VIDEO-COMPUTER MODELLING OF PERCEPTION IN THE EDUCATIONAL ARCHITECTURAL DESIGNING

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Abstract
In the report on the base of the example of the past and present term and diploma designs, executed in MARCHI, and taking into account the intermediate results, reported by us at past conferences EAEA, we have tried to analyse and generalize problems, versions of the techniques and technologies of education.

The use of the videocomputer technologies, which make it possible to realize the so-called “virtual reality”, helps to represent as verisimilar as possible (especially for not specialists) designs, which do not yet exist. Here we get a freedom of choosing the way of designing: by means of the computer or in the traditional way - with the presentation of the results by means of the small-scale model (mock-up), as the task of the methods, proposed by us, is the presentation of the future object in real situations, and it is indifferent for videocomputer techniques, in which way the result was achieved.

When the MARCHI students solve educational tasks, connected, at first, with three-dimenstional and spatial compositions, and then with such objects, as e.g. buildings and their interiors, residential districts, industrial complexes - it is convenient to use the system, consisting of a videocamera with an endoscope or micro-videocameras, placed on coordinate devices and connected with the computer. The chosen videoshots can be improved after their input into the computer depending on the available computer programs and printed. Thanks to the connection with the computer the work goes practically in real time. Such methods are used optionally during group design lessons on architectural designing, as their simplicity and sufficient reliability do not require practically students to have additional knowledge. It is convenient to use them in the educational process in junior years of study, when it is enough to include static video rows executed in
the form of black/white prints into the educational design documentation for the presentation of the design.

The training in senior years and diploma design require the use of more complicated systems, providing wider possibilities for the representation of designed objects. While the formation of dynamic video rows (study of the objects in movement, accompanied by videorecording) can be realized by means of the devices, described above, by simply connecting with VCR, the analysis of designed objects in a real situation requires to construct another kind of system. The complex, created by us, which is sufficiently cheap and available for Russian educational establishments, makes it possible to realize student’s work both with small-scale models and with computer models, both in traditional semi-professional analogue and in digital formats.

Introduction
Discussing the theme of our report, we came to the conclusion of feasibility of continuing the logical sequence of our reports at the previous conferences:
“Technical Conception of Videosystems Laboratory at Moscow Institute of Architecture”, Tampere, 1993 (1)
“Optimal Choice of the Equipment Depending on the Requirements of Educational Projecting”, Vienna, 1995 (2)
“Some Suggestions about the Role of Text Informations on Video Simulation”, Delft, 1997 (3)
“Modelling (Simulation) and Reality”, “Some Problems of the Light and Colour Factor in Videosimulation”, Dresden, 1999 (4)

Even the cursory acquaintance with the list of reports shows, that the direction of our investigations corresponds to the investigations of EAEA members. (Unfortunately, due to certain difficulties in Russia, we are not able to realize at present time such interesting investigations, as a light simulation (Stuttgart), environment behavior (Tokyo), interaction of architects and clients (Delft) and some others. The participation in the work of all conferences of EAEA widened
our ideas about usefulness of endoscopy technologies for the educational process and supported considerably their use in MARCHI. The analysis of the published reports, additional materials, presented by the participants of conferences, lets us use more fully possibilities of videosimulation. Our acquaintance with EAEA took place at the conference at Tampere, when we had the simplest techniques and worked with black/white representations, which defined the range of problems and possibilities of employing them during the education. In Vienna we were able already to speak about the accumulated experience in optimal use of various versions of relatively simple (and not only black/white) equipment for solving educational problems. For the conference in Delft we prepared materials of investigations on some particular aspects (which can, however, play sometimes a decisive role) - their further development was presented by us in Dresden. (At that time we told about our first attempts to compare purely computer and endoscopic methods of videosimulating perception of design solutions and about some occasional or conscious mistake, made by architects when modelling perception).

Continuing the search for original directions in videosimulation, we understood, that it was possible to make certain generalizations and passing in some cases to the complex video-computer simulation of the perception of design solutions. Further we shall describe shortly some results of our investigations and their practical application in the educational designing, taking into consideration particularities of the educational process in the Moscow Architectural Institute (State Academy).

**Employing videosimulations in the junior years**

In the second year, when students have finished getting acquainted with the essence of classical architectural designing, we provide a number of lecture and demonstration classes in the laboratory of video systems, their aim consists in introducing students to the problems of videosimulation (with the demonstration of characteristic examples), acquainting them with the used devices and their peculiarities as well as with the experience of foreign laboratories.
(on the basis of materials of conferences and additional works, with which we get acquainted at conferences, while they are being worked out and analysed). After it we provide, for optional, work of students of junior years at endoscope devices during the time, when they are engaged with educational designs (we spoke about it, for example, in Vienna) (5), and the possibility of observing a small-scale object from some real (low) points rises the efficiency of getting skills of designing, studying principles of composition (because a model, observed from low points, is perceived as a real objects). It is important, for example, to show the role of illumination and elements of scaling (such lessons can be called “classical” in the field of architectural endoscopy).

As a means of representing results (as well as for printing results of designing) it is enough to put the selected shots into the computer and after corresponding (if necessary) working up with possible use of special computer effects to print them, forming static video rows.
However, creation and analysis of abstract models does not make it possible for students to take into consideration in the sufficient manner peculiarities of visual perceptions of architectural composition under real conditions.

For the “immersion” of students into the reality already in the junior years we began a series of experiments on the placing of designed abstract models in the real videoenvironment. Because this work is purely educational, there are no strict requirements for exact observance of a number of spatial characteristics and this make it possible (in contrast to real projects) to get results quickly enough. Here we show a number of shots from the videomaterial, corresponding to the initial stage of the experiment (Figure 1 - 4.). Afterwards we suppose to include colour and light simulation, placing in real video (in photo we did it already 10-15 years ago) of real well-known small objects, in order to show junior students, how changing...
the scale and the level of observation can change their perception. It is possible to say, that we switch on here a kind of “play” elements, which, as it is known, always improve efficiency of mastering educational materials.

**Peculiarities of the employment of videosimulation in senior years**
The peculiarities of educational designing in senior years consist in making designed objects more complicated, in their diversity. Here the requirements approach the existing ones in real projects, the work in our laboratory is also carried on optionally. Students enjoy great independence, when working with endoscope devices. New directions here are research on the application of micro-videocamera and also the independent processing of the results of the endoscope video-shooting by the students, who are already acquainted with Photoshop.
On the base of working models it is possible to check up and to compare various versions (particular peculiarities of the work are determined by specific qualities of designed objects). The most successful version is being worked up, corrected, after which by means of the input into the computer and printing by the printer of the representations from chosen points, videosequences are formed (Figures 5 - 8).

In this object, showing the interiors of an industrial building, the author pays a great attention to constructive solutions. Another example besides the choice and checking colour solutions, touches also light simulation.

In some cases colour models, executed with details, make it possible to investigate and appreciate internal spaces. Movement inside rooms along trajectories, chosen by the author, is realized as well as recording videofragments on VCR. (In the videomaterial,
accompanying the report, we show fragments from the videofilm, demonstrating in detail the round of rooms of the restaurant, designed by students. In spite of some defects in movement, caused by the simplicity of the employed techniques and insufficient experience of work with it by the authors of the design, it is possible to see, as verisimilar the perception of interiors is).

Videocomputer simulation in diploma designing
The most interesting and important is the employment of videocomputer simulation in diploma designing, because, in the first place, the designed objects are remarkable as a rule for complexity, originality and carefulness of working up, are sometimes connected with real commissions, and, in the second place, the authors have already chosen a certain technology of designing and presentation. Unluckily, a great influence is produced by unfavourable relation "time/necessary volume of work for the preparation of the exposition" as well as the degree of the author's mastering the art of making traditional models or packets of architectural (PC) programs (ideally - both). Taking into consideration everythings, that has been said, and the originality of the project (i.e. the usefulness and probable efficiency of its representation) and the demand for solving new research and methodological problems of videosimulation, we prepare yearly, as a rule, at least one special videofilm to accompany the defense of the diploma design.

At the same time, in contrast to educational projects in junior years we, together with the author form a kind of creative collective, whose aim is to substantiate by videocomputer simulation means the correctness of the author’s concept and that it adequate to the environment. Almost every diploma design, executed with the participation of our laboratory, leads to the appearance of some original trends in videocomputer simulation and gives an impulse for new scientific investigations, including the ones connecting with the perfection and development of technical means.

We shall give some examples of using simulation methods of perceiving design solutions in some diploma designs, chosen by us:
• The use of the existing endoscopy methods and videosimulation in the complex diploma design (11 diploma projects) for the Northern-Western Ray in Moscow (one of the main transport thoroughfares Moscow) based on traditional model technology. At all stages of designing the analysis and correction of the design proposals was realized using the equipment of the videosystem laboratory, the results were fixed on a video (movement in the city territories) or with the help of prints of some shots, made (after input into the computer) by the printer (views of the designed object from the chosen low points). The proposals were checked at the model (scale M1: 500) with the help of an special endoscope device.

The example of the project, which is a part of the complex project, mentioned above, and devoted to the reconstruction of Pushkin Square (author D. Zinatulina) can show, that the endoscopy methode
gave possibility to perform a simplified “excursion” near the designed building. When it became necessary, to show this object and others, which are also parts of the complex design, in a real video environment, the complexity of this problem in combination very short time make us think about the advisability of “stopping half-way”, i.e. at the stage of MIX (we called it representation of the designed object by means of a "ghost". Such a representation with considerable reduction of labour and time gives still possibility to evaluate dimensional relations and advisability of placing the object in the existing space.

- The design of a public complex in Gagarin Square in Moscow (author M. Seredin) was executed by means of a computer. The analysis of some intermediate results showed (and we spoke about it at the conference in Dresden) that the construction of “dead” computer shots, which include the existing real development, simulated by the computer, gives a simplified and lifeless picture,
which does not enable us to perceive in a real way the represented existing space and, consequently, to appreciate the correspondence of the designed structure to it. We offered the author to make video shooting of the development place from the point, approximately corresponding to the point of "shooting" of the constructed computer shot (it turns out, that it is not always possible, because when choosing point for "shooting" the computer shot, the author is not

Fig 17 - 20: Real video shooting in computer designing for improving the verisimilitude of the perception of the designed object.
always interested in the possibility of the real shooting). Then we
gave the author the possibility, to superimpose various simplified
versions of the project on a real video shooting with the aim of
choosing the most suitable solution under real conditions. After being
worked up by the computer, the chosen version was also
demonstrated in the real video environment. It is possible to compare
the verisimilitude of video- and computer shots in figures. This
experiment, as well as a number of ones following, it confirm our
statements about the advisability to combine video and computer
means in order to achieve the verisimilitude of the presentation of
designs proposals.

• One of the diploma designs of 2001 drew our attention by its
originality, because it deals with a trade-exhibition complex, based
on aquariums. It is clear, that it is difficult to show the reality of the
underwater world by traditional graphic means and show the purpose
and functioning of rooms. That is why we used our traditional
technologies for the demonstration of the place of the object in the
real environment (the method of “ghost”) and real video shooting -
for the simulation of the proposed interiors. In this way we managed
to create fragments of the so-called “virtual reality”, which is
demonstrated in the video supplement to the report.

Conclusions
And now we can review our research and practical works:

Technical aspects
The peculiarities of works on video simulation have shown the
necessity of using in the chain of video devices a sufficiently powerful
computer, provided with corresponding programs for processing of
images and their superposition on video. Technological necessity to
copy the initial video subjects several times made us come to the
conclusion to begin to use digital video. During the intermediate stage
we use a hybrid complex, including S-VHS and miniDV devices.

We intend (depending on the financial possibilities) to continue
experiments with micro-videocameras, which will enable us to get
better (in comparison with the endoscope) representations, though at the present time there are a number of models, which it is difficult to investigate without endoscopes.

Scientific and methodological investigations
Our scientific work is subordinated to the effective provision of the teaching process. This includes, in the first place, processing and analysing of the investigations, conducted by analogous foreign laboratories and introduction of this experience into the educational process. As earlier, we pay attention to the construction of technical complexes for the solution of educational problems optimal from the point of price/quality relations. We shall also pay attention to the analysis of the possible mistakes and distortions when representing the simulated objects.

Educational work
Peculiarities of the educational work in different years we tried to demonstrate in the report. From everything mentioned above our attitude to the usefulness of endoscopy methods and videosimulation in a broader sense follows. In spite of the computer “boom”, continuing here, we, as earlier, believe, that while there are methods of small-scale model or, in a certain degree, abstract (computer) simulation, there should exist various methods and means in the educational process, including complex ones, enabling us verisimilar as possible, without isolation of the environment, to represent educational designed objects.

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