Computer, Creativity and Unpredictability

Alexander Asanowicz
Technical University of Bialystok, Poland

Computers in designing are usually considered as a tool for preparing technical documentation, storage and managing information, coordinating of flow of design process, modelling and all kind of visualisations (renderings, animation, VR models). At the early design stages, when an idea of the form is created, computer is not used very often. The reason for this is that traditional computer drawing is too completed to be used at this stage. In new methods of supporting creativity, computer should be used for creation of less precise, unpredictable but more inspiring images. This method are based on the thesis that emotional elements have a great affect on the decision making process in designing. Intuition, unpredictability and no logic are the essence of creativity in the selection of associations. Confirmation of this statement we may find in many theories of creativity (theory of incubation elaborated by Wallas, genploration (Finke, Ward and Smith), redundant generation (Lem), synectics (Gordon)). All these theories emphasize the role of unpredictable associations and metaphors in creativity. Process of metaphorisation is characteristic for our era and plays important role in creative process. That’s why we need the new methods of graphic computer and non-computer transformation, which allows us a fuller exploration of design metaphors. The final conclusion is built on the thesis that too precise tools promote cause to decrease differences.

Keywords: Creativity; design theory; metaphors.

Preface

Computers in designing are usually considered as a tool for preparing technical documentation, storage and managing information, coordinating of flow of design process, modelling and all kind of visualisations (renderings, animation, VR models). At the early design stages, when an idea of the form is created, computer is not used very often. The reason for this is that computer wants to render real things. It is extremely difficult to create a drawing that hints at a basic form or idea. A traditional computer drawing is too completed to be used at this stage. These simple and self-evident statements are the start point of this paper.

Case study - three examples of design idea searching

Designing the church
A few years ago, taking a sunbath at the seaside I saw a sea-holly leaf. I thought it was really similar to
a gothic church. I took it home and decided to use it as an inspiration for designing. The design was created according to the consciously defined direction of searching. From the series of images obtained by means of scanning the leaf placed on the scanner in different positions, one was chosen, which was later subject to processing by means of the Trace Contour operation under the Photo Shop programme. A digital sketch of the plane was obtained and design was supposed to be made on its basis. I gave this sketch to the student. One week later he announced that designing the church is rather impossible, but he succeeded in designing a museum. Result of this process is shown at the figure 1.

Figure 1
The process of the designing of the church.
Designing of the abstract dynamic form
The main goal of the design was creating an abstract dynamic form. For this purpose the pieces of folded paper and cardboard were used. 2D composition was created on the scanner surface and scanned. The images were achieved by coincidence, however not without the intervention of the authors, who were responsible for choosing the amount and the quality of the elements used. Like in the previous example composition was transformed into 2D linear drawing. Saved picture was opened in the AutoCAD, where it was converted into 3D wired form. The next step was visualisation in the 3D Studio. In the process of searching of new idea of architectural form was used simple graphic software, which enables to elaborate the linear pictures similar to the hand made sketch. In all cases find results were unpredictable but very inspiring. (Figure 2)

Forms inspired by Rodtchenko’s pictures
During last semester we were looking for a new method of teaching AutoCAD, as we started to teach the program at the second semester of the study, one year earlier than usually. Traditionally we taught the program designing simple architectural objects. This year the problem arose - students couldn’t design anything yet. We decided to give them Rodtchenko’s pictures as an inspiration for a design. On the basis of these pictures each student elaborated an abstract 2D composition. The sketch of the composition was made by hand. In the next step these sketches were transformed into plan of a gallery. From one Rodtchenko’s picture different students created totally different sketches, and in a consequence different unpredicted, even for them, 3D forms. (Figure 3)
**Intuition, unpredictability and no logic**

Similar to the above presented description of the way of searching we can find in statements of many artists, architects and scientists. In all of these opinion a role of emotions, imagination and metaphors in the process of creation are emphasized.

Ingarden (1981) asked the painter, author of series of paintings depicting flowers, about the process of painting and received a very funny answer. "I am lying in bed, by a small electric lamp (in a totally inappropriate conditions, without natural light) and I have a piece of cardboard in front of me, and now, just like that, I draw a small spot on the right side corner, and when I see this spot I feel like drawing

*Figure 3
Objects designing on the base of the Rodchenko’s picture.*
another one, but different, using a different colour. Eventually a whole painting is created from those spots.”

“Design can be characterised as generation within a “play of metaphors. (...) For example, an architect may see spaces as having the properties of a fluid (“space as fluid” metaphor). This metaphor suggests and opens up possibilities (or problems) of “shaping” spaces, improving their “flow”, and identifying their “source”. If a designer is operating within a “form as mass” metaphor, it may lead the designer to consider “emphasis”, “giving weight” to an element, and providing “balance”. Some of the metaphors used by architects enable them to see their designs in terms of focal points, concepts, points of departure, themes, ordering principles, and types. There are also various analogs – shells, pine cones, praying hands – and precedents that arise metaphors.” (Coyne, 1995)

“In architecture we derive knowledge at the same time from our intellect (intuition and mind) and from our emotions (intuition and imagination) as well as from logic (mind and imagination).“ (Araujo, 1982)

“One who designs imagines oneself this or that; thinks (not affirms) it to be this and that, and then he thinks again it to be in a different way; motivates, that if it is done in this way, it would be so and so, and if in that way - differently again; evaluates, if in such and such a case it would be right or wrong, and in what a way, to what a degree, and in what a case it would be better; and finally - chooses, that is decides to act in this, not in a different way to succeed in one's object.“ (Kotarbinski, 1986).

“...every human being is simultaneously a poet and an engineer (...). Only step by step do we learn to understand what we lose trying every day to be only and exclusively „sensible“, only „scientific“, only „logical“, only „reasonable“, only „practical“, only „responsible““. (Mslow, 1962)

The main conclusion from this quotations is that an emotional elements have a great affect on the decision making process in designing. Intuition, unpredictability and no logic are the essence of creativity in the selection of associations. The question arises: What should happen inside a designers mind to create really new idea?

### Theories of creativity

The problem, in what way designer create new idea, is deliberated in many theories of creativity In this part I would like to present three of these theories, which may be useful for explanation the design method used in case studies presented in the first part of the paper.

#### Theory of incubation

The most interesting, from architectonic point of view, theory of creation process is theory of incubation elaborated by Wallas (1926). According this theory creativity is based on subconscious activity of the mind. The process of creation is divided into four parts:

1. preparation (describing of a problem and collecting information),
2. incubation (subconscious generation of the idea),
3. illumination (unpredictable understanding of the problem and finding solution),
4. evaluation.

Illumination is an active process of sketching and discussion. This increases and accelerates the emotional experience which is the basis of illumination. Theory of incubation cannot be proved by scientific research, but confirmation of its evidence we can find in a works of many artists (Luis Bunuel, Salvador Dali, Krzysztof Penderecki).

#### Theory of genploration

In 90's Ward, Smith and Finke (1995) elaborate theory of genploration based on the thesis that human ability to generation of a new “units of knowledge” is a one of main characteristics of our mind. They divided creative process into two stages. First - creating of “preinventive structures”, which are
ambiguous and fuzzy, and second - decision of using of chosen structures, its interpretation and verification. Process “Generating – Interpretation” may help designer percept and understanding possibilities containing in preinventive structures. The successful ending of creation depend 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 contains infinite number of the rounds.

Redundant generation
Lem scheme of creation consists of: 1) a generator of excessfull diversity, 2) criterion filters sifting that diversity, 3) a program of the given transformation modifying the selected elements, according to the instruction included in this program (Lem S., 1988)
Those elements - generator, filters and program might be generally independent one from another. The generator may produce diversity in the strictly accidental way or according to its knowledge. The filters may sift “diversity” with regard to freely assumed criteria. The transformational matrix may perform a defined by itself transformation over the sifted elements.
However, that scheme works in a different way in the architectural creation. There is a changeable feedback - reaction of the created elements to what have created them. It means that the designed form is not only the result of an architect’s reaction to the unformed matter, but also the result of the reaction of the created form to its own creator. One should remember that owing to the experiences assumed during the further projecting activities, an architect may introduce some changes in elements that have already been designed. That correction is influenced by the feedback (object - architect - object) and also by the fact that the begun work has an endless amount of possible ways of development. Moreover, the development of the form is proportional to the reduction of invariants’ number. The influence of the earlier activities over the further ones may be double. They support the author when a development of the project corresponds to his ideas. Then we experience a feeling that the object is projecting itself. They may be also an obstacle when the development of the form is inconsistent with the authors’ ideas. Analysing the first stages of creation we can state that its beginnings as a strange incident, repeated undefined. We do not know what kind of set of elements we dispose. We cannot fully control all features of the selecting filters. Moreover, we do not know the transforming matrix which we launched during the process of creation.

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 creation act are emotions. Synectics 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 use procedures including analogy and metaphors. Thanks to metaphors we may see ordinary in extraordinary, and rare in common. (Gordon, 1961, 1971)
All these theories emphasize the role of unpredictable associations and metaphors in creativity. Process of metaphorisation is characteristic for our era and play important role in the creative process.

Methods of exploration of design metaphors
In the first part of this paper were presented three projects, in which graphic computer transformation of a scanned pictures or objects was implemented. Results confirm that using of this method in designing allows designer a fuller exploration of design metaphors. In this part a few different methods of
graphic transformation will be presented.

**Visual interpolation**
This method based on the process of interpolation (morphing) in which Parent “A” is mapped to Parent “B” and between steeps are 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 a starting forms. (Terzidis, 1999)

**Computer collage**
In the Collins Coubild English Dictionary we were found the definition of a collage: “Collage is the method of making pictures by sticking pieces of coloured paper and cloth onto paper. You can refer to something that has been made by combining a number of very different things as a collage of a particular kind”. (Collins, 2001) In the computer collage we may add to these elements 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 include many similar associations, computer collage is a very effective method supporting this process.

**Mathematics in form generation**
The theory of chaos makes possible to search for the form in the chaos of incidental elements with the use of random function, which helps generate both two-and three-dimensional spatial structures. The Webster dictionary defines randomness as “lacking a definite plan, purpose, or pattern”, and also “being or relating to a set or to an element of a set each of whose elements has equal probability of occurrence”. In this method of creation forms are not born in the architect’s mind but they are produced by the computer. The architect only chooses, evaluates and transforms that form. The architect defines the direction of changes and interactively transforms the primal forms. Accidental juxtapositions of these forms can be examined for valid and possibly unsuspected alternatives. (Asanowicz, 2002)

**Scanning**
We can use a 3D scanner 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. Thanks to CAD software, 3D forms may be moulded or carved. The availability of 3D scanning affords a greater freedom of movement between real and digital modelling environments.

**Conclusion**
Unpredictability is often said to be the essence of creativity. Pictures which are shown at the first part of this paper are the result of series studies aimed at using (and sometimes even misusing) existing techniques as design media which may surprise and stimulate, offering the designer unforeseen shapes and solutions. The attitude is to shift the creative boundaries of contemporary design tools. The final conclusion is built on the thesis that too precise tools promote cause to decrease differences. For expression of richness, variety and complexity of the form, designer uses compressed and reduced symbols capable to replace the direct and detailed description of created forms. The symbol reflects at the same degree what is known, as well as what is unknown. The designer can use symbols as a link between the description of the reality and its model. For this purpose he applies the language of metaphors or even the poetic language that conducts to significant discrepancy of results. How computer, which is considered as the tool for exact
accounts, may be applied in such situation? Computer may be used for creation of less precise but more inspiring images.

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