

# E-learning in Creative Planning Processes

## *Relational methods of designing on differentiated types of model*

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**Abstract.** *This conference paper examines experimental design exercises on a simulated model in relation to designing on a physical model. In the initial design phases, the process of designing on both a haptic and digital model is analysed with regard to the didactic objectives. In this context, only form-related aesthetic aspects are discussed.*

*The starting point is the didactic necessity of imparting to students the process of designing on spatial models. Reduced to form determination, the question examined is for which aspects of design theory the potentials of real and virtual models, as well as of the interaction of both types, can be exploited.*

**Keywords.** *Design methods; digital and physical models; 3D-Digizer; design education*

### **Designing as a process**

Our design didactics are based on work done by Bernhard Hoesli (1989), a co-founder of the Texas Rangers, who taught design as a process using simple forms as vocabulary. His exercises combine functional demands with sensory objectives.

The construction exercises were structured according to didactic considerations, the teaching dealing with such types as the development system, the structure of cubatures or the transition from outside to inside. The act of designing viewed as “waiting for a good idea” is, according to Hoesli, not communicable; students should, in contrast, learn to judge the “force of an idea”.

In the previous experimental work, have been traced the influences of the media employed on the design processes and combined the approaches of current CAAD research with aspects

from classic design theory. For mathematical rules of proportion, atmospheric influence factors and analogy concepts in architecture, we have developed design methods which have been applied and verified in several series of seminars. (2000)

### **One example of digital designing**

On the subject of morphology a form-generating method in the pre-design phase has been tested. Starting from urban-planning lines on an area map, two simple geometric initial images were produced which were merged by means of morphing software, in this case Morphit. Selected images from this film sequence were extruded with CAAD to produce solid models as sectional drawings. In the visualisation phase, the individual images were materialised by projecting them on to glass.

The students were given an inner-city site, which was being used as a car park at the time, to

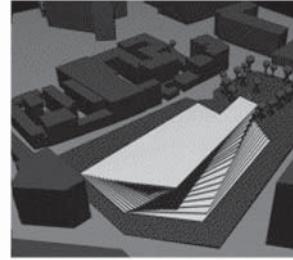
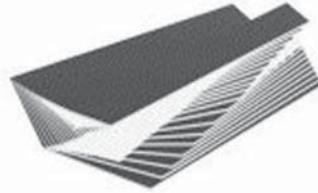
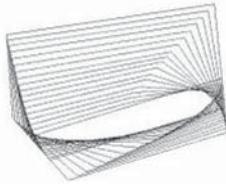


Figure 1. morphological image sequence and building conception. Student Birsch

work on. Their task was to focus the buildings ringing the site, consisting of half-timbered houses, a high-rise building and mid-Victorian houses, to form a morphological building as a development of the site.

In the early phase especially, the integration of software from other artistic and academic disciplines can lead students to creative use of the computer and open up new design methods beyond “bottom up” and “top down” techniques.

### Abstracting models as a method in the design process

Modern CAAD programs attempt to make their parameterisable objects available for a variety of scales by means of intelligent display and style managers. In manually created drawings a decision is made, project-related in each case, on, for example, the representation of a door on a scale of 1:200. In the computer-assisted drawing, in contrast, I focus on the input and less on the display.

Abstracting a plan clarifies the fundamental

idea of a design. The simplification of the plan with regard to a harmonic combination of idea and presentation serves, in the primary design phase, to distill the core notion of the person creating the design and subsequently to communicate the idea to others.

In modern design theory, this primacy must be reformulated. Designing on a haptic working model makes constant scale-dependent abstraction demands by reason of the material; it reveals physical limits not present in digital modeling.

As an experiment on rule-based design (2001), I defined the steps building up to the Bauhaus exercise “Le Cube”, with the “Golden Section” as a form-generating principle for ground plan and elevation. The solid models this produced are suitable for a comparative analysis of digital and analogue modeling.

Working on both types of model pursue very different educational intentions within the terms of creative training. The aim of the following table is to show the differences with the same degree of abstraction.

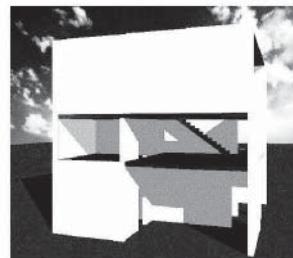
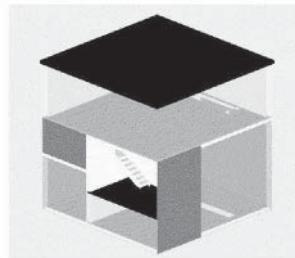
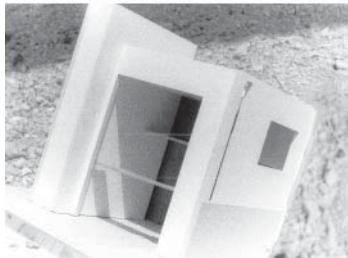


Figure 2. 1 haptic model; 2+3 digital models, 3 Student Kostrade

## **Haptic model**

Conveys a feeling for proportions. The object retains its constant size, which can be varied only by the different distances of the observer from it.

Perception of three-dimensionality and solidity. The glance round the corner is given. Well suited to exterior cubatures, less supportive of interior planning.

The materiality simulates both real building on a different scale and the related laws.

There are dependencies between material and scale.

Designing on the haptic model has its limits. A leap in scale necessitates starting a new time and again; as a result, models are only sparingly used on selected scales.

## **Urban-planning models**

In urban-planning models, large-scale spatial relationships can be better grasped, as the model sizes are variable. The bird's-eye view alienates the real view of, the building alignments.

The ability to move around an object helps with the assessment of proportions and other formal aspects, as this is all but identical with the contemplation of a real object.

## **Digital model**

Constantly changing zoom settings provide the student with no constant for dimensional interdependence.

Perception of the designed body is assisted by a large number of three-dimensional images that are primarily 2D images with distortions. Interior perspectives reproduce convincing spatial impressions.

The object remains "untouchable". The simulations of materials, colours and light are able to convey atmosphere.

Refining the model through various planning phases may prevent transference errors, but also the ability to verify and query; it is, however, an extremely time-saving approach.

The "constant" screen size is an obstacle to establishing large-scale spatial relationships, especially for large-format, urban-planning models. (When everything is visible on the screen, the zoom is so small that nothing can be made out.)

The revolving model on the monitor, as if on a tray, allows many different positions to be adopted.



Figure 3. initial-ideas sketch, analogue and digital model photos as shadow simulation

In contrast to haptic models, digital models with the standard features of the customary CAAD software can be “walked through”. They build up a representation in perspective step by step and suggest movement to the observer. The great importance of the dynamic analysis of architecture through movement was demonstrated by Choisy (1954) in his research on the Acropolis of Athens. He traces the path of a visitor to the Acropolis in detail; the view as concealed elements gradually reveal themselves and others, in their turn, drop out of sight. Le Corbusier (1995) evolves a dogma from this and discriminates architecture into living and dead, depending on whether the walk-through law was ignored or, on the contrary, brilliantly followed.

This reveals the importance of this function, less for the presentation of fine-looking films than for the analysis of individual section perspectives, also as understood by Hogarth (1753), who did not reduce the complexity of beauty to numbers, lines and their relationships but held the momentum of motion, the modulation of light and shadow, the moods and characters of the observers in equally

high regard.

### Perfecting analogue models through digital animated visualization techniques

Designing with atmospheric elements using analogue techniques comes up against limiting factors that cannot be overcome even by complex haptic models. Simulations can now generate visually convincing impressions on which results can be verified and improved interactively. Other sensory perceptions, such as hearing, touching, smelling and feeling, cannot yet be addressed by digital models, or not without unjustifiable expense.

The example described here of a cinema foyer designed to exploit the play of light was intended to reflect the different moods experienced by people on entering and exiting: a double panel of concrete, with functional areas in between, separated the entrance and exit areas, the entrance foyer being artificially rendered as bright as day with spotlights; the exit received its light exclusively from the entrance area through the perforated walls. While passing along the entrance hall, the



Figure 4. picture sequence of the pavilion “Plays of Light”, degree project by Students Roters and Schröde

Figure 5. 1. wood-clay model; 2. digitalization; 3. digital model., Student Korthals



people entering were projected as silhouettes on to the longitudinal wall of the otherwise quiet, contemplative exit foyer.

In order to estimate the effect of the perforations in association with the play of light and shadow, in 1986 I created a simulation in the haptic model with an artificial source of light and documented the result with photographs.

The unsatisfying presentation of a concept with the resources available at the time was the motive for reworking this idea with appropriate tools; a film with animated characters was the result. (<http://rzserve-bux.fhnon.de/fbab/kirschner/index.html>:May 2005)

The visualization of light as a central theme of architecture can benefit not only artificial light but also the design of daylight illumination as understood by a Louis Kahn. To design lights and shadows as parameters defining a space was the aim of a course entitled “Plays of Light” (1997). For Documenta XI, a pavilion dealing with the subject of

light and shadow was to be designed on the lawn in front of the Orangery in Kassel.

A project group developed a play of light for a two-storey pavilion: slit-like cut-out openings in an east wall and a circular opening in the roof produced light images which accompanied the day’s activities. The tranquil image of a parallel multitude of lights in the morning evolved into turbulent superposition patterns; towards evening all the lights bunched together to form a circle and slowly move upwards along the two-storey slatted wall and out of the building.

### Designing with haptic and digital models in teaching

At present, digital models in teaching are displacing classic model-building on account of speed and convenience. Insofar as teachers have recognized the didactic necessity of designing on a working model, convincing models need to be

Figure 6. degree project Michael Kögler, supervisor Prof. Dr. Kirschner : 1. Styrodur model; 2. digital model



developed.

The digitalization of haptic models combines both types of models; students experience working with materials as an integral part of the act of designing, not as additional work.

In the basic exercise “Semi-detached house as a pair of buildings”, two houses should produce an area of tension in the combination of the objects that is based on the contrast of transparent membranes and solid rectangular objects. The model was developed with clay and wood, digitalized and, following elaboration in the CAD program, exported to VIZ (3D Studio). This enabled it to be provided with materials, visualized and animated.

In a degree project a design was produced with similar techniques, which exploited the interplay between the two types of models. Almost all the above-mentioned aspects were drawn upon to monitor the design. Modulation took place solely with the use of solids created by extruding the ground plans and views and merging them.

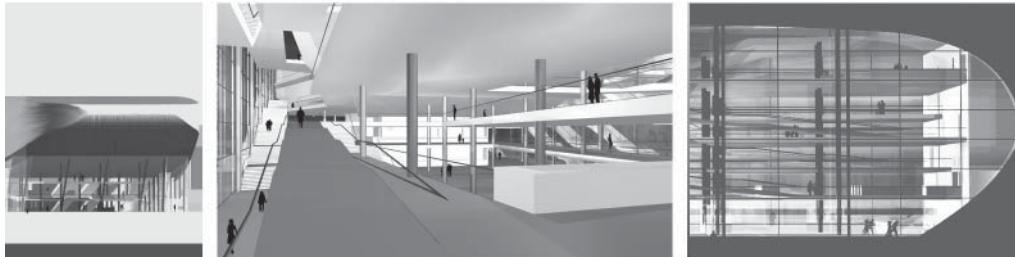
The planned building is both a multiplex cinema center and a museum for film art. It is located in the development area in the harbor city of Hamburg close to the banks of the Elbe. The degree project has been designed under the constraints of a competition concerning urban planning. The concrete shape of the house is similar to a stylish shoe which leans on the transparent volume containing the stairways and the museum. This work has after digitalization completely been evolved on a 3D-CAD-file.

## Students sum up

Surveys reveal that students determine the forms of buildings faster using the real models and it is easier for them to analyze the buildings in respect of their proportions and shape; in the creation phase they are more likely to identify difficult design points. Their studies are given a sensory counterbalance to the increasing amount of work at the computer screen, an element not to be underestimated. Digital models can be more easily represented in the true setting, surfaces and colors arranged with greater diversity. The virtual walk-through of the interior imparts a sense of space and atmosphere to the students. These statements are the result of questionings accomplished by the leader of the modelling laboratory. This experienced lecturer amended referring to the practice of model building that many students initially thought in terms of building a model railway, but finally had internalized the abstraction of model building as if it were quite natural.

## Conclusion

In the seminars, the students grasped the didactic learning goals of the various design methods. It seemed the students had to overcome an inhibition threshold to deal with a design assignment using a physical model. The 3D digitizer proved an efficient interface between the physical and digital model for form development on the model.



*Figure 7. degree project Michael Kögler, supervisor Prof. Dr. Kirschner; distinguish views of the digital model*

The AutoCAD data model showed limitations in shaping solids: ruled surfaces cannot be extruded to solids nor edited with 2D modification commands.

Using the physical model in design determination, teachers and students can effectively counter the known deficits of digitalization in the creative design process as regards imagining space and feeling proportion and material. The fascination of the digital world rests on its simulation capabilities, examples being the walk-through interior or light management.

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