Learning from the Old Market Hall - research by design methodology as an educational tool

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ABSTRACT: The Faculty of Architecture at Slovak University of Technology in Bratislava, Slovakia, in cooperation with the Alliance for Old Market Hall initiated a student studio project. Its main topic was architectural interventions to the Old Market Hall building in Bratislava. The objective was to bring new aesthetic, functional, operational and social qualities to this historic piece of architecture. The scope of studio work ranged from analytical to the production phase. The results were prototypes in 1:1 scale or prototypes of critical design details. This article deals with the implementation options of the research by design methodology into the educational process. One of the objectives was to combine this methodology with other design methods, e.g. with participatory design or socially focused research. The research by design methodology does not rule out using other supporting procedures, e.g. digital or parametric architecture methods.

INTRODUCTION

The Faculty of Architecture at Slovak University of Technology in Bratislava, Slovakia, in cooperation with the Alliance for Old Market Hall initiated a student studio project. Its main topic was architectural interventions to the Old Market Hall building in Bratislava. The objective was to bring new aesthetic, functional, operational and social qualities to this historic piece of architecture. The scope of studio work ranged from analytical to the construction phase. The results were prototypes in 1:1 scale or prototypes of critical design details. Design studio leaders were: Martin Šichman, Lukáš Šíp and Martin Uhrík.

This article deals with the implementation of the research by design methodology into educational processes at the Faculty of Architecture in Bratislava, using a retrospective analysis of already completed student projects as case studies. The design studio, in which this project was specified, is a part of the Bachelor's degree programme. The research can be regarded as an organic part of the studio projects. It teaches students a systematic way of working. One of the design studio objectives was to combine the research by design methodology with other design methods, e.g. with participatory design or socially focused research.

Part of the project's assignment was to take energy efficiency and sustainability of the proposed outcomes into account. In some cases, improvement of the energy balance of the Old Market Hall building was a part of the concept, in other cases, this condition was fulfilled indirectly. Energy resources can be saved by recycling, by using materials that mainstream culture considered to be waste. Students worked with the phenomenon of recycling, using recyclable or already recycled materials. Could the research by design methodology serve as one of the sustainable design solutions?

Figure 1: Interior and main facade view of the Old Market Hall in Bratislava, Slovakia.

ARCHITECTURAL RESEARCH

Research is a systematic inquiry the goal of which is communicable knowledge [1]. Research by design is any kind of inquiry in which design is a substantial part of the research process. In research by design, the architectural design process forms a pathway through which new insights, knowledge, practices or products come into being [2]. According to the Webster's dictionary, architecture is the art and science of designing and erecting buildings [3].

While seeking architectural expression is mostly art work, constructing a building is a matter of science. Even if there is agreement that a part of the architectural processes is *a matter of science*, it does not automatically mean that designing a building is a form of research in its own right. It is a myth that allows architects and architectural academics to eschew the norms of research. It makes architects to feel confident in saying that the very act of making (architecture) is sufficient in terms of research [4].

Designing a building is, thus, not necessarily research. And finally, architecture belongs to the humanities. Research in the humanities is generally subjective in character, and fundamentally, there is no such thing as objective knowledge in this field of research [5]. Research by design is research that produces knowledge through the architect's tools and working methods [6]. The aim of this design studio was not to bring new methods of architectural research, but to verify if existing schemas can be applied in design studio projects. The following are citations of two principles, as an example of research by design methods (draft), this being the situation in this design studio.

RIBA's model for architectural research is divided into three stages: architectural processes, architectural products and architectural performance [7].

Jørgen Hauberg suggests that research by design consists of the following elements: *basic perceptions* - philosophical, ethical and theoretical perceptions, norms and values regarding the surrounding world, the role of architecture and the object itself (architecture). These is a prerequisite (paradigm) for the research process, it may be discussed and, in part, advocated possibly as basic research. *Investigation* - analysis, criticism, selection, problem formulation... i.e. the process in everyday life. *Programme* - the actual problem, the definition of partial assignments and goals in an overall programme (rules and norms). This can take the form of strategic research. *Proposals* - (product) development work: a concrete, spatial proposal as a possible reply to the programme; this is the experimental and partially independent aspect of the analysis. *Subsequent rationalisation* - argumentation, theoretical explanation of the proposal and subsequent testing in practice, if applicable. *Communication* - presenting the material in the form of a text, a drawing, a model or an example that explains the correlation between the components of the methodology in a manner that is consistent, reasoned, made probable and cannot be contradicted [8].

ARCHITECTURAL PROCESSES

According to RIBA's research by design model, the first stage - process - refers to research into processes involved in the design and construction of buildings and, thus, might include, for example, issues of representation, theories of design, modelling of the environment, and so on [9]. In this stage, Hauberg's basic perceptions, investigation and programme definition can be included.

Architectural Programme

The most difficult task for the students was to find *their own* assignment on the main project topic. The particular form, exact location and size of the architectural interventions were not specified. The complexity of this task lies in the necessity to think outside the field of architectural design and to use other than a form-shaping creativity. Architectural assignment typically contains *programme* - operational scope or simply functional purpose of designed architecture. Architectural programme, in the meaning of buildings main function, is one of the pillars of architecture, the interpretation of the Vitruvius notion of *utilitas*.

The architect has to be able to evaluate social and cultural aspects of the site and suggest the optimal architectural programme. The programme itself can be the subject of research. The research by design method is engaged primarily in the form or construction of architecture. However, exploration and optimisation of an architectural programme can be an equally valuable research objective. Participatory design is one of the possible tools to achieve this objective. Architecture - no matter how attractive - is unsustainable without a functional programme, especially, if the end-user is a wider public.

Participatory Design

In order to achieve the optimal architectural design programme, methods of participatory design were used. Participatory design is an approach to design that attempts to involve all stakeholders (e.g. employees, partners, customers, citizens, end users) in the design process to help ensure the result meets their needs [10]. Participatory design is research. Participatory design has its own highly articulated methodological orientation, methods and techniques, just as does participatory action research, the approach on which it is based [11]. Implementations of

participatory design do vary in their attention to rigor and validity, but they all reflect a commitment to sustained, methodical investigation according to grounded methodological principles [12].

Regarding the Old Market Hall revitalisation project, all Alliance for Old Market Hall members, tenants of lease areas in the market hall, supplier firms and, finally, the public participated in the design process during the student projects exhibition. Students were instructed to take into account incentives, inputs and suggestions of all participants in their designs.

Case Study: Winter Garden on the Roof of the Old Market Hall (Author/student: Katarína Šoltýsová)

The Winter Garden project - plastic greenhouse - on the roof of the Old Market Hall took into account several interests of different participants. Alliance for Old Market Hall demanded the effective use of spatial building capacities, low-cost solutions, reduce- reuse- recycle design principles and temporary design solutions. One of the tenants intends to operate a cooking school and, therefore, needs a space for planting. Finally, building energy evaluation has showed significant weaknesses in the outer shell in terms of thermal insulation, particularly the roof of the building. Winter Garden serves as a thermal buffer zone; reducing heat loses through the roof. It will lead to the opportunity to grow certain types of plants and herbs on-site to ensure the participants' needs. As well as the standard architectural design, the student developed the architectural programme based on the participation processes.
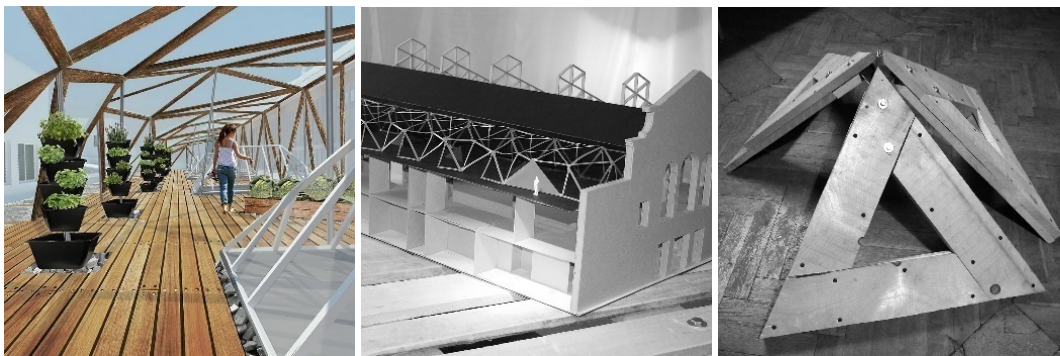

Figure 2: Winter Garden project presented by visualisation, a physical model and a prototype of wooden frames joint.

ARCHITECTURAL PRODUCT

According to RIBA's research by design model, the second stage - product - refers to research into buildings as projected or completed objects and systems and might include; for example, issues of aesthetics, material, constructional techniques, and so on [13]. In this stage, Hauberg's proposals - (product) development work can be included.

During their studies, students usually do not end up with a 1:1 scale model of their design. The result of their work remains as a two-dimensional plane on paper. They usually copy the construction details from the technical data sheets of the supplier of a particular product or in an *ideal case* they combine several of these details into one functional whole. Details are drawn *eventually*, just before handing over the work and, therefore, their reverse incorporation into the design concept is no longer possible. Thus, the students essentially lack an actual *work with detail*. However, as the relationship between the *whole* and the *detail* is basically relative, detail can be sufficiently pedagogically conveyed in the lesser extent.

Physical versus Digital Model

A physical model of architecture ceases to be an instrument of creation. It becomes a tool for presentation, *an appendix* to the graphical part of the design. An architecture student builds up a model at the end of the creative processes; only after all major decisions about architectural form have been already made. Some studios do not use models at all. Is the physical model obsolete in these digital architecture times? Today the impact of the absence of physical models on the creative process and the final quality of the architecture can be debated. Also, automatic production of models via 3D printers is changing parameters of design process.

Case Study: Revitalisation of Roof Skylights (Author/student: Lucia Trangošová)

The main idea of this project was to change the colour and to control the amount of incoming light inside the Market Hall. Existing windows provide sufficient, but uniform and monotonous light. The student has re-designed the roof skylights for this purpose by creating a structure inside each skylight, which can change the quantity and colour of the incoming light and also improve the thermal condition of the building. The roof skylight design was optimised by using both software analysis and a physical model. The student has been experimenting with the colour and intensity of the light. The main subject of this research was *light*, as one of the most important architectural elements. The result, in the form of an industrial design patent, can be used as a product for serial production.
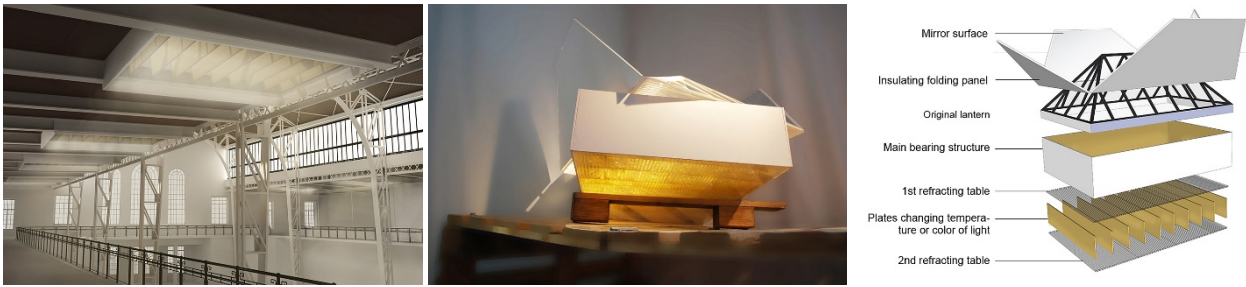
Figure 3: Roof skylight design presented by visualisation, a physical model and a diagram of skylight construction parts.
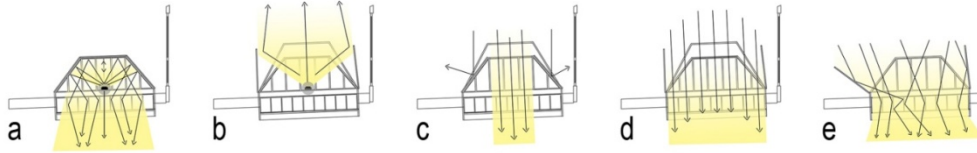

Figure 4: Variability of skylight is presented through schemes.

Material-based Research

One of the major differences between architecture and other research disciplines is that architecture is bound to materials and this gives research in architecture a specific material focus. Architecture, and its practice, is held by the media of its invention, and the practice-based tools and methods have a large and independent significance: a material focus, which involves sketches, models, material experiments and completed architectural works [14].

The results of these design studio projects are prototypes in 1:1 scale or prototypes of critical details of the designed architecture. Students designed architectural interventions, solved critical construction details and subsequently constructed those details in the workshop. Adjusting or correcting these details often resulted in the change of the whole architectural concept. *Fabrication* of architecture or its details may initiate a positive relationship to 1:1 scale for the students and allow them to understand its potential. This design studio aimed to promote active work with construction details and prototypes during the design process.

Case Study: Inflatable Acoustic Wall (Author/student: Dominika Szabová)

The Market Hall building will be used for several kinds of cultural activities, concerts, workshops, presentations, etc. Within such spaces, it is necessary to use sound absorbing materials to reduce the acoustic reverberation time. This student project introduced inflatable acoustic wall made from recycled material - billboard banners. Prototyping revealed problem areas in the principles of its operation. Subsequent optimisation of the shape and the mutual position of inflatable parts directly alter the visual concept of the work - its expression. In this case, the solution of detail changed the overall form of the inflatable walls.

Figure 5: Process of prototyping: cutting and joining banners - connecting to inflatable device - preparation of supporting structure - inflating the prototype.

Figure 6: Chasing the optimal mutual position of inflatable parts during the prototyping process.

Digital Processes

The research by design methodology does not preclude using other supporting procedures, e.g. digital or parametric architecture methods. One of the projects was based on a mathematical algorithm (programmed in Grasshopper, a plug-in for Rhinoceros) that calculates reflections of sunrays from a series of mirrors on the facade of the Old Market Hall. One of the definitions of simulation lies in imitation, in the sense of estimating the reactions and behaviour of the ongoing events, which cannot be verified experimentally [15].

Case Study: Light Up! (Author/student: Michal Kotvan)

The *Light Up!* architectural installation explores the properties of reflection and motion. It operates as an interactive sunlight reflector. The reflected sunrays land on a northern facade of the Old Market Hall and create a play of lights on the plaster. To analyse the sun's movement at a specific time, the student used mathematical representation of the sun's position and movement during the year for the given place. It allowed the student to find a suitable place in front of the building and the exact angles for tilting the mirrors. The design and the shape of reflective panels was achieved by using a parametric approach and a Voronoi diagram. Therefore, all panels had the same area and were stackable.
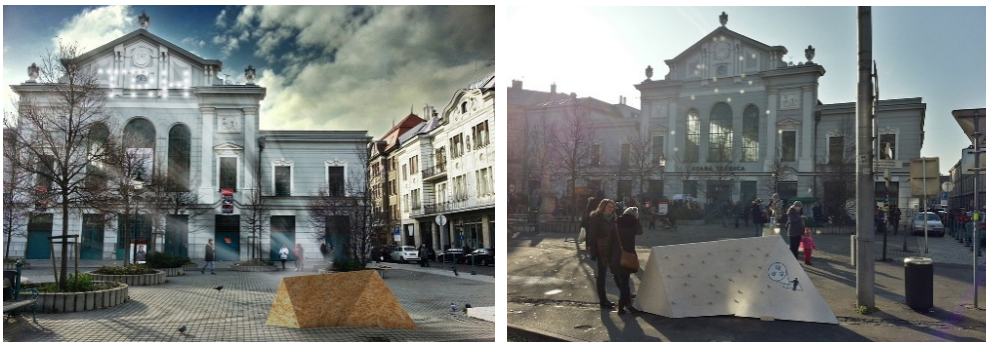

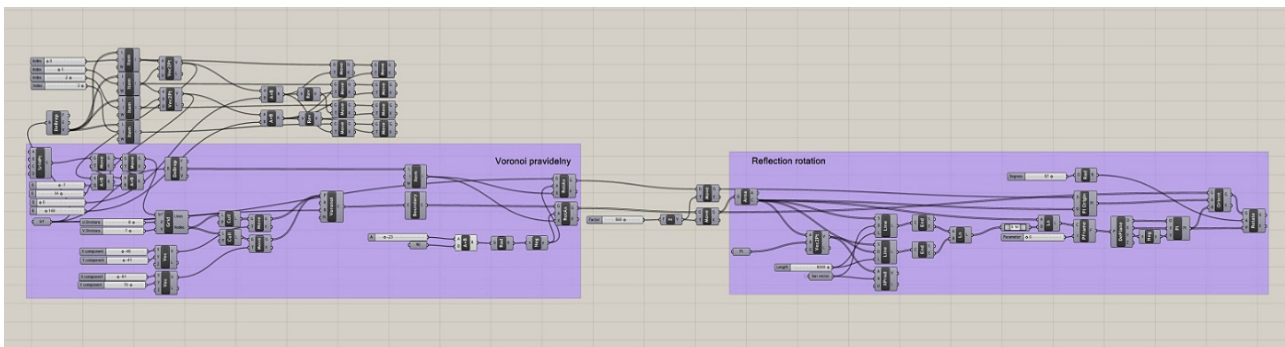Figure 7: Sunlight reflector presented in visualisation and final prototype during the exhibition.

Figure 8: Grasshopper plug-in for Rhinoceros is calculating the angles of mirror tilts.

ARCHITECTURAL PERFORMANCE

According to RIBA's research by design model, the third stage - performance - refers to research into buildings once completed and might; for example, include issues such as social occupation, environmental performance, cultural assimilation, and so on. [16]. At this stage, Hauberg's subsequent rationalisation and communication can be included.

One part of this design studio was a series of presentations during the semester: from standard mid-term evaluation, through repeated presentations in front of participants, to the public exhibition during the Christmas Good Market 2013 event. An important part of the process was self-reflection, in this case an evaluation of end-user's inputs and incorporation of their feedback into the project design.

Case Study: Fun_Play (Author/student: Danka Blaškovičová)

Fun_Play is a construction set that can be used to create space according to one's needs or imagination. Thanks to the flexibility of the set, it is possible to create a unique playground, private library or *living* space. A playground should not be fixed in its form, as it is meant for children to play with. The most important moment during the design process was an exhibition, at which the public could test this furniture and the designer could see how it was being used. Figure 9 shows the change in placement of construction sets during the exhibition day. In this particular project, end-user interventions into the design process completely changed the appearance and construction of these elements, and also changed the designer's future thinking about the design for the public use.

Figure 9: Fun_Play elements in use.

Student projects were also communicated to the experts. Cooperation and comments on each individual project were requested from the Berlin-based studio RaumLaborBerlin. They wrote a short review of each project and these comments were also incorporated into the final designs. One of the results of each project is the fulfilment of the theoretical part, which goes beyond the standard project description.

CONCLUSION

The architectural school as a whole, and the design studio in particular, are places for research practice par excellence [17]. This article dealt with the implementation options of the research by design methodology in the educational process at the Faculty of Architecture in Bratislava.

In the current environment, research at the Faculty of Architecture is understood to be an advanced part of traditional architecture. Research is exclusively part of a doctorate or of what is today called *post-academic science*. The interconnection of doctoral and post-doctoral research within the basic educational framework is limited. Today, content and tools used by architectural design are changing rapidly. Adherence to the experimental practices could be seen even at the beginning of programme; it is possible to show students the need to redefine the approaches used in architecture with each new project.

The classical approach education at the Faculty of Architecture defines the role of the architect very rigidly. It is the designer of the building, and the main purpose of the classical approach to architecture is to materialise design into physical form. The new environmental, economic and demographic challenges, have weakened the necessity for materialisation of architecture. Finding new relationships, redefining stereotypes of design and a new level of communication between the parties are becoming increasingly important variables in architecture. The Old Market Hall assignment that used the research by design procedure proved ideal in its scope and content for experimental practice in the Bachelor degree. The success has been demonstrated by the amount of positive feedback collected during the public exhibition of the projects.

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