HealthPack 2015
Altshuller Institute provides TRIZ Education, Publications and Certification around the world!

www.triz.org
Why are you here?

• Looking for something?

• Need to improve Innovation?

• Need to improve your ROI?
What is holding you back?

- Is there a problem(s) that is not solved?
- Do you have the right people?
- Are you waiting for the right moment?
- Do you have a plan to move forward?
Origin of TRIZ

TRIZ (pronounced as “trees”)
Russian acronym for
Theory of Inventive Problem Solving

Originated in 1946 by Genrich Altshuller from the study of patents.

Key Insights:
• People invent better with abstracted principles than with guesswork
• Studies of inventions can identify a comprehensive set of principles to use

“The well-being (both ethical & economical) of a society depends on the proportion of creative individuals in that society.” G. Altshuller
“TREES” or “TRIZ”
acronym for

Teoriya Resheniya Izobreatatelskikh Zadatch

- a methodical way of examining inventive situations and developing numerous solution concepts by utilizing all available solution space.
- based on the study of empirical data from patents, rather than psychology.
Why do we need TRIZ?

- Increase functionality {speed, comfort}
- Reduce cost, time of production
- Develop new products or systems
- Develop “umbrella” patents
- Solve difficult problems

Innovation is all about solving simple as well as complicated problems everyday !!!!
Barriers to Problem Solving

- Shortage of individual knowledge
- Psychological inertia
- Paradigm paralysis
- Lack of problem solving resources
- Avoiding contradictions
Normal Technologies Used

Psychological Inertia Vector

Present Technology

New Technology Needed
Altshuller’s Patent Research & Analysis

Initial Key findings and developments:

- Levels of Innovation
- Laws of Evolution
- Ideality
- Contradictions
- 40 Principles

Worldwide Patents

40,000 Patents selected
“Invention usually occurs when technical systems evolve to overcome contradictions, mostly by using existing resources.”

Genrikh Altshuller
Structure of TRIZ

Analytical Systems

- Methodology of Guided Technology Evolution
- Algorithm for Inventive Problem Solving
- Substance-Field Analysis

Knowledge Base of Tools and Effects

- Techniques for Overcoming Conflicts
- Altshuller's Matrix
- Standard Solutions to Problems
- Methods for Overcoming Physical Contradictions
- Indexes of Effects

Foundation

- Laws of Technological System Evolution
Evolution

Systems evolve according to **objective patterns**.

- Evolution is **not** a random process.
- Recognized “Patterns” allow for the **conscious development of systems** in place of trial-and-error methods.
8 Lines of Evolution

1. Life Cycle of Technical Systems
2. Dynamization
3. Transition to Bi- or Poly-System
4. Uneven development of subsystems
5. Synchronization (matching/mismatching)
6. Scaling up or down
7. Transition to microlevel using energy fields
8. Replacement of humans {automation}
Evolution of a Technical System
Product Evolution using Dynamization

TRIZ Evolutionary Trends

Automotive Implementation
6. Scaling Up or Down

<table>
<thead>
<tr>
<th>LARGER</th>
<th>SYSTEM</th>
<th>SMALLER</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANSPORTS</td>
<td>AIRPLANES</td>
<td>DRONES</td>
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<td>EARTH MOVERS</td>
<td>TRUCKS</td>
<td>GOLF CARS</td>
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<td>MAINFRAMES</td>
<td>COMPUTERS</td>
<td>LAPTOPS</td>
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<td>TABLETS</td>
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Gas Grill – new concept using 2 lines of evolution

- Dynamization
- Reduced size
3. Transition to Bi - or Polysystem

- MONO
  - Bi/Poly
    - Single Function
      - Same
        - Partially Wrapped
      - Shifted
        - WRAPPING PROCESS
    - Multi Function
      - Direct
        - Partially Wrapped
      - Opposite
        - Partially Wrapped
  - Completely Wrapped
  - New MONO
Some experts predict that the accuracy of DNA-based descriptions will edge past that of eyewitness accounts within 15 years.

Does he know what you look like? Tony Frudakis, DNAPrint’s research director, holds, double-fisted, two multichannel pipettors, devices for transferring multiple DNA samples. His lab is developing genomic tests to detect specific physical traits, the first of which—Retinome, for eye color—he and colleagues say will be ready for market by the end of 2003.
Evolution of Spark plug

1 anode -> 2 anode -> 4 anodes
What is the next generation???
8. Automation

REPLACEMENT of HUMANS

- PRINTING PRESSES
- ROBOTS
- TRAFFIC LIGHTS
- COMPUTER MODELING

- VOICE MAIL
- AUTO PILOTS
- REMOTE SENSORS
- ENGINES, MOTORS
## Evolution of Storage Devices

<table>
<thead>
<tr>
<th>MEDIA</th>
<th>WRITE/READ</th>
<th>ACCESS</th>
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<tbody>
<tr>
<td>Paintings-caves</td>
<td>Human/Human</td>
<td>Limited</td>
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<td>Clay Tablets</td>
<td>Human/Human</td>
<td>Mobile</td>
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<td>Scrolls</td>
<td>Human/Human</td>
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<td>Printed Books</td>
<td>Mechanical/Human</td>
<td>Segmented/RA</td>
</tr>
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<td>Punched tape</td>
<td>Mechanical/Mechanical</td>
<td>Continuous</td>
</tr>
<tr>
<td>Punched cards</td>
<td>Mechanical/Mechanical</td>
<td>Segmented/RA</td>
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<tr>
<td>Magnetic tape</td>
<td>Magnetic/Mechanical</td>
<td>Continuous</td>
</tr>
<tr>
<td>Hard Drive</td>
<td>Magnetic/Magnetic</td>
<td>Random Access</td>
</tr>
<tr>
<td>Disc</td>
<td>Optical/Optical</td>
<td>Random Access</td>
</tr>
</tbody>
</table>
Ideality

Systems evolve in the direction of increasing Ideality.

Ideality = \(\text{increasing the Useful Functions} - \text{decreasing the Harmful Functions} + \$\$\$\text{ (cost)}\)
The Ideal System

- Needs no additional energy to operate
- Costs nothing extra to produce
- Occupies no additional space
- Does not wear out
does not materially exist, yet the function is performed.
How Do We Get To Ideal Solutions?

**TRIZ** provides three general approaches for achieving close-to-ideal solutions (that is, solutions which do not increase system complexity):

- Resolution of contradictions
- Use resources
- Use scientific effects
  (physical, chemical and geometrical)
RESOURCES

Can be **INTERNAL** or **EXTERNAL** to the system.

**IDEALLY** → **FREE** or **LOW COST** and **READILY AVAILABLE**

~ AIR, AIR PRESSURE  ~ TEMPERATURE
~ WATER, HUMIDITY  ~ GRAVITY, etc.

**SUBSTANCE RESOURCES (SR)**

> RAW MATERIALS
> BYPRODUCT OF PROCESS
> WASTE of the PROCESS
> MODIFICATION of these SUBSTANCES
> PHASES CHANGES

**FIELD RESOURCES (FR)**

> MECHANICAL
> ELECTROMECHANICAL
> ELECTRICAL
> MAGNETIC
> CHEMICAL
> NUCLEAR

**OTHER RESOURCES**

TIME -- SPACE --- ENERGY TRANSFER -- OTHER SYSTEMS
The Ideal System

We need a system to perform its function, i.e., to change or modify the object.

An ideal system does not exist as a physical entity, while its function is fully performed.
Ideal System - Example

Airport / Roadside restrooms
Doors are cumbersome for people with luggage.

What is the function of the door? By using geometrical shape to replace the FUNCTION of the door. Doors are eliminated.
Ideal System – another example

Sewer gas was a real problem for families who could afford indoor plumbing.

J-Trap late 1800’s

Using available resources to perform the needed function. Geometry, water & pipe
How Should Stubborn Problems be Solved?

“If I were given an hour to solve a problem on which my life depended, I would spend:

- 40 minutes studying it;
- 15 minutes reviewing it;
- 5 minutes solving it.”

Albert Einstein
Example: Alloy Testing Problem

Lid

Protective Coating

Acid

Specimen Specimen Specimen

Container
Formulate Correct Problem

- For this particular example, it is noted that the Container and the Acid provide both a Useful and Harmful Function.
  - The Container Holds the Acid. Useful
  - The Acid Tests the Specimen. Useful
  - The Acid Destroys the Container. Harmful

- What should be the focus in solving this particular problem?
Primary Useful Function

• What is the Primary Useful Function of this System?
  – Test the specimen -- right?

• What is an Ideal System?
  – An Ideal System is a System that does not exist and yet its Function is Performed!
Transition to Ideal Solution

Container is absent

What can we do?
Ideal Solution

We perform the old function in reverse and the specimen becomes the container. We have improved the functionality of the test.

Other Applications

Recipe Hack: Milk and Cookie Shots
Packaging that exists today

- Acuity Pro Lead Delivery system
- Screw
- TKA Femoral
- TRENT Verrata Tray
Medical Packaging

What are the problems of medical packaging?

Where does packaging need to go?

For whom are we designing packaging?

Is waste a problem?

Is space a problem?

Is more expected from packaging?

What is the next step for packaging?
Who needs problem solving skills?

Mathematics
- Theoretical mathematics
- Calculus
- Algebra, Geometry
- Addition, Subtraction, Multiplication

Language
- Professional Writing
- Literature
- Language structure, Reading
- Basic communication skills

Knowledge Pyramid

- Almost everyone -- Level 1
  General Workers
- Professionals -- Level 2
  Engineers, managers, teachers
- Highly Skilled -- Level 3
  Executives, Project managers
- Masters

TRIZ
- Everyone – Basic
  Children, students

Who needs problem solving skills?
“TRIZ is a tool for strong thinking but not instead of thinking”

G. Altshuller
Final Thought

CHANGE is not your enemy
it’s your OPPORTUNITY.

We want to travel faster. Work faster. Communicate and connect faster. We’re a society fixated on speed, because we’re a society fixated on technology. It’s our collective accelerator. As technology moves, we move. But the same technology that fulfills our need for speed also poses our biggest challenge. Because technology doesn’t just increase the speed at which we move, it increases the speed at which change moves.

Questions?
Overcoming Contradictions

But you need both Black and White

Conventional approach: Compromise
Overcoming Contradictions with TRIZ

Separation in Time

At one time an object is BLACK, and it is WHITE at another time.

Separation in Space

One part of an object is BLACK, while another part is WHITE.

Separation Between Whole and Its Parts

A system is given property \( P \), while its components have anti-property \( \neg P \)
A Manufacturer supplies coated metal parts to an OEM.
This process consists of a vat containing a chemical solution that is heated; the parts are dipped into the heated solution and coating occurs.
For the current production rates, no problems are encountered other than normal preventive maintenance.
Due to increased customer demands, the OEM has now doubled its order.
To meet this new production requirement, it was determined that if the solution’s temperature is increased significantly, the production demand could be satisfied, but ... a problem.
After a short period of time the solution turns to salt, its quality deteriorates, and the vat needs to shut down for maintenance.
Time is of the essence; what can be done?
Overcoming Physical Contradictions

PLATING METAL PARTS

- To plate metal parts with nickel they were placed in a bath of nickel salt. The bath was heated to increase the productivity of the process. However, heating reduced the stability of the salt solution and it started to decompose.

System Conflict: The chemical solution must be very hot to meet the production schedules, however this causes the vat to become coated with salt that takes time to clean – reducing productivity. Physical Contradiction: The solution must be both hot for fast plating and warm not to breakdown the chemical solution.
Overcoming Physical Contradictions

Separation of Opposite Properties in Space

**SEPARATION IN SPACE**

- In the nickel plating of parts, increased temperature is necessary only in proximity to the parts. To accomplish this, the parts themselves may be heated, rather than the solution.

The part is heated instead of the chemical solution to the required temperature.

TRIZ Solution: No compromise