

# THE BACKGROUND OF DIGITAL EDUCATION IN ARCHITECTURE

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For the source of today's digital education and practice of architectural design supported by information technology or computerization and parametrization of creative processes, one needs to look back into the distant past. Both Euclid's *Elements*, written in the 3rd century BC, and the analytical geometry and coordinate system, introduced in the middle of the 17th century by René Descartes in his *La Géométrie*, lie at the base of the changes we have today, resulting from the application of digital tools and programs. Understanding the principles of geometry, right from the beginning gave architects quick and intuitive access to the tools and programs used in CAD and in geometric digital modeling. Early vector graphics used geometric figures placed in a mathematically defined coordinate system. Computer drawings were created out of simple geometric figures, where segments, curves, circles and polygons were defined using parameters, for instance, in the case of a line segment – the coordinates of its end points, and in the case of a circle – the coordinates of its centre and radius. Primitives could also have defined attributes telling us about such things as the thickness and color of a line. Computer graphics of this type were first used in the 1950s on the screens of the *US SAGE air defense system*, but it is a PhD work done at the Massachusetts Institute of Technology half a century ago that is considered the moment when computer graphics techniques began to spread. The author of the work, Ivan Sutherland, in 1963, using the primitive transistor computer TR-2, created the first Sketchpad, today considered the prototype of contemporary CAD programs with GUI (graphical user interface). Sutherland proposed using computer graphics both for technical and artistic purposes. A few years later, also at MIT, a student of architecture, Nicholas Negroponte, organized the first *Architectural Machine Group* (1967 r.).

Within a decade, the foremost faculties of architecture had computer laboratories, so-called CAD labs, equipped not with one minicomputer but with groups of dedicated graphic computers, workstations, used for research and teaching CAD. Among them was the Harvard Graduate School of Design,

where, in 1967, Prof. Jerzy Sołtan took over the chair of the architecture department (which he held until 1974), and where a Laboratory for Computer Graphics and Spatial Analysis was created. The next computer laboratory, called Center for Land Use and Build Form, was formed at Cambridge by Prof. Leslie Martin, followed by Prof. Tom Maver's - ABACUS (Architecture and Building Aids Computer Unit) at the University of Strathclyde (1972.). The famous MIT Media Lab, directed by Nicholas Negroponte was opened in the 1980s. At this time the first PCs with graphics capabilities become widespread: IBM PC XT or Apple II, and John Walker started Autodesk and brought out the first version of the popular AutoCAD software application.

Computer laboratories filled up with personal computers with graphics software installed, used not only for research but for popularizing and teaching CAD as part of architecture curricula. Polish professors Stefan Wrona and Maciej Gintowt visited the Harvard University GSD where Professor William Mitchell was already introducing computers to design labs, providing wide access to all students. At the Faculty of Architecture of the Warsaw University of Technology, the first laboratory in Poland was formed, later to become the Department of Computer Aided Architectural Design (1989). In 1992, at the University of British Columbia, I initiated the first Virtual Design Studio (VDS) with the participation of many universities and colleges (GSD, HKU, ETH), including the Warsaw University of Technology (WUT). The growing integration of information technology in teaching architects and the spread of the Internet have allowed for the dynamic development of a network of international and interdisciplinary cooperation in the field of education.

The current spread of information and digital culture requires the novice, first-year students of architecture to have their own laptops and be possessed of basic familiarity with software. But before this state was reached, digital education in architecture passed through several stages.

In the first decades, the impact of computerization was limited, requiring large expenditures,

specialized means, such as workstations and technologically advanced groups working in laboratories. In the second stage, the growing popularity of PCs with graphics capabilities facilitated the expansion of laboratories and the introduction of classes using CAD software. In many colleges of architecture computers were located in places accessible to the public; computer culture was integrated with architectural design throughout the course of study and internet access increased. Now, in the third stage, developing high-speed wireless networks, spreading of basic computer literacy and, at the same time, introduction of technologically highly advanced machines for numerical fabrication and modeling enable us to keep up with new trends and be aware of a significant change in the paradigm of educating the architect based on digital tools (Fig. 1). Among the noticeable tendencies taking place at the Department of Computer Aided Architectural Design (PPAWK) of the Faculty of Architecture of WUT and in English-language studies at the Faculty's Architecture for Society of Knowledge (ASK), we should enumerate the following:

1. parametric design in the education of an architect,
2. simulation and modeling of experiments in design,
3. instrumentalization of design and numerically controlled production and fast prototyping using CNC and 3D printers,
4. designing of interactive architecture, which reacts to changes of natural and functional conditions with the use of sensors and actuators, needing an understanding of the principles of mechatronics and robotics,
5. developing a culture of geographically dispersed design cooperation in a network; characterizing the age of growing globalization of the knowledge society and the resulting from these conditions new, participatory role of the designer and user.

Will digital practice in the future be in accordance with the futuristic vision of Prof. Mario Carpo of Yale University: “*Machine, at some point, can make craft dominant again and craft means unpredictability, variability and decisions that are made on the fly, that can not be anticipated on blueprint*”<sup>1</sup>.

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<sup>1</sup> F. Gramazio, *Fabricate: negotiating design & making*, gta-Verlag, Zürich 2014, p. 11.