TFC 2015 – TRIZ FUTURE 2015

From Altshuller to Alexander: Towards a Bridge between Architects and Engineers

Amirabbas Najari[a], Sebastien Dubois[a], Marc Barth[b], Michel Sonntag[a]

[a] University of Strasbourg- National Institute of Applied Sciencesof Strasbourg – Design Engineering Laboratory (LGéCo)- France
[b] StrasbourgBusiness School - HUMANIS (Humans and Management in Society)- France

* amirabbas.najari@insa-strasbourg.fr, sebestien.dubois@insa-strasbourg.fr, marc.barth@insa-strasbourg.fr, Michel.Sonntag@insa-strasbourg.fr

Abstract

To help designers to be more inventive during their practice of engineering design, Genrich Altshuller (1926-1998), during the second half of 20th century, developed a set of novel methods, techniques and tools, known as TRIZ. Almost at the same time, Christopher Alexander (born 1936), pursuing a similar goal but in architecture, introduced new concepts, methods and tools for environmental design. If at first, the differences between the thought of Altshuller and the one of Alexander seem important, a thorough analysis shows striking similarities.

In this paper, we first analyze two analogue concepts: the recurrent patterns of problem solving and the constant tendencies of evolution. This analysis will propose five axes to compare the two theoretical corpuses. And then, based on these axes, the differences in terms of goals, principles and outputs will be identified.

One of the aims of such comparison is to analyze the potential cross-fertilization between these theories, built in two fields of design. While the similarities, pointing out the common basic concepts in architecture and engineering, might facilitate developing a knowledge base integrating the phenomena of both domains, their divergence could point out the research fields for researchers interested in improving the practice of design regardless of its domain of application.

Keywords: Genrich Altshuller, Christopher Alexander, TRIZ, Architectural Design, Pattern Language

1. Introduction

The recent research on TRIZ has given the opportunity to cross border the technical aspects of design and develop application in non-technical domains. As for architecture, the research on the possible contributions of TRIZ based methods in architectural design has intensified during last ten years [1] [2] [3] [4] [5] [6] [7]. The architectural design is always considered as a process between art and engineering [8] [9], where the creativity is highly valued. Although the literature of architectural design covers a wide range of new concepts and inventive solutions, the processes to generate such concepts and solutions are rarely formally presented, and the capacity of generating new solutions is principally assigned to the creative ability of the architect/auteur [9] [10]. Therefore, the creative and inventive methods used in engineering are poorly explored by architects. An inquiry made among 27 famous architectural schools around the world shows that TRIZ is poorly known and almost never applied by the researchers [11]. The one who wishes to apply TRIZ in architecture have to cope with two challenges. First, from an architectural point of view, the challenge concerns the possibility of adapting the basic concepts of TRIZ to the architectural design. Secondly, from the point of view of TRIZ, the challenge is on the integration of known architectural phenomena into the knowledge base of TRIZ.

The purpose of this paper is to indicate a way to deal with these challenges. It is based on a comparative study on the main theoretical corpuses of two leading figures: Genrich Altshuller in engineering design and Christopher Alexander in architectural design.

During the second half of 20th century, Altshuller developed TRIZ for helping engineering designers to be more inventive, Christopher Alexander, almost at the same time, pursuing a similar goal but in architecture, introduced new concepts, methods and tools. There is no evidence showing that they have been aware of each other's works, but, we will argue that they developed some similar concepts and tools. Even though the similarities are more, we focus here on two concepts: the recurrent patterns of problem solving and the constant tendencies of evolution. However, their approaches toward the design are not identical.

One of the aims of such comparison is to analyze the potential cross-fertilization between these theories, built in two fields of design. While the similarities, pointing out the common basic concepts in architecture and engineering, might facilitate developing a knowledge base integrating the phenomena of both domains, their divergence could point out the research fields for researchers interested in improving the practice of design regardless of its domain of application.

This paper is structured in three sections. The Section of Materials presents the sources used to develop this comparative study. It contains a brief presentation of Alexander and his books in which two main concepts mentioned above are developed. As well, concerning Altshuller, the Inventive Principles and the Objective Laws of technical systems evolution are briefly presented. In Section Method, the approach used to build the comparison is described. Thus, the five axes of comparison are defined and used to analyze the theories of Alexander and Altshuller. The Section Result is dedicated to the outputs of this comparative study. The main analogies and also the main differences will then be summarized in a table. The paper ends by a discussion on how the theory of Alexander can be recognized as a bridge between architecture and TRIZ and how these two approaches can benefit from each other. A perspective for future research is also discussed.

2. Materials

2.1. Christopher Alexander

Christopher W. Alexander (born 1936) is a mathematician, anthropologist and architect known as one of the most influential persons there ever was in the world of design [12]. His research focuses principally on disciplines relating to environmental design such as architecture, landscape architecture and urban planning. But, his theoretical work has greatly influenced different areas of design theory from management to computer science [13]. His ideas can be traced in object-oriented programming [14], program design [15], interaction design [16] and in generative programming. Several inventors as Ward Cunningham, inventor of Wiki, and Will Wright, inventor of the game SimCity, recognize the role of Alexander in the development of their innovations [17].

Despite his great influence and vast reputation in the 70's, Alexander is seldom read during the past two decades by architecture students [18]; it is also quite recent that the researchers are again interested in his theories [19]. Regarding his professional status, although Alexander has designed several projects, he is not recognized as a famous architect [13].

Alexander started his investigations in the early 60's, when social movements criticize the orthodox Architectural Modernism for its reductive approach and claim a fundamental revision in the theoretical base of architecture and request new ways allowing a more responsible design towards human and environment [20]. These expectations guide Alexander in his research for more than forty years. The theoretical corpus of Alexander contains more than 16 books and dozens of articles, but in this paper, we focus on two of them in which two concepts of recurrent patterns of problem solving and the constant tendencies are presented:

- A pattern Language: town, buildings, constructions (1977) [21]
- The Nature of Order - Vol. 1: The Phenomenon of Life (2002) [22]

The first one presents 253 recurrent patterns of problem solving in architecture and the second introduces fifteen geometrical properties to which the build spaces trend. In Section 3, these two works are analyzed.

2.2. Genrich Altshuller

Genrich S. Altshuller (1926-1998), founder of TRIZ theory, was a Soviet scientist, engineer, and writer. As well, he was a recognized inventor. The methods, techniques and tools that he developed are known today as a widespread and powerful theory for inventive design [23]. The TRIZ-based methods are used constantly and over the world by engineers and researchers to develop new products and new processes [24] [25] [26] [27].

Altshuller started the TRIZ development in the late 40's in the social context of USSR, characterized by the will of progress and the promise of evolution. In such sphere, Altshuller was initially interested in patents, and more specifically in helping inventors to propose patentable solutions. Then, his researches were more and more focus on human mind, and on how to help people to be more creative [28]. His work covers different aspects of design, from the psychology of inventor [29] to the scientific effects. The theoretical work of Altshuller contains a coherent set of methods, techniques and tools. In this paper, we focus on two outputs of his research: the 40 Inventive Principles for the resolution of technical contradictions, and the 8 Objective Laws of technical systems evolution. The Inventive Principles suggest the recurrent models for solving technical contradiction between engineering parameters, and the Objective Laws indicate the evolution tendencies in technical systems. The analysis of these two sets, presented in Section 3, is mainly based on [28] [30] [31]. These two outputs have been chosen for their similarities with the two Alexander's studies outputs mentioned above.