Computer-Aided Visualization
Meaningful Support in the Context of Urban Design

Frank Pflüger
RWTH Aachen, Germany

In my present talk I want to discuss how computer-aided visualizations can contribute to the urban design process. Using an appropriate example, I shall illustrate how this might work and how cooperation might benefit. I shall conclude my talk by briefly referring to possible future developments.

This talk comprises therefore three parts:

- Images– not only beautiful but helpful within the planning process
- Cooperation – visually aided. An example
- The Future – not only colorful but enriching with regard to cooperation

Images are not only beautiful but helpful within the planning process

Concepts and ideas take shape in the head. Human beings think by relying on visual forms, they connect ideas and thoughts with images. Especially when we are dealing with complex processes, visualizations have always helped to increase our understanding of contents, to facilitate communication and thus to support cooperation. Communication and planning are not possible without real or imagined pictures or, as we prefer to say, images.This easily explains why computer-aided visualizations today are among the standard instruments in the field of construction and planning.

Hardly any new development project is being initiated without providing potential investors or political decision-makers with as detailed an impression as possible of the future reality, and this already in the initial phase. We all know the photo-realistic images or the virtual helicopter flight across a site which are to convince us of the merits of a project.

But are these ”perfect” visualizations always positive? Or do they frequently hide weaknesses of the ”content,” perhaps even suggesting a degree of concreteness which does not conform to the actually achieved degree of planning?

These are questions which do not let us expect general or simple answers. But any probe into the actual practice of planning will show us that such computer-generated images are mainly used for marketing purposes or to present a finished state of work or a future reality.

Fig. 1: Concepts with regard to future communication via videophone in 1930

At least at present, visualizations still play a minor role as a support in the primary work process, by facilitating the exchange of ideas and thoughts, and thus are (as yet) not really of major importance in the context of communication and cooperation of all those involved in the planning process in the course of a project. Normally the online communication is text-based.

Sustainable development presupposes an architectural and planning culture which demands the support and cooperation of many actively involved individuals. The cooperative and communicative shaping of the process attains considerable significance. To support these processes by way of visualizations could indeed contribute.

- to illustrate complex matters and relations between causes and effects, and to thus make them more transparent,
- to facilitate the linkage with related themes and to help,
- assisting by keeping the status up to date using digital means, allowing members access to current information and data bases at any time, and thereby,
- making understanding and communication easier.

In this way, the organization of the preparatory stage of a decision making process as well as the decision making process itself could be improved. And in fact, it would also become easier to reconstruct and understand it ex post. Thanks to the Internet, the necessary commonly shared platform is available.

Let me now briefly point to a few restrictive points before I come to the question of how communication within the planning process might be supported.

For the shaping of a process and its visualization are rather difficult matters to cope with:

- The object of planning as such is complex, only slightly linear and can be structured only to a certain extent. Each task is an individual one and so is the path followed when handling it. A considerable number of individuals characterized by different interests and preconditions are involved.
- This diversity in terms of content is mirrored by the heterogeneity of the data. Tight limits exist with regard to exchange and compatibility. A standardized digital data base usually is lacking; the existing points of intersection are unsatisfactory.

- The degree of previous technical knowledge and experience of the individuals involved is diverse; frequently, we have to presuppose deficits with regard to their qualification.
- Participation, fine-tuning, and transparency are aims within the planning process which require strenuous efforts. Increased transparency - which is possible - presupposes that it is desired both technically and politically.
- An important caveat: Not every planning process or every step in the process of drawing up the plan is fit for computer-aided handling. Nothing can replace direct cooperation and face-to-face communication.

But how can visualizations be used for the improvement of communication between those involved in the planning process despite all the difficulties on the technical, content-related, and mental level?

In view of the large number of approaches and developments to be observed in the field of visualization, I want to start out with three basic points. Three points which aim essentially at a meaningful and profitable way of supplementing a cooperative planning process:

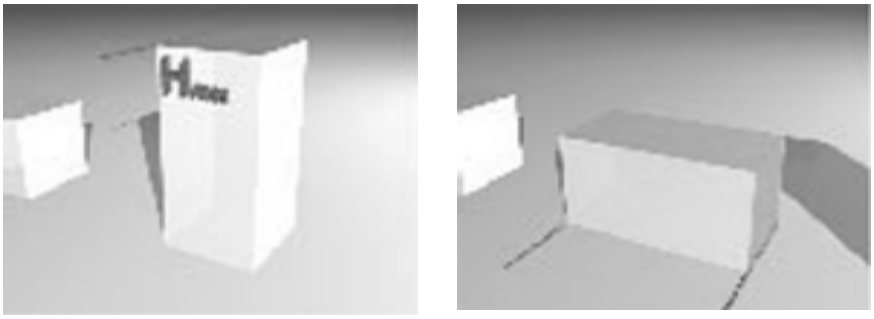
Presentation – made use of in a process-oriented way!
It should be our future aim to integrate information to the largest possible extent in visual form into our day-to-day project work. Team work and debates relying on sketches and intermediate results should be consciously encouraged; and those involved should make use of graphic forms of expression.

In the second part of this talk I shall return to this point once more by presenting the example I have chosen.

The illustrations used should correspond in their concreteness to the actually completed stage of planning, and they should form the basis for further work on the project. In this context I want to point to a research opinion, ”Computer-Aided Presentation in the Field of Housing Construction and Urban Design” [“Computergestützte Dar-

stellungen im Wohnungs- und Städtebau"] (http: www.pt.rwth-aachen.de/projekt/argecomputer) that we completed for the Ministry of Transportation, Construction, and Housing in 1999. Here you will find examples showing how informations that supplement text-based statements can be made available via images. Thus, the impact of planning contents and their combination, such as the relationship of density and traffic, height and shadowy areas, quality of a location, land values, and social structure can be remembered much better when it is communicated visually, for instance.

Participation – interactive and visually supplemented!
A desirable, intensive participation of different subjects of planning may receive important impulses when informations are processed in a way that interactively supports faster and more comprehensive mediation of spatial impressions, for instance, but also of movements through space in animations.



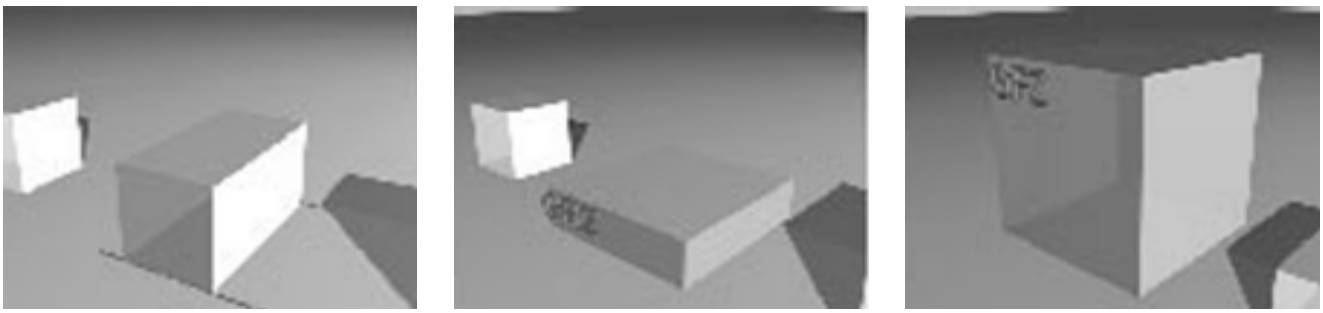


Fig 2: Computer studies towards interactive simulation of forms

It is exactly in urban design that in the course of a planning process numerous spatial situations are being discussed (just think of the parameters included and the standards established by a master plan, which allow for innumerous ways of concretization). The concretizations suggested can be very different, depending on one's point of view and understanding of the matter.

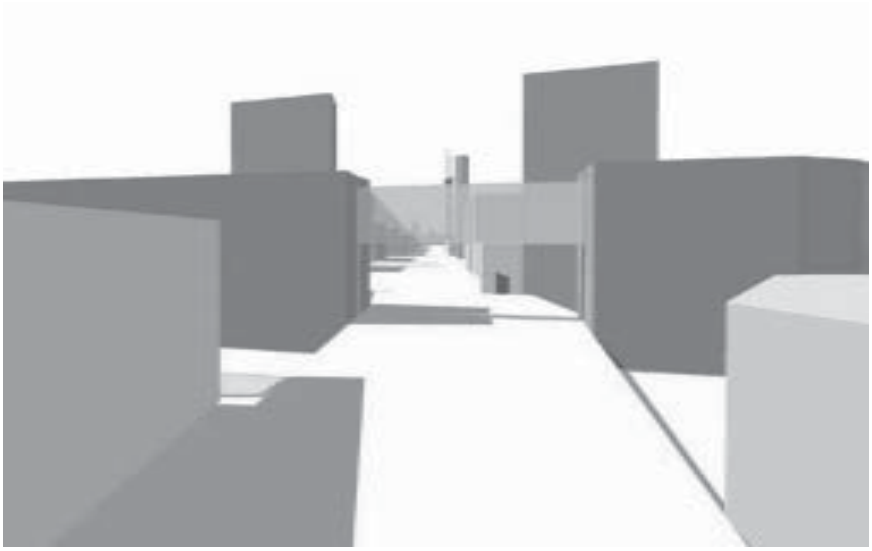
It is helpful in the context of the work process to shape, shift, geometrically deform and change, with regard to their color or material, both individual buildings and entire urban structures, relying for this on graphic-dynamic models. But up to now we have no possibility to produce and experience this diversity of forms in a goal-oriented way. I want to present to you, however, a simple trial run of a procedure in the form of this little animation which provides an interactive simulation of the possible variants for the development of sites within the framework of a given master plan. The building ”grows” up to the point where the maximum height, width, depth, space covered by the buildings ground plan [in German: Grundflächenzahl] or total floor space [in German: Geschossflächenzahl] has been reached (“BuildingLimitAnimation (“BauGrenzAnimation”), see under “Animation: Kuben”: http://www.pt.rwth-aachen.de/projekt/argecomputer/index.html

The contents of a master plan can be represented in a much more comprehensible way thanks to interactive graphic adaptation. Such representations might be influenced interactively, that is to say, by the viewer. And in this way, interrelationships between diverse parameters of urban design (such as density, height, proportion of area covered by buildings, size of buildings, proportion of greens, etc.) might become visible. The design options inherently present in the respective planning regulations and ordinances (such as GFZ, GRZ, alignments, etc.) are more easily understood when visualized.

A Lot of Expert Knowledge – So much can be done in a simpler way!

An important reason why computer-aided representation is not being used generally as a work tool can be seen in the separation of actual

Fig 3: Example of an abstract representation of street space



work on the plan from its visualization. Computer-aided representation more often than not is a special by-product which is generated after the plan has been drawn up.

The ”producer of images” and the ”consumer of images” act in two different worlds which should be superseded and merged. All those involved in the planning process should be able to grasp visual contents and to articulate themselves with respect to them in a graphic manner. As far as the demand for technical sophistication and for detailed specifications is concern, “less is more”. Sometimes, a simple sketch says more than a perfect computer simulation; for the representation of a spatial situation simple models of buildings may be enough, and photo-realistic high end realization of the model is unnecessary.

Generally we can say that the considerable degree of abstraction of urban design illustrations can be a big advantage. The amount of data that must be considered in the context of urban design questions can be much smaller than is the case with tasks formulated in other

fields (for instance, simulations of dynamic processes of gases in combustion engines, animations for science fiction productions, etc.).

Cooperation – visually supported. An Example
What I shall present here is an example showing how a planning task can be cooperatively tackled with rather simple technical means, by relying on visualized contents. The main emphasis is put on the practical test of a planning procedure relying on cooperation and communication.

In the context of training architects and town planners in computer-based approaches, I have been involved over a considerable period of time in computer-aided work processes.

In the example ”computer graphics in the Internet” that I’m now presenting to you, I have confronted students with the task of developing a given site.

On the basis of different ideas the group was expected to agree on a master plan. This master plan was to serve as the basis for the designs they were going to propose.

The presentation of ideas, their discussion as well as the decision-making process was to be realized on the Internet. A shared platform with an established code of conduct for their cooperation was supplied on a web server. Each participant had ftp access and was able to independently upload and download. Basic knowledge of HTML and 3D design using Acad had been provided as technical input.

Contentwise, the course was divided into four steps:
Step 1: Production of ideas
Right at the beginning the participants developed different ideas for the site. These design approaches were to be visualized and presented on the Internet in a comprehensible way.

In the context of a competition with other ideas, it was important to communicate ones enthusiasm and convictions, to conceptualize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the design approach, and to flesh it out sufficiently. This was to happen according to the motto: An image, a sketch says more than a thousand words. Accordingly, each team produced a specific Internet presentation. These presentations formed the basis for a professional debate that was to lead to a concept they could agree on.

Step 2: Reaching a consensus for master plan
The presentation of the first sketches did not take place in a given room of the university but on the world-wide web.

The contents of the individual project homepages formed the basis for an Internet-based discussion process which was concluded with the consensus of the group regarding a master plan.

In order to structure the debate, a ranking was introduced which allowed every participant to name the three concepts favored by her or him while basing this judgment on pre-established and in fact, pre-structured criteria. After the ranking and intensive discussions on the Internet had been completed, two ”proposals” remained in the race. Subsequently, these two variants as well as two further variations that seemed possible were presented in a sketched form and were debated in turn.

The group agreed on four items as parameters to be laid down by the master plan: use, development, density, and structure of public and private greens [the so-called Grünstruktur].

The remaining concepts were put to an on-line ballot and by an overwhelming majority, the group could agree on one of the concepts. The master plan thus was the result of a design process which was jointly shaped by many subjects in the context of an on-line procedure.

Step 3: Development of modules / construction of a library
After the basic frame and the general aims had been decided on, the concrete work on urban design and architectural facets began. As is common practice in the case of realizing larger projects, several teams participated in the concretization.

Fig. 4: Excerpt from the project homepage of the course ”computer graphics on the Internet”

Fig. 5: Opening page of the project-related library

In this phase, those involved in the job did no longer compete with each other. But they cooperated instead, on the basis of the master plan.

The diverse teams developed an Internet-supported data base of different modules for the five areas:

- Housing
- Industrial / office buildings
- Specific buildings (such as shops, cradles, kindergartens, etc.)
- ”Furnishing” of public space (such as lighting, [sculptures], devices installed in playgrounds, park benches etc.)
  art objects.

The modules were collected in a shared library of the established platform and thus were available to all participants as volume-oriented objects they could draw on for further modeling.

Step 4: Formulation of a concrete proposal for developing the site
In the final phase, the design teams worked on individual concepts on the basis of the master plan they had agreed upon. They used individual moduls from the library which they modified and amended. The solutions found were again presented on the Internet platform they shared. The examples show the visualizations of their proposals and the articulation of the concepts for the entire area to be planned. In the course of this work, no photo-realistic high-end results were produced, due to the brief work period of merely one semester. What we got were useful interim results and this was entirely in accordance

with the premises of the project.

The future – not only colorful but enriching with regard to cooperation

Planning processes which take place both on-line and off-line and which allow us to work in computer-aided fashion on segments of the decision making and communicative process will soon be a matter of course. Therefore, the reliance on computer-aided visualizations will increase.

Fig. 6: ”Virtual cooperation”

However, we do not have much experience as yet with this new way of working. Far-reaching concepts exist with regard to the future possibilities of computer-based communication. But we have not advanced very far when it comes to the question how they are to be put into practice and how they will stand the test of practice.

In order to say how visualizations can enrich planning processes and communication, we need their extensive application in the field we are here dealing with. Simultaneously, further technical improvements will be necessary, in order to gain desirable functionality in various regards. Thus, interactive dynamic applications could decisively support the cooperation of those involved, as shown above. In this area, considerable progress is to be expected from VR-technology. Why shouldn’t we think it possible, for example, to have some day

- dynamic urban development concepts which simulate in advance possible goals and their effects, making them comprehensible, and pointing out their relationship? Or why shouldn’t we have
- interactive master plans which let us experience the diversity of urban design options implied in a given legal frame of reference, quite similar to the way faces of wanted criminals can already be simulated? By way of such a [Gestalt] simulation even the interested laymen could realize his own interpretation of a plan on his computer monitor.

While this is merely a forward-looking projection, computer-supported visualizations can already by of great practical value even now. They can supplement cooperation, enrich routinely used pathways and structures of communication, and they could help indeed to further a better preparation and transparency of decision-making processes, thus making them more comprehensible while contributing to the quality of the results as well.

The way that still lies before us in this respect entails considerable needs for added research, on diverse levels. This concerns the adaptation of such processes to practical needs and their inclusion into existing organizational structures as well as the development of interactive applications and the improvement of existing soft ware products.

But what we need most of all, is practical application and testing, critical reflection, and the courage to try out something new.

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