Transformed architectural sketch modelling to improve conceptual design skills

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ABSTRACT: Conceptual design is one of the most important processes in architectural education. The formation of ideas and developing the architectural concept of the project are the main components of design in general. Some students in initial and senior courses of architectural specialties have difficulties finding and transferring the concept of architectural form. Architectural sketch modelling is a popular way to define the conceptual form. Nowadays, one may have many different examples of such models like the *Lego architecture studio* and *constructor molecules and forms* that develop the spatial and visual thinking of users. In this article, the author suggests her own model, and a programme that explains how to work on this model and improve conceptual design skills. Students from undergraduate and Master's courses from Cracow University of Technology (CUT), and students of similar courses from Kazakhstan, Romania, Spain and Malaysia studying by a bilateral agreement or Erasmus programme in CUT participated in this study. The research methodology included observations, surveys, personal interviews and the analysis of factors influencing the students, such as the level of tiredness, age and others. The results show that working with the model can affect the development of the visual, spatial, critical and creative thinking of students.

Keywords: Conceptual design, sketch-modelling, form-finding, architectural education

INTRODUCTION

Currently, conceptual design is one of the more important parts of the architectural education process. Searching for a project's idea and developing an architectural concept of the project are the core components of architectural design in general. According to Ovchinnikova, a concept is an overall design, a basic idea, an ideological and artistic interpretation of an architectural work, and a special way to understand and interpret the phenomena of architecture. It is a system of views on various phenomena of architecture [1]. Some students of initial and senior courses of architectural specialties have difficulties finding and transferring the concept of an architectural form.

According to Kozhevnikov, the most common techniques in this field are sketch-drawing, sketch physical modelling and sketch visualisation that can be characterised as follows:

> *…In a graphic sketch, no matter how it was detailed and well made, there is no tangible materiality and physical bulk. These qualities are present in the process of sketching - prototyping. The ability to physically tangible form, their relationship in space with each other, the presence of certain textures of these forms - all this makes sketching the models is very intuitive and convenient tool for the initial design. The work on the composition there is a constant visual correlation of one element to another* [2].

> *…This kind of model as the physical operating sketch modeling is one of the essential tools to search for conceptual architectural shape of the object* [2].

On the other hand, it cannot be said that sketch drawing is obsolete, as it can be a technique for finding an architectural concept. According to Koca and Uluengin, drawing analogies between things/objects by generating metaphors is also a method of expression/creation in architecture practice as in all design practices. Therefore, as in all design practice, drawing analogies - with/to/between - by generating metaphors is also an important instruction for learners/students in architectural design education [3]. This research suggestion is based on finding new forms by drawing the analogies, but analogies might be taken from transformed sketch models.

Nowadays, one may have many different examples of such models like *Lego architecture studio* and *constructor molecules and forms*, which develop spatial and visual thinking of users (Figure 1).

Figure 1: Elements of the model suggested by the author.

In this article, the author suggested her own model, and a programme, which explains how to work with this model in order to improve conceptual design skills.

By using these elements, students can have greater opportunities to see, touch and create new forms. Such forms play the role of basic analogies, which can be redrawn by students and changed on drawings. This approach may have several advantages:

- Students can see and touch the physical model and see the conceptual form from four perspectives, and can also feel the scale of elements;
- By watching the form and redrawing it, students can devise and develop new concepts, based on the first concept, which was made by physical modelling;
- Students can create many conceptual forms in a short period of time and alter the form by changing the place of individual elements.

AUTHOR'S SUGGESTIONS

This model is a set of thin-walled metal tubes of 10 mm in thickness, of different lengths and shapes. The connecting elements are magnetic plates in the shape of circles, which are 12 mm in diameter. There is a rectangular-shaped working place with the dimension of 30 by 40 mm (Figure 1). Two basic shapes were used in order to give students the opportunity to be able to create some smooth shapes by using semi-circular and sharp forms with straight-formed elements. On the other hand, it was decided not to add other forms in order to not confuse students, and provide the opportunity to continue their ideas on drawings.

Students from undergraduate and Master's courses from Cracow University of Technology (CUT), and students of similar courses from from Eurasian National University (ENU) that are studying via a bilateral agreement between CUT and ENU, studying by a bilateral agreement or Erasmus programme in CUT participated in this study. The research methodology involved observations, surveys, personal interviews, and the analysis of factors affecting the students while they were working with the model, such as the level of tiredness, age, number of elements, etc. The results show that this technique of searching for conceptual architectural forms is an interesting trend which, in turn, influences the development of visualisation, spatial and figurative thinking of students.

RESEARCH METHODOLOGY

During the study, students received brief instruction about how to work with the model, analogies and summary information about how architectural concepts usually develop, etc. Students also were instructed about the safety regulations while working with the model. Volunteers from every group were invited to work and to find conceptual forms. In this process, the volunteers were asked to *play* with the model and try to find as many conceptual forms as they could. In this case, in the author's opinion, they could develop new shapes and realise that such a simple element as a semicircle might be used in different combinations and positions.

After finding some new forms, volunteers took part in a survey. The survey format was as follows:

The total number of respondents: 30 students.

1. Did you enjoy working with the model? yes - 27, no - 3;

2. Do you have any suggestions or preferences for working with the model?

   adding more elements;
   adding different shapes of magnets;

3. If working with this model were to be included in the architectural programme of the educational process, in your university - would you choose it? yes - 29, no - 1.

After this assignment, the students were asked to take pictures of their developed forms from different perspectives and a view from above, and try to assign functions for the building, based on the form of each image (Figure 2).

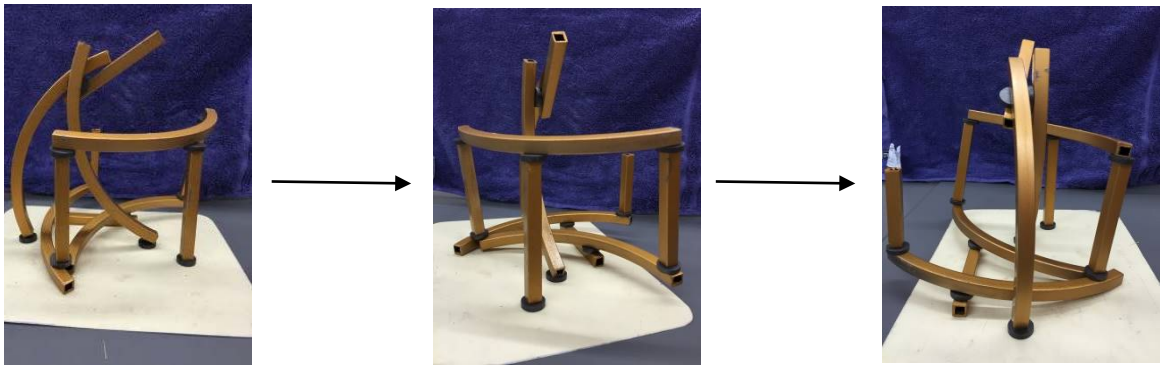

Figure 2: The process of finding the functions for one form. From left to right: one form - three functions: 1) theatre; 2) cinema centre; and 3) art gallery (by the author).

Also, some students were invited to continue the concept and do fast sketches. According to one student's idea, the building was a structure that consisted of large diametric pipes through which people could move inside and outside the building. Additionally, it had special places for having a rest, stairs and lifts for older people; it had pools and a *glass ball* pool where visitors could swim and see the surrounding areas of the building (Figure 3). Students also got to practise and develop their presentation skills, as they were asked to explain their conceptions by describing the features of their forms. This approach provided a good opportunity to express their idea more clearly in a peer environment.

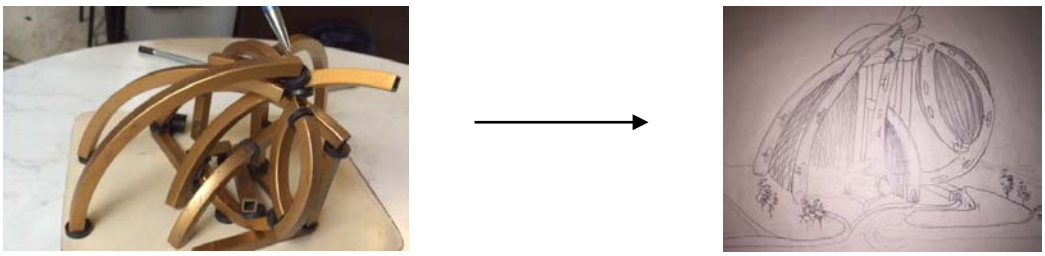

Figure 3: The process of transforming the model's form to the conceptual design project's form (by the author).

For the purpose of diversifying the task, the students were asked to work in different architectural styles by creating one simple form or element which is a feature of one style and, then, they tried adding other elements and changing this form into another one representing a different style.

As a method of work during observations, cooperation and teamwork were offered. However, most students of architectural specialties are individual persons for whom work in a team is not always easy. During observations, two or three students were asked to take only one working plane and try to *play* with it. One student had to add magnets and straight elements, another had to use only semi-circular elements, etc.

RESULTS

During the first experiment, it was revealed that the first courses caused fatigue after the first attempt, and it was assumed that such feelings were due to the absence of a programme that would gradually complicate the tasks of searching for the forms. Also, the time factor was disruptive. The students had to make forms and find functions in a short period of time. Thus, strict requirements were essential in all exercises, in order to see how many forms each student could find and how long it takes to complete each exercise. It was also revealed that after the end of searching for a form and starting to build a new one, students who had elements from the first form on the working planes were diverted to these elements and could not concentrate on a finding new elements.

When considering these factors, the programme developed by the author was offered, according to which work assignments gradually became more complicated, and took into account the factor of time between each task. According to the personal interviews, the working process on the proposed programme was successful for subsequent groups of students as they did not feel tired and large numbers of forms with functions were created.

By working with subsequent groups, it was determined that a large number of elements was not an advantage but, on the contrary, the students were confused and could not concentrate on the forms. According to the surveys and individual interviews, the optimal number of details was approximately 15-20 pieces, comprising 5-6 pieces of each type of element. Further, the students were asked to *shake* the working plane with the model. This action was supposed to give the students an adumbration about the structure, as well as its carrying and supporting elements.

DISCUSSION AND FUTURE WORK

The factors present in the first group of students, such as fatigue, confusion and the lack of interest were not revealed before the implementation of the suggested programme. Taking into account the results of observations, surveys and individual interviews, the author has developed and expanded the final version of the programme:

Exercise 1

Constructing a simple 2D or 3D shape as the arch, geometric shapes, etc (Figure 4):

In this stage, the observer observes, whether the student is acquainted with the instruction by using the model.

Exercise 2

Building a simple 3D composition consisting of three or more elements (Figure 5):

During of this exercise, the observer observes the level of the student's basic skills of composition and harmonious combination of elements; and makes recommendations on how to improve the basic compositional skills of student.

Exercise 3

Building a complex shape consisting of three or more elements; then, to make it more complicated by adding more elements, with the requirement that the form has to be aesthetic and the structure stable (Figure 6):

At this stage, the observer elicits the levels of critical and creative thinking of the student, by the way he/she combined the elements and on the way the elements are installed and fastened together; and makes recommendations on how to see simple shapes and forms from different perspectives.

Exercise 4

Taking a picture from four perspectives of this form and one from above, considering each picture and trying to give the function for the building based on the form of each image:

At this stage, the observer elicits the level of spatial and visual thinking of the student, his/her level of creativity, diligence in looking at the pictures and intensity to associate that form with others which the student has seen before, he/she can take the opportunity to improve spatial and creative thinking skills (Figure 3).

Figure 4: The form built according to Exercise 1.

Figure 5: The form built according to Exercise 2.

Figure 6: The form built according to Exercise 3.

CONCLUSIONS AND RECOMMENDATIONS

The author has described working on the transformed model with reusable elements. Students from undergraduate and Master's courses from Cracow University of Technology (CUT), and students of similar courses from Kazakhstan, Romania, Spain and Malaysia studying by a bilateral agreement or Erasmus programme in CUT participated in this study. The research methodology involved observations, personal interviews, surveys and the analysis of factors influencing students' performance, such as the level of tiredness, age, number of elements, etc. The results obtained revealed that the work with the model can affect the development of visual, spatial, critical and creative thinking of students. In this article, the author suggested her own programme that explains how to work on this model and improve conceptual design skills.

By using this approach, students can have a greater opportunity to see, touch and create new forms. These forms play the role of basic analogies, which can be redrawn by students and changed on drawings.

This model is only a suggestion and a test exercise for the development of visual, creative and spatial thinking of students. In the near future, it is planned to continue this research by offering students an opportunity to create conceptual forms, then, offering them a chance to redraw these forms from different perspectives and, finally, to try use them like a basic form for the design project.

It is anticipated that this model and the additional programme will be helpful for novice students to develop their own way of creating and finding new forms; hence, creating a good impact for theirs design skills.

Based on the experience gained, a set of recommendations may be proposed as follows:

- After searching for each form, it is strongly recommended to clean the work plane from all the elements;
- Between each task, the students have to have two-three minutes of rest;
- The proposed number of details for each student is 15-20 pieces. It is proposed to increase the amount of elements gradually, taking into account factors, such as the age of the student and the speed in increasing his/her skills;
- It is proposed to *shake* the form together with the working plane. In this way, a test checking of the structures is generated, as well the opportunity for the student to get a rough idea about the elements that are carrying and the elements that are supporting the others.

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Figure 7: A group of 1st year students of Bachelor of Landscape Architecture (CUT 2015/16), with Professor Sabina Kuc (seated right) supervisor of the author (photo by the author).

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BIOGRAPHY

Ms Assel Pazylbekova is a Year 1 Master's degree student in the Faculty of Architecture at Eurasian National University, based in Astana, Kazakhstan. Her research interests are in mobile and transform architecture, sustainable development and green economy. She has published three articles in these fields in collaboration with A. Toishiyeva (senior lecturer) and other teachers of this University. In addition, she has been awarded two diplomas for her research: first, the Diploma of II Degree for an informative report of the Republican Conference dedicated to the 50th Anniversary of Tselinograd Civil Engineering Institute, achieved under the leadership of A. Toishiyeva, and entitled: *Actual problems of architecture, construction and transport: state and development prospects;* and second, the Diploma of I Degree for a comprehensive report delivered at the International Scientific Conference of Young Scientists, carried out under the auspices of the VII Astana Economic Forum (Section VII architecture). The report was entitled: *Sustainable development and green economy in the Republic of Kazakhstan: current state and prospects of development*; and was realised under the leadership of A. Toishiyeva. In 2016, Ms Pazylbekova won the first prize at the Science Slam - Kazakhstan, held by the Foundation of the First President of the Republic of Kazakhstan - Leader of the Nation. The award was based on her presentation of a project entitled *Convertible Working Model for the Conceptual Design Process* that was supervised by Professor Sabina Kuc at Cracow University of Technology, Kraków, Poland.