How to Find an Idea? - Computer Aided Creativity

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Abstract. In this paper the possibilities of using computer software in creative searching of design ideas is analysed. At the basis of such psychological theories as Incubation, Synectics, Geneplore, Bisociation, Conceptual Blending, Visual Synectics the implementation of digital technologies in the idea searching – the main stage of design process – is presented. In all computer ‘metaphorisation’ methods presented in this paper pictures are treated as idea triggers. Designer generate the ideas of the form by use the pictures as triggers for free association or for metaphorisation. The two cases of implementation of these methods, which based on graphic transformations, will be presented.

Keywords: Creativity; design methods; form searching.

What is design?

In the proceedings of ECAADE Conferences we may find a huge number of design methods in which computers play the main role. All presented methods very useful when designer knows what they want - if they have an idea and tools for realizing it. But what should they do if they have no idea what the form should look like?

Designing is creative process of finding, fixing and developing an abstract idea of real spatial forms, not a ‘process of problem solving’ as scientific research is. How the processes of design flow? In what way the design idea arises? Conscious activities or serendipity are the main principles of designing?

The basic conditions of creation are intuition, that is the ability to foresee without trying to understand, and imagination, that is the ability to create certain images in our mind. Therefore, the core of creation is based on creating an idea in our thoughts, which had never before been brought to life by anybody, as well as images, which are not associated with any past experiences. (Maslow 1962) A. Koestler in his book ‘The act of Creation’ emphasized a concomitant presence of inspiration, cognitive leaps, or intuitive insight as a part of creative thought and action. (Koestler, 1964)

Stanislaw Lem has claimed that the ‘serendipity’ is an early, especially turning point of the great process of evolution. ‘Serendipity’ is the effect by which one accidentally discovers something fortunate, especially while looking for something else entirely. In Wikipedia we can find some useful definitions of Serendipity:

“Serendipity - Look for something, find something else, and realize that what you’ve found is more suited to your needs than what you thought you were looking for.” Lawrence Block

“The most exciting phrase to hear in science, the one that heralds new discoveries, is not ‘Eureka!’, but ‘That’s funny …’” Isaac Asimov

“Serendipity is the art of making an unsought finding.” Pek van Andel
Theories of creativity

**Incubation**
In this theory creative activities may be explained by a process consisting of 5 stages:
- preparation (describing of a problem and collecting information),
- incubation (where the problem is internalized into the unconscious mind and nothing appears externally to be happening),
- intimation (the creative person gets a ‘feeling’ that a solution is on its way),
- illumination or insight (unpredictable understanding of the problem and finding solution)
- verification (where the idea is consciously verified, elaborated, and then applied).

The main stage is Illumination - an active process of sketching and discussion. This increases and accelerates the emotional experience which is the basis of illumination. (Wallas, 1926)

**Synectics.**
A source of creative possibilities in synectics is connection of different elements which don’t have anything in common. On their base arise sometimes weird associations. A process of problem solving is treated as emotional and rationale at the same time. The main factor of the act of creation is emotions. Gordon claims that for effective process of searching designer’s mind should achieve emotional instability. Designer needs new perspective to synthesis of a new solution. That means he needs some kind of distance to all known facts and ideas. For this purpose he uses procedures including analogy and metaphors. Thanks to metaphors we may see ordinary in extraordinary and rare in common. (Gordon, 1961)

In Synectics two operational principles are used. The first, ‘making the strange familiar’, helps designers better understand the problem by viewing it in a new way. The second principle is ‘making the familiar strange’ – attempts to pull designer away from the problem so that more creative solutions can be developed. (Gitter, 1964)

**Visual Synectics**
Visual Synectics is divergent idea generating technique in which pictures are used as visual stimuli. A designer can generate useful ideas to a problem by looking at a number of pictures. Visual Synectics operates in three main stages: analysis and understanding of problem, estrangement through a study of pictures (illumination), idea development through a study of pictures.

The process of generation includes three stages:
- The designer look at a picture or small set of pictures. The picture(s) can be drawn from anything: e.g. art, environment, recreational or sport activities.
- The designer write the comparison between the picture and the topic, using a stem such as ‘________ is like _________ because …’ or ‘______ is like _____, as well as not like _____ because …’ and sketch what he/she saw at this picture. It is phase of illumination.
- He/she tries to relate sketch to design starting from total impression to more and more detailed analysis.

Geschka described this process as follow (1980): “In the normal intuitive process the idea evolves when individual is confronted with an object which is quite distant from the problem area. The idea which emerges is a product of intuitive confrontation. This is a most fruitful principle for idea generation.”

**Geneplore model**
In this model creativity takes place in two phases: a generative phase, where an individual constructs mental representations called preinventive structures, which are ambiguous and fuzzy, and an exploratory phase where those structures are used to come up with creative ideas. Process ‘Generating – Interpretation’ may help designer percept and understanding possibilities containing in preinventive structures. The successful ending of creation depends from ability to see metaphoric meaning of concrete structure. Usually, in the result of the first round of the process, designer back to the stage of
generation, as preinventive structures needs modification. The whole process may contain infinite number of the rounds. (Finke, 1992)

**Bisociation**
According this theory creativity arises as a result of the intersection of two quite different frames of reference. The creative process is based at metaphoric thinking. (Koestler, 1990) Koestler invented this term to distinguish the type of analogical thinking that have place in creativity from the logical thinking, with which we are familiar in our everyday lives.

**Conceptual blending**
In Conceptual Blending, elements and vital relations from diverse scenarios are ‘blended’ in a subconscious process, which is assumed to be ubiquitous to everyday thought and language. Insights obtained from these blends constitute the products of creative thinking. Forerunner of conceptual blending was the theory of bisociation of Arthur Koestler. (Turner, Faucher, 2002)

All presented theories emphasize the role of unpredictable associations and metaphors in creativity. Lakoff and Johnson (1980) write that, the essence of metaphor is understanding and experiencing one kind of thing in terms of another. Metaphors help designers to understand unfamiliar design problems by juxtaposing them with known situations. Retrieving concepts from metaphors demands creative thinking. Metaphors affect the way we perceive the world and organize our thoughts. These devices have a fundamental role, because they enhance innovative thinking. They allow the designer to think unconventionally. (Casakin, 2007)

Application of metaphors in designing is one of more interesting ways of form creation, as metaphors can be used for the description of the projected form with symbolical values. Designing is considered as process of a combination of the ideas borrowed from different areas. In this process visual image, metaphors and analogies expands area of search of alternatives.

Especially interesting are a visual metaphor which defines the new semantic space of searching. Efficiency of metaphorical process of form creation is determined by a graphic operating mode as architects think graphically. Visual, graphic metaphors allow making transformations with the minimum loss of conceptual value. The mechanism of appearing of visual metaphors is based on the purely visual principles. Calatrava asserted that the columns at the Orient station in Lisbon were inspired by palms. Arup claim, that the form of Sydney Operas’ reflects yachts sails in the Sydney harbour. An interesting example of metaphor is the Moebius’s tape. Eisenman used it, projecting Max Reinhardt House. The idea of a tape was used also by Ben van Berkel in Moebius House Het Gooi.

**Methods of exploration of design metaphors**
The concept of ‘metaphorisation’ is based on intensifying hidden meanings. On the basis of association of images, impressions and concepts an additional aesthetic quality – a metaphor – is created. When designers sketch and search for architectural forms them consciously or subconsciously think metaphorically. Computer ‘metaphorisation’ methods presented in this paper are based at presented above theories of creativity. In all methods pictures are treated as idea triggers. ‘Designer’ generate the ideas of the form by use the pictures as triggers for free association or for metaphorisation.

There are two methods of working. In first, designer uses existing pictures. He/she can use any pictures as photograph, art painting or pictures which was the result of printer crash. In the second case designer create own picture using such methods as diagrams, scanning, collage or visual sampling.

Next step in both cases is the transformation of these pictures into graphic one. For preparation of the ‘sketch’ of the architectural form the different methods of graphical transformation are applied (‘speeding drawing’ or ‘photoshoping’). In this
process the existing graphical software as Gimp, Photoshop, and Corel Trace is used.

**Speeding drawing.**

Speeding drawing is based on search of the form by deformation of initial forms. Such way of search existed in «pre-computer» time. G. Raggatt used photocopier for deformation of the buildings plan. The sheet of paper with the drawn plan had been put in pawn in the photocopier, and then during copying was quickly stretched manually. As a result, there was a plan which length was several times more than the original. Depending on a direction of movement of the original the new plan can have also not rectilinear outline. G. Raggatt applies definition «the accelerated plan», or the plan which has resulted ‘speeding plan’. Introduction of time factor changes value of space, and use photocopier allows fixing this process immediately. (Raggatt, 1993.) This method has been checked up by the author of the present work at designing of several plans and facades of buildings of various types. In experiment the scanner and the computer was used. The received forms were very interesting. Results were completely not expected, that affects their unfitness in real designing, but they can become a source of new design ideas.

**‘Go wrong’**

Each architect who applies the computer in his work, meets set of problems resulted from incomplete mastering of computer programs, or which aroused due to the crash of the computer software or hardware. As a result the unexpected pictures came into existence. The author has the interesting collection of graphic files and the printer listings which occurrence is impossible to explain in no way. In this set are the renderings in which the program itself has changed colour of forms, pictures received by opening of graphic files in text programs, texts from Microsoft Word in which the program has changed a font size and simultaneously an interval. The separate group is the pictures which have resulted of the printer crash during printing. Some of these artefacts are unusually beautiful, some are not clear, but all can become a source of inspiration in the course of search of the new form.

**Diagrams**

Diagrams are the representations created for visualisation of a problem. Designers apply diagrams to creation of spatial metaphors in the decision process. Diagram’s helps to combine the information with spatial forms and support process of perceptual conclusions. (Larkin, Simon, 1987). Diagram’s can be consider as record system, the artefacts created for ‘replacement’, for creation of metaphors and by that a tool for problem ‘catching’. Integration of relations between different forms and different spatial values opens new possibilities of search of idea and allows using models of analytical factors as design metaphors.

**Scanning**

2D scanning - is based on computer processing of the scanned elements. In this method for input of the initial information 2D scanner was used. Scanning different subjects, for example small pieces of a colour paper, leaves, a scattered beads, the designer receives various pictures. They arise casually, but not without intervention of the author which makes the decision on quantity and quality of the applied elements. Pictures which most full correspond to author’s idea, become a basis for the further graphic computer transformations in which result there are computer sketches of the form (scansketches).

3D scanning - may be used to transcribe the formal surface qualities of handmade models directly to the computer. The transposition of the digital spaces of spatial forms makes their later transformation possible. It is possible to scan not only the handmade models but also other forms, which then become an inspiration for creating an architectural form.

Designing starts from preparing working model of the form in traditional way as cardboard model. After a scanning the form is modified by using CAD software. Author in experimental designing as
starting form used the deformed manually cube. The cube was scanned and modified in CAD software. It is possible to scan any spatial forms, for example leaves, flowers, stones which also can become ‘inspiration’ for creation of the architectural form. Thanks to CAD software, 3D forms may be moulded or carved. The availability of 3D scanning enabled a connection between real and digital modelling environments.

**Collage or visual sampling**
The collage is association of two realities association of which would seem impossible. The elements taken from the real live created unexpected associations, raising subjective sensations at spectators. The computer collage may be named – ‘visual sampling’. Similarly musical sampling in which diverse sounds are used for music creation, in ‘visual sampling’ an equivalent of sounds are images. These images are used for creation of new forms, structures and diagram’s. In visual sampling, the designer, applying digital process of scanning, transforms images to colour raster. It allows performing such numerical operations as a fragmentation, association, distortion, or duplication. The images can be transformed by means of a wide set of various editing methods (colorizing, mixing, punching, rotation, greasing, etc.). In the computer collage designer can use different layers, which illustrate different aspects of a form – spatial, functional, constructive, formal, chronological or biological. Spatial form may be percept as a collage vertical and horizontal surfaces, empties and volumes, colour and light, transparent and non-transparent, mirror and frosted. Because searching process of the form already includes many similar associations, computer collage is a very effective method supporting this process.

Morphing. Separate method is – ‘Morphing’ - dynamic, smooth transformation of one image to another by means of geometrical operations. This method based on the process of interpolation (morphing) in which Parent ‘A’ is mapped to Parent ‘B’ and between steeps is calculated. Geometrical coordinates both form are changed and in result we have some kind of morphogenetic process of creation. The morphed child shares characteristics of its parents yet has its own identity. Designer may define percentage balance of starting forms. (Terzidis, 1999) The user can change and operate the transformation process and repeat it many times, changing some or all of transformation parameters. The result of the morphing is the genealogical tree of all possible mutations, which are the basis for further exploration. Each object, being continuation of ‘parents’, is simultaneously unique.

**Experimental work**

**Case 1**
**Visual Synectics - Art Gallery – 3rd year course work**
In our experiment we used the Russian constructivist painting but newspapers and magazines are an obvious source; advertisements often have eye-catching and stimulating material. We decided to give them Rodtchenko’s, Kandinsky, and Malevich pictures as an inspiration for a design. The problem statement is put on view and discussed until clearly understood. Then each student chose one of the pictures and on the basis of this picture created an abstract 2D composition. The sketch of the composition could be done by hand or use Photoshop filter as Bas Relief, Glowing Edges or Photocopy. Some of students use the Corel Trace software to obtain more linear drawing. In the next step they transformed sketches into plan of a gallery. The idea was discussed and evaluated. At the basis of this sketch students create the space form of gallery. From one picture different students created totally different sketches, and in a consequence different unpredicted, even for them, 3D forms.

The choice of relevant picture criteria is important. Our experience shows that the more useful is the abstract patterns. Pictures should be unrelated to the problem; it can help if the picture is open to a variety of interpretations.
Case 2
Incubation - Passageway through the street – diploma work of Ursula Rusek

The design goal was to create a passageway through the busy street. It should connect the city centre with the park. At the first stage, the description of the problem was elaborated. Student collected all needed information: maps, photographs of the site, photographs of different examples of such kind of objects. When all information was collected, the idea incubation stage starts. We analyzed photographs of site and objects, and discussed what passageway means, how people walk through spaces, what are their needs (shopping, resting, looking, talking, waiting, walking). The process of illumination was intensive process of discussion. During discussion arose the idea of the ‘gentle flow of spaces’ as we thought that principle of space flow express people needs in better way. Student starts quest of the form which are correspond to idea of soft form and illustrated the dynamic of people moving. She found the photograph of ribbon dancer at rhythmic gymnastics competition. In this dance, the performer makes a ribbon move to the beat of the music and the changing rhythms dictate the flow and size of the various movements. It is based on a form of Chinese choreography. The ribbon is long and light and may be thrown in all directions. Its function is to create designs in space. Its flights through the air make images and shapes of every kind. Figures of many different sizes are executed at varying rhythms. Snakes, spirals and throws are the essentials of the ribbon’s flight. It was the groundbreaking moment in the process searching.
In next steep students created a set of digital sketches of the form, as we decided used digital media at all design stages. The examples of these sketches are shown at the figure 2. At the basis of these sketches we verified of the idea, and then used it into design. Resulting form was very interesting and confirmed usefulness of applied design method.

Figure 2
The process of design of the Passageway through the street
Conclusion

Creative processes are based on extraction of new associations from the subconscious. These processes are close to mythical and simultaneously poetic understanding of the world. The designer reminds the primitive men who for expression of richness, variety and complexity of the word used compressed and reduced symbols, capable to replace the direct and detailed description of the perceived phenomena. They have used symbols as their language. For designing, however, other aspect of a problem is important: that the symbol reflects what is known and what is not known to the same extent. The designer can use symbols as a link between the description of the meanings and its representations. For this purpose he applies a language of metaphors that conducts to considerable discrepancy of results, but, that is paradoxical - simultaneously raises efficiency of creative process. The metaphorical design thinking is based on a «divergent thinking», which comprises withdrawal from stereotypes, human's ability of finding unexpected alternatives and possible logic ruptures. Results of all these methods' work are characterized by high level of abstraction and include a different sort of association. Computers start to play the role of intermediary, the arbitrator between the designer and idea.

References


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