Educational issues

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Contemporary architectural practice – a challenge for educational process
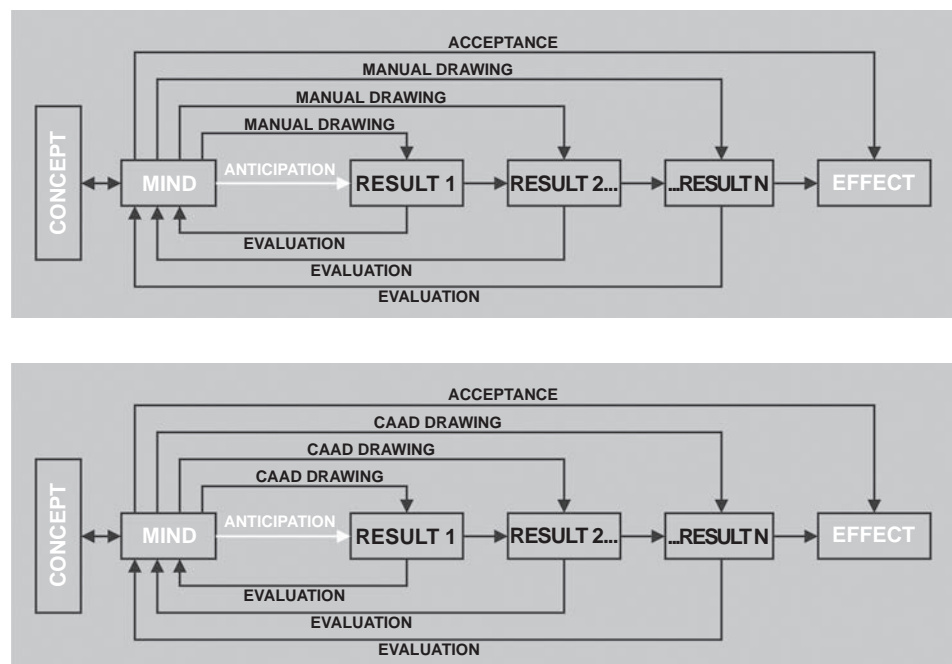

Fig. 1. The process of the project creation on the basis of traditional architect's practice – freehand or computer drawing (by authors)

Builders used drawings from the earliest times. The statue of the Sumerian ruler of Gudea (circa 2500 BC) – kept in the collections of the Louvre Museum – who is sitting on the throne and keeping a drawing of the temple plan on his lap can be considered to be the oldest drawing representation of the structure. Ancient civilizations con-tributed to the development of mathematics and geometry as well as the studies on proportions and in this way they set the trends of architectural thought development for the next centuries. The Roman creators of architecture com-monly used drawings of projections and facades. In order to make the communication with clients easier, some of them tried to present a project by means of perspective drawings. Such a method of presenting the space devel-oped and was popularized only in the period of the Ren-aissance.

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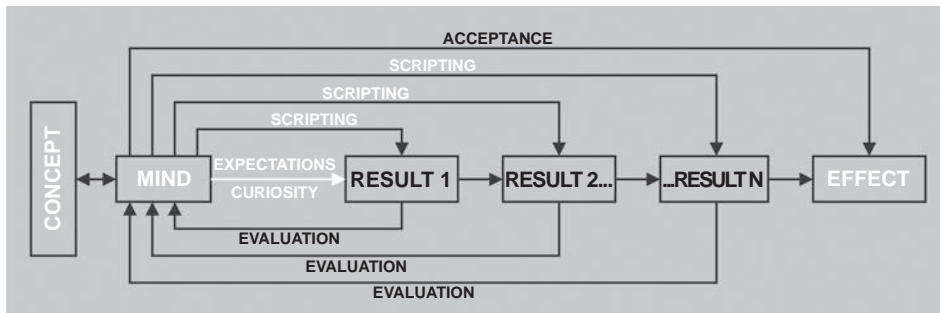
Fig. 2. The process of the project creation on the basis of parametric and generative methods (by authors)
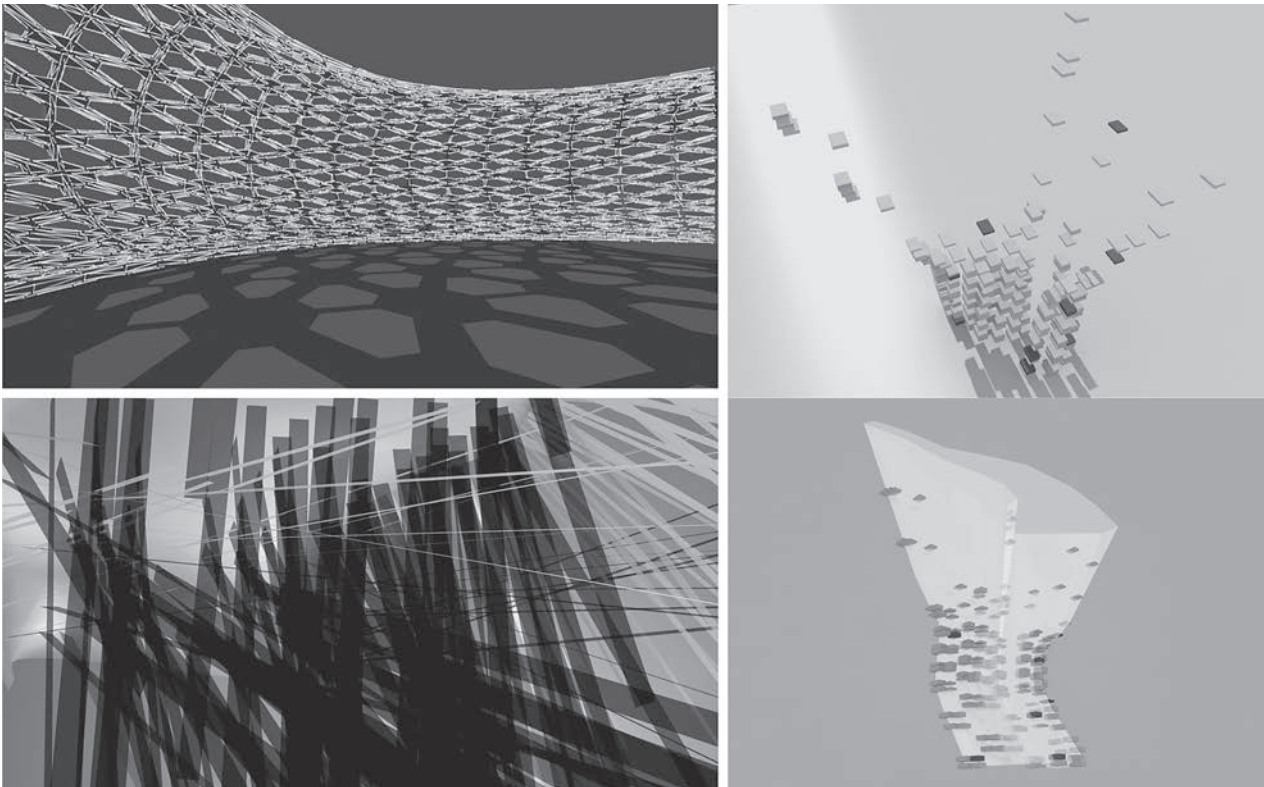

Fig. 3. Designs of IAiU students created during the first workshops (by authors on the basis of students' designs)

The architect was responsible not only for the project but also for its realization. He lived and created in the direct contact with constructions, materials and the process of actual building. Architects, who not only designed buildings but also used their profound knowledge and numerous skills in painting, sculpture and widely-understood engineering, performed a particular role in the period of the Renaissance. Dissonance between aesthetics and technology appeared only in the 19th century. S. Giedion confirms that a particular feature of the architecture of that period was isolation from technological development, in which he observes the manifestation of a division into architects and constructors[1] [1, 3]. From that time, architects were concerned with designing and construction engineers dealt with the realization of projects. Thus, no wonder architects were associated first of all with a drawing board, T-square and pencil until recently.

The process of creating a design can be regarded as invariable through centuries. It consisted in presenting the concept, which was first commenced in the architect's thoughts, in form of flat drawings. The eye and hand were responsible for the most precise imitating of the expected effect. Basically, this method has not been changed even after the introduction of programs which aid designing (Fig. 1). It should be explained that initially CAD abbreviation stood for Computer Aided Drafting or drawing. In other words, architects started using electronic drawing boards. The moment the systems were developed to the level of spatial modelling, the letter D was extended to designing.

Apparent simplicity of operating the programs, which dealt with composing simple objects with ready-made elements and with the possibility of seeing them in 3D (without the necessity to have the knowledge of descriptive geometry as it used to be) gave the impression that at the beginning of the 21st century it was possible for everyone – at least in theory – to become a creator and designer ('design your garden!'). Fascination with spatial model-

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[1] Giedion S., *Space, time and architecture*, Harvard University Press, Cambridge 1959, pp. 209–216 (chapter „The schism between architecture and technology").
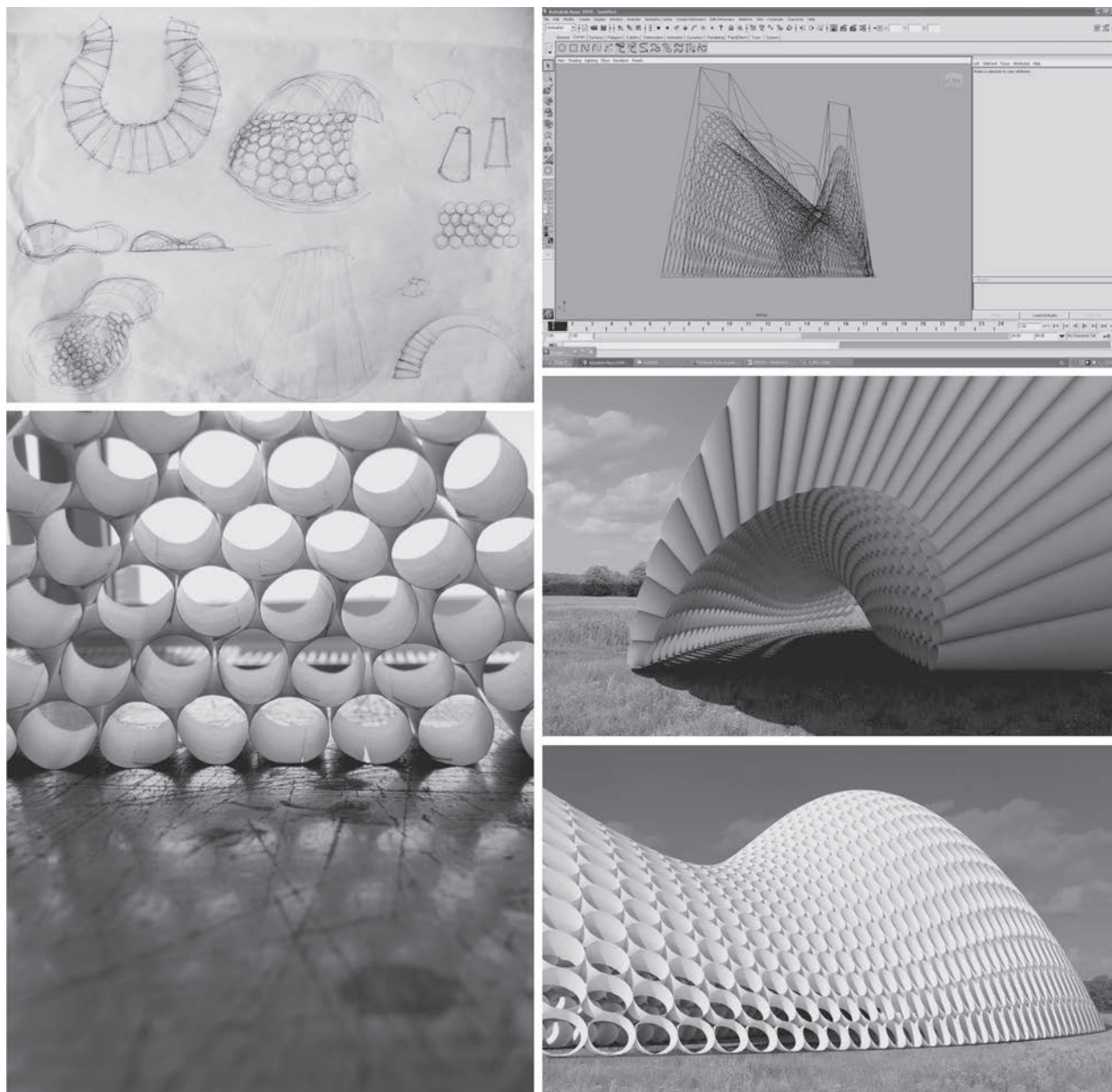
Fig. 4. Designs of IAiU students created during the second workshops (by authors on the basis of students' designs)

ling, visualisation and creation of technical documentation programs even made some people draw conclusions that 'thanks to new technologies architecture shall not be the faculty of university of technology any longer but it will come back to the academy of fine arts'[2] [4, 7].

During the recent years, numerous studies have been written about new possibilities which are provided for architects who use computer aided architectural design[3] [14]. Advanced tools and CAAD software, which in fact is within each contemporary designer's reach, allow creating and describing complicated forms and constructions[4] [8]. Thanks to new technologies, which made 3D designing possible, architects who solve complex spatial problems do not have to use complicated models as Antoni Gaudi used to do who constructed vault inverse systems by means of cords and plummets[5] [11]. Modern architects have at their disposal a wide range of programs which support designing, management, realisation and exploitation of the structure. BIM programs (Building Information Modelling) support not only the creation and transforma-

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[2] Knap J., *Wirtualny architekt*, Wprost No. 28/2001 (972).

[3] *Inter alia*: Świt-Jankowska B., *Współczesne narzędzia pracy architekta, a jakość nowo projektowanej przestrzeni mieszkalnej*, ARCHITECTURAE et ARTIBUS, No. 2/2010, pp. 79–85; Krzaczek M., *Inteligentny Modeler Graficzny w komputerowych systemach wspomagania projektowania budowlanego*, typescript, Politechnika Gdańska, 2004; Górska A., *Integrating CAD and Manual Design Methods for Visual Science*, „Materiały Seminarium Geometrii i Grafiki Inżynierskiej", Script 8, Gliwice 2000, pp. 14–19.

[4] Kocaturk T., Veltkamp M., *Interdisciplinary Knowledge Modelling of Free-Form Design – An Educational Experiment*, [in:] Martens B. Brown A. (eds.) *Computer Aided Architectural Design Futures 2005*, Springer, Dordrecht 2005, pp. 465–474.

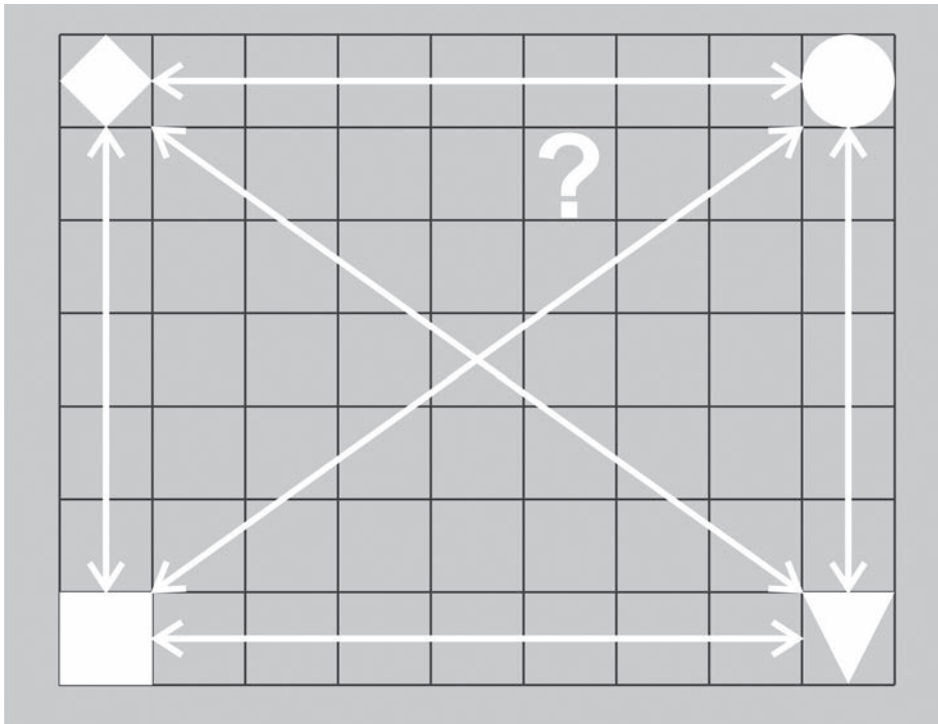[5] Moravanszky, A., *Antoni Gaudi*, Arkady, Warszawa 1983, pp. 26–29.

Fig. 5. Matrix illustrating the problem of designer's imagination limits. The arrows indicate transformations of figures. With appropriate software, we are able to obtain the shape which ought to be in the square with the question mark. But are we able to imagine it before we see the result on the screen? (by authors)

tion of geometry in the computer environment but they also control the construction of the structure, quantitative, materials, areas and cubage statements. Architects can also operate new methods of communication and information transmission, which are different from the old ones.

This breakthrough that we have been witnessing nowadays consists in another transformation of the architect's work. It is connected with a fluent transition from the design phase to its realisation, which is carried out totally on the basis of the digital platform. It is possible thanks to scripts (i.e. a kind of the computer programming language), which has been a domain of computer technologists and programmers. In this way, architects are faced with new challenges. 'In generative methods the architect does not directly model the form (…). In spite of this, the form is generated by the computer, while the architect controls it by means of a code or script. The designer's work starts resembling the work of the computer programmer very much (…). It consists in writing a computer program'[6] [12]. Moreover, designing of this type requires a high level of mathematical knowledge which in most cases the graduates from architecture schools do not have[7] [13].

For the first time in the history of architectural designing the process of creation is changing so diametrically. A different cognitive model appeared – digital continuum – smooth transition between architectural designing, engineering and realization. This introduces new conditions and dependencies between interdisciplinary domains which are connected with the designing process. With the

usage of generative methods, designing does not consist in imitating a vision which was intended by the architect. It rather constitutes a quest for computer generated forms and their transformations until a satisfying effect is achieved. At the same time, the forms, which were not possible to be achieved, became feasible thanks to the usage of generative methods of designing (Fig. 2).

Faculties of Architecture of Warsaw and Wrocław Universities of Technology are proud to have introduced the newest solutions to the didactic process. Also in the Institute of Architecture and Urban Planning of Łódź Technical University some actions were taken up in this matter. Already in 2007 computer work-rooms were equipped with Autodesk Maya Complete 8.5 software. In the same year, similarly to the next years, several-day workshops of generative programming were organized in which invited foreign lecturers as well as designers from well-known architectural studios such as SOM – Skidmore Owings and Merrill oraz Zaha Hadid Architects took part.

At that time these precursory actions were carried out additionally to the obligatory schedule of classes. They aroused a lot of interest and a wide response from students. Unfortunately, so far this aspect has not been taken into account as regards the program of education.

During the first workshops, students were familiarised with the possibilities of Maya program and MEL script language (Maya Embedded Language). They experimented with simple software and checking effects in the virtual space. Later, they tried to write a script in order to achieve a spatial form in a control way – assumed *a priori* (Fig. 3). During the second edition, the participants had an opportunity to experience a real designing process a bit – from the idea, through its development, to the realization of the designed structure. It should be emphasized that thanks to such workshops, students are able to understand

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[6] Piasecki, M., *Architektura generatywna*, http://www.sztuka-architektury.pl/ (access: 13.10.2010).

[7] Pottman H., Asperl, A., Hofer M., Kilian A., *Architectural Geometry*, Bentley Institute Press, Exton 2007, pp.i–iv.

the concept of generative designing but it requires a lot of time and exercises to acquire skills allowing them to operate the software fluently. The results of the workshops depended on the skills in using a new tool which aided designing and to a lesser extent on spatial imagination as well as a designer's concept (Fig. 4). It is not the case with CAAD 'traditional' software in which limited possibilities of the program along with the lack of skills in operating it did not allow visualization of the idea and imagination[8] [6, 15].

In consideration of the above, an appropriate introduction of programs which support designing in the education of future architects acquires particular significance. Unfortunately, it often happens that the so called 'CAD education' is identified with learning about a chosen computer program and this makes the students passive and unaware users of tools which they are not able to use in a complete way. In order to realise how challenging generative methods of designing are, it is enough to point out that a popular CAD application has about several thousand commands which an average user uses in 10 per cent only[9] [5, 9].

A digital revolution in architectural designing as well as CAD implementation in the construction industry are considered to be the most radical technological leaps in the history of architectural designing. This revolution requires from a designer algorithmic and procedural thinking as well as the skill of programming. The software is more and more complex and more difficult in operating. It also re-

quires a specialist and computer science knowledge from the user. In the nearest future, education of the architect will be based on computer studies to a much larger extent, similarly to a situation in other engineering domains[10] [5]. In other words, the requirements and skills, which modern designers need, result in the fact that architecture must again be connected with engineering more strictly, but this time with the domains of computer studies and automatics. Therefore, can we say that – as it used to be in the past, when no difference between an architect and engineer-constructor was to be found – it is possible that the difference between an architect and a computer scientist will gradually be blurred now? Where are the boundaries of architecture and designing? Are we able to predict the final shape that is expressed by means of mathematical parameters before we see its visualization on the screen (Fig. 5)? Who is the real author – a human being or a machine?

In the past, buildings used to be materialized drawings. At present, they are rather materialized digital information – designed and documented by means of techniques of computer aided designing. Buildings are also constructed thanks to the machines which are computer controlled (MAD – *Machine Aided Design*) [11] [10]. Thus, we should appreciate great masters like Gaudi who were able to imagine complicated spatial forms and carry out their projects without having at their disposal computer techniques, in this way creating works of art which permanently entered the history of architecture[12] [2].

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[8] Kępczyńska-Walczak A., *Contemporary Renaissance Architect – Yet Architect?,* [in:] Muylle M. (ed.), *eCAADe 2008: Architecture 'in computero' Integrating methods and techniques*, eCAADe/Artesis University College, Antwerp 2008, pp. 445–450.

[9] Kacprzyk Z., *Wirtualne modelowanie w projektowaniu*, II Krajowa Konferencja Naukowo-Dydaktyczna „Kształcenie na kierunku Budownictwo – problemy studiów wielostopniowych", Politechnika Świętokrzyska, Kielce 2005.

[10] Kacprzyk Z., op. cit.

[11] Mitchell W.J., *Constructing Complexity,* [in:] Martens B., Brown A. (eds.), *Computer Aided Architectural Design Futures 2005*, Springer, Dordrecht 2005, pp. 41–50.

[12] Cf.: Burry, M., *Digitally Sponsored Convergence of Design Education, Research and Practice*, [in:] Martens B., Brown A. (eds.), *Computer Aided Architectural Design Futures 2005*, Springer, Dordrecht 2005, pp. 3–40.

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[1] *Architectural Theory from the Renaissance to the Present*, Taschen, Koln 2006.

[2] Burry M., *Digitally Sponsored Convergence of Design Education, Research and Practice*, [in:] Martens B., Brown A. (eds.), *Computer Aided Architectural Design Futures 2005*, Springer, Dordrecht 2005, pp. 3–40.

[3] Giedion S., *Space, time and architecture*, Harvard University Press, Cambridge 1959.

[4] Górska A., *Integrating CAD and Manual Design Methods for Visual Sience*, „Materiały Seminarium Geometrii i Grafiki Inżynierskiej", Zeszyt 8, Gliwice 2000, pp. 4–19.

[5] Kacprzyk Z., *Wirtualne modelowanie w projektowaniu*, *II Krajowa Konferencja Naukowo-Dydaktyczna „Kształcenie na kierunku Budownictwo – problemy studiów wielostopniowych"*, Politechnika Świętokrzyska, Kielce 2005.

[6] Kępczyńska-Walczak A., *Contemporary Renaissance Architect – Yet Architect?,* [in:] Muylle M. (ed.), *eCAADe 2008: Architecture 'in computero' Integrating methods and techniques*, eCAADe/Artesis University College, Antwerp 2008, pp. 445–450.

[7] Knap J., *Wirtualny architekt*, Wprost, 2001, No. 28.

[8] Kocaturk T., Veltkamp M., *Interdisciplinary Knowledge Modelling of Free-Form Design – An Educational Experiment*, [in:] Martens B., Brown A. (eds.), *Computer Aided Architectural Design Futures 2005*, Springer, Dordrecht 2005, pp. 465–474.

[9] Krzaczek M., *Inteligentny Modeler Graficzny w komputerowych systemach wspomagania projektowania budowlanego*, typescript, Politechnika Gdańska, 2004.

[10] Mitchell W.J., *Constructing Complexity*, [in:] Martens B., Brown A. (eds.), *Computer Aided Architectural Design Futures 2005*, Springer, Dordrecht 2005, pp. 41–50.

[11] Moravanszky A., *Antoni Gaudi*, Arkady, Warszawa1983.

[12] Piasecki M., *Architektura generatywna*, http://www.sztuka-architektury.pl/ (access: 13.10.2010).

[13] Pottman H., Asperl A., Hofer M., Kilian A., *Architectural Geometry*, Bentley Institute Press, Exton 2007.

[14] Świt-Jankowska B., *Współczesne narzędzia pracy architekta, a jakość nowo projektowanej przestrzeni mieszkalnej*, ARCHITECTURAE et ARTIBUS No. 2/2010, pp. 79–85.

[15] Yüce Gün O., *Anti UV: Progressive Component Design in Cross Platforms*, [in:] Muylle M. (ed.), *eCAADe 2008: Architecture 'in computero' Integrating methods and techniques*, eCAADe/Artesis University College, Antwerp 2008, pp. 69–75.

Współczesny warsztat architekta – wyzwanie dla procesu dydaktycznego

Czy rzeczywiście istnieje architektura bez granic? Zależy jak zdefiniujemy to pojęcie. Czy granicę stanowi wyobraźnia?, zdolności rysunkowe?, wykonalność projektu?, umiejętność obsługi programów komputerowych wspomagających projektowanie?, ograniczenia oprogramowania CAAD?, a może jeszcze coś innego?

Współczesne pokolenia architektów dla rozwoju zawodowego i osiągnięcia sukcesów potrzebują wiedzy i umiejętności wykraczających poza zakres tradycyjnego warsztatu projektowego. W czasach renesansu architekci nie tylko projektowali budynki. Swoją głęboką wiedzę i liczne umiejętności wykorzystywali w malarstwie, rzeźbiarstwie, szeroko pojętej inżynierii.

Obecnie projektanci, podobnie jak wówczas, penetrują niezbadane rejony architektury i sztuki, stając przed wyzwaniami, jakie stawiają przed nimi nowe rozwiązania technologiczne.

Dzieła największych współczesnych architektów nie mogłyby powstać bez zaawansowanych technologii komputerowych. Należałoby postawić pytanie: Czy technologie CAAD nie wyprzedzają wyobraźni kreatora, podsuwając/dając gotowe rozwiązania? Jakie w związku z tym są potrzeby i oczekiwania w stosunku do procesu dydaktycznego? Dla pełniejszego zobrazowania problematyki przedstawiono wyniki warsztatów zorganizowanych w Instytucie Architektury i Urbanistyki Politechniki Łódzkiej.

Key words: architecture, education

Słowa kluczowe: architektura, edukacja