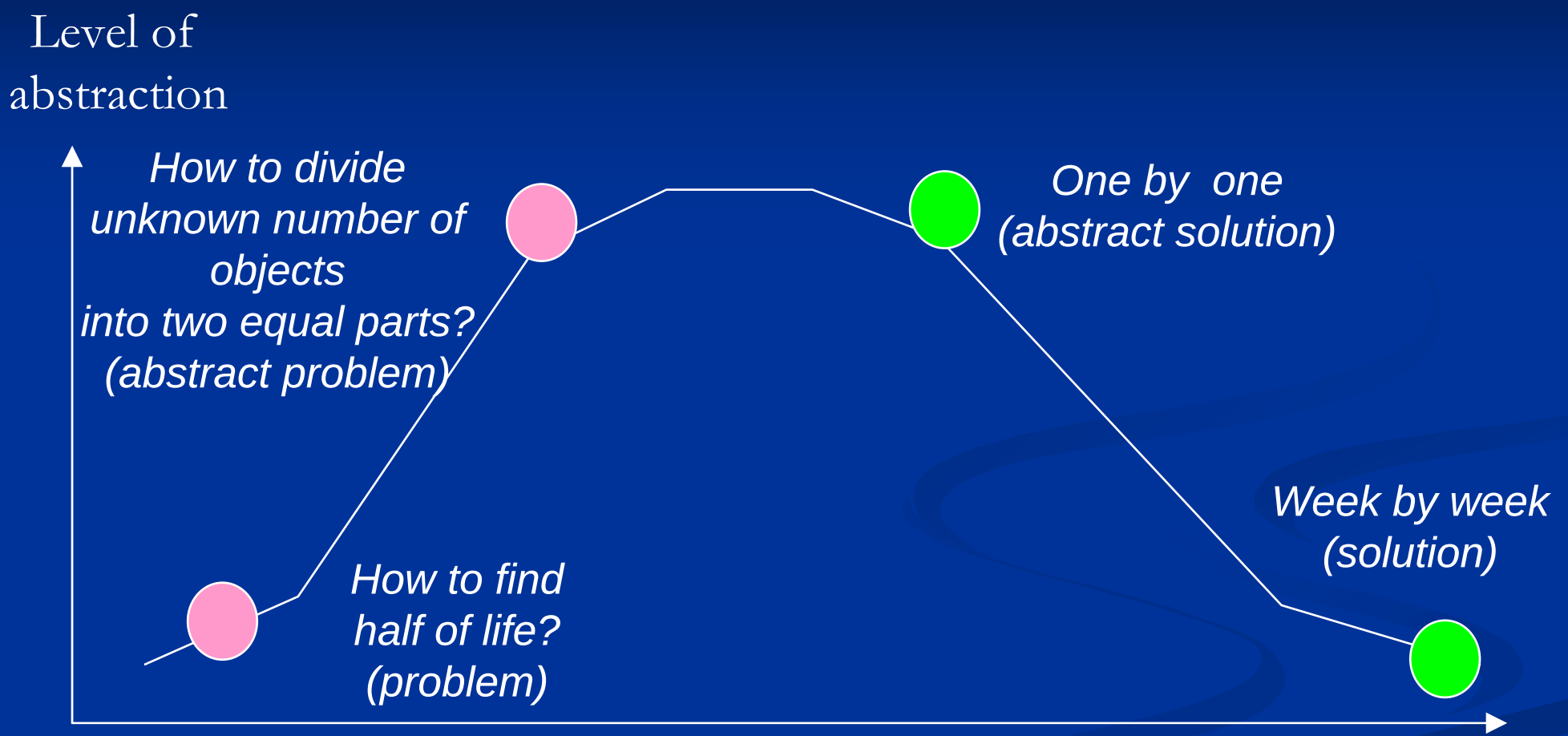
CONTRADICTION:

we need to know the life duration of inmates in order to find the half of their life,
but
nobody knows how many years one will live.

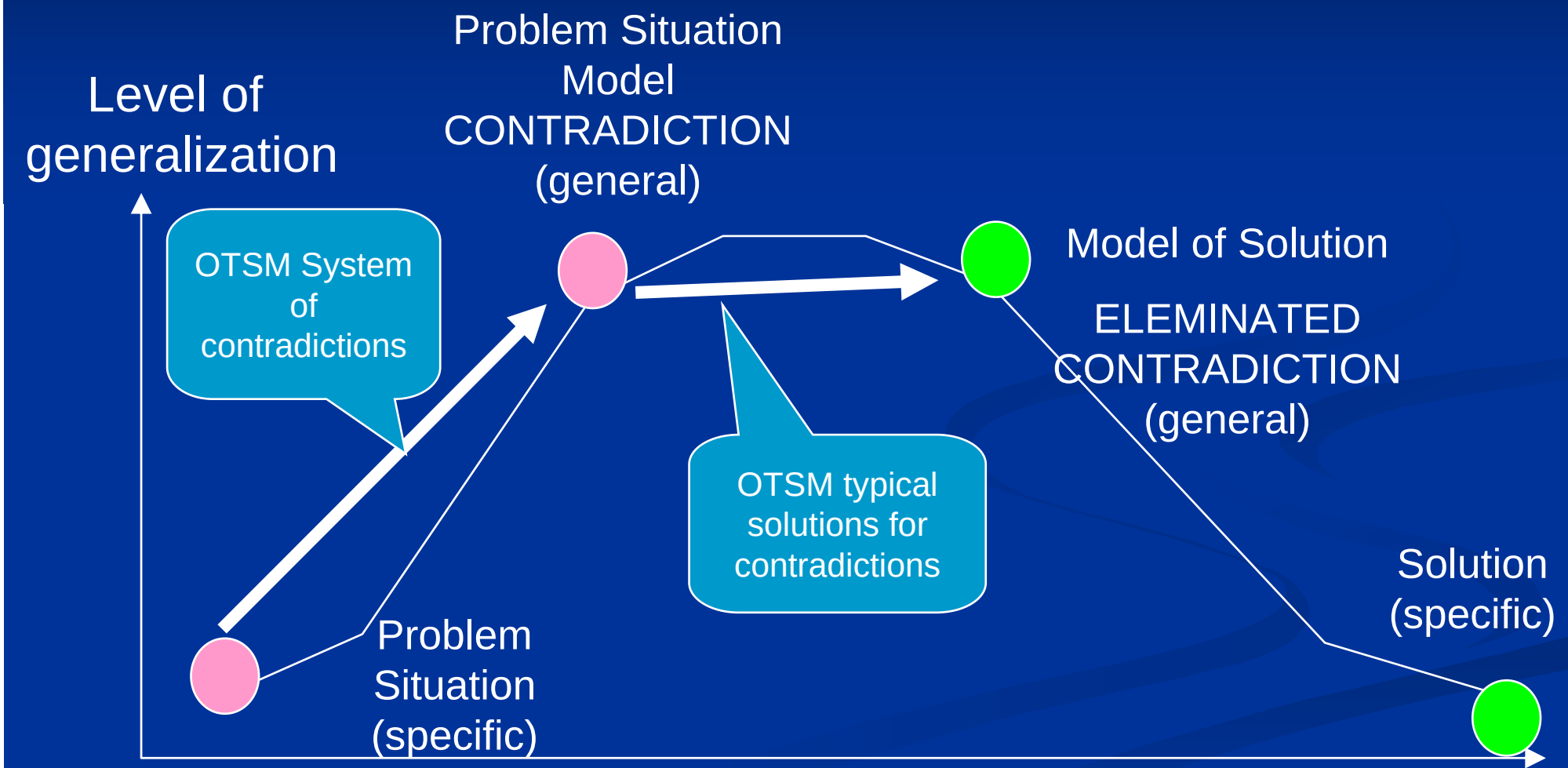
ABSTRACT DESCRIPTION OF THE PROBLEM:

how can we divide an unknown number of objects into two equal parts?

King's Problem (3)

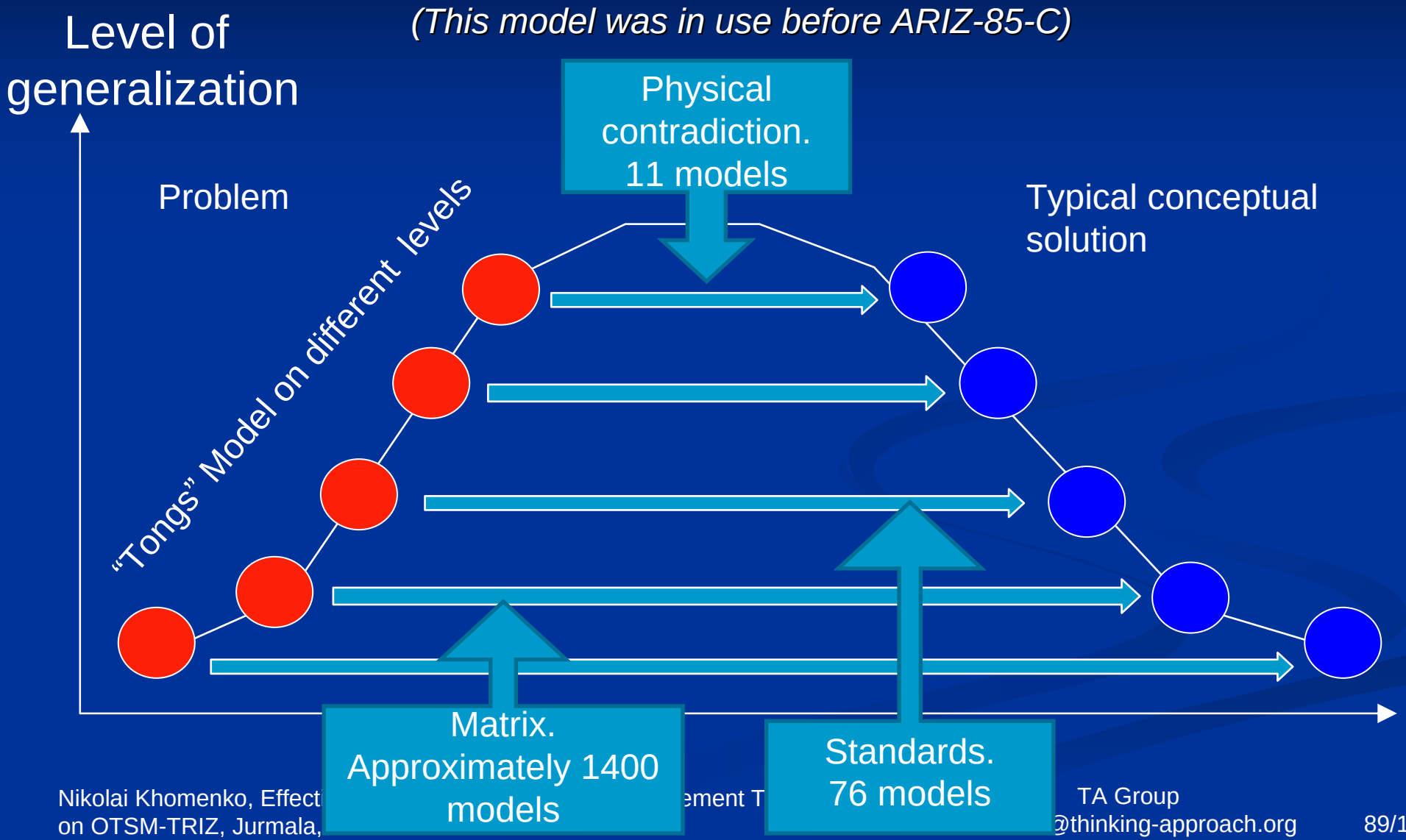


Conclusion: Contradiction Can Be Used as a Tool for Generalisation



“Hill” Model of the Problem Solving Process

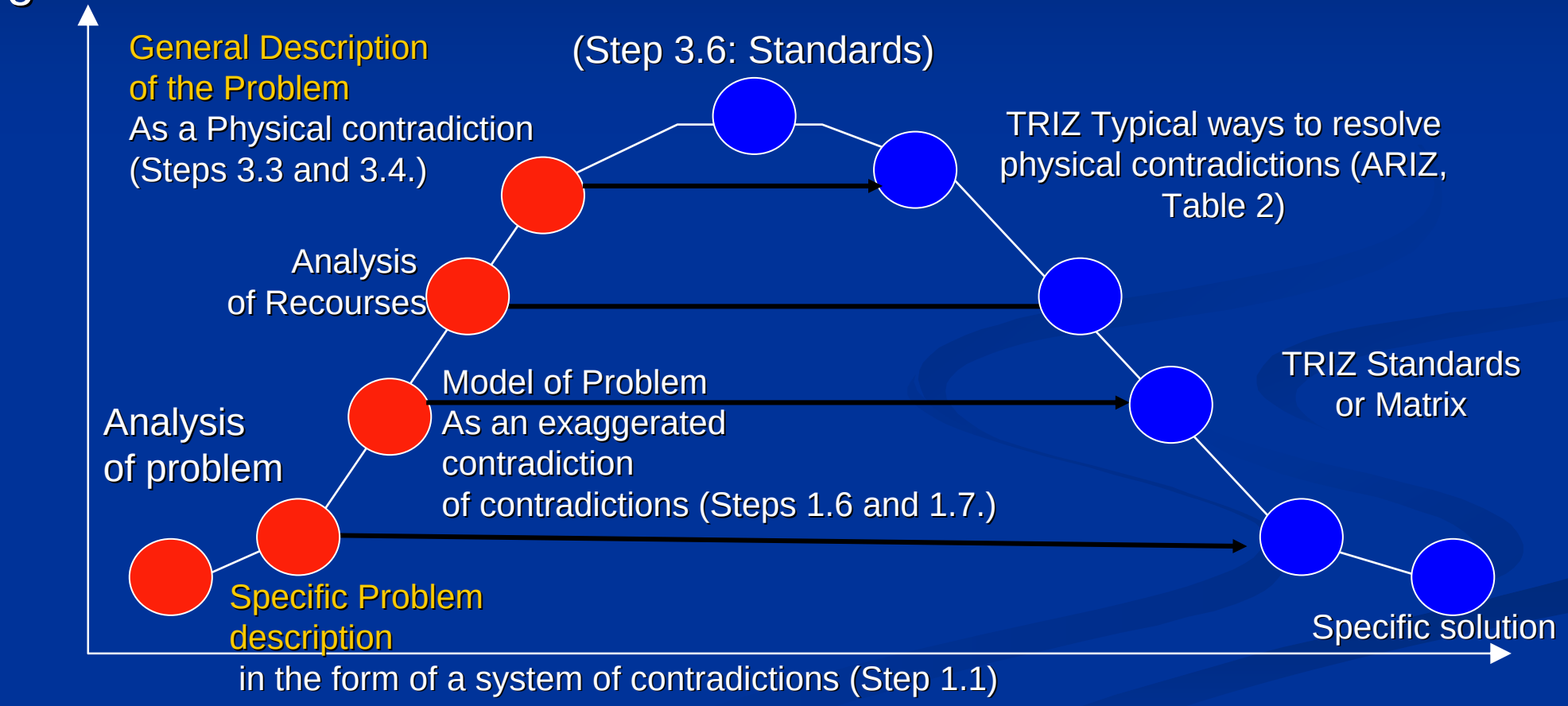
(This model was in use before ARIZ-85-C)



ARIZ process as "Hill" Model

(oversimplified)

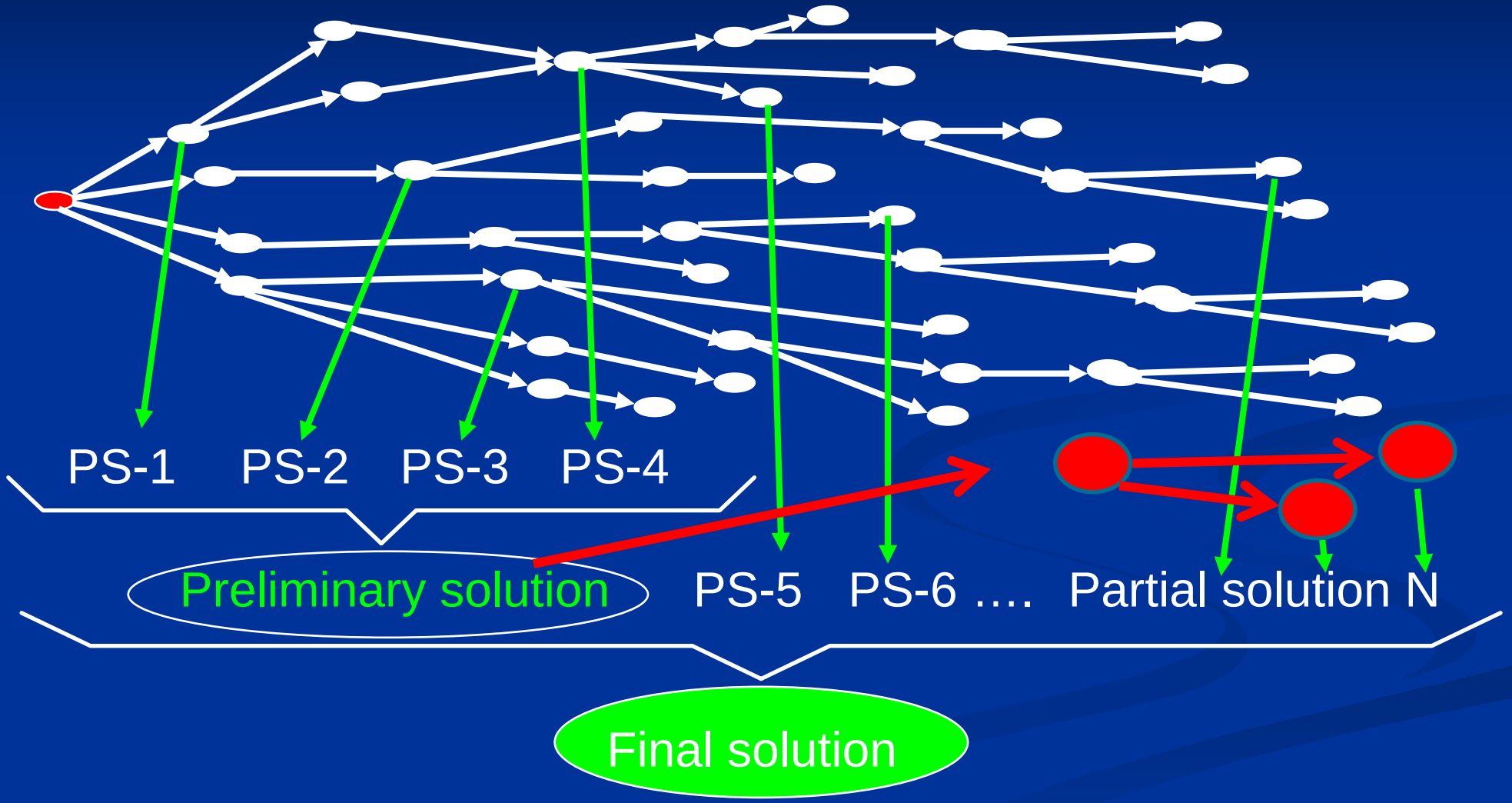
Depending on the user's experience a solution can be obtained at earlier stages of ARIZ. However, it is strongly recommended to perform all steps anyway.



What should be done if the “Hill” model does not lead us to a proper Typical solution?

“PROBLEM FLOW” MODEL OF A PROBLEM SOLVING PROCESS

“Problems Flow” technology



Gathering Partial Solutions

- Using all the available Models of the problem solving process analyse the flow of problems and sub-problems.
- Collect Partial solutions in a special place, separately form the log of the problem analysis.
- Use Convergency techniques and the knowledge of a particular situation to integrate those Partial Solutions into satisfactory solutions.

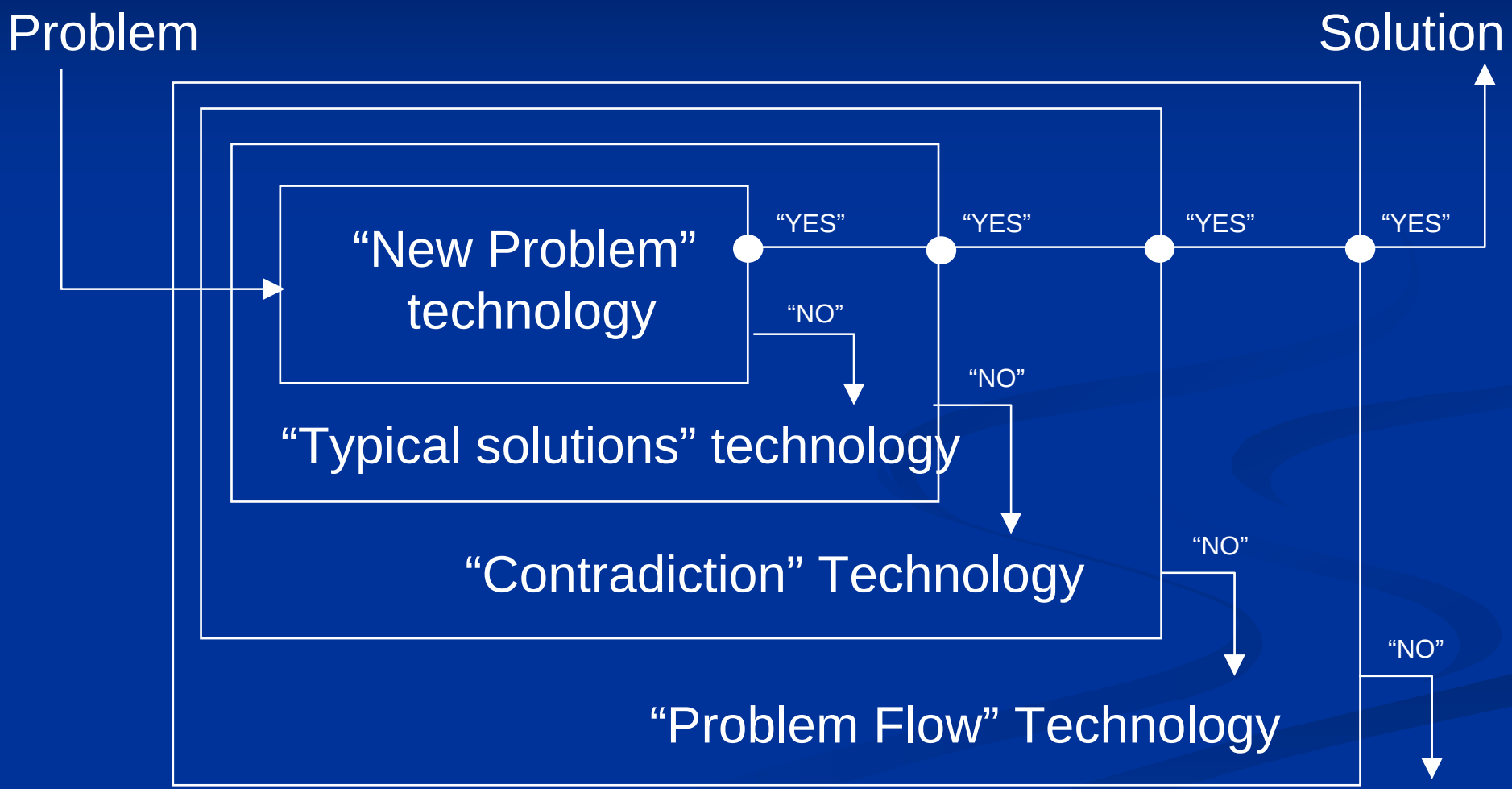
What should be done when facing a Non-Typical complex problematic situation?

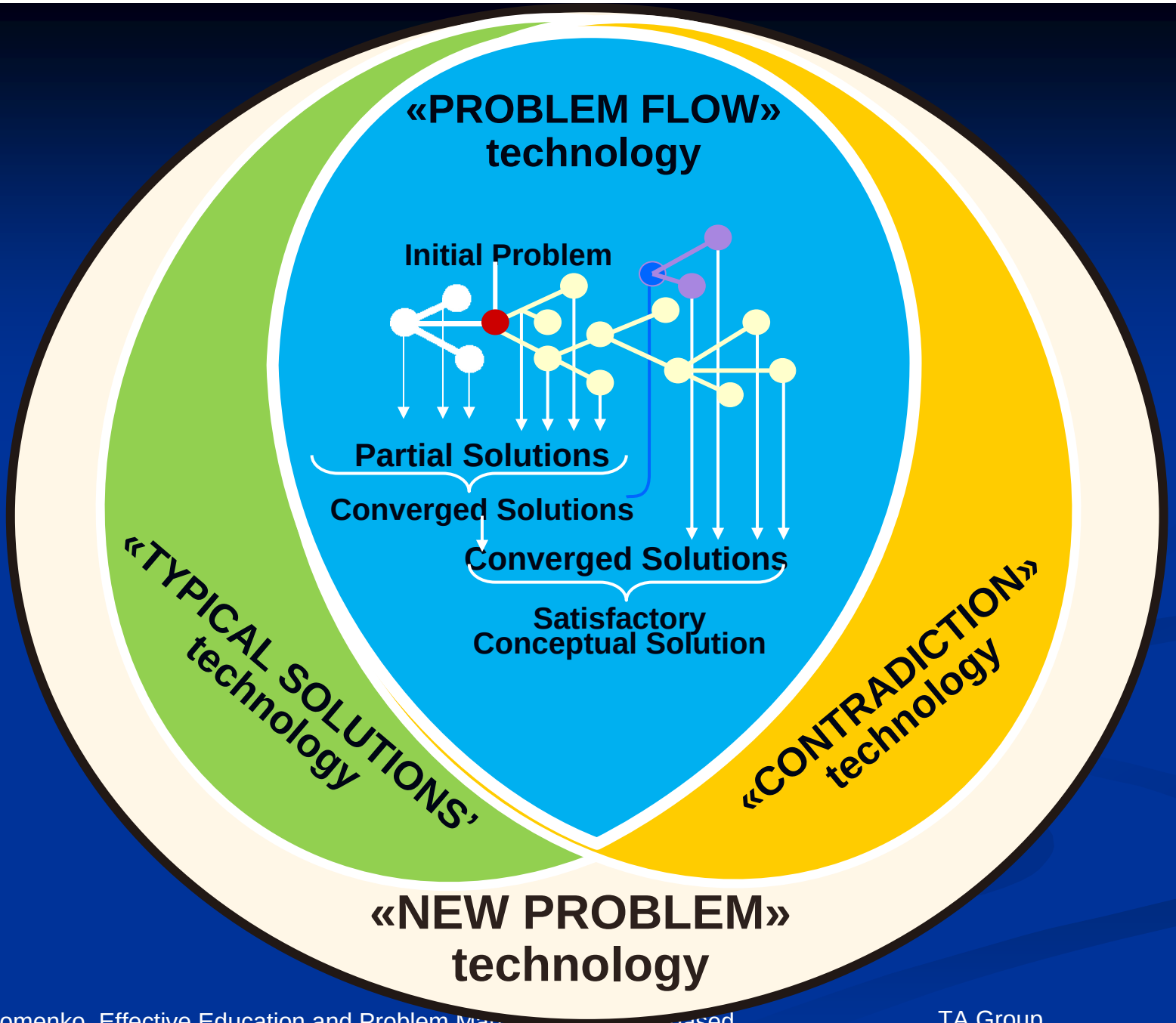
FOUR MAIN OTSM TECHNOLOGIES AND FRACTAL MODEL OF THE PROBLEM SOLVING PROCESS

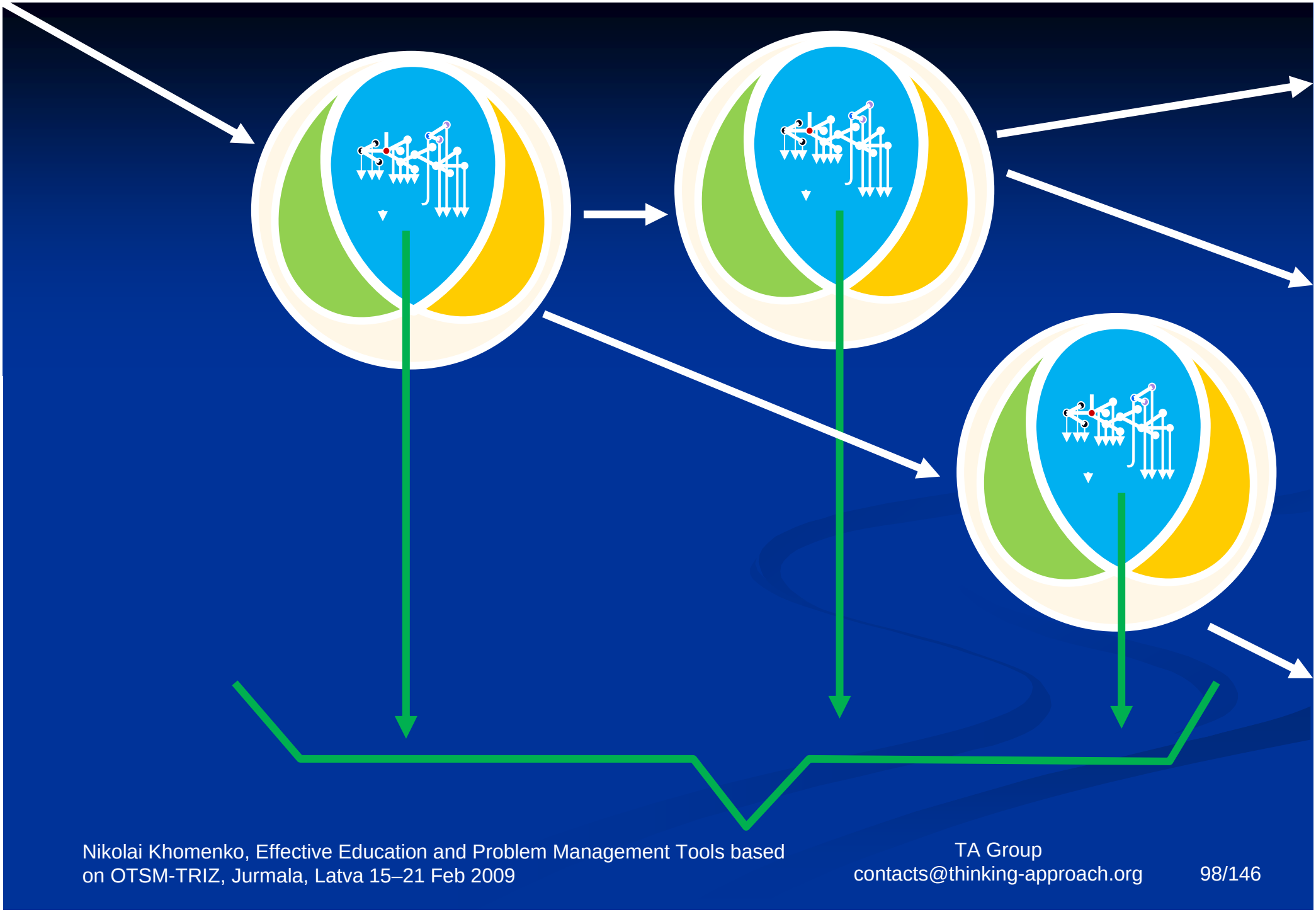
Instruments for practical application of OTSM

- **New Problem technologies** - instruments for transition from the description of the Initial problematic situation to the description of specific problems to be solved.
- **Typical Solution technologies**: If… Then…. Used for solving typical inventive problems or generate partial solutions for the Contradiction Technology and the Problem Flow technology.
- **Contradiction Technology** for transforming a Non-typical problem into a Typical problem and applying the Typical Solution Technology and for solving relatively simple Non-Typical Problems that consist of several contradictions. It is used as a component of the Problem Flow Technology.
- **Problem Flow technology** that is based on OTSM Fractal Model of the problem solving process and includes all the three technologies listed above as components of the fractal model of the problem solving process.

OTSM-TRIZ Technologies




«PROBLEM FLOW» technology
Initial Problem
Partial Solutions
Converged Solutions
Converged Solutions
Satisfactory Conceptual Solution
«TYPICAL SOLUTIONS' technology
«CONTRADICTION» technology
«NEW PROBLEM» technology



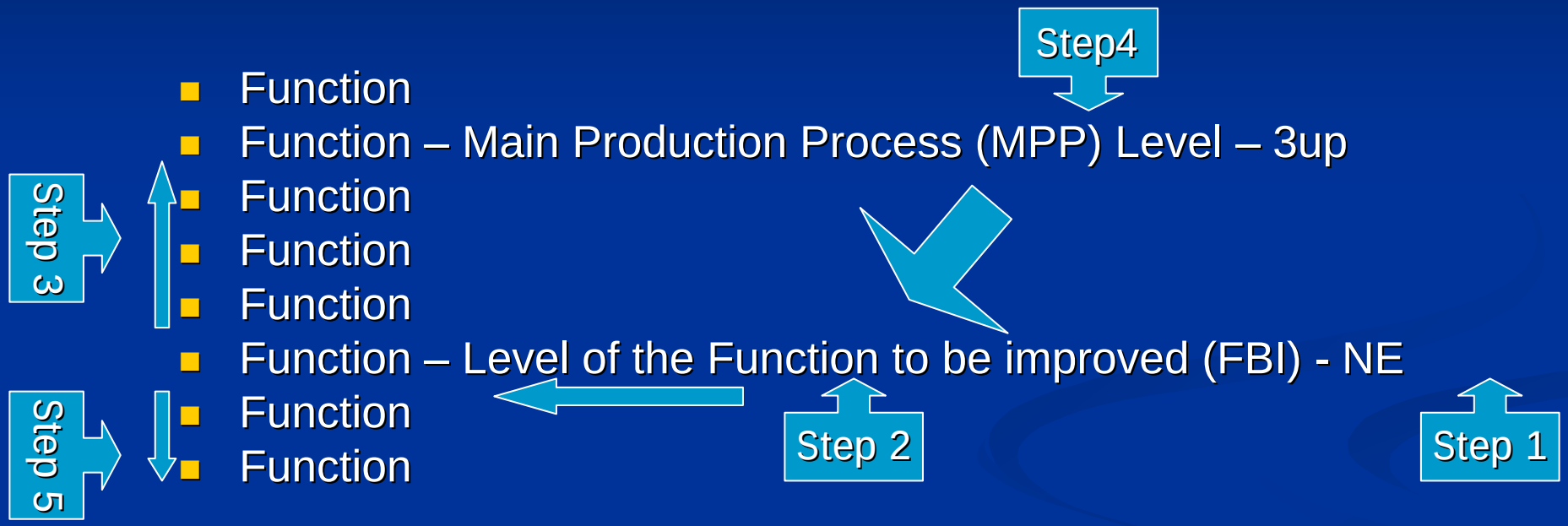
OTSM Contradiction Technology application

Simplified

Where is the root of a problem?

OTSM EXPRESS ANALYSIS OF A PROBLEMATIC SITUATION

Function (Goals) Hierarchy



Comments:

Undesirable (Negative) Effect (NE) – Certain Evaluation Parameter has an unsatisfactory Value

Step 5: analysis of deep roots of NE in sub-systems

OTSM Function Definition: 3 Step Algorithm

1. Common language model of Function
2. “Verb – Noun (product)” model
3. OTSM Function Definition – “Four Verbs” model:
    1. Keep
    2. Change
    3. Increase
    4. Decrease

Value - Name - Element
parameter (product)

Law of Completeness: OTSM Interpretation

1. OTSM ENV Function Definition
2. Product
3. Tool
4. Energy for the Tool to Change Product
5. Energy Source and Flow through the system
6. Engine
7. Transmission

Positive (Desirable) Effect System (PES) vs. Negative (UnDesirable) Effect System (NES)

1. Use OTSM ENV model of function description and OTSM Minimal Complete Engineering System in order to develop models of positive and negative systems (PES and NES).

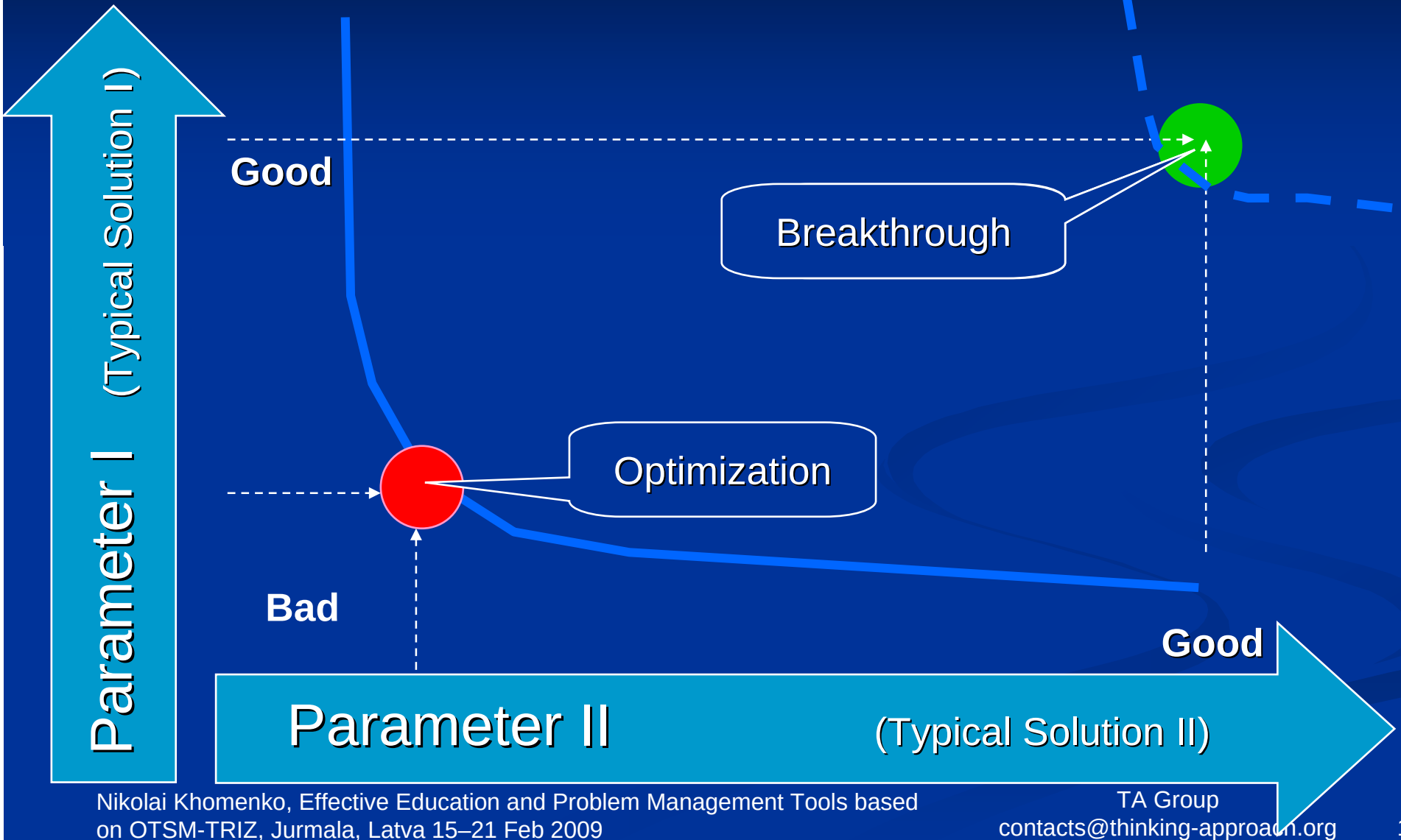
2. Compare the structure of PES and NES in order to discover common components between them.

3. Which component of NES and which its property should be changed to stop the functioning NES without negatively affecting the MPP? What typical solution can we apply to make these changes? What new NE do these typical solutions cause?

Comment:

For educational purpose we will skip this step and perform it later.

Optimization vs. Breakthrough
Typical vs. Non-Typical



Step 1.1 of ARIZ: Non Typical Problem Indicator

Typical Solution I

Evaluation Parameter-1 (+)

But

Evaluation Parameter-2 (-)

TC-1

TC-2

Typical Solution II

Evaluation Parameter-2 (+)

But

Evaluation Parameter-1 (-)

OTSM Diagram for Problem Description

CP is a cross parameter for parameters EP1 and EP2

EP-1 = f1 (…….CP……)

EP-2 = f2 (....CP……)

List of resources here

Reflection Stage – Present the Chosen Problem: Summary of the Previous Steps (Analogue ARIZ 1.1)

1. To fulfil <MPP> <Function> should be performed.
2. List of Elements to perform the Function:
3. C of SS-1 (Analogue of TC-1)
4. C of SS-2 (Analogue of TC-2)
5. It is necessary with minimum changes to achieve: <MDR= EP-1(+) & EP-2(+)>
6. Check Twice eliminating professional terminology.

Define the Product and the Tool (Analogue ARIZ 1.2)

1. Use the PES and OTSM definition of the <Function> to identify the Product.
2. The Tool is an Element of the system that directly interacts with the Product to perform the <Function>
3. OTSM model of the Minimal Complete Engineering System can be useful.

Graphic models of CofSS-1 (TC1) and CofSS-2 (TC2) (Analogue ARIZ 1.3)

1. This is a reflection and check point to verify one more time the choices made during previous steps.

2. For this purpose one more alternative way is used – graphical one (Table 1 of Altshuller's ARIZ can be used).

3. If at least one element appears in graphical models which is not presented in CofSS-1 (TC1) and CofSS-2 (TC2) or the Product and the Tool of the Positive Effect System (PES) does not appear in the graphical models, then whole previous thinking process should be reviewed.

Chose a Conflict to be Solved (Analogue ARIZ 1.4)

1. Analyze which of the two conflicts lead to an increase in ideality of the <MPP> NOT <Function> but <MPP>!): increase productivity, decrease complexity, etc.
2. By choosing the conflict we chose the appropriate Value of the Control Parameter of the <Element> (See OTSM Diagram of Problem Description). From now on only this Value will be considered.
3. Often the <Element> appear as a Tool. If it is not then double check the whole previous analysis.
4. This step is a check point for the whole previous reasoning.

Intensify the Chosen Conflict (Analogue ARIZ 1.5)

1. Apply the rule of the DTC operator to the Parameter of an Element in the OTSM diagram for problem Description (Control Parameter): Step by step change the value of the Parameter of the Element in the OTSM diagram for problem Description to increase the Negative (Undesirable) Effect.
2. **Do not jump (!)** directly to the situation that looks like “maximum-maximorum” or “minimum-minimorum”. You can miss something important. Instead, increase or decrease the Value of the parameter by small steps.
3. Conduct mental experiments in order to be sure that when you make the Undesirable Effect (-) even more negative the Desirable effect (+) can potentially be even more positive. And vise versa: if you decrease the Negative effect, then positive effect will potentially decrease either.
4. Remember the OTSM axiom of a Specific Situation. Look for qualitative changes of the situation as a result of quantitative changes of the Value of the Control Parameter of the Element (Tool).
5. This is a check point to verify the dependence of EP-1 and EP-2 of the chosen Control Parameter. Then we should use this intensified Value and the appropriate situation it leads to.

Reflection Stage - Model of the Problem
(Analogue ARIZ 1.6)

1. What are the Tool and the Product now?
   After the intensification of the conflict (intensified Value of the Parameter of the Element (often Tool).
2. Describe clearly the intensified contradiction that fits your choice of the conflict.
3. Clarify the MDR for intensified Conflict:
   One must find an X-Element (System of X-Modifications) that will KEEP the intensified Positive Effect (result) and ELIMINATE the Negative effect, while the <Intensified Value> of the Control Parameter of the Element (often the Tool).
4. Check all the previous steps and look for the points where the logic is broken or not clear.
5. From Now this description of the problem should be used for further analysis.

Apply Typical Solutions (Mostly Standards)
(Analogue ARIZ 1.7)

- Now the problem is reformulated and Su-Field models can be easier to construct.
- Some other TRIZ and Non-TRIZ Typical Solutions can be applied.
- After the analysis of the achieved solutions one should write down all of them and comment on Positive and Negative points and come back to this analysis.
- All of these and other partial solutions should be written separately from the log of the analysis.
- It is necessary to continue the analysis even if a satisfactory solution seems to have been obtained.

How can the “Funnel” model help with complex interdisciplinary problematic situations?

OTSM PROBLEM FLOW NETWORKS APPROACH

TA Group
contacts@thinking-approach.org

Comparison of the “Funnel” models in:

Classical TRIZ ARIZ

- Administrative Contradiction (General problem description)
- Technical Contradiction (Clear problem description)
- Physical Contradiction (Deep root of the initial Problem)

OTSM PFN Approach

- Network of Problems (A big picture of a set of problematic situations)
- Network of Contradictions (Clear description of a Problematic situation)
- Network of Parameters (Deep roots of problematic situations)
- ARIZ

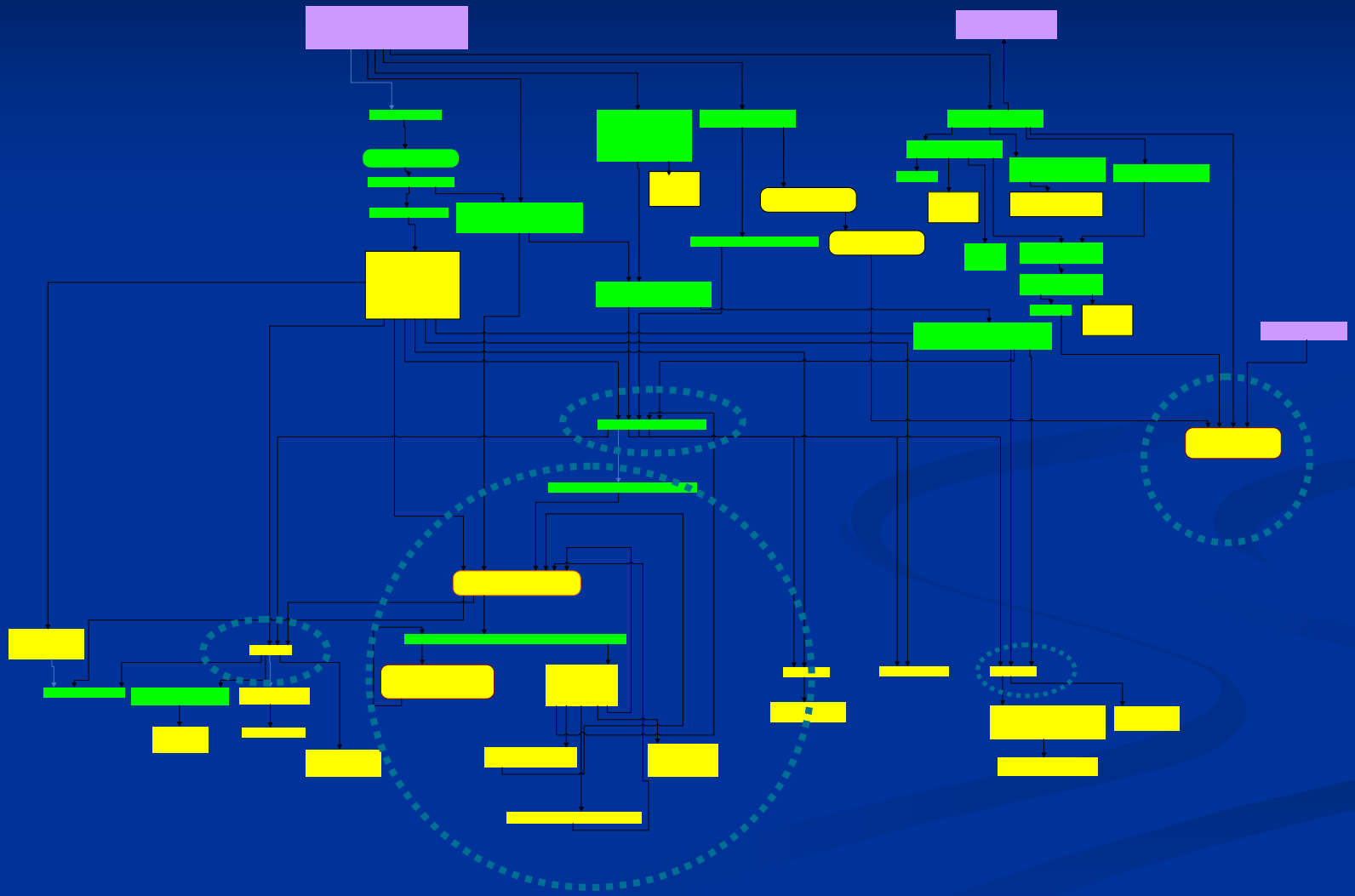
Scheme of Powerful Thinking = Big Picture of a problematic situation

NETWORK OF PROBLEMS

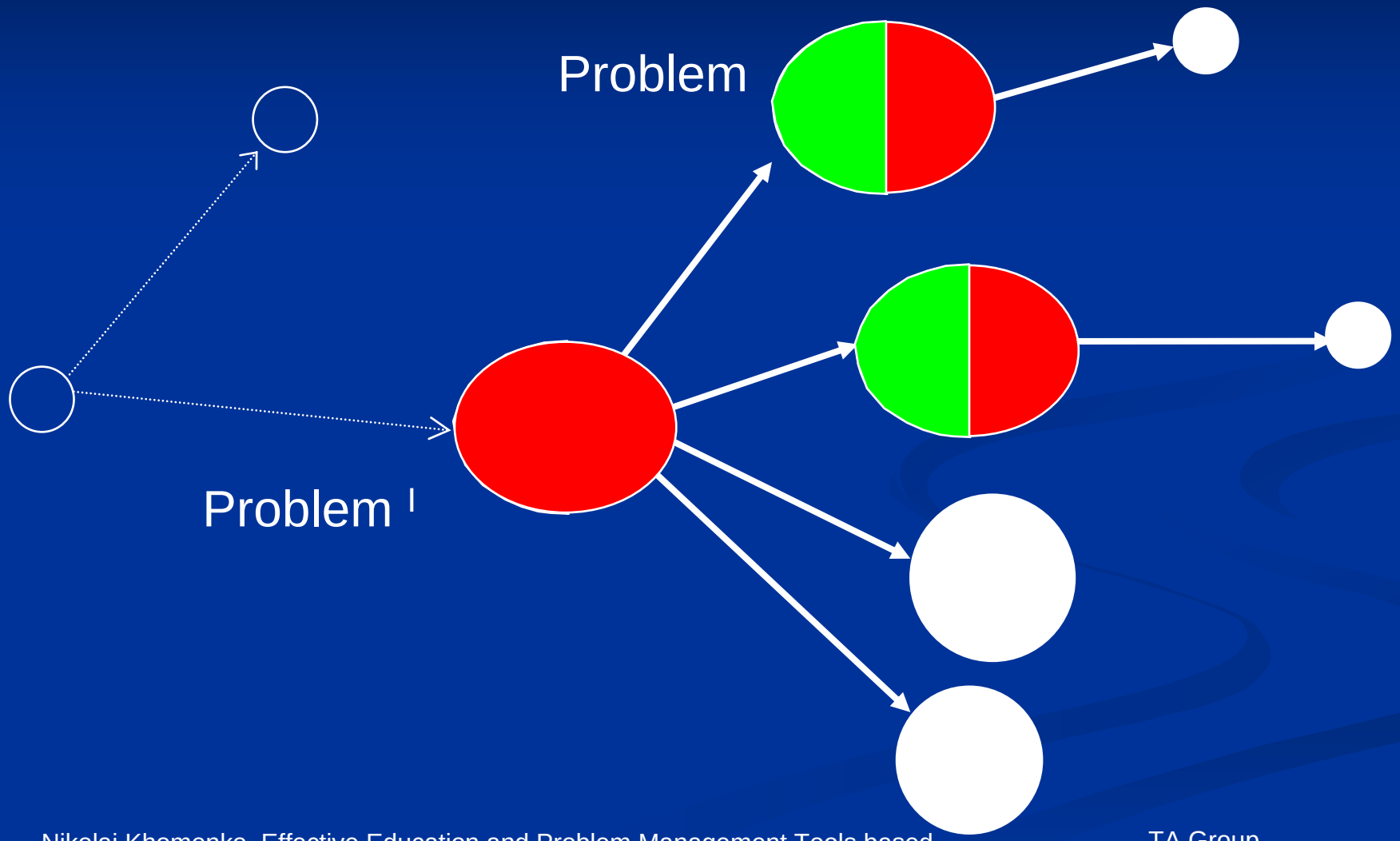
(SUPER SHORT INTRODUCTION)

TA Group
contacts@thinking-approach.org

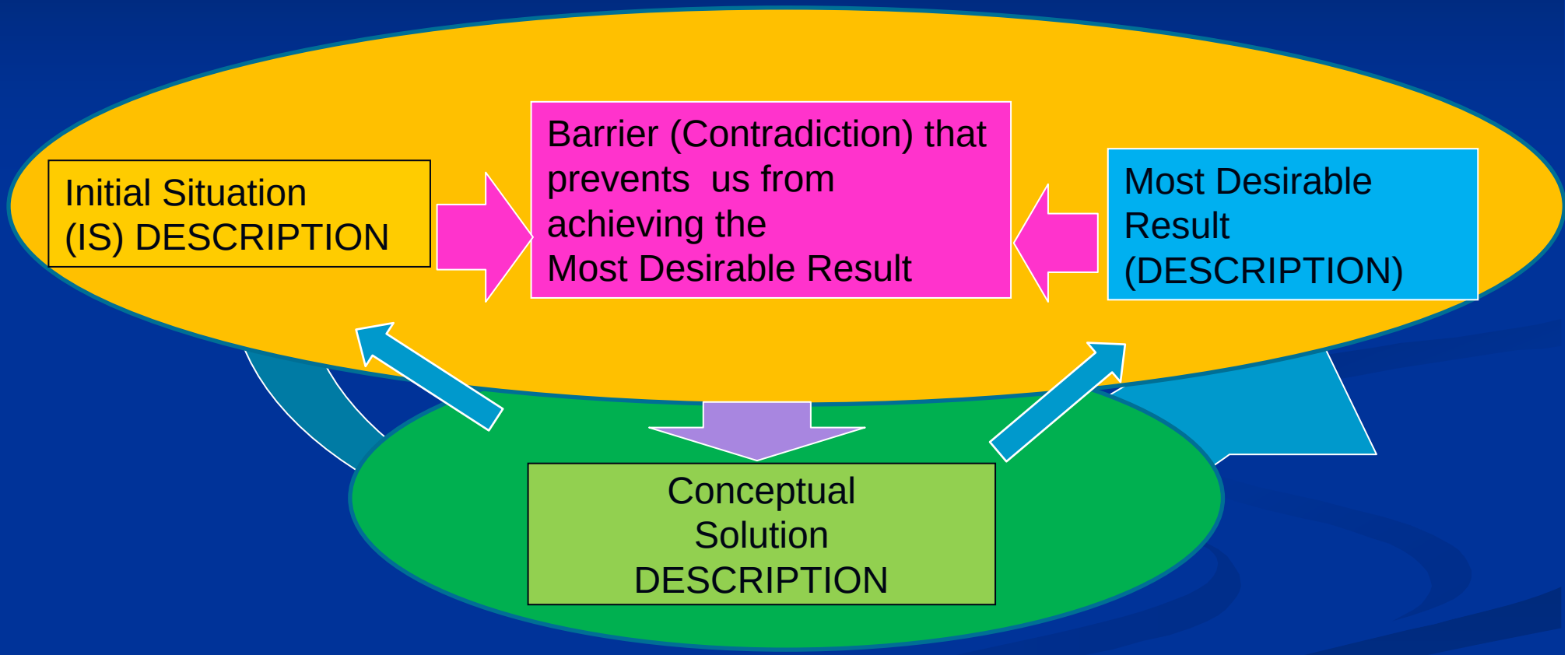
Example: Fragment of Interdisciplinary Network of Problems



Problem = Solution of (Problem)’

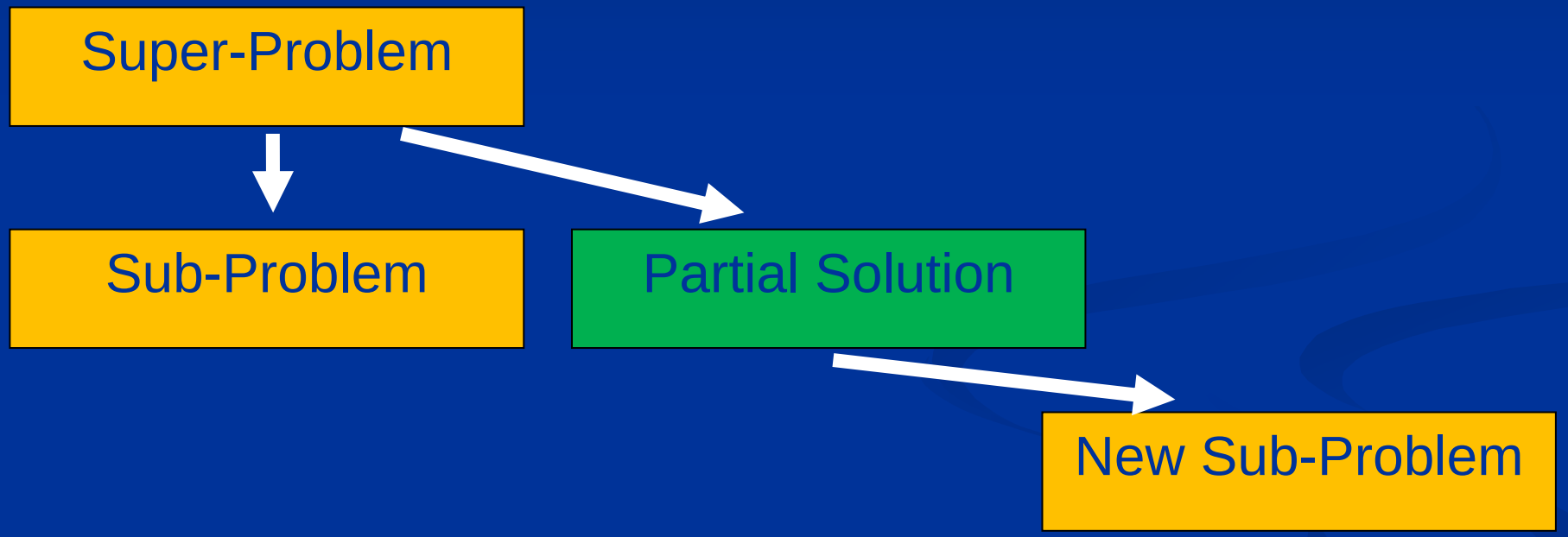


Transition form the “Tongs” Model to a Network of Problems

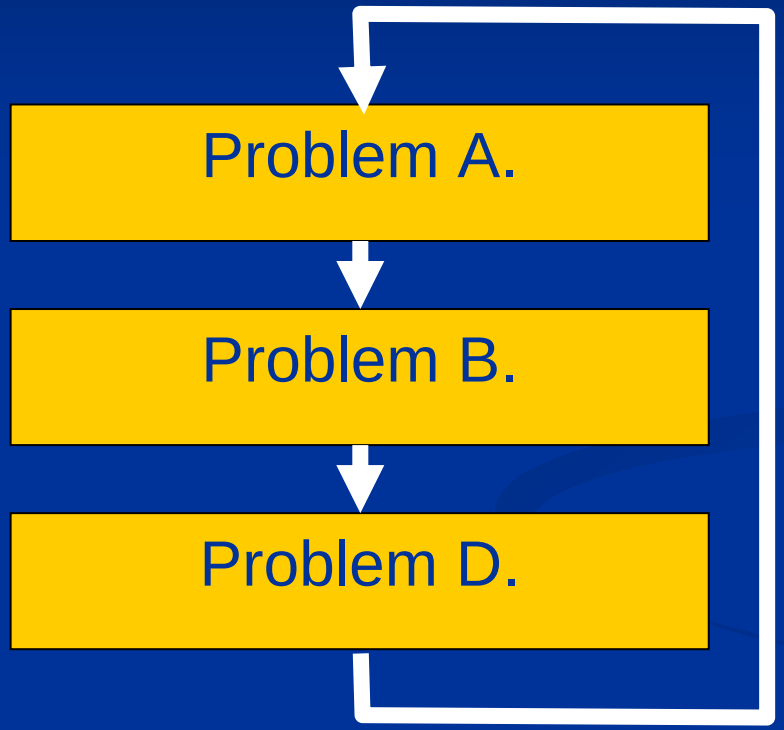


BUT!!!

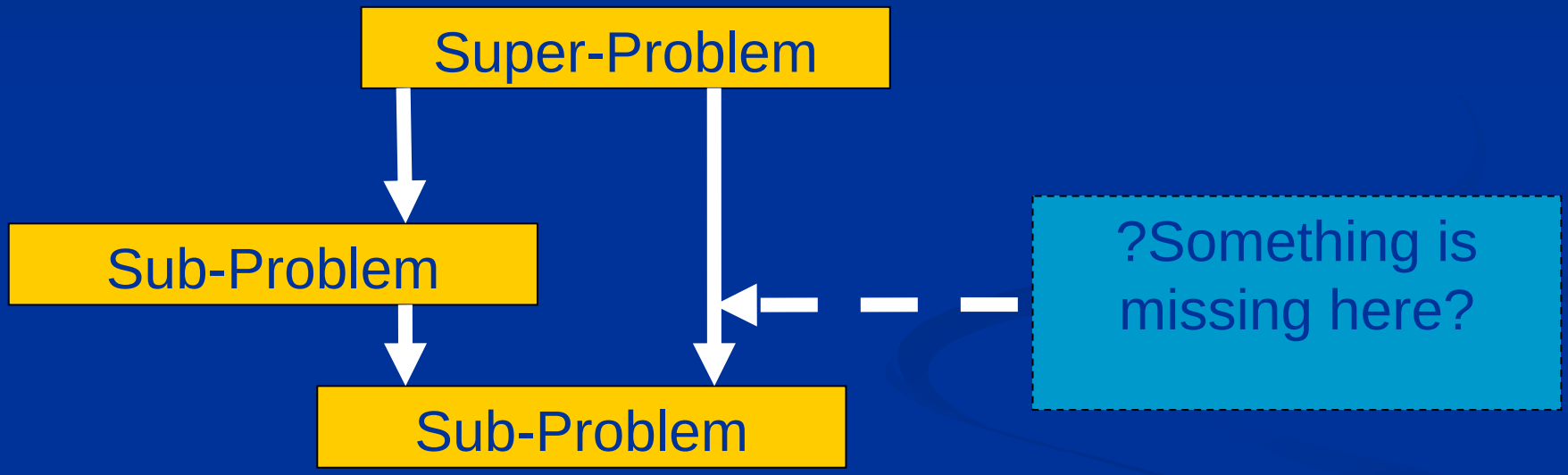
Relationships Between Nodes:
(based on our actual state of knowledge)



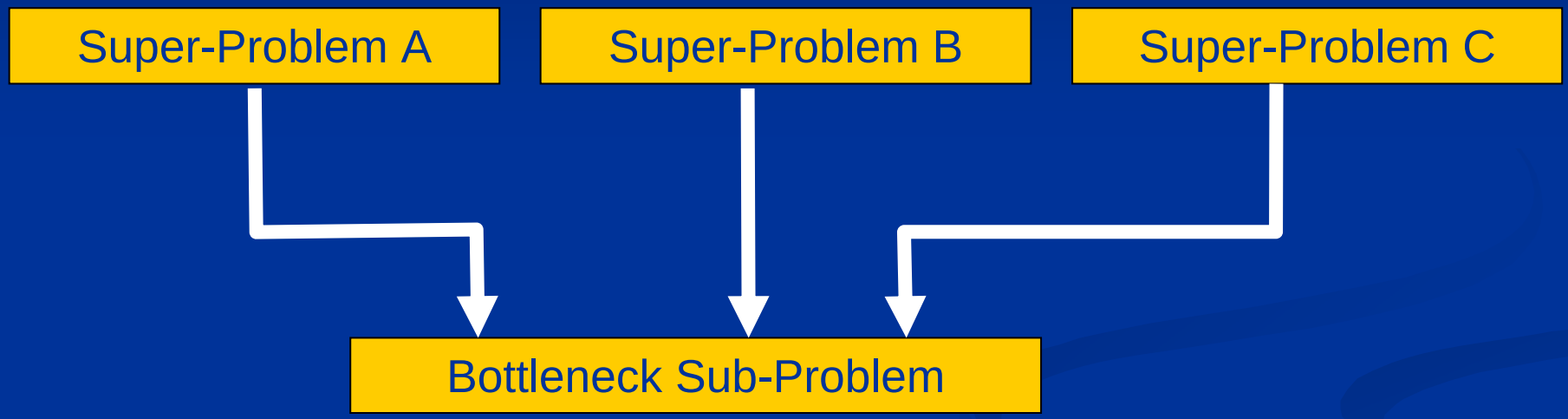
Vicious Circle
(at least one contradiction is hidden or lack of understanding)



Short-Cut - Indicates the Lack of Understanding or a Special Case



Bottleneck – Could Signal a Hidden System of Contradictions



SOME DOMAINS OF OTSM APPLICATION

Further Application of Problem Flow Networks (PFN) Approach

- Competitive Analysis of patents.
- Scientific and Business Research Problem solving.
- Application to extracting, storing and using knowledge necessary for sustainable development of an organization.
- Forecasting and Road maps.
- Strategy planning.
- R&D planning.
- Planning of an evolution of various organizations.
- Developing Educational system for Knowledge workers.
- Knowledge proccessing system of various kinds, including application to Artificial Intelligence.

Competitive Analysis of Patents

- Patent is considered as a solution to the initial problem situation composed by a network of problems.
- The structure of an engineering system appears as a solution of the network.
- In order to find a new solution we should change the structure of the engineering system.
- Laws of system evolution can be used for this purpose.
- We can use the initial network of problems to choose which part of the system should be changed according to the Laws.
- We can also consider the initial patent as a new system that has some disadvantages to be eliminated and apply OTSM-TRIZ instruments to improve the system.

Research Problem solving

- Lots of research problems can be considered as a phenomenon to be explaned.
- In this case we can reformulate the problem “How can the phenomenon be EXPLAINED” to the problem “How can the phenomenon be produced without any additional recourses”.
- To solve the reformulated problem appropriate OTSM-TRIZ instruments can be used.

Knowledge Management Application of OTSM

- During the coaching session with professionals an OTSM coach extracts and presents knowledge in a formalized way. For this the coach usually uses the Problem Flow Networks approach.
- As a result we can have a network of contradictions and finally a network of parameters. They will represent the system of natural laws for a certain domain.
- This knowledge can be stored and used for various needs of an organization. For instance, to evaluate solutions or forecast the consequences of the implementation of certain solution, etc.

OTSM Based Approach to Forecasting

- Present can be considered as a system of implemented solutions of the network of problems in the past.
- Future can be considered as a system or just a network of solutions of the modern network of problems.
- Forecasting is composed of two parts: (1) Forecasting of Solutions of a modern network of problems and (2) Forecasting of new problems that will be the result of the implementation of the solutions we can discover.
- As soon as we start implementing the result of forecasting, we start changing the future.
- The process of these changes should and could be monitored and the result of the monitoring can be used for correcting the initial forecast.
- During this process the instruments for OTSM based forecasting will be permanently improved and developed (Example: City Roadmap).

OTSM Approach for Forecasting and Road Map.

- Actual situation is a result of solving a network of problems that existed in the past.
- Modern network of problems predefines the future situation.
- Future will come as a result of resolution of the modern network of problems.

- Knowing Modern Network of problems we can apply the OTSM PFN approach to foresee the options for the future.

Strategy Planning

- OTSM based technology of forecasting can be complementary to other forecasting techniques.
- OTSM network of problems relevant to strategy planning should be developed and maintained appropriately.
- System of strategic goals can be developed on the basis of forecasting.
- Network of problems that should be solved to reach these goals should be developed.
- Analysis of the Problem Network can help us construct the programme of solving problems and implementing the obtained solutions for reaching the strategic goals.

R&D planning

- System of goals for R&D can be developed on the basis of Forecasting and Strategy planning.
- Analysis of the Problem Network and Forecasting of the technology barriers will help us develop an R&D plan which should be harmonized with other aspects of R&D planning.
- Problem Flow Approach can be used to implement this plan.

Planning Evolution of Various Organizations

- Set of networks constructed for forecasting, strategy planning and R&D department could be used for the organization of evolution planning: OTSM Problem Flow Network Approach based on Classical TRIZ.

- In this case all previously constructed Networks can be used as initial information for the development of Network of problems related to the evolution of an organization.

Why can OTSM-TRIZ instruments be useful for Innovation and Transformation?

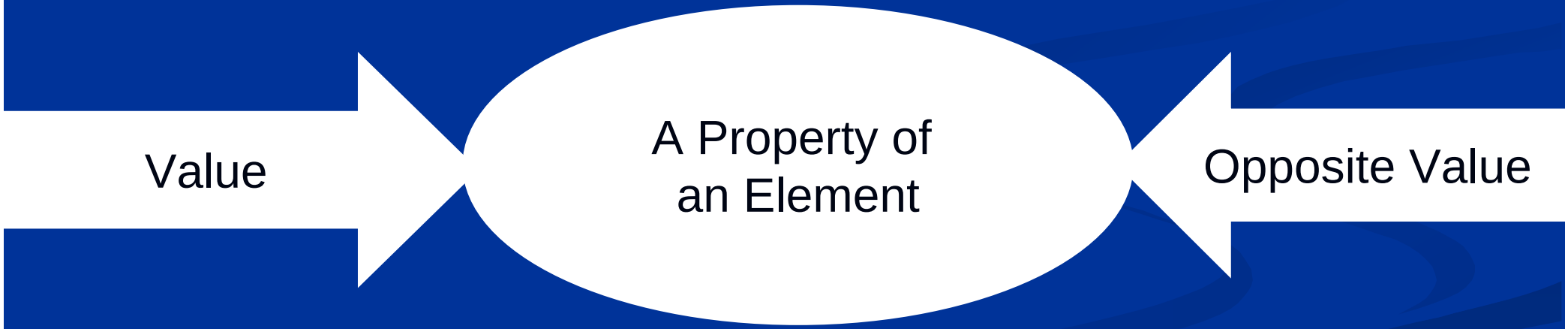
- We need Innovation in order to solve current problems.
- Innovation leads to Transformation.
- Transformation causes new problems that need Innovation in order to solve them. The circle is closed.
- During last decades the rotation of this circle accelerates more and more.
- OTSM-TRIZ approach can be useful to manage the toration of this circle.
- Special software can be developed for this purpose. Now the prototype of this software is being tested.

How can Contradictions be resolved?

COMBINATION OF OPPOSITE DEMANDS: OTSM CLASSIFICATION

Assignment

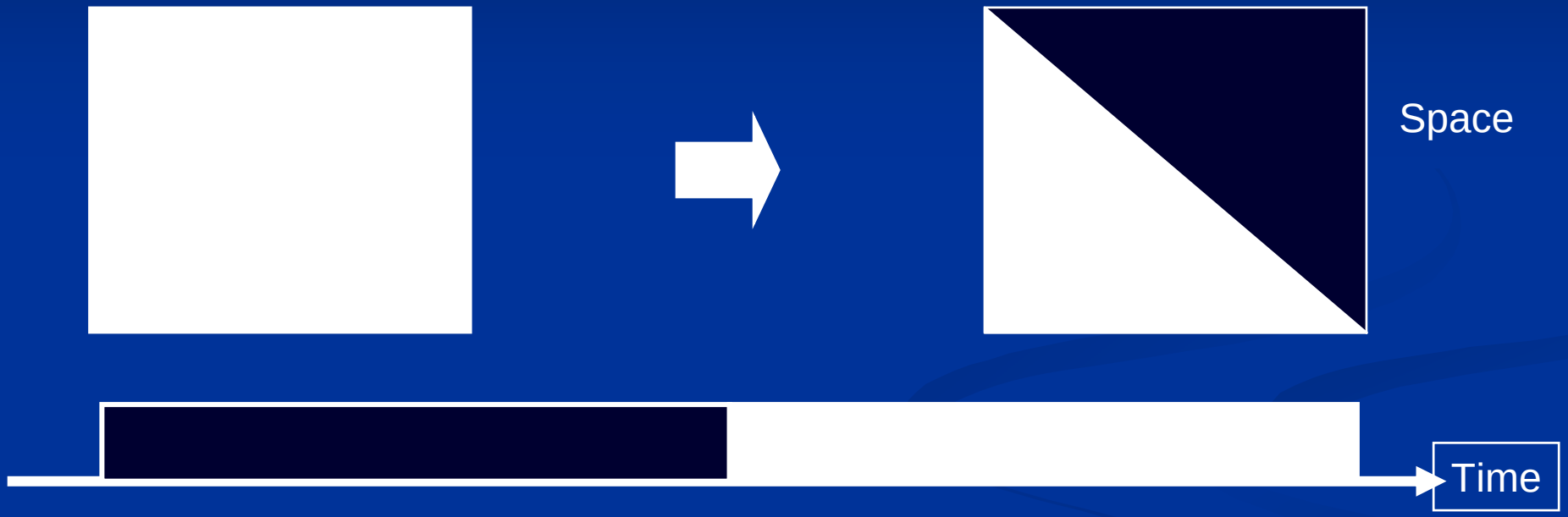
- Give 4 examples of the opposite value.
- Propose several options how to combine the opposite values.



Combination of Opposite Demands.

E-level. Subsystems: Macro-level

Black and White:

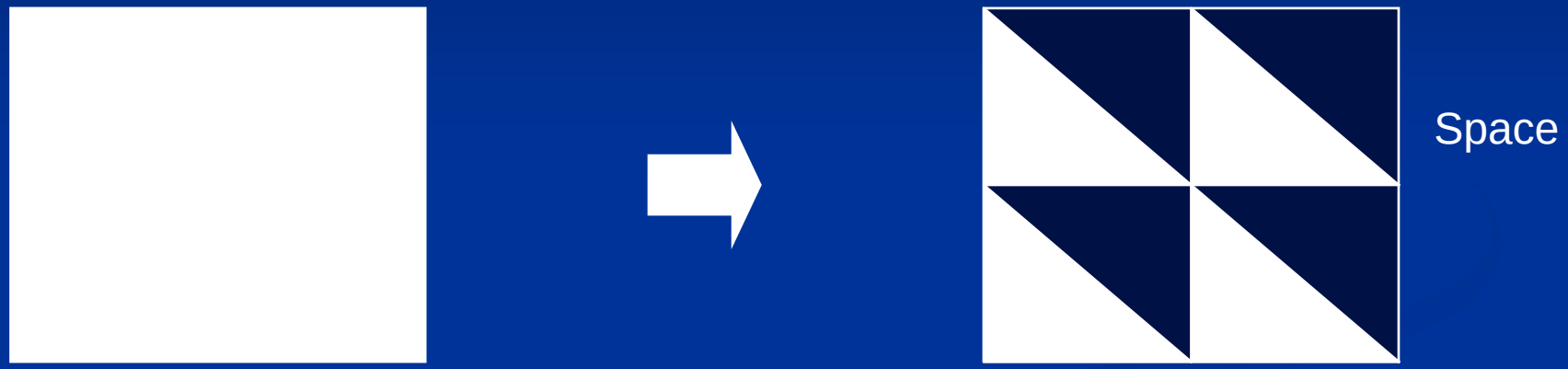


OR
any other
appropriate
parameter

Combination of Opposite Demands.

E-level. Subsystems: Micro-level

Black and White:



OR
any other
appropriate
parameter

Combination of Opposite Demands.
E-level. System: Sub-system - System levels

Soft and Hard:

Watchband

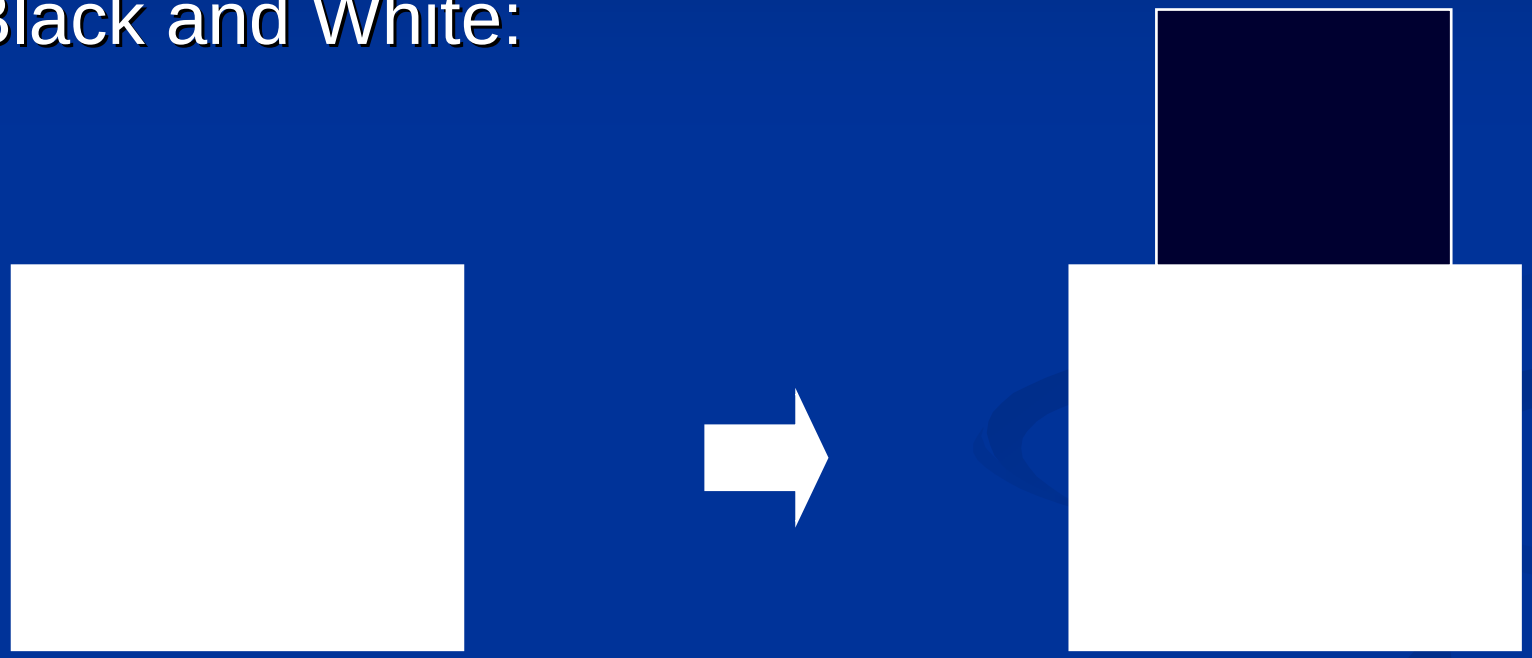
Sub-systems (components) are Hard (Not Flexible)
System as a whole is Soft (Flexible)


www.cartoon.ru

Combination of Opposite Demands.

E-level. Super-system: System + Anti-system

Black and White:

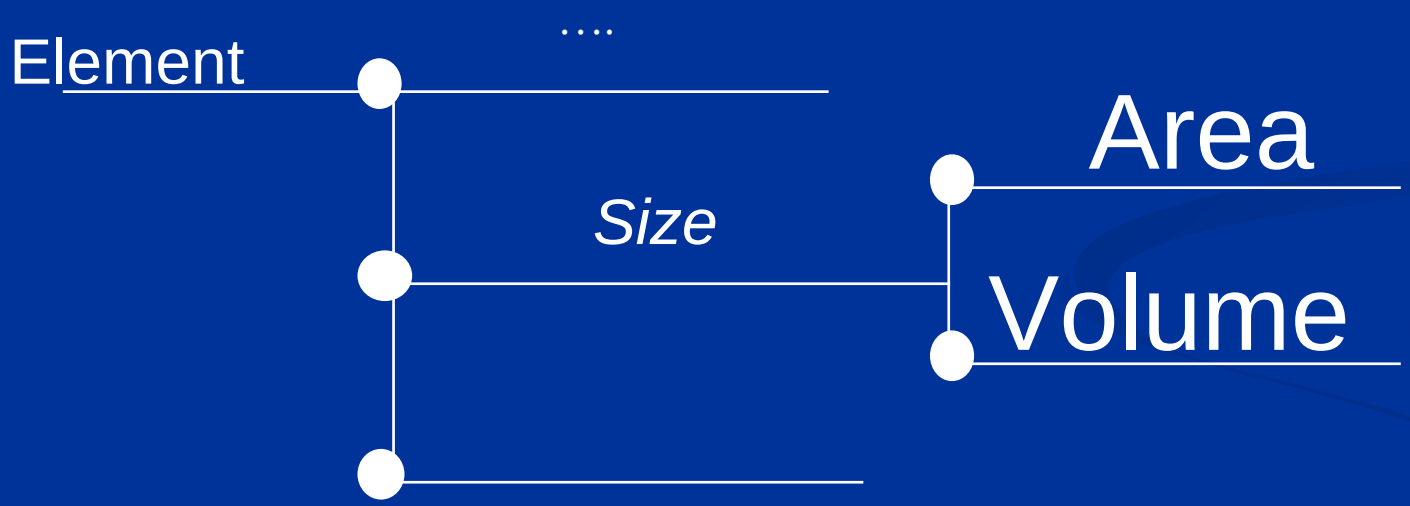


We “borrow” from either the Environment or the Super system an appropriate Element that has a value of a property we need and converge it into our system

Combination of Opposite Demands

N-Level. Adding new Features

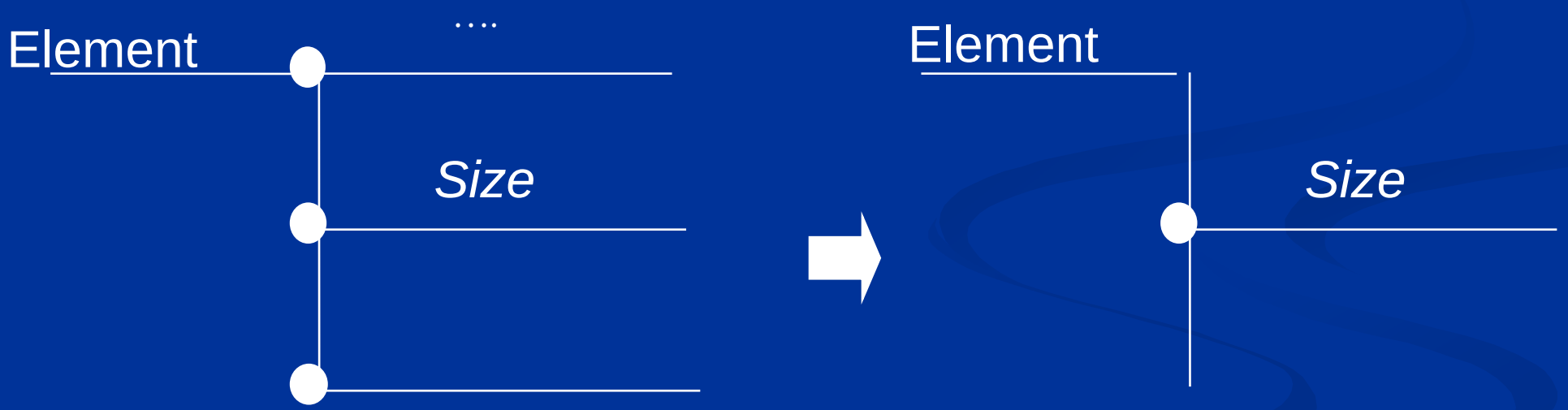
Size: Big and Small



Combination of Opposite Demands

N- level: Deduction (Imitation)

Must Be and Must NOT Be:



Combination of Opposite Demands

N-Level. Replace or Add Another Parameter.

Size of balloon: Big and Small

We can change the size of the balloon by increasing the PRESSURE but if the compressor is not powerful enough it is impossible.
The compressor should be powerful in order to increase the size of the balloon but the compressor cannot be powerful enough to increase PRESSURE.

Way out of this dead end:
Increase TEMPERATURE inside the balloon instead of increasing the power of the compressor.

Combination of Opposite Demands (ENV interpretation).

V-Level. Change the value of prototype for comparison

Size: Big and Small

Boa: “Measured by parrots (more than 38 parrots) I see myself bigger then measured by monkeys (less than 12 monkeys)”.