Using the Endoscope in the Country of Lilliput

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The present contribution focuses on the interaction of light and color in the context of spatial changes. A project study on ”Color Overlay” from the study course ”Experimental Color Design” issued the focal point for consideration. The relation between projection and original in the scale model results in incomplete but useful findings on the effects to be expected. Only in the course of the full-scale model test series the performed activities were to be clearly recognized. This contribution thus intends to disentangle the relation web between scale (endoscopic) model viewing and simulation in true size.

1 First work model: rectangular color elements

1. Introduction

To date Gulliver’s Travels into foreign worlds still are fiction: only Hollywood has managed to conquer the world of the scaled-down or -up for a few film minutes. The access to the world of the real tiny has become everyday practice in university life. The endoscope makes for insight into architectural models of differing scales from the angle of the fictious inhabitants. Material worlds normally made out by touching with the finger tips mutate to space-occupying structures by means of the lense system. The world of the changed lies at the endoscopist`s feet. The exit is achieved without effort. In the twinkling of an eye we are back to our familiar world, the world we study in turn by means of 1:1 models. These models appear in front of us in the familiar size, but call for a changed manner of viewing. Trips into worlds of differing scales are readily offered, however, always requiring a great amount of attention from the travellers.

2. Model Viewing in the Design Process

The mentioned stories of Jonathan Swift surely issue a terse topic trying to combine extreme positions: the miniature and the gigantic: a problem often faced in the course of design work. The translation of a design idea in the 1:1 scale always turns out to be something like an adventure trip. In the ”early” design phase working models have a generally catalyzing function and are to convey ideas. The potential of ”dis-covery” is disclosed gradually in the course of (e.g. endoscopic) model viewing. In scaled representation often problematic issues become visible, this applying to generally all model scales ranging from 1:1 to 1:n. In viewing

2a

2b

2a -c Second work model: systematic arrangement

of models possibilities and limitations are registered caused by the simulation technique as such, e.g. also due to the endoscopic viewing. The compact make of the endoscopic hardware allows for access to specific areas without destruction, picture quality, however, being problematic without subsequent (digital) editing. Furthermore, endoscopy without peripheral media such as photography, film and video is practically not imaginable.

3. Project "Color Overlay"

A project study performed within the study course on "Experimental Color Design" at the Vienna University of Technology in the summer term of 1999 is to be exemplified below [1]. The teaching aim of this lab exercise is defined as follows:

As integral component of everyday perception, colour in architecture is not a mere minor visual addition but an effective means for shaping structure and significance. Impact and meaning of architectural design are substantially determined by the colour of appearance. Space-related colour is not a simple perceptive unit, but the outcome of complex interactions of various factors. Colour design in the context of contemporary architecture can no longer be understood exclusively as the design of surfaces; it embraces the overall effect of material and surface properties, light and lighting, space and time, of movement, change, fiction and reality. The increasing use of modern materials and artificial light makes it increasingly necessary to take into account, in both theory and practice, the resultant complex (colour) impressions and their (psychological and social) effects.

During the workshop the participants have the opportunity to explore experimentally the appearance, effect, meaning and functions of colour and light in architectural space by using and compering different techniques of spatial simulation and project visualisation. Of particular interest is the question to what extend these methods can help to assess and predict how above mentioned factors interact and contribute to the overall colour impression in the completed architectural space.

3.1 Development of a Color Structur

In concept development first a limitation of subject fields as to transparency/translucence, overlay/layering/compaction, reflection/transmission/absorption as well as movement/change/alteration was achieved. Soon the idea of a space-occupying structure emerged resulting in color overlays in form of spatially staggered translucent filter areas and their

projected images. In order to avoid too much complexity a limitation to the (primary-) colors red, yellow and blue in the course of the first working model was agreed upon. By means of rectangular transparent plastic sheets in above colors hanging freely in space from wires an initially chaotic and haphazardly arranged ”color structure” was achieved. In the course of experimental approaches from differing arrangements of colors a clear compaction of color layers was to be determined from differing angles of view.*(Pic.1)*

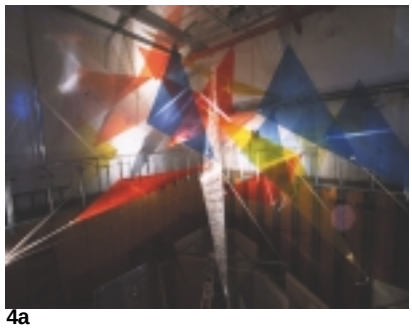
3.2 Arrangement of Color Areas

Based on above observations the arrangement of color patches were optimized by computer-assisted representation and arranged accordingly in further models (scale 1:20). The rectangular sheet elements were then replaced by triangular ones. In addition perforated colorless-transparent sheets were added to the structure. Each individual color element was attached at three point of the room each. Elements of the same color had two fixation points in common, the third one was freely chosen. Furthermore, the elements of one color had one fixation point together with the elements of both the other colors.

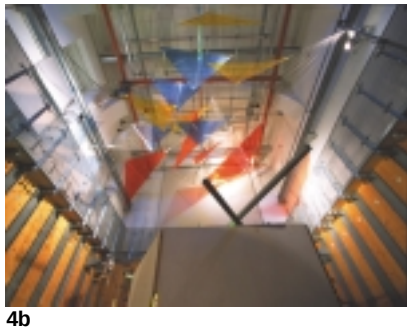
This arrangement was based on the consideration that two of the three color areas can be ”eliminated” optically from the predetermined angles of view and that the respective visible area can be selectively highlighted by spotlights. Outside the three given points of observation the viewer will experience differing qualities and degrees of color overlays and compaction. Substractive color overlays of yellow and red, yellow and blue, red and blue, yellow, red and blue might occur. Additional overlays and (in the 1:20 model still not foreseeable as in the subsequent 1:1 translation) scatter- and refraction effects were achieved by means of the perforated colorless transparent sheets and the projected images of the individual elements in combination to each other and to the room-enclosing walls. *(Pict. 2a-c)*

3.3 Constructional Translation

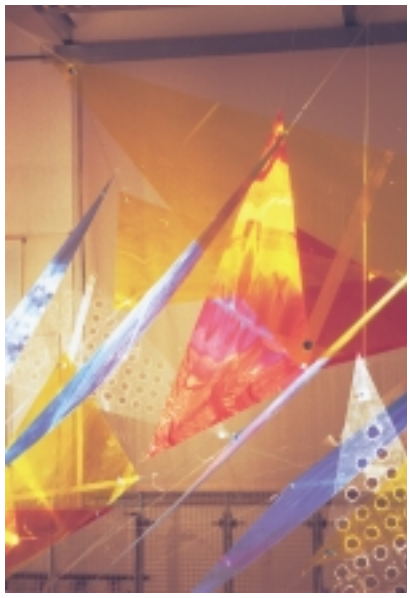
The spatial arrangement of the 1:20 model was precisely transferred to the 1:1 situation. Following attempts with frame constructions being too heavy the translucent color sheets and (subsequently the perforated elements) were hung by means of attachment with thin nylon threads through eyelets. As the nylon threads were hardly visible the impression of an airborne structure was achieved.



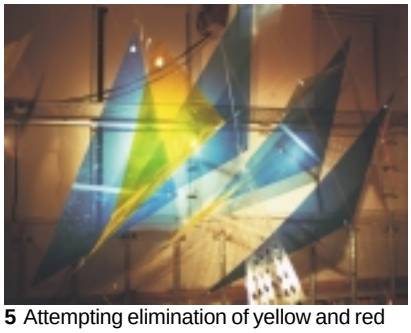
4a



4b



4a-4c Reflections and reflectance result in unexpected effects



5 Attempting elimination of yellow and red

6 Experiment: blue appearing on the wall

7a

7a, b The object matches up with its projections

The anticipated (optic) separation of the three color layers in the 1:20 model only was substantiated satisfactorily in the 1:1 installation. By means of three spotlights positioned exactly in their joint fixation points of the color elements one color layer each was clearly highlighted. Addition of a single spotlight made for a monochrome picture (yellow, red or blue). Two spotlights made for overlaying of the two respective color layers. Yellow and red made up orange, yellow and blue green, red and blue violet. The latter only occurred in the projection as the blue filter apparently issued less density as the red one. Spotlighting with three spotlights made for a compact, practically sculptural structure of the three color layers, resulting in a space-filling wholistic composition in interaction with the projected images. The perforated colorless-transparent elements added interesting reflective,- scattering and refraction effects. Within the structure the perforated elements became visible predominantly in narrow rays turning up along the edges of the holes. In the projection they appeared as shadowed surfaces. Reflectances and diffuse reflections were also registered on the color elements and the room-enclosing wall surfaces.*(Pic 4a-4c; 5; 6; 7a,b)*

4. Assessment

The task was too complex and time-consuming to be directly solved in the 1:1 model situation. Working and experimenting with the 1:20-model permitted an efficient analysis of differing spatial arrangements and color layers. The desired impacts of optic elimination and emphasizing of individual color levels were clearly anticipated by means of endoscopic insights. A considerable limitation regarding the scale model, however, is that the surface structures and optical (i.e. spectral and optical-linear) properties of materials cannot be scaled-down to one's liking. Lighting by means of differing lighting gear and fittings are significantly limited in the scale-model: in particular, if the color effect expected in reality is not restricted to the colors of surface and members but is made up by the complex interaction of lighting, light (and surface color, transparency and translucency, reflection and reflectance) as being studied in this project, this cannot be sufficiently simulated in the small-scale model. A realistic representation and assessment of complex color impact only becomes possible in the 1:1 scale.

Some light- and color effects only became visible and effective in the 1:1 simulation. Especially the color overlays, - courses and projections caused by means of reflectance and (diffuse) reflection were partly only registered lateron. The effect of the color areas projected on the walls

was actually of far more impact in the 1:1-model than in the scaled-down model. The brilliance of the images matched the built structure up with its projection thus making for a resolution of the spatial contours leading to a spatial vagueness.

The comparison of scaled models and 1:1 simulation by means of above project study suggests that even when ignoring the indicated problems of miniaturizing optical and structural surface properties the differing scales result in differing specific perceptive phenomena (e.g. contrast intensification): the images produced by projection were of a considerably more intense unity than in the significantly scaled-down model.

This may be traced back to following reasons: the subjectively perceived quality (hue, chromaticness and lightness) of a color depends on color of light, size of area, surrounding color, duration of presenting and chromatic adaptation, amongst others. These factors do not become effective in the small-scale model (in both direct and endoscopic viewing) in the same way as in the large-scale situation. The small-scale model and its endoscopic presentation always will remain a transmitted image of a physically non-accessible spatial situation compared to the walk-through 1:1 model. The color impact of the architectural space does not result from the viewing of a (two-dimensional) image but from the (three-dimensional) being surrounded by light, volume and space-defining elements. The 1:1 model thus acts as the link between small-scale model and built realty. *(Videoclip liegt auf CD bei)*

Notes and References

[1] Participating students: Christoph Egger, Helmut Hürner, Lothar Puttinger, Martin Standfest, Christina Schneider, Susanne Magedler, Michael Lisner, Ingo Kerschischnik und Brigitte Lerchner.

[2] Martens, Bob (Ed). Full-scale Modeling and the Simulation of Light [Proceedings 7th EFA-Conference 1999]. Wien: ÖKK-Verlag, 1999 [forthcoming]

[3] Oberascher, Leonhard. ”Environmental Colour Design - Simulating Realworld Complexity”, in: Sivik, Lars (Ed.). Colour Report - Colour and Psychology - F 50. An Anthology. Göteborg, 1997, pp. 49-55.

[4] Martens, Bob. Räumliche Simulationstechniken in der Architektur. Wege zu einer neuzeitlichen Raumgestaltung (Europäische Hochschulschriften - 37 - Architektur). Frankfurt a.M.: Lang Verlag, 1995.