A Smooth Introduction to BIM in Interior Design Studies

The reversed ‘in steps’ design procedure.

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This article presents a specific description and findings in teaching architectural computing using 3D modeling software at the undergraduate level of Interior Design Studies (second academic year). This paper is mainly concerned with the analysis of issues and advantages resulting from teaching design through the “modeling first” in the overall design practice. By “the reversed ‘in steps’ design procedure” we recognize the design process encompassing the idea of “form first”. We introduce BIM based modeling to Interior Design students at the undergraduate level through “in steps” procedure, which is the opposite to typical CAD procedures. With 3D model based method, the beginning of the design process by making the abstract, conceptual designs, and later translating it into design solutions are made possible. The use of BIM technology not only gives architecture, engineering, and construction professions tools to more efficient collaboration but also provides inventors such as architects with complete and integrated tools for the entire design development.

Keywords: interior design, education, BIM, 3D modelling, visualization

In the two presented and analyzed here courses - Computer Techniques in Design 1, which is held in third semester of undergraduate studies and, as a continuation, Computer Techniques in Design 2 in fourth semester of undergraduate studies of Interior Design, we introduce ArchiCAD as, in our opinion, the most suitable software for Interior Design studies. ArchiCAD enables several outcomes - work with 3D model, renders of models, animations, scale plans, sections, elevations and schedules at any point of the design process.

By “the reversed (in steps) design procedure” we identify the design process encompassing the idea of “form first”- from spatial model to technical architectural documentation. It is the opposite to the traditional procedures used in architectural design, based on 2D plans for the design of buildings. The availability of 3D modeling currently integrated in the majority of architectural software helps to deal with the complexity of projects in the pre-construction level on wide variety of issues from conceptual ideology to mechanics, HVAC, costs of the designed buildings, construction management, efficiency, costs, optimized scheduling.

Our greatest intention is to build up student’s competences in architectural computing in steps. However, we propose certain reversal in the typical CAD instruction procedure. We begin with an
abstract play in virtual space and design by visualizations to a delivery of a full architectural project - by producing an architectural design presentation (plans, sections, elevations, schedules) using the same BIM software in two consecutive terms (3rd and 4th semester of Undergraduate Studies).

In this day and age three-dimensional digital modeling is a skill that needs to be incorporated in students’ education, to allow an adequate preparation to the professional world. Just like the traditional disciplines of drawing and architectural representation, computer graphics techniques rapidly evolved over the years, introducing several fascinating possibilities in architectural representation of designs. (Garagnani, Cattoli 2015)

The proposed reversal is aimed to construct a kind of a common conceptual platform between student and teacher and to develop engagement from the beginning of the design task:

“In an academic setting, the recipient of the training does not usually have enough background to challenge the trainer. They do not have a benchmark to measure the productivity of the software against, and most likely are happy with what the application can produce while in the same time face difficulty understanding all of its commands. The focus of the educator in this case should always be on the concepts rather than the specifics. A lot of high level ideas about computing and database views and queries might be necessary in order to insure the comprehension of why things are the way they are and why do they behave the way they behave. A usual course at the undergraduate level will be delivered in a 15 weeks semester. The knowledge has to be divided into smaller digestible portions for the students to follow successfully.” (Magdy, Ibrahim 2014)

Therefore, at the preliminary level of BIM use and student’s first steps with 3D modeling (3-rd semester of Undergraduate Studies), the introduction to design by modeling is kept on the conceptual and playful level without getting into technical architectural documentations. The above mentioned course assignments are made purely in virtual space using BIM software -such as ArchiCAD, to get students used to thinking and designing in a 3D.

One of the greatest benefits of BIM technology, is the 3D visualization, which is integrated into the process of making the project documentation. A 3D model that is created with BIM is more precise than a model that is generated afterwards from 2D plans. Such 3D model can be used for visualization at any stage of project development.

“Despite the rapid adoption of BIM in architectural practice, different views about BIM in architectural education exist in academia (Cheng 2006; Seletsky 2006). Ibrahim (2007) argues that the viewpoints were either underestimating the rapid conversion of the workplace into BIM, or ignoring the fact that learning is a process of adding up knowledge in a layered manner.” (Wei 2010)

It become obvious that BIM technology speeds up the process of architectural visualization and positions images of designed objects on equally beneficial level with technical graphic representation of projects (plans, sections, elevations, schedules) and 3D model is inseparable element of such documentation. Furthermore, the growing importance of architectural visualization is developing and changing to be more interactive. There are several ways to create more interactive and immersive visualizations from BIM models, such as animations and movement through designed space, different views. All of this is becoming essential and beneficial to student’s design development process.

The creation of a building model with BIM technology is based on parametric rules, which make sure that the model is correct, according to various criteria. This ensures that the 3D model has less geometrical and alignment errors. When changes are made to the model, there is no need for designers to check if the alignment in every view is correct. In addition, accurate drawings can be created from any view or of any specific object in the model. Compared to traditional CAD drawing technology, this reduces the amount of time and number of errors significantly by updating changes in every view automatically. (East-
“Hence BIM is high on agenda and it is a real need to prepare students to meet the growing challenges of industry and technology, a new concept of interdisciplinary design process simulation course based on BIM has been proposed. It is planned to continue the idea of teaching by “simple steps towards complex results”. (Kepczynska-Walczak 2016)

Surprisingly, BIM technology, although more complex than the traditional CAD software, becomes very suitable at the undergraduate levels, even in teaching basic architectural design courses. Integration of different design data that is produced while using BIM becomes a ‘playful’ value and becomes an aspect that enables students’ deeper involvement in the design ‘game’.

Many educational specialists over the years have turned their attention to the constructivist learning models (Taxén 2003), emphasizing students’ active construction of their own subjective understanding (Twomey Fosnot 1996). Constructivist pedagogies have been successfully used in learning situations where the acquiring of a deep comprehension of a subject is required, even if they seem to be less suitable for memorization (Von Glasersfeld, 2001). Thus, the easiest way to encourage reflections is by having the learners talk with their teachers about what they are thinking, joining a problem solving conversation that emphasizes the so called Joint Productive Activity (Stoll Dalton And Tharp 2002), in which educators and learners produce together. In order to describe a teaching approach similar to this one, results of an academic course in computer graphics applied to the architectural modeling are below presented.” (Garagnani, Cattoli 2015)

In order to discuss these issues in academic curricula, two courses have been described below. Our case studies are two curriculum subjects concerning virtual modeling - Computer Techniques in Design 1 and Computer Techniques in Design 2 in the third and fourth semester of undergraduate studies of Interior Design. Educational objectives of these courses are:

1. Testing basic principles of creating spatial forms and architectural interiors in the virtual space.
2. Teaching the essentials of BIM software and basic principles of making 3D models and their visualizations.
3. Accomplishing the ability to present designed spatial compositions and architectural interiors.

Here modeling process involves:

- Establishing clear aims;
- Providing an examples;
- Exploring thinking - teachers and the students;
- Demonstrating the process;
- Working together through the examples;
- Providing an opportunity for students to work themselves;
- Drawing out the key learning.

COMPUTER TECHNIQUES IN DESIGN 1
ASSIGNMENT # 1 - SCULPTURE IN 3D
The task is to design a spatial abstract form and make two visualizations in ArchiCAD.

Sculpture should be characterized by high artistic values and derive from the author’s emotional and meaningful intentions. The final shape depends...
on the discussed with the teacher concept and the progress of work. The whole form should fit in a 30 x 30 x 30 m space and should be placed on a 30 x 30 m base, as seen in Figure 1, 2 and 3.

In the presented form, student is expressing his or her attitude towards it, giving it a certain assessment, not only giving it a material form, but also encoding some emotions in the work (his subjective experiences) caused by the aspects of reality. From this one can conclude that every human information about the world around has an emotional value. The perception of any form contained in the surrounding space evokes certain emotions that are adequate to form. Exploration of three-dimensional space with three-dimensional solids is one of the fundamental architectural activities. Typically, this type of investigation is part of the conceptual design phase and is implemented using sketches of drawings and physical models. However, this type of action is also possible in three-dimensional computer modeling, without experiencing real limitations of matter. At the same time, at the conceptual stage of design, when formal values are blurred, computer modeling can be implemented intuitively. Simple operations on basic shapes allow one to create an architectural sculpture - a form with a specific emotional impact.

The aim of the exercise is to combine means of composition and selected emotionally apprehensible assessments, such as: dynamism, monumentality, lightness and massiveness.

ASSIGNMENT # 2 - INTERIOR WITH THE WINDOW AND THE SEAT

The task is to design the conceptual 3D model of an abstract interior with a window and a seat and make two visualizations in ArchiCAD Interior should be characterized by spatial and artistic values, as shown on Figure 4.

These divisions are the result of both the differentiation of functional processes and formal assumptions adopted by the designer. Determining the form of the object requires knowledge of the principles of using such composition means as: geometric characteristics of the form, divisions, weight ratios, rhythm, symmetry, accent, color, texture, proportions. The task is to design an architectural interior, characterized by high spatial and artistic values, and emotional expressiveness defined by the author. You should apply basic solids and operations such as moving, scaling, rotating, trimming, extruding and adding. The size and number of objects depends on the concept adopted. In this assignment the inhabitation of abstract space is introduced by the use of elements such as seats and windows (for human scale).
COMPUTER TECHNIQUES IN DESIGN 2
PROJECT OF A SMALL APARTMENT FOR TWO PEOPLE

The task is to design an apartment for two people based on the existing overall plan and a given program. Final presentation of the design includes 3D model in ArchiCAD and physical presentation board including scale drawings - plans, sections and visualizations which can be seen on Figure 5.

My intent was to present the ‘reversed’ methodology in design studio teaching using BIM application. The “in steps” procedure introduces BIM based modeling to Interior Design students at the undergraduate level, but ‘from the end’, beginning the design process with making the abstract, conceptual designs, and later translating them into design solutions. All within BIM, even though the courses and this presentation focus more on 3D modeling & visualization rather than the currently present essence of BIM (Building Information Modeling). Teaching conceptual design with BIM tools and using the most efficient and effective design software is not a matter of choice anymore. As architectural teachers, it is our responsibility to introduce students to most suitable design computing possibilities available right from the start. It is trainer’s responsibility to help student’s realize, that what they design is not a set of plans and sections, but a spatial 3D model of an actual form and spatial relations.

Although BIM is not the main theme of this paper, it has to be highlighted how computer models, reliable and always up to date graphical data sets are paramount into its culture in order to reach higher quality, reliability, optimized scheduling, errors and costs reduction together with avoidance of any possible misinterpretation by different team members involved in the design process. When a computer gen-
reated model embeds precise geometry and relevant data needed to support the construction, fabrication, and procurement activities, it is supposed to be a BIM Model and the interactions with it by various figures determine a BIM process. (Garagnani, Cattoli 2015, Eastman, Teicholz, Sacks And Liston 2008).

Among other professions, architects are involved in BIM - 3D model based process that gives architecture, engineering, and construction professions (AEC) tools to more efficient collaboration. Let us not forget, that architects not only depend on the cooperation with other professions, but most of all begin the whole process. The issues concerning creative formation of the projects are often underestimated and majority of attention is given to matters concerning alliance of professionals involved in BIM design to improve and effectively organize the whole building process in order to enhance management, efficiency, costs, optimized scheduling.

For that reason, I decided to present issues and advantages resulting from teaching design through the “modeling first” in the overall design development with the use of BIM software.

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