Computer Analysis of Visual Perception - endoscopy without endoscope

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Abstract
This paper presents a method of using computer animation techniques in order to solve problems of visual pollution of city environment. It is our observation that human-induced degradation of city environmental results from well - intentioned but inappropriate preservation actions by uninformed designers and local administration. Very often, a local municipality administration permits to build bad-fitting surroundings houses. It is usually connected with lack of visual information's about housing areas of a city, its features and characteristics.

The CAMUS system (Computer Aided Management of Urban Structure) is being created at the Faculty of Architecture of Białystok Technical University. One of its integral parts is VIA - Visual Impact of Architecture. The basic element of this system is a geometrical model of the housing areas of Białystok. This model can be enhanced using rendering packages as they create the basis to check our perception of a given area.

An inspiration of this approach was the digital endoscopy presented by J. Breen and M. Stellingwerff at the 2nd EAEIA Conferences in Vienna. We are presenting the possibilities of using simple computer programs for analysis of spatial model. This contribution presents those factors of computer presentation which can demonstrate that computers achieve such effects as endoscopy and often their use be much more efficient and effective.

State of our city
Present-day parts of the city are criticised for the fact that they do not form the space, neither create the housing environment, nor adopt it to human needs and feelings. (see figure 1)

These areas are not accepted by the dwellers. People do not experience the link with their place of habitation.

The area outside their own flat, „the urban area“ of the estate is treated as completely alien. Research made in Polish housing estates shows that only a few of the inhabitants have a good opinion about their surroundings.

Centres of the cities are degraded both functionally and aesthetically. Many public buildings (hotels, banks, schools, shops) have been raised without any link with the surroundings - verdure, configuration of the surface and existing buildings. Simultaneously, the historical continuum has been broken. This resulted in a complete desemantisation of the downtown areas. (Asanowicz A., 1995)

Figure 1. Examples of the architecture in the Białystok habitat areas. [see 03p01, 03p02, 03p03.tif]

Reason
In the past war years millions of people moved from villages and small towns to big agglomerations. There was a need to provide those people with housing. Hence to that the ideas of an international modernism, concepts of mass and affordable housing prefabricated on an industrial scale found a fruitful political & social climate. Wide spread implementation of those ideas took place in sixties, when by decision of the central government building industry a priority was given to manufacture prefabrication systems. The construction period of gigantic subdivisions of "military quarters" begun..." (Dąbrowska G., 1994)

Not all of us realise the fact that the space order of our city, influences positively or negatively all our senses, creating our visions. The aesthetically perception of an architectural object is related to its spatial concept. Chaotic concentration of buildings does not provide adequate quantity of information either influence our memory. On the other hand, too much orderly spatial setting of objects is easily memorised, but ceases easily attracting our attention.

Spatial arrangements of prefabricated buildings situated according to a schematic order provide minimum portion of information. That is caused by the fact that we've seen those buildings many times before. Monotony of living districts built of ferro-concrete prefabricated blocks (inadequately called modernistic) does not contribute to create a spatial order either develop social contacts.

Self expressiveness of living districts is below normal level of perception, due also to its bad spatial arrangement and to face the outlook of various buildings. The same windows and balconies in the same spatial rhythm are repeated. A primitive sculpture and lack of facial expression causes that observer receives minimum quantity of visual information. Simultaneously repeating of the same buildings complicates spatial orientation. The phenomenon of visual pollution of city environment occurs.

Possibilities

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If we want to improve state of our living districts we ought to consider three problems related to their perception. The first is expressiveness of buildings form, the second natural and artificial illumination, and finally the third - dynamic perception.

**Expressiveness**
Aesthetically information of urban spaces is strictly connected to their spatial - massive composition, proportions, rhythm, symmetry or asymmetry. It contains such notions like: facture treatment, colour, detail.

Figure 2. Form expressiveness [see 03p04, 03p05.tif]

Providing these elements we would like an architectural object to be distinguished by its expressiveness, it should contain a set of elements of which informational impulses possess various value, not overpassing though the power of the whole informational area of a building. Verifying the quality and quantity of information carried by the elements creating a form and defining the minimum information level causing that such object, is being perceived and memorised and could be carried out experimentally. In view of such a purpose drawings containing progressively more and more elements in a form should be prepared. The first drawing would be just a contour of a form. The following drawings present a form enriched by the next elements as: windows, balconies, terraces, bay windows, columns etc. (see figure 2). After introduction of each group of elements a subjective evaluation of a form expression could be done.

**Illumination**
Urbanistic space on the level of visual reception is realised by the light. Daily light renders accessible the architecture to a receiver always in the same way. The artificial light has become new category - something that turns out to be a qualitatively different medium in the space. It has huge perspectives in creating space from the new beginning in a completely different reception of architecture.

The light used in housing estates does not have to just assure the security or safety of the dwellers. Appearing among the small architecture, shrubs and trees, lights are to expose the beauty and climate of designed forms in the more suggestive way than a daily light. In order to efface the growing plain of housing estates the specific way of visual reception has to be created in every estate.

It can be done by:
* varying the exertion of lights source, not to let the user feel confused in local informational structures of space.
* creating spaces by setting with light orientational points (characteristic buildings, dominants)
* variety of light colours in order to emphasise the importance of lighted set pieces
* leading a passer-by with a light
* careful organisation of dispersed light arrangement (from several delicate sources), not too excessive exposing the fragments of space with strongly accumulated light
* creating scenery and climate by architecture; exposing architecture in urbanistic meaning

According to the treatment of the architecture as a medium by which one can create a separate architecture of lights, it would be also possible to create specific characteristic climate and emphasise the architectural forms.

Figure 3. Light on the street. [see 03p06, 03p07, 03p08.tif]

**Dynamic perception**
The important aspect of perception is a fact that we constantly move, changing position and perception points of an object. According to the point of perception various buildings and their parts group together, move, hide, enlarge or shrink in perspective and finally totally disappear. The closer we get to the object, the more detailed information we receive.

Quantity and quality of information are not only influenced by the form of urbanistic spaces but also by such factors as: distance between the object and the observer, road and quickness of the observer. However, despite of so many factors influencing the perception, among analysed by us housing estates, we can determine two basic types of space and two types of perception connected with them.
1. Wide open spaces - perception is possible in any direction (360 degrees) which means that the reception of space is potentially more universal. Unfortunately it makes impossible to determine the closed view frames and it is also one of the reasons why housing estates are estimate chaotic and uncomposed.
2. Closed spaces - determining the direction of perception and precisely determining the view frames. The example of such spaces are: streets, squares and pedestrian ways.
Methods
The digital endoscopy as the inspiration of this approach were presented by J. Breen and M. Stellingwerf at the 2nd EEA Conference in Vienna. (Breen, J., 1995) We’ve presenting the possibilities of using simple computer programs for analysing of a spatial model. This contribution presents those factors of computer presentation which can demonstrate that computers achieve such effects as endoscope and often their use is much more efficient and effective. The CAMUS system (Computer Aided Management of Urban Structure) is being created at the Faculty of Architecture of Bialystok Technical University. One of its integral parts is VIA - Visual Impact of Architecture. It shall help us to create the methodological base enabling the analysis of the different relations and space conflicts and the answer at the question, „What should be done in order to make our surroundings look nice?” The basic element of this system is a geometrical town data base. It will integrate various data types, such as: cultural heritage, contemporary housing areas, suggested design directions according to plans of extension of a city, proposals, based on work of our Faculty, which could be a useful information base for the municipal administration.

From the beginning it seemed clear that two separate models, the 2D model of the plan and the 3D model had to be developed. The first step was to establish a 2D basemap of chosen housing areas. The level of detail and resolution of this map was still limited to an urban planning scale and depended on the level of detail of the source material. Based on the 2D-representation already built up in the computer, the 3D model was developed. Following experience in conventional model building, the computer model was subdivided into a number of „morphological units” (insert models). Again similar to the traditional building of a model, one also has to consider different levels of resolution in order to represent different levels of scale and information.

Tools
Whereas computer is used in the architectural office to design future objects, it can also be used as a drafting tool for drawing architectural objects which already exists. In the present work the computer is used as drafting tool and as a digital endoscope.

Usefulness of an endoscope and graphical computer programs should be considered within three already mentioned problems to be solved out. Both tools are to enable the estimation of the reaction of designed spaces or changeable urbanistic assumptions.

Problem number one - expressiveness
The study of reaction of spatial spaces and checking of quantity and quality of information, using the endoscope and the computer, is similar. The first item to estimate is a strictly massive model. In order to further verify the quantity and quality of additional elements, we have to make a new element at the endoscope and put it in the model. In a computer we have to make new spatial element and put in the place of the old one. We use AutoCAD program for building a spatial model. The limited massive forms are constructed from prepared elements of the program and they are connected by AME. All others additional elements are made as repeating block set put on existing blocks. Such made spatial arrangement is imported to 3D Studio by DXF format. The difficulty is less or more at the same level. The first and the second method is only for building different massive elements and checking their mutual connections. In 3D studio, in order to present a created spatial assumption, we set a camera (our endoscope). The camera used in this program has a different focus, from a fish eye to a wide angle. For our needs we choose a focus close to possibilities of human eye.

Problem two - Illumination
A computer is unreplaceable in studying lights, not sunny, which can be simulated in endoscopy by a lamp, but an artificial and local one. We can test the lighting of urbanistic ways, particular buildings and also create the climates - a huge number of modification and possibilities of testing many variants. In respect to the unperfection of a computer in using the light exertion (no possibility of expressing exertion in Lux) we are able to check the quality of lighting only in a small scale but we can perfectly check the way of lighting of spatial partitions. We are able to try to interpret the reception of space, created by the light, from the user’s point of view. Artificial lighting is simulated by using the lights „Omni and Spotlight”. One of them is a pointing light without making the edge shadow. The second one is a directing light with possibility of generating the realistic shadows (Ray - tracing).With respect to possibility of changing the volume of light’s source, light’s reach (attenuation) and degree of dispersion, they are used as reflectors lighting the concerned space. The climate of lighting can be obtained by using many - coloured lights within the scale of 256 colours.

Problem number three - Dynamic perception.
Passing through the model is the only factor which makes endoscopy better than a computer, because of its real time and its choice of the optional way. Generating the set in way’s path is tedious and time consuming when using a computer. There are almost no possible modifications in already existing animation and there are no possibilities of instant changes. Every new way and each new element brought into a spatial assumption must be followed by creating a new animation. However, this statement does not discredit a computer comparing with the endoscope, because problems discussed above concern only those programs and the equipment that we have used. This restriction does not concern super multiprocessoral computers which
animation in real time are not worse comparing with the endoscope. A computer animation does not only concern passing through the concerned space. We can animate buildings (stretching and shortening), materials put on elevations (mapping). Additionally we can create an animation of light of different colour and with an extention and an animation of the sun route.

By the computer animation, using every possible computer options, we can perfectly and relatively quickly verify and choose the best variant of space cultivation, cube’s colouristic and the way of lighting them.

References