Some Features of Movement as One of the Necessary Elements for the Development of Architectural Education

Michael Matalasov; Natalja Timantseva
Moscow Architectural Institute (State Academy) 
Russia
Introduction (about movement in general)

As to the Russian word “dvizhenije” two almost equal English words - “movement” and “motion” correspond, we had to decide, which approaches our message better. As a result we have chosen “movement”, as in the interpretation of our dictionaries this word reflects its philosophical essence more.

In philosophical treatment the movement is a general concept uniting characteristics of moving, made by objects, interactions between them, changes which take place between them, transformations of some objects into other ones. There are forms of movement in which objects change their positions, but do not change themselves, and such forms in which there are quantitative and qualitative changes in objects. Aristotle writes about six kinds of movement: appearance, destruction, increase, reduction, transformation, relocation.

If at first the movement was examined for a long time only as movement of bodies, many years later ideas enlarged and in the foreground there appeared such versions of movement, as becoming, change and development. [1]

Proceeding from these basic concepts we have tried to analyse briefly the role of movement as some necessary element of realisation in architectural education.

Movement (development in time) as a necessary element of technical perfection for modelling of project space perception

The educational laboratory of video systems was created in February 1985 as an independent structural division of MARCHI. We have paid basic attention to the search and introduction of nonconventional technical means in educational architectural designing, at that time the most “fashionable” of them were devices which, as a rule, were created on the basis of medical endoscopes by users themselves. In such a way using serial medical endoscopes, industrial black / white video cameras and monitors, amateur mirror cameras and self-made coordinate devices we
made the first variants of our endoscopic devices – “telemaketoscopes”
Despite the insufficient quality of the image and getting pictures “in a
circle”, filling not the whole photo frame or black / white the video frame
(which was explained by the “handicraft” connection of the endoscope with
an objective), impossibility of video recording, complexity of qualitative
processing of the photo frames, necessity of using strong light sources, we
have started to apply endoscopic technology widely at design lessons of
the 2nd year. Already at that time rather primitive images allowed students
to carry out static researches of physical models designed by them from the
real points of observation, to check various variants of solutions (Figure 3,
Figure 4)

Getting operational experience with endoscopic devices and fixing their
drawbacks, we could carry out a number of modernisations which have
allowed us to make black / white video recordings of endoscopic images,
to increase considerably the size of photo images (including colour ones) in
the field of the photo frame (usage of various objectives and teleconverters)
(Figure 5, Figure 6)

Approximately upto this moment all of us were making a “simple” without-
alternative “movement” - technical perfection, as a wide “ advance” of PC
in the field of architectural designing was only beginning, and the “scales”,
loaded only with traditional designing and physical modelling + endoscopy,
were still motionless. We heard one of first signals of the beginning of
the movement of the “ scales” in Tampere [2] and since then a kind of
“competition” of two various methods and means of the architectural
designing, influencing also the process of training, began to be seen. The
positive moment of this “competition” was that it initiated afterwards more
intensive searches and researches in the field of technical and methodical
interaction and mutual additions (instead of oppositions) of the specified
directions and definition of the fields of their most expedient application.

The beginning changes in the USSR economics (the period of
“reorganisation”) enabled us to realise our ideas and to carry out
manufacturing of a small series of original endoscopic devices for MARCHI
and some architectural faculties in other cities of Russia. Because of the
deterioration of economic conditions in Russia this plan, unfortunately, has
not been carried out in toto.
Appearance in MARCHI of a new endoscopic device made it possible to carry out further scientific - methodical researches and wider application of endoscopic technologies. Among the characteristic features of the device at that moment it is can to note the possibility of video recording endoscopic images, the opportunity of changing the direction of observing in the vertical plane, the whole screen image with the opportunity of focusing, exact photofixing of the chosen video frame (Figure 7, Figure 8).

The special micrometric device provided the possibility of photographing for receiving stereo pairs of endoscopic photo images. After a while we made the first step on the way of rapprochement of video and computer technologies of modelling – the device was connected to the personal computer equipped with a special video card for inputting, processing and printout of the chosen video frames which has improved considerably the quality of images and has reduced the time of their execution, and also a colour video camera connected with an endoscope has been installed. In a combination with a specialised computer and a mini-video studio S-VHS acquired by us it has allowed to carry out “embedding” of endoscopic images of small-scale physical models into a real video environment (a video shooting of real territories). According to the contents of this work we already began to speak about video computer modelling of perceiving projected objects in a real video environment, i.e. we went on to a higher level of modelling.

A long-term multilateral and bilateral cooperation with EAEA members, carried out scientific researches has created conditions for the radical modernisation of the laboratory means. As the principal equipment for the realisation of video computer modelling of the perception of educational designs we chose digital video equipment of a miniDV format, a modern computer with opportunities of an input / output (analog and digital) video images and an analog endoscopic complex of the equipment of “Karl Storz” firm (the digital complex is now inaccessible to the MARCHI because of its high cost).

The new equipment is constructed on the basis of the existing coordinate device. One of its few drawbacks is the absence of an opportunity of the automated moving of the endoscope inside the space of the physical model which is to a certain extent compensated by the admissible cost of the
equipment, simplicity and efficiency of working with it (Figure 9, Figure 10, Figure 11a, Figure 11b, Figure 12a, Figure 12b, Figure 13a, Figure 13b).

Movement (application of different computer programmes at different stages in time) as creation of optimal conditions for the application of computer means in educational architectural designing

Application of video and computer modelling in architectural practice which, especially, was spoken about and in our previous reports at EAEA-conferences [3 – 7], can be completive at the design stage for the provision of the most real demonstration of the project. Video computer technologies make it possible to display the structure of the future object as close as possible to the reality, its interrelation with the existing historical environment, to reveal disadvantages and advantages of the project, to present clearly the project to the client [8, 9]. In the offered report we would like to analyse briefly also another aspect of application of video and computer modelling in the field of architectural education: the help to the future architect at the initial stages of designing not only from the point of view of the compositional configuration, working out details of large objects, but also the definition and estimation of importance of modelling movement in projected space.

In any educational system the basis is always a “classical” chain of interaction “the pupil - the training material - the teacher”. The traditional training material in the modern process of training can and should complete video and computer technologies providing an opportunity of interactive dialogue.

The offered material, being based on N.Timantseva’s diploma project «Lunar hotel complex», (the scientific supervisor was A. Cherepushkina, Vladimir State University, Russia) illustrates, taking into account unique feature of the projected object, all stages of one of the variants of modern educational computer designing.
Compositional construction of volumes

Their basic parameters have been determined by physical and thermal-technical calculations, requirements of artificial gravitation and the possibility of comfortable living of the person in outer space. The basic residential element in the form of a paraboloid rotates around its own axis. It is necessary to connect it with a supporting structure of a greenhouse, an entrance complex and the scientific modules placed in the under-the-surface layer of a crater (Figure 14).

When moving the central element should not touch other objects being at the same time connected with them. At the given design stage the 3D Studio MAX programme was used, it makes it possible to construct a conceptual model of the future project even with only initial skills of working with it, and simultaneously to see its three projections and its image in the perspective, which should help to develop spatial thinking. The programme is convenient when creating non-standard objects. Even having only little experience in working with the programme it is possible to create the elementary animation which becomes more and more actual with the development of dynamic architecture.

A stage of detailed study of the project

One of the difficult problems of the given project was the necessity of arranging 60 single and 48 inhabited double cells placed round the central axis of a paraboloid on 5 levels (Figure 15).

The calculation of the sizes of cells and their number became complicated because of their inclination of 80 degrees in relation to the surface, a radial arrangement, two tiers, which increased the angular distortions. During the initial calculation without using a computer the mistake included 2 elements. To provide the required accuracy it was necessary to construct drawings in large scales (1:100, 1:50) while the short terms of designing allowed executing the project by traditional methods only in scale 1:500, that was obviously insufficient. Here two more programmes of the CAD package have been applied: ArchiCAD and AutoCAD. The ArchiCAD programme allows constructing a three-dimensional model taking into account ergonomic parameters, building norms, and economic requirements. It includes
the whole set of such typical building elements, as, for example, doors, stairs, roof elements. This programme is irreplaceable in real architectural designing, and due to opportunities of an interfile exchange it can be used for constructing non-standard elements. In the diploma project “Lunar hotel complex” ArchiCAD has been used for designing inhabited cells, the main requirements for which became ergonomics and the simplest solution of the cramped space (Figure 16, Figure 18). As on the moon in the zone without artificial gravitation the gravity is very small – the modules are more spacious, than their “artificial” counterparts. It is explained by the need of more vast space in connection with awkward movements of the person under these conditions. Because of this here are higher ceilings and steps, the interiors are whenever possible deprived of sharp angles (Figure 17).

After the sizes of cells were determined, it was necessary to place them round an axis in two tiers and the turn of floors of rooms was to be 80 degrees in relation to the surface. Between the capsules there should be a place for fastenings. For exact calculations the AutoCAD programme was used which made it possible not only to arrange elements precisely from the mathematical point of view, but also to construct developments of conic surfaces of inhabited cells in order to receive storey plans.

**Presentational visualization**

Constructed by ArchiCAD (*.3ds) and AutoCAD (*.dwg, *.dxf) the files have been transferred in 3D Studio MAX where qualitative visualization has been executed. Further the received materials are edited from the artistic point of view, scaled and are grouped to be printed for the diploma work in a printing house, necessary inscriptions (Adobe Photoshop programme, are made (Figure 19).
**Movement as moving in design space and its role in training perception of the design solution**

Separately the same materials have been prepared for independent presentation (Microsoft Power Point). For the key dynamic features of the object 3D-animations have been executed: presentation of the general view of the complex, demonstration of consecutive analysis / disassembly of the design of the complex are executed by the 3Ds MAX programme, the scheme of movement of lifts which turn themselves is made in the appendix to the Photoshop - Adobe Image Ready programme.
Conclusions

1. Recognizing that physical modelling (for example, computer designing with the subsequent construction of physical models by a 3D-plotter) will exist also in future as an integral component of training architectural designing, that is shown by a three-year experience of colleagues from TU Delft [10], MARCHI Laboratory of video systems, as well as related European laboratories, will continue to work at the further development of video computer modelling, including also analog endoscopy.

2. In this connection it is interesting to note the creation in future in our laboratory (taking also into consideration experience of our colleagues from TU Delft) of a “hybrid” video computer complex combining traditional and computer technologies of designing with the use of digitalization devices of initial physical models and automated manufacturing of final physical models on the basis of the digital information received from a computer:
3. As a logic development of the said things, we shall continue (as far as it is possible) experiments at the work of educational “virtual collectives” (including international ones) in the Internet network, based on technologies of video computer modelling of perception of projected objects and modern information technologies.

4. Last our example shows that it is difficult to execute an architectural project, especially non-standard, without spoiling quality of studying and loosing time, using only one programme. Specificity of various architectural projects is also various, that is why the set of used programmes will change too.

Certainly, studying the whole package of appendices demands time, therefore an optimal variant is studying several programmes supplementing each other with a dominating one (depending on the specificity, for the architect it can be ArchiCAD, for the designer - 3Ds MAX, for the engineer - AutoCAD). Thus, when training students using computer models, the principal aim will consist not in ideal knowledge of any one programme, but in providing a clear approach to several products of related packages.

References

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