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## **Research in Architecture: Looking Backward and Forward: Forty-Year Experience in Architectural Research at the Faculty of Architecture STU**

### Abstract

The introduction of my contribution contains a brief information on the Faculty of Architecture of the Slovak University of Technology in Bratislava (FA STU) and the architectural research performed at this institution. Schemes and priorities of our research in architecture have changed several times since the very beginning in early 50's. The most significant change occurred after “the velvet revolution” in 1989. Since 1990 there have been several sources to support research at universities.

The significant part of my contribution is rooted in my own research experience since the time I had joined FA STU in 1975 as a young architect and researcher. The period of the 80's is characterized by the first unintentional attempts to do “research by design” and my “scientific” achievements as by-products of my design work. Some of them resulted in the following issues: conception of mezzo-space, theory of the complex perception of architectural space and definition of basic principles of ecologically conscious architecture. Nowadays I continue my research by design within the application of so called solar envelope in urban scale with my students.

## Introduction

The Faculty of Architecture represents one of the seven faculties of the Slovak University of Technology (STU) in Bratislava. It is the oldest and greatest faculty of architecture in Slovakia with about 1200 students studying in the branch Architecture and Urban Design at bachelor, master and doctoral levels at present. Beside the branch Landscape and Garden Architecture and Products Design are read at the Faculty, too.

## History

The tradition of architectural education within technical university in Slovakia begins after 1946 when research in architecture starts as well.<sup>1</sup> Simultaneously with their pedagogical engagement the schoolmasters-founders<sup>2</sup> were involved into foundation and development of theoretical disciplines of architecture and town-planning and they initiated creation of the basis of architectural and town-planning science in Slovakia. Till 1960 architectural research was closely connected with individual personalities working in Slovakia; it was mostly based on professors' initiative. They not only educated students within their specialisation, they attempted to enrich the specialisation via their research, in which lecturers and students were involved. Architectural heritage related topics were most popular,<sup>3</sup> however, several attempts for architectural theory development, new technologies implementation and their experimental use in civil engineering occurred, too. In academic year 1960-61 the architectural research was „institutionalized” at the technical university – a specialized department was created: „Research Institute of Theory and History of Architecture”.<sup>4</sup> The research, as it is clearly legible from the Institutes' name, was primarily focussed in the history of architecture. However, at the time the call for interconnection between university studies and practice strengthened. This

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<sup>1</sup> In 1946 Department of Architecture and Civil Engineering was established; in 1947-1948 five following institutes were created: Institute of History of Architecture, Institute of Interior Architecture, Institute of Architecture I. and II., Institute of Theory of Architecture.

<sup>2</sup> Prof. Ing. Arch. Dr. Techn. Karel Hannauer, Prof. Ing. Arch. Dr. Techn. Alfréd Piffli, Prof. Ing. Arch. Jan. E. Koula, Dr. Sc., Prof. Ing. Arch. Dr. Techn. Vladimír Karfík, Prof. Ing. Arch. Dr. Techn. Emmanuel Hruška, Dr. Sc.

<sup>3</sup> Works of Prof. Piffli on surveying and documentation of ruins of the Castle in Bratislava are highly valued.

<sup>4</sup> Ing. Arch. I Kuhn, CSc. was the first director of the Institute.

comprised designing and realisation of buildings. The task did not mean any problem as the faculty had been built on the mentioned abilities of its founders – former practitioners. At the turn of 60s and 70s a Research Institute of Agricultural Buildings was included into the technical university with its task to prepare and verify constructions for their mass production and use in agriculture. The Institute carried out research from the basic typology for plant and cattle-breeding production<sup>5</sup> up to the design of prototypes of some buildings e.g. modulare sheep-folds, multi storey cow barns etc. Those experimental projects had often originated in students´ studios, where the most courageous ideas could be verified. Results of building typology were used in the designing process, students took part in prototypes construction and later also in real objects building up during their technical training. Students specialized in civil buildings did not have so many opportunities to profit from close connection with the practice, though. There were several research institutes<sup>6</sup> outside the technical university which focussed in other important, interesting or more complex typological fields. Our technical university used to co-operate with them in work over some partial issues.

Since 1976 teaching of architecture continued at the first independent Faculty of Architecture which had been created from existing institutes specialized in education of architects within the technical university. The Faculty has become a coordination centre of basic research and the projects inspired by social needs were initiated and proposed by the Faculty. Research was funded from national resources only; research projects have been divided into two groups: a) national and b) departmental.<sup>7</sup> The proposed partial topic of research had to be closely related to the basic topic of the state (national) research task. The proposal had to face an entry expert opinion. After approval of the partial research topic, the project was endowed with financial means according to researchers´ capacities<sup>8</sup> and production expenses. If the task requested expenses for necessary special technical equipment the extra money could be

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<sup>5</sup> The research started e.g. by checking body dimensions of animals, the constructions would be designed for, in cases animals did not have their standard breed dimensions.

<sup>6</sup> E.g. National Institute for Design and Standardization in Bratislava, Research Institute of Construction and Architecture in Prague and Brno, Institute for Interior Design and Clothing Culture in Prague.

<sup>7</sup> Research project was initiated by the relevant department – Ministry of Culture for instance. The topic of the project implied usually a particular issue as applied research was in question exclusively.

<sup>8</sup> Research capacity of a researcher represents 2 000 hours per year, research capacity of a teacher is 1 000 hours per year.

provided. In the research half-time the project had to undergo an inner expert opinion procedure. After closing the research project up a final research report was worked up. During its final expert opinion a technical and scientific contributions of the project were evaluated and funds expenditure was checked up, as well.

In 70s and 80s our students were involved into research in an interesting way – by students’ scientific and technical activities programme (ŠVOČ). The best students taking part in the programme became internal post-graduate students/researchers (which correspond to contemporary students of 3-rd level of doctoral study).

### Status after 1989 up to now

Since 1990 the research activities of FA STU have been oriented in basic and applied research of architecture, town-planning and spatial planning. The activities are being developed within inter-branch scientific cooperation of STU, Slovak Academy of Sciences, departmental research institutes and other institutional bodies in Slovakia and abroad. International cooperation has become more intensive and so have international contacts of the Faculty of Architecture. A new academic periodical media: „ALFA“ – Architectural Letters of the Faculty of Architecture has started to publish results of work of researchers and teachers of the Faculty . Remarkable results have been gained in research of the history of architecture in Slovakia. Those successful results of retrospective research have been proved by a couple of excellent books on history of architecture<sup>9</sup> , personalities and by several very successful conferences on founders of architectural education in Slovakia or prominent architects Prof. Belluš (1999), Prof. Karfik (2001) and Prof. Piffli (2007).

The most important change after 1990 came about in research funding system. Grant agencies have been established<sup>10</sup> and a principle of competition began to come in use in obtaining funds. Principles of academic freedom have brought the freedom of scientific research, several topics could be inquired, which previously could not be due to the lack of their provable useful contribution for society. Now it was scientific

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<sup>9</sup> Dulla, M.; Moravčíková, H. (2006). *Architektúra 20. storočia na Slovensku* (Architecture of 20th century in Slovakia). Bratislava: Slovart. Lukáčová, E.; Pohaničová, J. (2008). *Rozmanité 19. storočie – Architektúra na Slovensku od Hefeľeho po Jurkoviča* (Omnigenous 19th Century – Architecture in Slovakia from Hefeľe to Jurkovič). Perfekt. Dulla, M. et al. (2008). *Majstri architektúry* (Masters of Architecture). Bratislava: Perfekt.

<sup>10</sup> E.g. GAV – Grant Agency for Science, Pro Slovakia etc.

contribution of the project which had to be proved by the researcher who had applied for funds at the agency. Sometimes it was a one-man project. By virtue of such an individual researcher the Faculty of Architecture was able to build up an endoscopic laboratory of space simulation. In case the proposed project has been declined by the agency it could be tackled within so called institutional research at the Faculty on the account of funds allocated to the Faculty by the Ministry of Education. The amount of money was significantly smaller, however at least a part of production expenses could be covered. The amount of funds provided by the Ministry of Education depends on results of faculty research activities in previous year. The funds are used for challenging projects worked out at the Faculty but also for expenses connected with participation in topic related conferences which had not been listed in the Faculty working plan.

The other sources of financing research from the funds of the Ministry of Education are the following grant schemes: VEGA (Scientific Grant Agency), KEGA (Cultural and Educational Grant Agency), APVV (Agency for Research and Development Support). Researchers claiming for funds have to apply for them similarly as for funds within the Ministry of Education. No research in architecture or town-planning has been funded by private agencies or bodies in Slovakia so far.

There are several international research projects funded by EU or from other countries' resources. Unfortunately, there is no real chance for an architectural project to be accepted as architecture is not listed as a priority in most research schemes. However, there is still a possibility to join a topic more or less connected with architecture. For instance in 2008 – 2010 we participated in a project focussed on safe environment of towns and housing estates: „Crime Prevention through Environmental Design“. The project initiator was Garda Síochána – the police force in an Irish town Cork and several partner police corps from England, Scotland, Germany, the Netherland, France and Hungary participated. Slovakia was the only country which was represented also by the Faculty of Architecture. We presented our experience of refurbishing housing estates which had been built during 60s and 70s of previous century. We concentrated on boundary lines between public and semi-public spaces, between semi-public and semi-private spaces and finally between semi-private and private spaces. The mentioned topic had been tackled in our students' projects, too.<sup>11</sup>

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<sup>11</sup> As an example Project of Šúr – Chorvátsky Grob Region is presented. Author: K. Šťastná.

Considering the importance of research results for university evaluation in national<sup>12</sup> and international<sup>13</sup> ranking scales, research and study surveys are given great attention on university, faculty or institute levels now. The Ministry of Education divides their funds accordingly, the bigger allotments are provided to faculties which had achieved significant results in their research in previous year. This promotion of research represents great motivation as faculty can gain 30% of financial resources up to the school budget due to their intensive research activities. This scheme works well in case of the faculties cooperating with industries (Faculty of Chemistry of Faculty of Informatics Technologies). However, the scheme is not so friendly to faculties as e.g. Faculty of Architecture, Academy of Fine Arts, etc.

### Short survey of my personal experience

I enrolled the Slovak Technical University in 1968, I read study branch Architecture and Town Planning. After graduation I joined the Department of Architecture II - Typology of Industrial and Agricultural Buildings at the Faculty of Civil Engineering<sup>14</sup> as a researcher. I specialized in industrial buildings until the first half of 80s when the issue of building energy demand and the need of alternative energy resources started dominating. The topic was not new for me as I had studied several related issues during my work on my thesis on architecture of nuclear power plants.<sup>15</sup> Energy saving topic brought a new method of research „research by design” which had not been used before. We started in 1983 (!) with a project of family house prototype, which should have been presented as a permanent exhibition pavilion of new technologies using alternative energy resources. The house should have been a part of the trade fair „Agrokomplex“ in Nitra town. The project was worked out by me and my colleague Professor Robert Špaček. We had been inspired by houses which used solar energy in a passive way, mostly they were houses with an additional space - a conservatory/winter garden/green house. The green house was almost an inevitable element of the design as the exhibition area was used mostly for agricultural exhibitions. However, due to lack of funds the exhibition pavilion has not been built;

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<sup>12</sup> Independent agency ARRA.

<sup>13</sup> E.c. QS University ranking.

<sup>14</sup> Study branch Architecture and Town Planning was taught at the Faculty of Civil Engineering until 1976.

<sup>15</sup> In 70s and 80s of previous century nuclear power plants was the most perspective and dynamic branch of industry, two nuclear power stations have been built and works on several other were going on in Czechoslovakia at the time.

exhibition management decided that just a model will do for presentation the idea of a house which exploits alternative sources of energy. Therefore we constructed a model of 2x2 m dimensions. Projecting the green house as a means for capture and storage of solar energy and the following distribution of heat we were speculating on this type of additional space in a wider context. We have substituted the peripheral (external) walls of the house, which used to be built of bricks or concrete mostly, by two glass walls or by a glass wall and a massive wall with a free space in between. It was then when we begun to entertain the idea of boundary space between interior and exterior which we have named „mezzo-space“. Our colleagues from the Faculty of Civil Engineering became interested in the topic and we were invited to cooperate in a research project on cutting down energy demand of buildings. Therefore we were able to study the issue from architects' and town planners' point of view between 1985 and 1990. We still kept regarding the „mezzo-space“ our basic topic, the phenomenon covered a complex range of spaces: from „open mezzo-spaces“ as patios, arcades, columned halls, balconies, loggias, galleries (back porches), atriums, internal courtyards, lanes and squares<sup>16</sup>, up to „enclosed mezzo-spaces“: veranda, conservatories or greenhouses, enclosed loggias, passages, roofed internal courtyards etc.

A special type of enclosed mezzo-space is represented by so called interactive or respiration walls which have become an inseparable part of contemporary architecture. It is the type our colleagues from Faculty of Civil Engineering concentrated on and they continued working on its technical details and calculation procedures. Results of their works can be seen in the design of National Bank in Bratislava, where such a „mezzo-space“ has been used<sup>17</sup>. Their physical characteristics are the basic difference between a massive external construction (made of bricks, concrete, wood or sandwich walls) and external construction created by the „mezzo-space“. While the massive wall has constant physical characteristics, the „mezzo-space“ has changeable physical characteristics.

Working on projects in which we tried to apply „mezzo-space“ principles<sup>18</sup> we studied physical characteristics of the phenomenon and a by-product of these studies has

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<sup>16</sup> See Nolli's map of Rome.

<sup>17</sup> Architectural design: M Kusý and P. Paňák, technical design of the external construction: Prof. M. Bielek.

<sup>18</sup> In 1985 me and prof. Špaček took part in an architectural competition for enlargement of Reduta concert hall in Bratislava. Our project was awarded a prize, however the jury blamed us for waste of space as we had roofed the original inner service yard and changed it into a public place belonging to a music centre complex.

arisen: a theory of complex perception of environment. During inquiry into thermal comfort in different types of mezzo-space we encountered a description of sequence of perception of environment by individual senses: touch, smell, hearing and sight, elaborated by a German psychologist Marielene Putscher.<sup>19</sup> Her description of sensual perception of space had inspired us to construct a diagram illustrating spatial frameworks according to the corresponding sense dominance and we designed so called Sensulor (1986). The following discovery was surprising. In spite of the fact that more than 90% of all stimuli we perceive by our sight we still prefer those which are closer to the surface of our body, subconsciously. For example, if we are listening to beautiful music and at the same moment we are struck by an unpleasant smell, the smell overlaps our acoustic sensation. On the other side we are able to tolerate a bad smell inside a nicely heated cottage in freezing winter.

The year 1990 meant a new opportunity to tackle the topics which had been on the perimeter of interest of official authorities previously and to enrich architects' education with new approaches to architectural design. In the same year we established Department of Experimental and Ecologically Determined Architectural Design at the Faculty. The results we had achieved in our previous research and design activities qualified us to establish the Department with such a topical orientation focussed mainly on reducing energy consumption in buildings, designing low energy buildings, use of alternative energy resources, alternative building materials and technologies. Opening western borderlines meant an opportunity to establish contacts with colleagues and institutions from abroad who were tackling the same issues. Professor Ralph Knowles from the University of Southern California in Los Angeles was one of the first partners we established cooperation with. In 1993 he had accepted our invitation and he taught as a Fulbright Professor at our Faculty of Architecture. During his teaching in my Architectural Design Studio he implemented his solar envelope method into our design process. The solar envelope is an imaginary construction defined by solar rays in given period of year (e.g. 1<sup>st</sup> of March), in given time interval (e.g. from 10:00 till 14:00), in given location and within defined overshadow limits. If the shape of the building is designed within this envelope, the building will not cast a shadow on defined surroundings. The advantage of this method (procedure) is that we can "predict" casting a shadow in advance (*a priori*) in the contrary to the regular procedure when we locate casting a shadow after the design of a building is ready (*a posteriori*). If one of the characteristics of the

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<sup>19</sup> Putscher, Marielene (1978). *Die Fünf Sinne, Beiträge zu einer medizinischen Psychologie*. München: Moos.

adjective “ecological” is tolerance, then the method of solar envelope can be one of essential methods which demonstrate a tolerant approach to creating our built environment.

In the first half of 90s the method of solar envelope meant certain enrichment of architectural design in searching various unusual, atypical but meaningful architectural shapes. In the last years we encounter growing efforts to substitute the energy produced in classic thermal power plants and nuclear power plants by alternative energy resources mainly by solar energy. The initiatives to reduce the amount of greenhouse gases emitting into atmosphere are strengthening, too. The method of solar envelope becomes a welcome design tool offering a procedure how to insure so called a solar access. It is the access to direct sun light which is inevitable for either exploiting sophisticated solar technologies, solar panel, solar cells or designing a passive house in which the certain amount of solar gains is an unconditional premise for efficient performance of the house. No effective legal tool ensuring the solar access exists in Slovakian legislation so far. Consequently a new built building can overshadow the existing building equipped with solar collectors or solar cells and thus decrease the efficiency of solar technology considerably. There are no legal obstacles which could avoid such a situation. Such status of national legislation brings a weak motivation for solar technology installations and building passive houses which are both considerably dependant on certain solar gains.

## Janus

In my contribution to our academic periodical I had expressed my opinion that if I had to look for a patron of architectural research I would vote for Roman god Janus without any doubt; Janus being also a gate guard is depicted with two faces: one looking into the past and the other towards the future. Janus could stand for architectural research: looking backwards he inquires history of architecture, meanwhile his second face is looking into the future, searching for original, unique solutions which can prepare a sufficient ground for new inventions in the branch of architecture.

I am personally most impressed by Janus´ second face representing perspective research, research closely connected with hard work over an old fashioned drawing board which allows us to encounter new puzzles and their solutions. Yes, I really am in spite of the “fear of blank sheet of paper” well-known not only by writers but by us, architects, as well.