

ANALOGY AS A BASIC TECHNIQUE IN THE PROCESS OF CREATING NEW PRODUCTS

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ABSTRACT

The analogy as a basic technique used in a number of design methods as a result of the application of close and distant similarities from other areas, has been studied in the present report. It is based on a very common and recommended technique of creative thinking.

Analogy is the basic means of the subjective logic of people, based on the systematic approach to the comparison of objects. Making analogies develops intuition and imagination, as in fact it is a result of the qualitative synthesis of the appearance of the technical system by a distant similarity. The professional development of designers is connected with the gradual acquisition and development of the capacity of synectic techniques.

The analogies are very widely used in the design of industrial products. The creation of new products and services can be significantly enhanced by applying this technique, compared with the use of random ideas.

The aim of this report is to show the effectiveness of this technique for improving the creative process and present the working mechanisms of the most frequently used design methods using the technique of analogy.

Key words: analogy, types of analogies, action principles, creative process

INTRODUCTION

Analogy is the most universal heuristic technique for finding new ideas and solutions, which mobilizes human intellectual capacity. It is a general scientific and methodological tool, used in all areas of scientific creativity. There are no natural sciences or humanities which do not use this technique in the research process. The methodology of research in some scientific areas (e. g. Bionics) is almost completely oriented towards the use of analogies.

The search for new ideas can be implemented on the basis of analogies with objects from other areas of scientific and technical creativity, analogies with biological objects, as well as with objects and phenomena from the inanimate matter. By using the analogies certain terms or words may provoke new thoughts in human conscious-

ness and 'include' the information from the gained experience.

The analogies do not provide a concrete answer to the referred question, but lead to one or more assumptions. In a certain sense, they transform the unknown matter into known one, and due to the found similarities, allow solving the problem by using well known approaches and at the same time look at the problem from another, unexpected point of view.

STATEMENT

Analogy (from Greek “ἀναλογία”) in the most general sense means similarity, likeness or resemblance between objects, phenomena and images, caused by common characteristics. The analogy is a technique, used to determine a similarity between implicit but similar by a significant feature concepts and phenomena. At the basis of

this technique stands the transfer of information from one comparable analogue (source, model) to another one (aim, prototype). [7] The common source of creative ideas in any case is the presence of a relation by analogy between the compared objects, phenomena and processes, and the probable conclusion, made by analogy, as the transfer of information. Noticing and detection of similarities between the model and prototype leads to the understanding of new situations, based on similar ones.

There are different by nature and type analogies between the objects (phenomena, processes): material; symbolic; verbal; direct and remote; by shape, structure, etc.

Depending on the type of information, transferred from the model to the prototype, there are: analogy by properties (attributive) and analogy by relations (relational). [3]

The analogy is present in the creative process in two aspects: as a means for acquiring knowledge about the object, and as a means for a synthesis of new knowledge for the object and the surrounding environment. In the first case we are dealing with the didactic and practical function of the analogy, and in the second case – with its heuristic and cognitive function. The second aspect is important for the activation of the creative thinking, which stimulates the generation of new ideas, knowledge, conjectures, hypotheses and principles.

Finding new ideas and solutions, based on making analogies, is carried out by using groups of heuristic methods. The method of heuristic analogy is based on the natural drive of people to imitate, and in the general sense consists of searching solutions and comparisons between the objects, choosing prototype and transferring the information, obtained on the basis of its study, to the new object. As a cognitive and creative method, it can be used at all stages of the creative

process: in detecting and predicting the social needs; staging the problem task; searching initial conjectures and hypotheses; transferring ideas, solutions and techniques to new areas or for different purposes; for classification and typification of objects and phenomena; for explanation and interpretation of the new by using well known terms; for implementation of the new solution. At any stage the role of the analogy is different, but its heuristic properties are most clearly expressed in the generation of ideas, hypotheses and in finding principles for solving the problem. Namely these operations characterise the originality, effectiveness and quality of the final solution.

Analogies, as a widely used technique in the modern empirical and theoretical human activity, are related to terms like modeling, interpretation, extrapolation, induction, deduction, generalization, specification, classification, typification, unification, standardization, adaptation, heredity, symbolism, metaphoricity, scientific prediction, etc.

Making analogies can be considered in two aspects: as a transfer of properties and relations from one area to another, and as a transfer of analogies within a certain area (creation of samples, models, standards for reproductive imitation).

Types of analogies. According to Grebenyuk and Bush [2, 4] the different types of analogies can be summarised in the following groups: functional analogy, structural analogy, relational analogy, analogy by external shape and substrate analogy.

Functional analogy. This type of analogy could be transferred to the prototype from the following models: analogical natural phenomena with apparent similar functional properties; analogical natural phenomena with hidden functional properties; objects from other areas with analogical

functions; objects from other areas with analogical functions and additional representative functions; prosthetics – replacement of the object or its element with a functionally equivalent one.

The structural analogy can be expressed by three main types – isomorphism, homomorphism and homology. In the industrial design the most effective analogical

conclusions are connected with the following structures: biomechanical; biochemical; bio-architectural; natural inorganic; objects from the past; use of structural prototype in another area to perform analogical functions; re-intergration – creation of complex objects by structural analogy with simple objects or details.

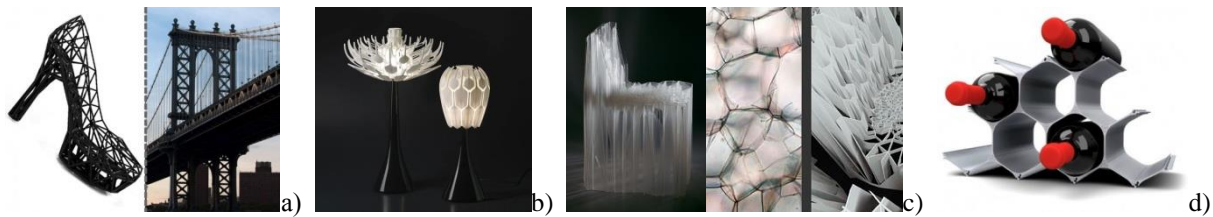


Figure 1: Application of analogies in the field of industrial production:

- a) shoes from the „strvct” series, inspired by the construction of the Manhattan bridge, design: Continuum Fashion; b) Table light Bloom, which opens like a flower, design: Patrick Jouin, manufacturer: MGX; c) Crystalline chair, inspired by the inanimate nature, design: Patrick Jouin; d) WineHive wine rack, inspired by the shape of bee cells, design: John Paulick, Kickstarter page

Analogy by external shape. In order to obtain high quality products, the following analogies, made by external shape, structure, texture and composition tools, can be used: biomorphism, which is expressed in imitating the appearance of natural objects; imitating traditional objects in order to provide social value; pseudomorphism by analogy with the external shape of other objects in order to create a false impression; copying the form of objects; expressing specific external features of an object to another one.

Substrate analogy. Some of the most common ways of implementing the substrate analogy are: creation of artificial materials by analogy with the natural ones; imitation of expensive materials; standardization and unification of materials by comparison with models; replacement of scarce and expensive materials with more afforda-

ble equivalents; transfer of materials to other areas by analogy with secondary properties; replacement of auxiliary materials and additives with their equivalents.

Relational analogy. The relations between the objects are extremely diverse, but due to the substantive unity and common connection between everything, are analogical. The usual types of relations, such as cause – consequence; part – whole; part – part; subordination – co-subordination; argument – function, as well as relations such as order, sequence, synchronism, proportionality, scale, etc., are of interest. The following relational analogies are most commonly used in the industrial design: standardization with regard to dimensions; scale copying; shaping and modeling; analogies by cause-consequence relations; relations by order and sequence.



Figure 2: Application of analogies in architecture:

a) Wuxi Grand Theatre, design: PES-Architects. The shape of the eight roofs is inspired by a butterfly, perched on a lake shore; b) The roof of Auditorio de Tenerife concert hall is curved like a palm leaf. Project: arch. Santiago Calatrava; c) Yorkshire Diamond Pavilion. Analogy with the atomic structure of the diamond is used in its design. Project: Various Architects AS; d) One of the series of hotels, built on trees. Inspired by bird nests, architect: Inredningsgruppen

According to the rules used for creating analogies, the following four main types can be distinguished: direct, subjective, symbolic and fantastic analogies.

Direct analogy. This technique is used for finding solutions to the problem in similar objects or processes from different areas. When using this analogy, a special attention is given to the living nature (biological analogy), as the stock of biological ideas in nature is practically inexhaustible.

The direct analogy handles with the following procedures: 1) task presentation in general terms; 2) searching solutions in different areas by the description; in this stage it is useful to make a list and classification of the areas; 3) adaptation of the solutions, found in the second stage, to the specific task provisions.

Subjective analogy, empathy. This type of analogy is a personalised representation (immersion) of the image of the designed object through emotional description of the object function, made by first person. The aim is to find the causes of functional impairment and provide suggestions for its removal. It is considered that the in-depth examination of the problem from the inside would lead to a better solution. Entering the role of something or someone is trained like

in the theatre – habits, knowledge and developed creative imagination are needed.

Symbolic analogy. In this technique, the problem is described in a few words, summarized and abstractly. Metaphors are used in the formulation of the task, which to depict the essence of the object concisely, but at the same time in the best possible way. [1] The most commonly used metaphor is of the catachresis type, based on relational oppositeness. The metaphor is a result of the fantasy and is based on one of the human properties - to compare and distinguish.

Symbolic analogy allows the use of original, paradoxical description of the problem and to thus to look at the task from a new perspective. It allows to show the conflict, lying at the core of the problem, visually. The symbolic analogy can be identified with the invention of the name of a book. For this reason it is known as ‘book title’ technique.

There are three ways for the implementation of the symbolic analogy. Each of these methods begins with a specification of the problem by a keyword, but continues in a different way: 1) except with a keyword (e.g. power) the problem is defined with another word, having the opposite meaning (e.g. weakness) and the found words are

linked grammatically correct (e.g. power weakness, weak power, power through weakness, weakness through power, etc.); 2) duplicating the specified keyword (e.g. powerful power, power-power); 3) determining the characteristic properties of the keyword and their connection in unusual, paradoxical combinations. The third way is one of the most commonly used and easily applicable in practice.

Fantastic analogy. It is a technique in which unreal, fantastic means and personalities, fulfilling the requirements of the task condition, are used. An ideal situation, even contrary to the natural laws, in which the task can be solved without any problems, is mentally created. In this case questions like ‘How could these objects or personalities solve the given task?’, or ‘Is it possible to make these objects or personalities real by using certain technical means?’, are asked.



Figure 3: Products, derived by using symbolic analogy:

a) „Sprout“ pencil, design: Democratech. The dream of writers and poets their words to ‘blossom’ from their pens, can be visually implemented by using this pencil; b) Wax lamp, design: Merve Kahraman. This lamp recycles its shade alone. While turned on, this part of it goes through a cycle of melting and subsequent shaping. This continuous cycle represents the transformation through metamorphoses; c) Apparatus for air purification, representing a perfect partnership between human and plant. Design: Andrea

The analogy can be provoked consciously, intentionally or accidentally, without the participation of consciousness (by association).

The mechanisms of finding similarities in objects and phenomena of the surrounding world are so often used in the human thinking that many of the analogies act not at conscious but at subconscious, associative level. Association is a psychological property of man to freely connect different phenomena (images, concepts, thoughts, feelings, etc.) in which the occurrence of one of them serves as an incentive to invoke another one, present in the consciousness. Conditionally, the first element can be called cause and the second one – consequence. Association can be implemented on the basis of a similarity, contrast or objective rela-

tion, verified by the human experience. It occurs uncontrollably (without participation of the consciousness) and is a reflection of real objects and phenomena in the human consciousness. To a great extent it depends on the experience, emotions and other human characteristics, as well as on the conditions at the time of its implementation. The human capabilities to generate associations are practically unlimited.

Association is a component of several design methods. Some of the most commonly used by the designers methods that use the associative searching and heuristic properties of randomness are: ‘brainstorming’, ‘focal objects’ method, ‘chain association’ method and metaphorical method. These heuristic methods are distinguished by sim-

plicity and unlimited opportunities for searching new solutions.

CONCLUSIONS

Analogies are not simply a result of the unbridled imagination but have an objective determination. We can establish relations between almost everything and reach new ideas.

The analogy is a means of specifying the thoughts, so it plays a special role in the scientific explanations. It is important to note that analogical conclusions do not prove anything themselves, but prove the deductive inferences based on analogy. That is why finding the expected credibility level of conclusions is of theoretical and practical interest. The effectiveness of the analogical conclusions depends on the following prerequisites: abstracting from the limitations and conditions when searching new ideas; using distant, inaccurate analogies for obtaining more original results; using as many properties and relations as possible in order to expand the field of new ideas.

The ability to make analogies is one of the most important prerequisites for the effectiveness of the creative process. The professional development of designers is connected with the gradual acquisition of analogies, as this process is connected mainly with the constructive rationalization and visual image of what has stimulated human brain as well as its visual interpretation. Solving the task is connected with processing the obtained information (mental modeling).

The use of analogies stimulates brain activity, triggers fantasy and imagination,

contributes to 'break' the stereotypical concepts dealing with psychological inertia of thinking, but its implementation requires training, rich imagination and ability to think abstractly.

REFERENCES

1. Ангелова, Д., (2010). Дизайн методи стимулиращи генерирането на идеи и тяхното приложение в образованието по дизайн, Майски четения – Дни на науката 2010, Велико Търново.
2. Буш Г. Я. (1981). Аналогия и техническое творчество. Рига: Авотс.
3. Буш Г. Я. (1972). Методы технического творчества. Рига: Лиесма, <http://www.metodolog.ru/00931/00931.html>
4. Гребенюк О. С., Гребенюк Т. Б., Основы педагогики индивидуальности. Средства развития интеллектуальной сферы, <http://uchebnikfree.com/page/pedagogu/ist/ist-4--idz-ax250.html>
5. Коллектив (2004). Иновациите – политика и практика, Фондация „Приложни изследвания и комуникации“.
6. Кузьмин А.М. (2003). Методы поиска новых идей и решений. Приемы аналогий, Интеллект Клуб, Опубликовано: „Методы менеджмента качества“, № 4, 2003. <http://www.inven-tech.ru/pub/club/091/>
7. Техническое творчество: теория, методология, практика. Энциклопедический словарь-справочник. /Под ред. Половинкина А.И., В.В. Попова. М.: НПО „Информ-система“, 1995, <http://doc.unicor.ru/tt/124.html>
8. Casakin H. (2003). Visual Analogy as a Cognitive Strategy in the Design Process: Expert Versus Novice Performance, Expertise in Design, Design Thinking Research Symposium 6, Sydney, 17–19 November 2003., http://www.creativityandcognition.com/cc_conferences/cc03Design/papers/22CasakinDTRS6.pdf