A BRIEF HISTORY OF TRIZ

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Sooner or later, almost everyone who seriously studies TRIZ and Systematic Innovation, starts wondering about a history of TRIZ: why there are so many TRIZ tools, what followed what, and how TRIZ has been evolving. Since a modern version of TRIZ has been developed by a really massive effort undertaken by many people during more than 50 years, it would be too difficult to mention every person who contributed to TRIZ and even all the tools which were proposed to be included to TRIZ. Nevertheless, such extensive historical studies are already being conducted by Vladimir Petrov [26,32] who presents evolution of several major TRIZ techniques in every detail (currently this work is being done in Russian).

This article is not supposed to give a comprehensive overview of TRIZ evolution; instead it focuses on underlining most important dates and events which resulted in major TRIZ improvements and development of new TRIZ tools and techniques. Information for this article was taken from personal observations and communication [49], TRIZ literature, and V. Petrov's work on the history of ARIZ [32].

- **1946-1950:**
  - G. Altshuller started developing TRIZ and conducting his first TRIZ training sessions. At this time he realized a key role of resolving a technical contradiction in order to come up with an inventive solution.
- **1950-1954**:
  - In 1950, Altshuller wrote a letter to Soviet leader, I. Stalin, with a sharp critique of Soviet system of inventiveness. As a result he was imprisoned as a political prisoner. In 1954, he was released and rehabilitated.
- **1956:**
  - G. Altshuller and R. Shapiro published the article "**About Technical Creativity**" in the journal ***Questions of Psychology***, #6, 37-49. 1956 [1]. It was the first official TRIZ publication, which introduced such concepts as **technical contradiction**, **ideality**, **inventive system thinking** (currently known as "**System Operator**" or "**Multi-Screen Diagram of Thinking**"), the law of **Technical System Completeness**, and **Inventive Principles**.
  - The same year the first algorithm to support a process for inventive solving problems was introduced, which included 10 steps and the first **5 Inventive Principles** (which later in 1963 became sub-principles of more general **40 Inventive Principles** as known today), which were targeted for search for analogies. Extensive research on discovering new **Inventive Principles** begins.
- **1959:**
  - The algorithm included 15 steps and 18 **Inventive Principles** (sub-principles); a step with "**Ideal Final Result**" was introduced.
- **1963:**
  - The term "**ARIZ**" was introduced, thus an improved algorithm was titled "**ARIZ**"**.** The algorithm included 18 steps and **7 inventive principles** (with 39 sub-principles) [2].
  - Altshuller published the first system of the Laws of Technical Systems Evolution.

- **1964:**
  - The algorithm included 18 steps, **31 inventive principles**, and the first version of the **Matrix for Resolving Technical Contradictions** with generalized technical parameters (16x16 parameters).
- **1968:**
  - The next version of **ARIZ** included 25 steps, **35 inventive principles**, and the **Matrix for Resolving Technical Contradictions** (32x32 parameters).
  - At this time, in addition to developing a tool for inventive problem solving, Altshuller and his associates put considerable attention to the development and teaching techniques for **Creative Imagination Development** [5] (e.g. **Method of Focal Objects**, **Fantograma**, **Operator "Size-Time-Cost"**).
  - Altshuller also introduced definition of an "**Ideal Machine**".
- **1969:**
  - G. Altshuller establishes **AZOIIT** (**Azerbajdzhan Public Institute for Inventive Creativity**) which becomes the first TRIZ training and research center in the USSR.
  - G. Altshuller establishes **OLMI (a Public Laboratory of Invention Methodology)**: the first public open source initiative targeted at uniting efforts on developing TRIZ nationwide.
- **1971:**
  - **ARIZ-71** included 35 steps, **40 inventive principles** (with 88 sub-principles), and the **Matrix for Resolving Technical Contradictions** with 39x39 parameters (it is the same matrix for resolving technical contradictions which is still in the wide use today). **ARIZ-71** was a major step in TRIZ development. It introduced **Operator "Time-Size-Cost"**, the first version of the **Method of Little Men**, and included references to physical effects for solving inventive problems.
  - At the same time, development of a **Database of Physical Effects** [4] had begun by Yuri Gorin, which linked generic technical functions with specific physical effects and phenomena.
- **1974:**
  - Establishing a **St. Petersburg (ex USSR) School of TRIZ** under chair of V. Mitrofanov, probably the most influential school of TRIZ in the exUSSR.
- **1975:**
  - A new approach to solving inventive problems was introduced: **Substance-Field Modeling** (also known as **Su-field Modeling**) and the first **5 Inventive Standards** (which were later extended to **76 Inventive Standards** [10]) were published by Altshuller.
  - **ARIZ-75B** included 35 steps, and introduced several new major TRIZ concepts: **Physical Contradiction** and **Substance-Field Modeling** (also known as **Su-Field Modeling**). Altshuller realized that to find most ideal technical solutions, it was not enough to use the **Matrix of Resolving Technical Contradictions**, which he considered although a refined, but still a variation of the trial and error method. Thus the **Matrix of Resolving Technical Contradictions** was excluded from the main text of ARIZ (only used as additional material), and all operations on solving inventive problems were targeted at formulation and elimination of a physical contradiction.
- **1977:**
  - **ARIZ-77** included 31 steps, and introduced the concepts of a **physical contradiction at micro-level**, **a pair of conflicting components**, **operational time** and **operational zone**. Although the **Matrix of Resolving Technical Contradictions** still remained as a part of ARIZ as an additional material, its use was limited.
  - **18 Inventive Standards** were presented.

- **1979:**
  - Altshuller publishes "**Creativity as an Exact Science**", which is still considered as his major book [6].
  - At the same time Altshuller defined a **Theory of Technical Systems Evolution** (abbreviated **TRTS** in Russian) as a separate subject for study, and identified a number of **Life Lines of Technical Systems** which later became known as "**9 Laws of Technical Systems Evolution**".
- **1982:**
  - **ARIZ-82** included 34 steps, and introduced the concepts of **"X-element"** and a **mini-problem**, a table **of Typical Conflicts**, **Principles for Resolving Physical Contradictions**, **Method of Little Men**. The **Matrix of Resolving Technical Contradictions** and **40 Inventive Principles** were completely excluded from ARIZ. Altshuller positioned ARIZ as a tool for solving "*non-standard*" inventive problems, while the remaining, "*standard*" inventive problems can be solved with **Inventive Standards**. It becomes clear that **Inventive Standards** were not separate stand-alone patterns for solving problems, but they mapped the **Laws and Trends of Technology Evolution**. Therefore newly emerging **Inventive Standards** incorporated the lines of technical systems evolution. Quite extensive research on Inventive Standards as well as on the Laws and Trends of Technology Evolution was conducted by the TRIZ community.
  - A system of **54 Inventive Standards** was presented.
  - Altshuller also initiated a new research into **Biological Effects** [8] which he considered as analogies of **Physical Effects**.
  - Extensions of TRIZ applications in other areas rather than technology began, such as arts [21] and mathematics [17].
- **1985:**
  - A major step in TRIZ evolution: appearance of **ARIZ-85C** [9,15]. Even today, it is the only officially accepted version of ARIZ. It included 32 steps, and introduced a number of new rules and recommendations, as well as put a special focus on using time, space, and substance-field resources to obtain most ideal solutions. References to Inventive Standards were introduced in several parts of ARIZ.
  - The system of Inventive Standards was organized in 5 classes accordingly a structure of technical systems evolution and included **76 Inventive Standards** (which is still remains in use today).
  - In addition to the **Database of Physical Effects**, the **Databases of Geometrical** [12] and **Chemical effects** [14] were developed.
  - Altshuller concluded that ARIZ-85C was a complete tool for solving inventive problems, and did not need to be improved further very much since its application had been tested at thousands of real problems and proven to be effective. Now he considered further evolution of ARIZ and a Theory of Technical Systems Evolution as a major step towards **OTSM** (a Russian abbreviation for a "**General Theory of Powerful Thinking**").
  - At the same time, a group of TRIZ experts including B. Zlotin, S. Litvin and V. Guerassimov developed **Function-Cost Analysis** (**FCA**) [13] for analyzing technical systems and products, and a new extended version of TRIZ was titled "**FCA-TRIZ**" (currently **Function-Cost Analysis** is mostly referred as **Function Analysis**, and the term **FCA-TRIZ** is not in the wide use assuming that **FCA** is a part of TRIZ).
  - In parallel, research was conducted on the **TRIZ Laws and Trends of Systems Evolution**, which resulted in identifying a number of specific trends and lines of technology evolution.

  - An “officially” accepted version of FCA-TRIZ at that time included: **ARIZ-85C**, **Databases of Physical**, **Chemical, and Geometrical effects**, **76 Inventive Standards**, **a system of Laws of Technology Evolution**, **Function Analysis**, **Functional Idealization** (also known as “**Trimming**”).
  - New techniques **Alternative Systems Merging**, **Subversion Analysis**, **Functional Analysis of Inventive Situations** were proposed. Application of TRIZ tools was extended to the area of patent circumvention.
- **1986:**
  - Altshuller switched his attention from developing technical TRIZ to studying creative personality. Together with his associate, I. Vertkin, they studied a vast massive of biographies of outstanding creative people and started developing a “**Theory of Creative Personality Development**” (abbreviated **TRTL** in Russian), which identifies what types of contradictions creative people face during their lifetimes and how they resolve these contradictions.
  - A version of TRIZ for children was developed, and numerous experiments were conducted in schools and preschools.
  - If in the past TRIZ was mostly identified with ARIZ (both words used to be almost synonyms), which organized the use of different TRIZ techniques together, now some TRIZ techniques were often used independently (e.g. Inventive Standards, Physical Effects, etc).
- **1989:**
  - The first TRIZ software “**Invention Machine™**” was released by Invention Machine Labs (later evolved to “**TechOptimizer™**” and “**Goldfire Innovator™**” by Invention Machine Corp. [40]), which included **Function Analysis**, **40 Inventive Principles**, **Matrix of Resolving Technical Contradictions**, **76 inventive Standards**, **Databases of Physical, Chemical, and Geometric Effects**, and **Feature Transfer** (**Alternative Systems Merging**). The software brought back the **Matrix of Resolving Technical Contradictions** as an independent tool due to its simplicity of use by TRIZ beginners (a modern version of software also includes **Semantic Search Engine** to index patent and document information according technical functions, and the **Database of Effects** now includes thousands of entries.)
  - At the same time a **Database of Technological Effects** [16] was demonstrated which links technical functions with specific technologies.
  - N. Khomenko started massive research within **OTSM** [18], which introduces principles and develops skills with domain-independent “powerful” thinking for kids and adults.
  - Russian TRIZ Association is established.
- **1994:**
  - G. Altshuller and I. Vertkin published the book ***“A Life Strategy of a Creative Person”*** [20], in which they summarized their work on the **Theory of Creative Personality Development**.
  - A new TRIZ-based software package **Innovation Workbench™** was released in the US by Ideation International [39], which included the first TRIZ technique for causal modeling of inventive situations: **Problem Formulator** and a restructured database of **Inventive Operators**, based on **Inventive Principles**, **Inventive Standards** and **Physical Effects** (currently Ideation International offers a range of various TRIZ-related software packages).
  - A database of **Biological Effects** was published by V. Timokhov [19].
- **1998:**
  - The Russian **TRIZ Association** becomes **International TRIZ Association**.

- In 1998, G. Altshuller had passed away and further coordination of TRIZ developments almost disappeared.
- The **Online TRIZ Journal** is launched in 1996 [36].

- **2004:**
  - Different organizations with TRIZ expertise developed their own versions of TRIZ (**I-TRIZ**, **TRIZ+**, **xTRIZ**, **CreaTRIZ**, **OTSM-TRIZ**), thus a set of TRIZ tools developed under a guidance of Altshuller before 1998 is now titled "**Classical TRIZ**" to avoid confusion [22].
  - Creax (Belgium) releases the first version of "**Innovation Suite**" software [38].
  - Research and applications of TRIZ in other areas rather than technology continued (most developed today are **TRIZ for Business and Management** [29], **OTSM-TRIZ for kids** [33] and **TRIZ for Pedagogy** [24]).
  - Although officially abandoned from classical TRIZ, new versions of the **Matrix for Solving Technical Contradictions** emerge (e.g. **Matrix 2003** [27]), as well as adaptations of **40 Inventive Principles** for the use in different application areas (business, arts, architecture, specific industries, etc. [36]). The Matrix and 40 principles still remain the most popular TRIZ tools, although their applicability is limited.
  - A simplified version of TRIZ, **Systematic Inventive Thinking** (**SIT**) [41] and its variations (e.g. **ASIT: Advanced Systematic Inventive Thinking** [44] and **USIT: Unified Structured Inventive Thinking** [45]) are introduced (although not very much supported by the majority of the TRIZ community due to oversimplification and elimination of some key TRIZ concepts).
  - **European TRIZ Association** (ETRIA) and **TRIZ France Association** are established.
  - **Altshuller Institute for TRIZ Studies** is established in the US.
- **2004-2008**:
  - A number of new tools emerge to help with complex problem analysis and management, which still remained a weak part of TRIZ: **Root Conflict Analysis** (**RCA+**) [28] for decomposing inventive problems, **Problem Flow Technology**, **Problem Networking** [18] for managing complex problems involving networks of contradictions.
  - New tools based on previous studies emerge, such as **Hybridization** [30] (further development of **Alternative Systems Merging**), **Functional Clues** [34], **Anticipatory Failure Determination** (**AFD**) [39], **Function-Oriented Search** [31], **Inventive Standards for Business Systems**, **Radar Plot for Mapping Trends of Systems Evolution**.
  - New experimental versions of **ARIZ** appear, but their use is limited due to complexity and necessity to be tested on a larger number of problems.
  - There is a proposal for a system of **150 Inventive Standards** [26].
  - Different systems of the **Trends of Technology Evolution** emerge, and new lines of systems evolution are introduced: for instance, a current version of **Directed Evolution** [25] by Ideation International presents 400 lines of technical systems evolution.
  - A number of attempts are undertaken to integrate TRIZ with modern methods of Quality Management (e.g. **Quality Function Deployment - QFD**), and such systems as Six Sigma (e.g. TRIZ is used within **Design for Six Sigma - DFSS**).
  - The **Japan TRIZ Society** is established.

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