Laboratorial Verification of Ideas for Urban Space Compositional Design Completion

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**Abstract**

The subject-matter of the contribution is presentation of the non-conventional didactical methods application in architectural education and research at the Faculty of Architecture of the Slovak Technical University in Bratislava. It is an application of a laboratorial method of architectural endoscopy based on a model urban space simulation principle and on the acquisition of an electrooptical visual display image information from a recording periscope unit interaction in the real time and the real model space, with the option of spontaneous semantic evaluation of the output on a video-monitor and of a synchronic timing process recording on a magnetoscope. Application of a consequential powerful PC-configuration with creative software enables further digital sequential processing both on the graphical output and for multimedial presentation.

**Introduction**

Urban spatial structure showed to be the most sophisticated form and the most complex manifestation of vital activity of a man. An inhabitant develops an individual relationship to all component parts that represent the notion of dwelling to him. By sensual communication, focused mainly on iconic manifestation of individual urban structural components, the inhabitant stores in his/her mind a mental conception of its image [1; 2]. Significant components of this conception are also spatial quality and complexity which are subconsciously confronted and evaluated in subjective identification. Alongside the quantitative and qualitative aspects and the expression aspects there activates an image of acceptable scale, of spatial proportions, of space division, its differentiation, continuity, polarisation or of gradation. The basic category of qualitative analysis and appreciation of urban structures and urban environment is urbanity, by which we characterise and perceive the components’ signs, differentiate their properties necessary to comply with the criteria (image) of urbanity. Rational or numerical quantification of the urban environment level is ever so difficult. It is however possible to enregister it in the psychic background of visual perception in particular images that evaluate mainly the positive (cultural) attributes of an urban environment in complexity and with correspondence to the life style and taste of the society. Urbanity is thus perceived as a qualitative aspect of an urban structure or an urban environment reflecting, in a subjective consciousness, a concept of possibilities of choice and satisfaction of individual or social demands [3].

Our department has proved that model (artificial) representation of spatial conception is a base for effective and notably creative method of design [4]. The improvement of electronic media graphical representation systems brought possibilities of didactical applications and development of architectural endoscopy in urbanism by making it possible to medially process the simulation outputs immediately in real time and real environment [5]. The above mentioned principles, aspects and experience are the basis of the model simulation and endoscopy application in research and in the teaching process at our Faculty, namely in the laboratorial verification programme taken by our students in Urban composition classes in the 4th term of their studies. The goal of the programme is visual application and verification of compositional urban spatial structural design principles, and also to contribute to the quality and complexity of urban environment reception training, to develop a feeling for space and a more complex dimension of urban environment creation, transformation and evaluation.

**Methodical approach and content of laboratorial verification**

Verification of urban environment completion ideas, as a didactical programme topic, is done by a specialised laboratory equipment which enables an interactive spatial experience simulation both without and with movement in a chosen horizon on models with an image output on a TV screen or a PC display. The main parts of the simulation lab-unit are as follows (see figure 1):

- a - operating area lightning,
- b - vertical scanning unit,
- c - rails of the scanning unit,
- d - operating area restricted optically by white/sky-blue matt background,
- e - controlling microcomputer,
- f - screens and display,
- g - electronic section.
The students become familiar with the principles and with the practical spatial endoscopy method of application. Individually, or in groups, they carry out the situation survey, verification and appreciation of alternative ideas for compositional completion or urban structure completion on models trying to find and evaluate the spatial and image impact in the sense of conception crystallisation. The verification itself is realised spontaneously by visual judgement of the image information change on the output, in compliance with the urbanistic creative concept process criteria and principles [6] (see figures 2 and 3).

What is of a special importance to the observer from the psychological point of view in real spatial perception is the *cinaesthetical experience* (the perception of motion and position in the space). This is what is reflected the most emotionally in the psychic experience processing in his/her consciousness [7]. The simulator mechanics is therefore adapted for interactive way of gaining visual information and spatial perceptions, but it has to respect the principles of sensorial (sensual) perception in a real environment [8] in the same way as a camera directing in the cinematography. By the monocular receptor transposition within the frame of random side and directional sequences in interactive form (see figure 4) the students control the simulation process of perception experience on a model in a walking horizon, and according to a prepared scenario.

**Scenario**

The idea sketch of the scenario contains a brief comment of idea intention with exploitation and application of theoretical urbanistic composition knowledge acquired in the lecture cycle and practised in seminars. Apart from dimensional parameters of a chosen or designed area, as well as the image of both spatial and space-creating components of its urban structure (squares, street routes, urban blocks, block corners, buildings in free locations, individual buildings, structural elements of the buildings, entries and passages in urban parterre level, urban furnishing, trees, highlighting and others), the verification objects are also themes representing spatial manifestations of applied kinds of design and compositional categories (dimensional, positional, hierarchical or sectional) [7;9]. The route of the movement, the positions of characteristic viewpoints and view directions on the route are explained in the end.

In the graphical part of the scenario the route of the chosen sequential motion and view directions are marked into the situation plan of the verified area in M 1:400 or M 1:500 scales in connection with the idea concept and the verification goal (see figure 5). The route and its direction are designed from the spatial experience dynamics point of view, while the viewpoints and view directions are designed synchronously with the ideas of compositional completion or regarding the characteristic settings and wider spatial compositional relations.

**Model elaboration**

By artificial model construction in urban and architectural design the model simulation is traditionally realised, when relevant spatial demonstration of planned reality are displayed in scale reduction, represented by urbanistic and architectural design [10]. By working with the model in the studio the students are spontaneously becoming aware of internal spatial structural aspects, and thanks to imagination they carry out a simplified form of spatial perception anticipation and of subjective interaction in the designed environment. The endoscope optics on the simulation lab-unit enables the real perception transposition into the model, its temporal anticipation as a simulating interaction of a participant in simulated conditions. The *statement value (validity)* of simulation endoscopic method on the screen output is determined by the quality of the models. The information content increases according to the applied scale [8]. Suitable are models elaborated in 1:200, 1:400, 1:500, 1:1000, or in 1:2000 scales.

To support the simulation participants’ sensual identification in the model interpretation we recommend graphical elaboration and application of all building facades that are in sequences component parts of the viewing sceneries. The easiest way to obtain a good result is to acquire a *shadowless* facade image, or to draw one’s own design and then contact-scale it down to a required scale, or to process the representation by computer graphics. In case of remarkably dynamic facades and details it is good to make more copies right away, from which it is later possible to model characteristic structural elements like the gantrees, marquises, corner towers, stairs, balconies, cornices, stocks, cover arcades, roof wells and such. Advisable is also presentation of paving design and decorative areas (fine raster, structure, colour), as well as an elegant colour model interpretation. The spatial imagination will be enhanced by designing representative urban furnishing components (waterworks, works of art, information columns, lighting), stylized vegetation (in summer or in winter), in low-scale models also figures, cars, etc. (see figures 6 and 7). Some elements can retard imagination while the simulating receptor is in motion, such as e.g. figures that are in reality usually in motion. This fact, however, is not an obstacle because it gives a true picture of the reality anticipation process as the main goal of urban simulation [7].

**Aesthetical and compositional appreciation**

Validity of the described procedure results meets the requirements for simulation results evaluation application by means of a method based on aesthetical and compositional analysis of visual changes in continual urban
interior experience as elaborated by K. Wejchert [11]. He assembled in fact a perception differential manual, with values classified in decimal scale according to subjective classification. The value scale gives the possibility of graphic comparison of spatial scenery emotive visual experiences during the motion on the route of the urban interior section which is being evaluated. The aesthetical and compositional content hierarchy of spatial experience is differentiated in principle according to the following characteristics of urban structure demonstrations:

- spatial monotony, non-interconnection, weak architectural expression,
- marks of spatial interconnection and expression richness,
- spatial richness, interconnection, urban and architectural value of elements, absence of dominants,
- variety and urban space interconnection, presence of dominants,
- high urban and architectural value, dominancy of characteristic elements and units in the spatial structure,

in the image and the sky-line of the city.

By calibration of destined values at y axis of the graph, where in x axis direction the experience values vary on the route in particular points or in temporal observation distances, the resultant is the so-called perception trace (curve of experiences). The students process this trace individually for their programmes. They generally adjust the manual of the trace elaboration to the character of the programme also according to their subjective approaches (see figure 8). To objectify the evaluation results of each locality (route) it is possible to elaborate various graphs - perception curves in groups. According to the experience in group evaluation the particular graph curves have similar tendencies. On routes directed in opposite directions a certain difference of values is understandable.

Conclusions
Application of endoscopy in architectural research and education became an important tool for gradual assertion of exact aim dimension in the sphere of revitalization, valorization, humanization and urban environment completion. The computer graphics development significantly contributed to the possibility of e.g. immediate editing of graphical sequence output, the possibility to correct the image parameters by means of digital photographic software (see figures 9 and 10), to create composite images, retouch, to create one’s own library of urban spatial elements (figures, vegetation, paving, sky, background), to transfer images intermedially, to create dynamic sequences and to make use of many other achievements of the modern world of electronic medial communications. It is possible to state that the interoperative effect of the original endoscopic optical information and its further digital interpretation is at the moment suitable for architectural verification and arbitrary medial creative programme presentation. However, there is another sphere in which we would like to see some more development.

It is generally known that spatial (stere) perception of all living beings is accomplished via a double channel (stereo). Spatial orientation and the feeling of existence in a space are synchronically determined, besides the acoustic (stereophonic) perceptions, mainly by binocular visual perceptions which are evaluated in mind on the principle of two synchronic monocular images perception, and on continually accommodated eye parallax as a real environment spatial experience, as an exact position and importance perception of its elements in it. In urban interior this effect considerably enhances the directional motion, when a dynamic spatial continuum in time (the so-called dynamic perspective) is experienced [12; 13]. Therefore it is effective to direct ocular systems of endoscopy to the double-channel principle of scanning (stereo-endoscopy). We had the possibility to ensure ourselves of these facts during the presentation of the firm Storz at the 2nd EAEA Conference in Vienna. For the today already conventional technology of laboratorial endoscopy it would be advisable to use a binocular endoscope with the 90° angle of the entrance optics. Further double-channel elaboration of real video and stereoscopy signal is basically resolved (picture transfer and conservation ), though the costs are doubled, compared to the standard.

The present aim of the architectural endoscopy horizon is a good sign for us, and I believe not an inaccessible one.

References
[1] Norberg-Schulz, Ch.: *Genius loci*, Odeon, Prague, 1994
scientific conference Electronics ’96, Brno, 1996


Figure captions

Fig.1 Interactive electrooptical simulation lab-unit based on spatial endoscopy in the department laboratory. [see 11p01.tif]
Fig.2 Verification process of urban composition in laboratorial conditions on a 1:500 scale model. [see 11p02.tif]
Fig.3 Verification of studio design ideas on a 1:1000 scale model. [see 11p03.tif]
Fig.4 Principle of endoscopic interaction in simulated urban environment. [see 11p04.tif]
Fig.5 Situation plan with marked route, viewpoints and characteristic view directions. [see 11p05.tif]
Fig.6 M 1:400 endoscopic model elaboration for an analysis of a city historical core. [see 11p06.tif]
Fig.7 M 1:500 endoscopic model elaboration for design and verification of an internal urban structure fragment. [see 11p07.tif]
Fig.8 Graphic representation of subjective spatial experience values - perception trace. [see 11p08.tif]
Fig.9 Visualization of graphic output by electronics. [see 11p09.tif]
Fig.10 Digital processing of graphic output via PC software. [see 11p10.tif]
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Peter Kardos
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INTRODUCTION  Urban spatial structure showed to be the most sophisticated form and the most complex manifestation of vital activity of a man. An inhabitant develops an individual relationship to all component parts that represent the notion of dwelling to him. By sensual communication, focused mainly on iconic manifestation of individual urban structural components, the inhabitant stores in his/her mind a mental conception of its image. Significant components of this conception are also spatial quality and complexity which are subconsciously confronted and evaluated in subjective identification. Alongside the quantitative and qualitative aspects and the expression aspects there activates an image of acceptable scale, of spatial proportions, of space division, its differentiation, continuity, polarisation or of gradation. The basic category of qualitative analysis and appreciation of urban structures and urban environment is urbaneity, by which we characterise and perceive the components' signs, differentiate their properties necessary to comply with the criteria (image) of urbaneity. Rational or numerical quantification of the urban environment level is ever so difficult. It is however possible to reregister it in the psychic background of visual perception in particular images that evaluate mainly the positive (cultural) attributes of an urban environment in complexity and with correspondence to the life style and taste of the society. Urbanity is thus perceived as a qualitative aspect of an urban structure or an urban environment reflecting, in a subjective consciousness, a concept of possibilities of choice and satisfaction of individual or social demands.

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**METHODOLOGICAL APPROACH AND CONTENT OF LABORATORIAL VERIFICATION**

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