# SPATIAL IMAGINATION IN PRACTICE AND TEACHING

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***Abstract***

*At the last conference we emphasized, that the presentation had to transport the whole project. This time we will present adequate methods of computer aided spatial simulation in education and practice that promote spatial imagination in the design process and the suggestive power of a presentation, while we still bear in mind the unity and the reciprocal influence of the design process and the presentation, that is spatial imagination and spatial simulation. Working on the computer first of all means to choose the appropriate software tool to exploit different aspects of specialized software from mathematical constructions to emotional experiences and from interaction to immersion.*

**Practice**

Our practice shows more and more that spatial imagination is one of the most important prerequisites for drafting and representation of spatial ideas. During talks with clients the capacity to communicate on space is crucial for the success of the cooperation. That is why we think it is important not only to persuade clients practically by illustrative representations, but also to begin much earlier and to develop concepts for the education of architects. We'll first talk about ”reanimating stills”, our current research on illustrative representations, and in the second part about computer aided experimental geometry as a design method, in order to have students get an introduction as complete as possible into spatial thinking and working as preparation for their own practice.

Depart from the developments of the stills we have looked for possibilities to basically increase the presentation of architecture. The problem of stills is their inflexibility. As long as the motive is static the problem does not occur, but when there are elements in the picture that are flexible in reality the inflexibility lets the picture obviously appear as a reproduction. The picture has the message ”I am a picture”.

Animated representations are mostly made in order to explain technical functions or processes or to demonstrate a sequence of spaces by movement of the point of view. Technical processes have the

*Urban Study · Lengyel Toulouse Architects*

*Industrial Building · Lengyel Toulouse Architects with Agiplan* character of documents without having to have a direct relation with the real appearance as for example simulations of the sunlight. For movements in the point of view it is rather difficult to fulfil a natural movement. They often follow traces of vehicles without actually intending to simulate the movement of a vehicle.

Non-animated representations are undoubtedly apt to transport ideas illustratively.

But in order to arouse emotions, we think the representation has to offer the possibility for identification. Our target was therefore to increase the identify ability of the representation. We searched for the reasons, why someone identifies himself with the representation. To a certain degree it depends on the similarity with the reality, not to mix up with the degree of realism. As already said about stills, the recognizability of the material as such is sufficient for its emotional effect.

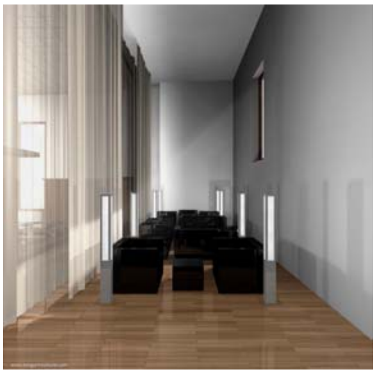
Something that looks like exactly worked on wood evokes similar emotions as exactly worked on wood.

The restrictions of stills and the problems of the animation led us to the concept of ”reanimating stills”. Because the movement of movable elements contributes to making a scene more real and to transport emotions and moods of the picture more clearly. And here again the recognizability of the movement is decisive but not the degree of realism.

Apart from the persuasion risen by emotions, ”reanimating stills” contribute furthermore to another important aspect for the representation of architecture. They give the static nature of architecture a new importance. Just as geometry, light and material, the movement of the architecture will become an issue of the representation and so maybe of the architecture itself. In order to include movements in the representations of architecture we first of all researched some movements to find out which are really apt.

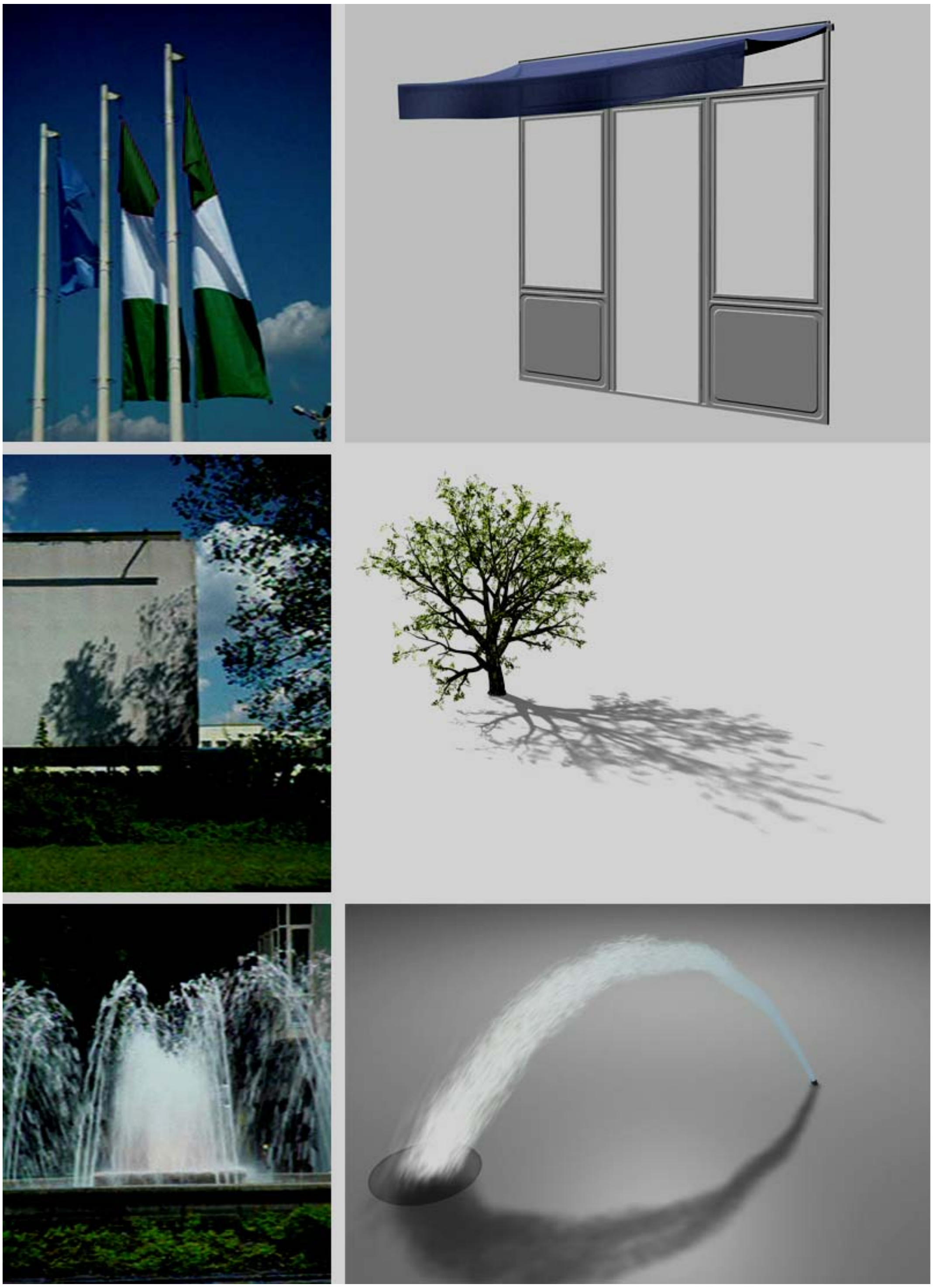
Nature always moves. What is known in large scale as simulation of the place of sun during a day is a fact even within small periods of time: The light changes, clearest of all by way of the shadows of the clouds. The shadow does not only darken but changes the colour. While the sun comprises nearly all the spectrum of colours, the shadow area only gets indirect light, i.e. broken, thus blue light. Plants permanently move by way of the wind and consequently their shadow moves, too. Light elements of built architecture move as well: masts, poles, bars and textiles.

The real movements are dependent on physical laws. Because we work on the illustrativeness and the emotional effect, we made an abstraction of these physical phenomena to a visually important matter. We accept that much of the complexity gets lost, since similar to the lighting and



*Forum Cinema Trier · Architect J. Götz · Visualization Lengyel Toulouse Architects*

*Reanimating Stills · Default Scene · Lengyel Toulouse Architects*



*Reanimating Stills · Research · Lengyel Toulouse Architects*

*Reanimating Stills · Sequences · Lengyel Toulouse Architects*

materialisation of the virtual models we do not follow the way of simulation. As it is often known from art we remain with our visual demand to make representations in order to recreate ideas.
So we call it imitation. Having examined the natural process, we reproduce it only in so far as it is necessary for the recognizability. Efficiency plays a big role even in this context. As an example for

movement of material we examined the movement of an awning and differentiated three zones: the flounce, the tarpaulin and the whole scaffolding. The flounce freely swings, the tarpaulin is tight, the scaffolding bears out. All movements are realized with interfering sinus waves. For example, for the flounce we have interfered two reversed sinus waves with a different amplitude and frequency. As parameters the horizontal position was linearly combined with the time. On the other hand we took the distance from the suspension as slightly powered reciprocal.

Another example is the representation of water. Here we first examined the jet of a fountain. In this case the water appears as a diffuse, white, cloudy-like mass, the density and velocity of which decrease.

We have built a typical scene of town planning that we use as basis for the examination of the applicability of the movements. In order to apply the movements we completed the model by some objects: a canvas for casting shadow, lanterns, fountains and at last a tree only the shadow of which is used. Thus we have created a town / building situation as an example that stands for the urban structure and the qualities of the public space.

The next step of the architectonic realisation might be the characterising of the buildings, i.e. relief, readability of the function or materialism.

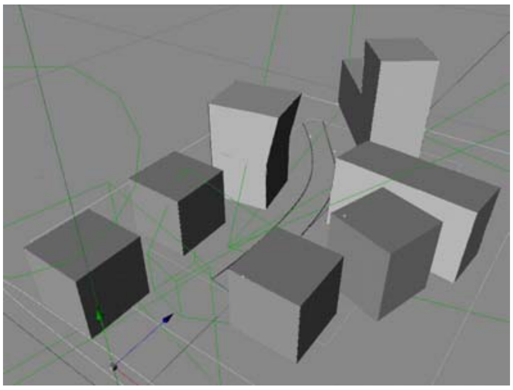
In the first scene we have combined the various effects of winds. The sunny atmosphere is being intensified by the change of light and shadow. Generally wind and the clouds produce an impression of freshness.

The second scene shows the impact of fog and swathes of mist. The scene becomes more threatening as a whole, the buildings at the same time more massive and stable. A kind of attitude from the distance replaced the freshness, underlining the stableness of the buildings.

The third scene is intended to underline the calmness. The movements of the winds are still there, the twilight of the dusk, however, is the very moment between day and night that especially underlies the change, as most impressively known during sunset. This mood to be on idle gives the scene a thrilling attractive force.

It is of course only the first step to examine phenomena of the nature. There exist an endless variety of atmospheric phenomena. In addition there are many movements that are imminent in built architecture and symbolize a very important part of their real appearance. Still they are rarely shown in representation up to now.

By ”reanimating stills” this aspect might be taken into consideration and made clear. Maybe they can be a contribution to support the movability and immovability in the field of architecture as a draft parameter.



*Reanimating Stills · Model · Lengyel Toulouse Architects*

*Office Building · Architecture Agiplan · Visualizatioin Lengyel Toulouse Architects*

**Teaching**

During education, movement in architecture plays a more subordinate role. But the movement might have been forced into the background. Thus the traditional methods of representation, drawing and model making, do not raise the idea of movements. So the perceptive impression of the real movement is a matter of imagination. In order to do a persuading spatial work, again spatial imagination is a prerequisite. During the draft the spatial imagination is the generator.

The draft process is generated by the spatial imagination. The ideas will be transformed into a visual picture. During the representation spatial imagination is the analyst. The project has to undergo a spatial examination, the imaginary process will be reversed, the visual picture will be transformed into an imaginary picture.

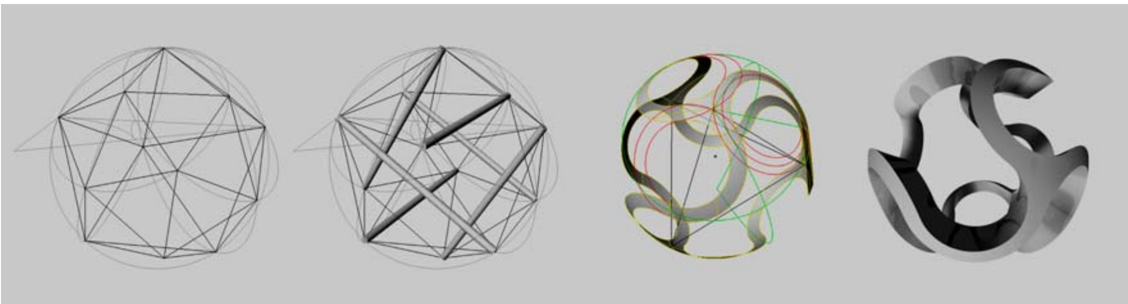
The processes of transformation can efficiently be supported by computer. Basically the process does not much differ from the traditional one by hand, a decisive factor is, however, the direct response. The computer offers the immediate control of the input, automation of processes, calculation of complex coherences and the repetition and variation of once defined information. The choice of the appropriate software depends on different aspects for different needs. Consequently, it is necessary to use different programmes for different tasks.

The creation of architecture on the computer obviously starts with the construction. Software is always oriented towards the need of a certain target group, architects for example. But here are also chances to use the specialities of a foreign field for the architecture, first of all the industrial design.

The movement in space, that is the navigation in the own virtual model is decisive for a real intuitive design in the space. If here the answer of the computer on the input of the designer is too slow, it is detrimental for the directness and so the usability of the design process. This is even more relevant for the texturing. Purely architectural programmes first of all work on an immediate context to the mass and cost calculation up to the invitations for tenders to supply, on the other hand the design and especially the animation programmes offer many more possibilities of the texturing and the lighting. Nevertheless a programme does never think of real materials, insofar the idea of ”wood” cannot be transferred.

*HKM Hüttenwerke Krupp Mannesmann · Duisburg · Lengyel Toulouse Architects*

Most of the fields are relatively well developed and can be used efficiently, as long as the user knows what he wants. If the renderer is to a certain degree experienced in photography and painting, he knows how to handle specialized software.
In most of the cases the difficulties start right up with the construction of the geometry in the head as an imagination. At this particular point we assume the starting point of many of the later arousing difficulties in computer work of architects. We think that one decisive factor is the geometry. In the subject ”representative geometry” an analytic mathematic path is chosen to teach geometric laws. By way of the computer this abstract method might be extended by an important aspect of the architecture, that is the illustrativeness.
As soon as we succeed in making geometry experimental, the mere theory might become an intuitive method of draft: experimental geometry.
This does not mean to teach representative geometry on a computer aided construction programme. On the contrary, experimental geometry on the computer is only reasonable after having intensively learned the basics of representative geometry by hand.
Prerequisite on the computer is therefore the object-orientated construction. The construction with geometric objects in an object oriented way means that straight lines are defined with two points, curves with key points, circles with center and radius and so forth.
Not every software offers this direct analogy and furthermore all those construction methods, that correspond to the analogue working method of the ”representative geometry” by hand.
But if the above-mentioned prerequisites are fulfilled, the computer aided construction serves as experimental field. Experimental knowledge is very important for the student because they are to be put by far over the usual deductive coherences deriving from general to special knowledge.
A general advantage of using CAD in geometry is the computer’s precision, because the inherent precision of the computer serves as self-control. The computer constructs so precisely that false constructions with a result that only seems to be correct, might almost be excluded. Thus the correct result might be on trial experimentally.
On the way to integrating geometry in the design process it is very important to use general construction software instead of specialized educational geometry software. Only if the software in which the geometry is researched is also apt for engineering construction, it might become the starting-point for an intuitive, creative work leading to a complex design result.
The routine then lets the geometry to become an everyday design tool. The main efforts for creating a draft may now be put on the contents, the sense of the architecture.



*Tensegrity Ikosahedron (Buckminster Fuller) · Spheric Tetrahedron (Josza Balint)*