SCHOLAR ARCHITECT 2021

English edition

COORDINATOR: Anda-Ioana SFINTEŞ
TRANSLATED BY Florina TUFESCU

Editura universitară "Ion Mincu"
Bucharest, 2022

This volume is the full translation of **Scholar Architect 2021**
(Romanian edition) ISBN: 978-606-638-231-1
https://doi.org/10.54508/9786066382311
First published 2021 (Romanian edition) by Editura universitară “Ion Mincu”

Developed within the framework of the **SCHOLAR ARCHITECT** project
“Ion Mincu” University of Architecture and Urban Planning

www.uauim.ro/cercetare/scholarh
www.facebook.com/scholarhuauim

© COORDINATOR: Anda-Ioana SFINTEȘ

© AUTHORS: Magdalena STĂNCULESCU, Oana Anca ABĂLARU OBANCEA, Anda-Ioana SFINTEȘ, Ionuț ANTON, Ana Daniela ANTON, Andrei MITREA, Dana MILEA, Ioana Elena ZACHARIAS VULTUR, Adrian MOLEAVIN, Marian MOICEANU, Tiberiu FLORESCU, Simona MUNTEANU, Georgică MITRACHE, Horia MOLDOVAN, Melania DULĂMEA, Anca MITRACHE, Niculae GRAMA, Dan MARIN

TRANSLATOR: Florina TUFESCU

DTP: Anda-Ioana SFINTEȘ / Diana RUSU

DESIGN: Anda-Ioana SFINTEȘ / Ioana BOGHIAN-NISTOR / Diana RUSU

COVER IMAGE: Diana RUSU

ISBN 978-606-638-246-5

https://doi.org/10.54508/9786066382465

Descrierea CIP a Bibliotecii Naţionale a României

Scholar Architect 2021 / coord.: Anda-Ioana Sfinteş;

translated by Florina Tufescu. - English edition. -
Bucureşti: Editura Universitară “Ion Mincu”, 2022
ISBN 978-606-638-246-5

I. Sfinteş, Anda-Ioana (coord.)

II. Tufescu, Florina (trad.)

72

editura.uauim.ro / Tel.: 40.21.30.77.193

SCHOLAR ARCHITECT

The Romanian edition was developed within
the framework of the project

SCHOLAR ARCHITECT 2021
Improving the quality of research and teaching in architectural education

Project financed by CNFIS-FDI-2021-0069

The English edition was translated from Romanian within
the framework of the project

SCHOLAR ARCHITECT 2022
Research and implementation of new trends, innovations and experiments in architecture and related fields of education

Project financed by CNFIS-FDI-2022-0075

The Institutional Development Fund, Domain 5:
Improving the quality of teaching, including the
observance of professional and academic ethics

In contemporary architectural practice, the architect's role is in the process of renegotiation, in the sense of their direct and active involvement in computational design and digital fabrication. The use of digital tools enables designers to apply their knowledge and to re-establish their interdisciplinary credentials. Architects have started to actively develop their own design culture by customising working technology as part of their professional practice.

https://doi.org/10.54508/9786066382465.07

Digital tools

Univ. Assist. Ana-Daniela ANTON PhD Arch.
Assoc. Prof. Ionuț ANTON PhD Arch.

Interoperability and BIM design

Contemporary architectural practice explores the potential of digital technologies from the concept stage to materialisation, thus creating the need for communication between digital tools with different applications. The computational environment provides the opportunity of integrating design, analysis, representation, fabrication and assembly as parts of the same collaborative process. The aim of bringing information to the fore is to create a digital continuum (Kolarevic, 2005), a direct connection between the project and the built object. By establishing a common data flow, information can be extracted, exchanged, and thus used with greater ease and speed.

Digital tools, mathematics and coding

Regrettably, the architectural approach to technology, perhaps inherited from the modern period, has until recently focused on what it does (Heidegger, 1995), not on what it might do. Thus, architects have focused on what can be done within the limits of currently available technologies; constrained by the use of the existing standard technologies, they have attempted to master the capabilities of the tools employed and they have designed specifically for these. As a result of this process, the possibilities and advantages provided by a standard tool eventually became mere convenience through repeated usage while architects lost the control and freedom they formerly possessed.

Today's digital environment provides architects with more than a drawing tool, albeit a very advanced drawing tool. The computer can at present be regarded as an extension of the mind or as an advanced tool of logical exploration.

Prompted by the need to survive or by the thirst for knowledge, human beings have always attempted to build augmentations that would intensify physical strength, increase sensory capacity or amplify cognitive functions: memory, judgement, information processing, communicative competence (Marcus, 2011).

The computer is a means of combining the architect's experience and intuition with logical reasoning, skill with rationality. As a tool, it enables us attain a process that is richer in meanings by helping us give shape to our ideas. Concepts materialise; they are not yet tangible, but we can see, analyse and modify them, but with other tools, different from the manual ones. The role of the visual has increased due to the development of computer science, which has expanded the possibilities of approximating the invisible by means of the visible (Marcus, 2011), thus leading to the definition of matter through the abstract, through code.

In the field of contemporary architecture, mathematics and coding give the architect control over the way in which the building will be constructed yet they are also a means to invent. All digital technologies are based on numerical control, yet so are the standardised means of production. While numbers were initially used to control and to enforce standards, at present the qualities of the computational environment are being explored and they can generate diversity and creativity.

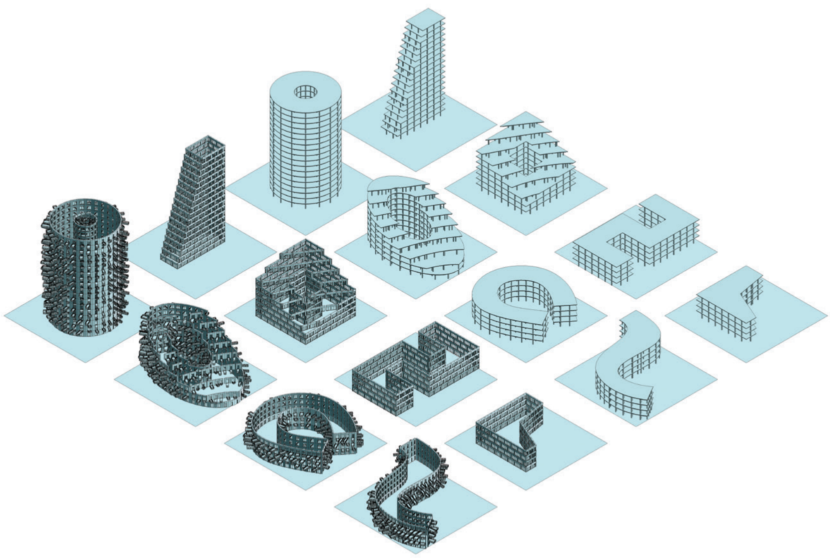

Fig. 1. Study for the workshop: Interoperability Rhino-Grasshopper-Revit – 2021

BIM

Building Information Modelling (BIM) is a digital model of the design intent which, in addition to a three-dimensional geometric description of the constructive elements, also has associated physical and functional characteristics of these elements. BIM is more than a simple tridimensional model that can be used for visualisation since it integrates elements from the different actors involved in the project and thus diminishes ambiguity, reduces errors, increases the architect's degree of control and, not least, lowers the financial cost of the investment (Pittman, 2005).

With the complete pre-realisation of the building in virtual space and the use of a common language where everything is tested and integrated, architecture may be said to have reached full allographic status. Yet with the use of BIM, the process is also autographic through the testing of possibilities, the emphasis on materialisation, which constitutes a return to craft (Picon, 2010). Thus we witness a transition from the representational model of the building, indebted to the allographic tradition of architecture, to a model that comes close to a simulation of the building process (Carpo, 2011). By means of BIM, materialisation becomes part of the design process, which means that the creation process is no longer linear but cyclic, with feedback loops. At present, fabricators can be involved in design and designers can be involved in fabrication (Kieran & Timberlake, 2003). The traditional hierarchical process of design and construction has become a field of interdependent relationships with the aid of computation.

Using this integrative principle enables the architect to become more involved in the materialisation of the project.

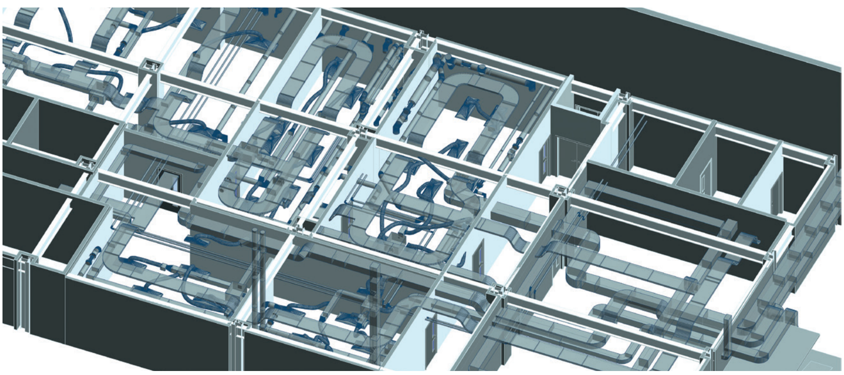

Fig. 2. BIM model, idz arhitectură, 2011

Although BIM seems to be a product of the virtual environment, it obviously contributes significantly to the materialisation of the project due to its anticipatory capacity. The designer has the opportunity of transforming the concept and of integrating data linked to materials and fabrication into the design, thereby generating an architectural object which is based on a much larger amount of information.

BIM is becoming an international standard, adopted by several countries and by an increasing number of architects. Its global spread is only a matter of time. Emphasis should not be placed, however, on its use for management and control and for standardising design but on the connection between the virtual and the real that BIM provides.

So to avoid its being turned into an automated design process which contributes to the multiplication of standard solutions that simply fulfil quantitative criteria of efficiency, there is a need for transformation into a more flexible process that allows for the development of customised solutions. Thus, BIM technology has already started to aim towards communication with other software – towards interoperability. It has also started to exploit the possibility of building customised components to replace the libraries of standard components.

Computational design

The current tools of computational design bring more abstract building components, a system that can be modified and adapted so as to allow the designer to build components specific to each situation. We are no longer interested in the local economy, imposed by restrictive systems; the designer now has the opportunity to define their own vocabulary, but only after understanding the abstract, algorithmic and geometric part (Aish, 2011).

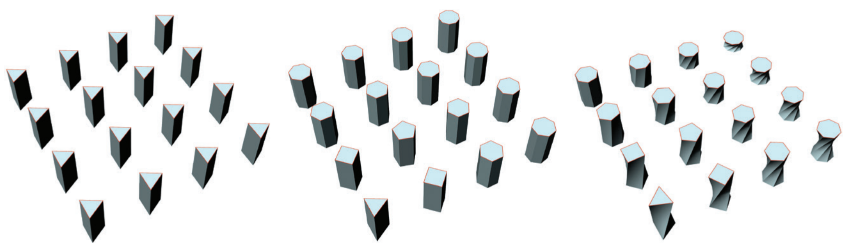

Fig. 3. (a) series of identical elements (b) series with a single variable (c) series with three variables. Parametric variation – 2014

Design is thus approached in more abstract terms, as relationships that interconnect principles of design. Programming can be a tool of the mind; it is not a purely technical act since its application to architecture can be a method for the symbolic communication of intentions (Reas & McWilliams, 2010). The digital model thus becomes an abstraction through the translation of intentions, by transposing them into algorithms.

This abstraction through code and algorithm has been deemed responsible for the exclusion of intuitive experience from design. This may be due to the fact that scripting has not been part of architectural design until recently. Most frequently, scripting has intervened in this field through the involvement of a programmer. Yet on the one hand, the architect must have some knowledge of coding in order to communicate while on the other, the code must be influenced by aspects that are specific to architectural practice (Burry, 2011). Thus, if they are used by the one who creates, by the architect, the tools normally deemed rigid are charged with attributes specific to design and they can become creative. The modification of architectural practice through the introduction of programming in modelling software offers a customised working process, providing both an environment for creative exploration and a productive and efficient method.

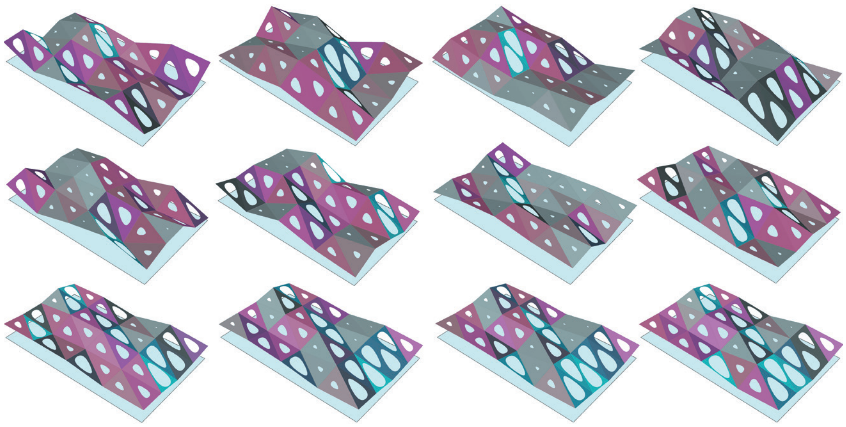

Fig. 4. Genetic algorithm – 2013

It is no longer the form to be produced that is designed but the production process itself. The project incorporates the idea and the method of fabrication from the moment of its conception. Thus, construction is understood as a process that is integrated into design, as it was during the era of craft production. Essentially, by integrating programming into architectural practice, digital tools are designed in their turn and the entire process is reoriented towards the materialisation of the project.

3D printing, robots and digital craft

Currently, digital tools, both design and fabrication, are increasingly explored in architectural research but also in practice, and they generate the connection of the creative process with the materialisation process.

Digital fabrication is now part of the design process and it encompasses conceptual aspects as well as aspects connected to the materialisation of the project.

The primary tools with applications in digital fabrication are archaic and essentially similar to those used by craftspeople in traditional production. These have been refined over time and changes have been made to the way in which they are set in motion and to control methods.

What is new in digital fabrication is that the tool is no longer variably controlled by a human being or repeatedly and precisely by a mechanised system but variably and precisely by digital means. The movement of the digitally controlled tool is defined by precisely set spatial coordinates, via logical sequences.

3D printing

The potential of 3D printing for the production of goods has been compared to the impact of the development of the internet. The spread of 3D printing is seen as another revolution in the area of goods manufacturing. The centralised form of production characteristic of the manufacturing environment is replaced by a decentralised one. The small number of giant corporations can be replaced, through the spread of 3D printing, by countless fab-labs. The large producers' control over resources can be replaced by the ingenious use of local, accessible and cheap materials. When the technology becomes widespread, the complex system of goods distribution will no longer be justified since the raw material will be accessible and the object will be manufactured close to the buyer. The only thing that will continue to circulate is information, the 3D model which transforms into an object.

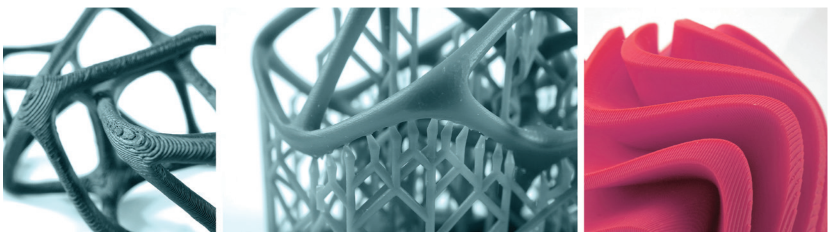

Fig. 5. 3D printed objects that use several technologies and materials – 2018

Industrial robots

Industrial robots have become of interest to the creative field due to their multifunctional character as well as to the low cost of developing different applications. A single robot equipped with a great variety of tools, of end effectors, can be used instead of several specialised machines. Thus, in using the same machine but with different tools, we come closer to the traditional manufacturing process in which the craftsperson's hand switched tools, depending on what was required (Brell-Cokcan & Braumann, 2012).

Robotic fabrication combines generic equipment with a personalised process, thus turning the robots into an open source fabrication tool. It is therefore the creation of interfaces accessible to users from the creative fields rather than the improvement of the robots' performance that has been acknowledged as the area of future development in the field of robotic fabrication.

What is significant is not the value of these machines or fabrication methods but the distancing from the determinist or neutral attitude towards materialisation. Moving towards an integrative model wherein materialisation, i.e. the way in which a project presents itself and occupies reality, becomes an internal component of the design process (FABLAB, Taubman College of Architecture, 2011).

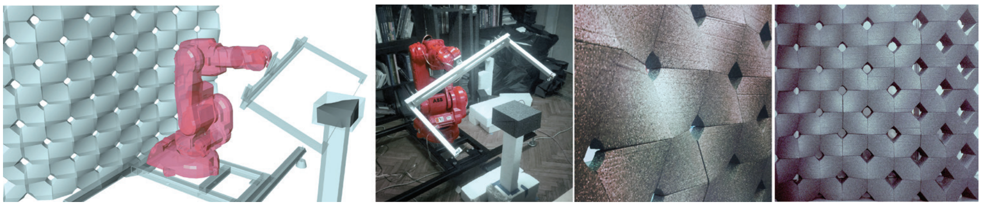

Fig. 6. ROBO_CRAFT WALL, robotic fabrication system – 2013

Digital craft

From the perspective of designers, technology has been perceived as inflexible, forcing them to work with the available. Until recently, architects merely waited for other disciplines to develop tools and to choose from a catalogue of possibilities. This manner of acting could lead to the loss of architectural culture and of its characteristics, which stem from individual experience and professional knowledge (Kohler & Kara, 2011).

This has caused the architect to lose the connection to the production process and to assume a more abstract status. Digital technology gives architects the opportunity to design and adapt highly customisable tools, which can be used in design and in digital fabrication.

The architect's role is in the process of being renegotiated, in the sense of direct and active involvement in computational design and digital fabrication as opposed to passively waiting for technology to emerge around them. By using the attributes of the digital environment, designers can apply their knowledge and re-establish their interdisciplinary credentials. Architects need to actively develop their own design culture by building their own working tools as part of their professional practice.

Facilitating the architect's nearness to materialisation represents a return to craft and recalls the status of master builder that the architect used to possess both as a designer and as a construction expert.

This should not be understood as a demand for total control over all design and construction processes. On the contrary, it is an invitation to explore the collaborative aspect of construction processes, thereby integrating conceptual design tools, digital design and fabrication tools.

Digital technology enables architects to become more involved in project materialisation. They can design and adapt highly flexible tools for architectural practice. The digital environment provides a common ground where creativity is connected to digital conceptual and fabrication tools.

References

Aish, R. (2011). Foreword. In R. Glynn & B. Sheil (Eds.), *Fabricate: Making Digital Architecture*. Riverside Architectural Press.

Brell-Cokcan, S. & J. Braumann. (2012). Introduction. In S. Brell-Cokcan & J. Braumann (Eds.), Rob|Arch 2012: *Robotic Fabrication in Architecture, Art and Design*. (pp. 8-11). Springer.

Burry, M. (2011). *Scripting Cultures: Architectural Design and Programming*. Wiley.

Carpo, M. (2011). *The Alphabet and the Algorithm*. Cambridge The MIT Press.

FABLAB, Taubman College of Architecture (2011). Matter & Making. In R. Glynn & B. Sheil (Eds.), *Fabricate: Making Digital Architecture*. (pp.74-85). Riverside Architectural Press.

Heidegger, M. (1995). *Originea operei de artă*. Transl. Gabriel Liiceanu & Thomas Kleininger. First edition 1935. Humanitas.

Kieran, S. & J. Timberlake (2003). *Refabricating Architecture: How Manufacturing Methodologies are Poised to Transform Building Construction.* McGraw-Hill Professional.

Kohler, M. & H. Kara (2011). Q&A Matthias Kohler - Hanif Kara. In R. Glynn & B. Sheil (Eds.), *Fabricate: Making Digital Architecture*. (pp. 116-123). Riverside Architectural Press.

Kolarevic, B. (2005). Digital Morphogenesis. In B. Kolarevic (Ed.), *Architecture in the Digital Age: Design and Manufacturing*. (pp. 11-28). Taylor & Francis.

Marcus, S. (2011). Calculatorul. In *Paradigme Universale*. (pp.108-113). Paralela 45.

Picon, A. (2010). *Digital Culture in Architecture: An Introduction for the Design Professions.* Birkhäuser.

Pittman, J. (2005). Bulding Information Modeling: Current Challenges and Future Directions. In B. Kolarevic (Ed.), *Architecture in the Digital Age: Design and Manufacturing*. (pp.253-258). Taylor & Francis.

Reas, C. & C. McWilliams (2010). *Form+Code in Design, Art, and Architecture.* Princeton Architectural Press.