THE FUTURE OF ENDOSCOPY

Proceedings of the 2nd
European Architectural Endoscopy Association
Conference in Vienna, Austria,
August 30th - September 1st 1995

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EDITED BY BOB MARTENS

VIENNA UNIVERSITY OF TECHNOLOGY
DEPARTMENT FOR SPATIAL SIMULATION

IN COLLABORATION WITH THE

INSTITUTE FOR SPATIAL INTERACTION
AND SIMULATION (ISIS)

CIP-Kurztitelaufnahme der Deutschen Bibliothek:

Martens, Bob (ed.)

The Future of Endoscopy. Proceedings of the 2nd European Architectural Endoscopy Association Conference in Vienna, 1995 - IRIS-ISIS-Publications at ÖKK-Editions - vol. 1 - Österreichischer Kunst- und Kulturverlag, Wien 1996.

ISBN- 3-85437-114-4

NE: Martens, Bob (Hrsg.)

Cover (image processing): Borislav Petrov

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Preface

The first EAEA-Conference took place at Tampere University of Technology (Finland, 1993) serving as an meeting point for specialists of endoscopy in architecture and displayed an approach to the potentials of endoscopy. The Vienna Conference in 1995 continued this direction and tried furthermore to serve as a platform for non-advanced users. EAEA '95 Vienna aimed at a critical investigation of today's endoscopic culture with a focus on three themes:

- SPACESCAPES: The Re-Design of Spatial Experience
- HIGH TECH & LOW COST: The Choice of Appropriate Technology
- THE NEXT GENERATION: The Implementation of Applications

The Aspern-Workshop represented the highlight of this conference. Prior to the conference nine universities had submitted endoscopic and computer-assisted space simulations for this urban expansion area north of the Vienna Danube. The outcome was not to be regarded as a “noble competition” between the various institutions participating, but rather to sound out the actual potential of various simulation techniques and their combinations for future use.

Some of the events were attended by more than 50 participants, the accompanying manufacturers’ exhibition adding to the attractiveness of the conference. Amongst others the newest development on the field of stereo-endoscopy such as high-resolution camera technologies and endoscopic exposure vicinities were presented. One of the evening events dedicated to the roots of endoscopy took place at the Institute of Medical History, impressingly demonstrating history by means of the collection of historical endoscopes.

The conference proceedings contain the papers presented at the meeting by 23 experts from 15 universities. The papers cover such areas as the technical features of endoscopy and environmental simulation, theories supporting the use of endoscopy, practical applications, and discussions on the future of endoscopy and environmental simulation in comparison with other means of architectural representation.

EAEA '95 was hosted by the Vienna University of Technology in collaboration with the Institute for Spatial Interaction and Simulation (ISIS). The conference was furthermore supported by the Federal Ministry of Science, the Cultural Department of the City of Vienna, Viennese Association of Tourism and several enterprises all of which we render our sincere thanks.

Finally, we take pleasure in announcing the third EAEA-conference taking place at the Technical University of Delft in 1997.

Bob Martens
February 1996

"Institute for Spatial Interaction and Simulation" (ISIS)

Man and space result in an intense interaction. On the one hand specific features influence human perception, on the other hand man impresses on space, changing and shaping it. Scientific research within the field of regional planning and architecture, particularly concerning the relation and interaction field *Man and Space* represents the main focus of the *Institute for Spatial Interaction and Simulation (ISIS)*. By means of visualization and modelling the quality of communication is enhanced. Simulation of space processes with special attention as to applied methods, media and techniques consequently falls within the activities of the institute.

IRIS-ISIS

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C O N T E N T S

I THE RE-DESIGN OF SPATIAL EXPERIENCE

Michael Kwartler:
Beyond the Adversarial: Conflict Resolution, Simulation and Community Design 3

Manfred Walz:
User's View and Utilization Process in Urban Space 7

Arne Branzell:
Management of Sequential Space Experiences 17

Peter Kardos:
The Role of Spatial Experience Anticipation in Architectural Education and Urban Design 23

II THE CHOICE OF APPROPRIATE TECHNOLOGY

Jan van der Does:
A Student's Project: Choices in Media for Communication and Presentation 27

Jack Breen:
Dynamic Perspective: The Media Research Program 37

Alexander G. Keul and Bob Martens:
Simulation - How Does it Shape the Message? 47

Martijn Stellingwerff and Jack Breen:
Applications of Optical and Digital Endoscopy 55

Petri Siitonen:
Future of Endoscopy, Updated 69

III WORKSHOP ASPERN: THE (IN-) VISIBLE CITY

Bob Martens:
Introduction to Workshop Aspern 77

Hildebrand Frey
Workshop Aspern: Strathclyde Approach 80

Aleksander Asanowicz et. al.
(In-) Visible City - In The Mood 92

Martijn Stellingwerff and Jack Breen
Dynamic Perspective: Workshop Aspern 94

Wolfgang Thomas
A Didactic Drama 95

Gerhard Fast et. al.
Visit at Aspern 99

Wolf-Michael Tschuppik
Languages - Final Settlement: Discussion 101

Thomas Zwiefelhofer
Living in (In-) Visible City 105

Bob Martens:
Pictures of a City: an Attempted Summary 107

IV THE IMPLEMENTATION OF APPLICATIONS

Ryuzo Ohno, Koichi Sonoda and Masashi Soeda:
Street-scape and Way-finding Performance 111

Wolfgang Thomas:
Implementation of Endoscopic Model Simulation: Essen-Centre 121

Michael Matalasov:
Optimal Choice of the Equipment
Depending on the Requirements of Educational Projecting 127

Ranulph Glanville:
Creativity and Media in Architecture 133

I

THE RE-DESIGN OF SPATIAL EXPERIENCE

Beyond the Adversarial: Conflict Resolution, Simulation, and Community Design

Michael Kwartler

New School for Social Research, USA

The American Context for Urban Design

Fundamentally, urban design in the United States is grounded in the Constitution‘s evolving definition of property and the rights and obligations attendant to the ownership and use of real property. The realization of the American dream is directly related to the goal of universal private ownership and use of property in contradistinction to the practices of, for example, field enclosures in Great Britain resulting in a disenfranchised agricultural proletariat of tenant farmers and urban work force. The rearticulation of Jefferson‘s dictum “that individuals have certain inalienable rights, among them life, liberty, and the pursuit of happiness” in the *Declaration of Independence,* to “life, liberty, and property” in the 5th Amendment represents a pragmatic understanding of the relationship between property and the actualization of the individual in society.

In an effort to balance the Enlightenment ideals of Lockean individualism and Rosseauean communitarianism the Constitution recognizes both the need to “protect the public welfare” (the police power), and the protection of private property from capricious governmental action (the “takings” clause of the 5th Amendment), and mediated through other clauses dealing with due process values and the uniform application of the law. In other words, the ownership and use of property in the U.S. is a highly charged issue of almost mythic proportions where the rights and obligations of ownership are a matter of public debate. In terms of urban design, this means extensive public involvement and participation in not only the formulation of rules and regulations but of individual projects as well. It is in this context that Donald Appleyard, of the University of California at Berkeley wrote:

> „[T]echnical planning, and environmental decisions are not only value based [...] but [...] identity based [...] [P]hysical planning decisions can, and frequently do, threaten the identity and status of certain groups, while enlarging the powers of others ... The environment is divided into „ours„ and „theirs„, the trees may be ours, the billboards theirs, the authentic ours, the phony theirs or ours. [...] The city and the natural environment are arenas of symbolic social conflicts and as such raise their own issues of social justice.”

Anglo-American empiricism and legal system have tended to dominate planning and urban design decision making. The legal system's adversarial approach to adjudication is essentially a zero-sum game of winners and losers, and as most land-use lawyers will agree is not a good model for the planning and design of cities, while, the adversarial approach does resolve disputes, it rarely creates a positive and constructive consensus for change, nor has it clearly defined both the limits of the individual rights and the public's interest in the use of property. Because these, as noted earlier, are value laden and identity based, consensus building has emerged as a new paradigm for physical planning decision making as the broadest spectrum of a diverse society must relate to the urban design proposal if it is to have resonance and attract meaning. It is in this context that the representation of city form, and urban design concepts must communicate successfully to all the participants in the debate.

Simulation and Their Uses

Traditionally, planning and urban design issues have been conveyed in words, numbers, and static images. Environmental simulation, by contrast, is dynamic and highly interactive. In addition to generating moving images, modeling and simulation techniques allow the viewer to step into the images and experience alternative proposals from an infinite variety of perspectives. In simulation, as in the real world, time and movement are in constant flux, making the viewer not just an observer, but an active participant.

The *Environmental Simulation Center* employs two complementary techniques for environmental simulation: computer modeling and physical modeling, which can be used individually or in combination, Because it produces mathematically accurate images of data, computer simulation is principally applied to urban design issues that require quantitative analysis, such as zoning alternatives, micro-climate conditions, or growth management plans. Physical modeling, while not as mathematically precise as computer simulation, is photorealistic and perceptually accurate, and can convincingly depict building textures, landscaping, and streetscape details. It is best suited for specific sites, districts, and structures, and for conveying how the environment will look and feel, particularly at the pedestrian level. The power of simulation and visualization was strikingly evident in a workshop at the Simulation Center, which brought together regional planners and residents to study a "village center" proposed for a location adjacent to a regional rail station. The master plan called for a mixed-use development, with buildings no more than two stories high - a height limit strongly favored by the residents. But once the words and numbers used to describe the plan, was modeled on the computer, people saw immediately that what had seemed like an attractive

plan described in words had all the appeal of a blandly designed suburban mall, with little of the urban quality they sought. Working interactively with the Center‘s Lego-like computer kit-of-parts the participants were able, in a brief period of time, to begin to change it, to give it the feeling of Central Town Square. The computer was extremely effective in visually translating the words and numbers contained in the pages of the master plan, and it helped residents to overcome the opposition of their own mental images.

The Center‘s most ambitious undertaking is the development of a comprehensive, three-dimensional computer model and a data base for New York City, known as a three-dimensional Geographic Information System (3-D/GIS). At first glance, the model looks like an aerial view drawing. Upon closer inspection, however, it becomes evident that it is an enormously sophisticated resource, with unusual potential for enabling an understanding of the dynamics of New York. The 3-D/GIS includes layers of statistical, graphic, and numerical information, combining data such as census, land-use, zoning, landmarks and landmark districts, ownership, vacancies with corresponding three-dimensional images of the built environment. Like the real city, the three-dimensional model is constantly evolving: buildings are demolished, new parks are created, populations shift, and zoning, historic preservation, and urban design regulations change. The 3-D/GIS will be continually updated with new data to reflect growth and change, making it both an accurate document of New York today, and a permanent record of the city over time.

Beyond the Arrested Image: Representation in Urban Design

If as Appleyard noted, planning and environmental decisions are not only value-based but identity based then it also follows that the history of the representation of cities is deeply connected to the history and politics of the perception in which the representation of cities and places has been simultaneously liberating, constraining, and manipulative. Representations of the city have been used to communicate not only what is but also what could be. Typically two dimensional, images imagine the city as an idealized environment frozen in time (timeless?). While liberating in one sense (the world as seen from an individual singular point of view), perspective drawings and photographs, among others, represent the power of the static or arrested image to manipulate and control experience through the canonization of meaning in the images themselves. Their power, oddly, may lie in their defying both our experience and common sense that the world as we perceive it is dynamic and filled with movement.

Digital and related technologies have the potential to provide richer representational environments that are responsive to the contingent and existential

qualities of cities paralleling our own experience. Three dimensional digital models, such as the one the Center has created for Lower Manhattan, include visual and non-visual information, represent information as a flow where the relationships between information are shown simultaneously and dynamically and are randomly accessible, affording the viewer the ability to perceive and interactively query and engage the place on their own terms. There is a latent egalitarian potential in these digital technologies which to borrow from Burger King allows you "to have it your way".

One thing is certain, is that the emerging digital forms of representation will change the way we think about cities. The ability digitally to image and integrate visual and non-visual descriptions of cities and the form they take - simultaneously matching the qualitative and the quantitative/the experiential and the rational - is not merely a tool. Like Renaissance perspective it represents another way to think of the world - not only from the individuals point of view but as a flow of relationships which are dynamic. In many respects, the computer's facility to represent information dynamically is conducive to the recognition of patterns which otherwise might be opaque to the viewer, and recalls a passage from Kevin Lynch's *Images of the City* in which he defines his contingent view of urban design practice:

> "Not only is the city an object which is perceived (and perhaps enjoyed) by millions of people of widely diverse class and character, but it is the product of many builders who are constantly modifying the structure for reasons of their own. While it may be stable in general outlines for some time, it is ever changing in detail. Only partial control can be exercised over its growth and form. There is no final result, only a continuous succession of phases. No wonder, then, that the art of shaping cities for sensuous enjoyment is an art quite separate from architecture or music or literature. It may learn a great deal from these other arts, but it cannot imitate them."

Citizens who have had the unhappy lot of having to live through a built theory - "what a human being can adjust to nobody should have to live through" (Gussie Singer, 1962) - want an active voice in how their environments are shaped and a better understanding of the consequences of their individual and collective actions. If urban design representation is to move beyond the idealized static image and embrace the messiness of the city as described by Lynch, the computers capability to image dynamic relationships between information as well as the individual's ability to directly query, manipulate, and if need be - be in the information flow will become central to the inclusive design of cities. Their wants, desires, and perceptions are real and need to be communicated, understood, and ultimately realized in built form of the city.

User's View and Utilization Process in Urban Space

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Abstract

How does the user's view get into the endoscope? The endoscopical picture makes no difference between centralized perspective parts and the perception in the borderzones of the eyes' view. The utilization of endoscopical pictures shows that we learned this way of viewing in renaissance. The user's view is obtained by everyday experiences:

- It accounts for the extension of the own body in motion. Everything happening in the borderzones of the eyes' view is perceived with reduced attention and depth of focus;
- The user's movement is only guided by the user's view. The other senses are added;
- In habitual surroundings the user's view sorts out according to the significance of objects.

In this contribution these aspects are demonstrated in examples of simulating the utilization process in urban space. According to our (three year) experience with endoscopical simulation there are at least three different manors of view, which we are trying to make visible with the available hardware: a.) architect's or planner's view, b.) owner's view and c.) user's view.

Introduction

Planners often claim to be in touch with everything about utilization processes in general, but in fact little knowledge on real utilization processes in urban space is available. Not exactly known is f.i. which of our senses realizes the individual and collective using of urban spaces and in which way they cooperate simultaneously [1]. It seems quite clear that the endoscope can serve as a suitable instrument to demonstrate the user's view and become popular regarding users' participation in the design process. The description of some particular experiences aims at differentiating those assumptions.

Example 1: Orientation and Use of Space at Mykonos (Greece)

This village has been constructed by the users themselves without architects. Some years ago we found a place, we later on called "place of seven churches". Seven days we went measuring and mapping it. When finishing work,

we left the place every evening always at the same street, we had taken in the morning. But on the way back we never reached the same point where we started out near our house in the morning. Obviously, an information system was incorporated in this town, which guided our senses every day to the same but wrong way and we didn't grasp it.

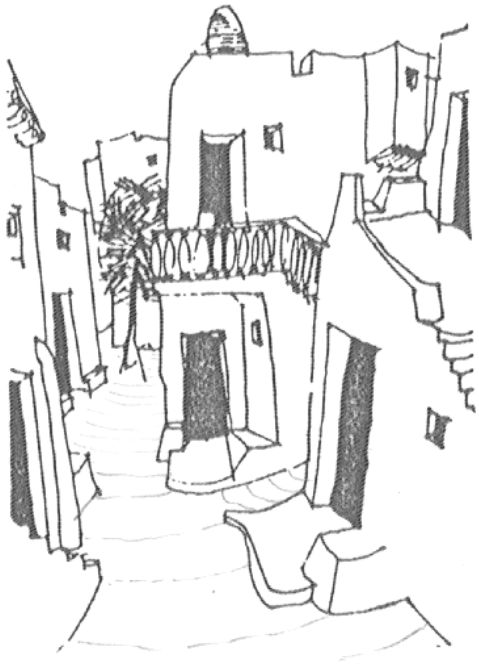

Fig. 1 Main Street and entrance to a by-lane in Mykonos.

Each space, we passed through, was built out as a line of outer living places on both sides, defined by several common designed objects. The incorporated information system guided us by the following means:

- the perspective view guides into the far but bright depth of the street with a tree or another peculiar object as point of attraction;
- the main moving direction is enforced by the design of windows, doors, stairways and other elements which are placed to define and influence ways passing by;
- in this way "passing strangers" were kept out of the outer living places by series of elements like little walls to sit on, groups and rows of flower pots, little trees and their rims which all appear as a barrier to movement only in the borderzones of our eyes view;
- In contrary to the façades and the furniture of street the zone of movement itself is not painted all white and it is formed at the same time as a trough in longitudinal direction.

Such a system is combining the senses of seeing, moving, balance and the complex feeling of rhythm and is guiding our movement into the main direction. If you want to leave for example into a by-lane, you have to break it consciously. When we brought it to our mind, we soon found the points of misguidance and we found the shortest way at last.

Example 2: Placa dels paisos catalans in Barcelona

This place is a modern example demonstrating the misguidance if you only trust on seeings believing. The place was built by architects and artists with the objective to rebuild the quarter round the main railway station in Barcelona.

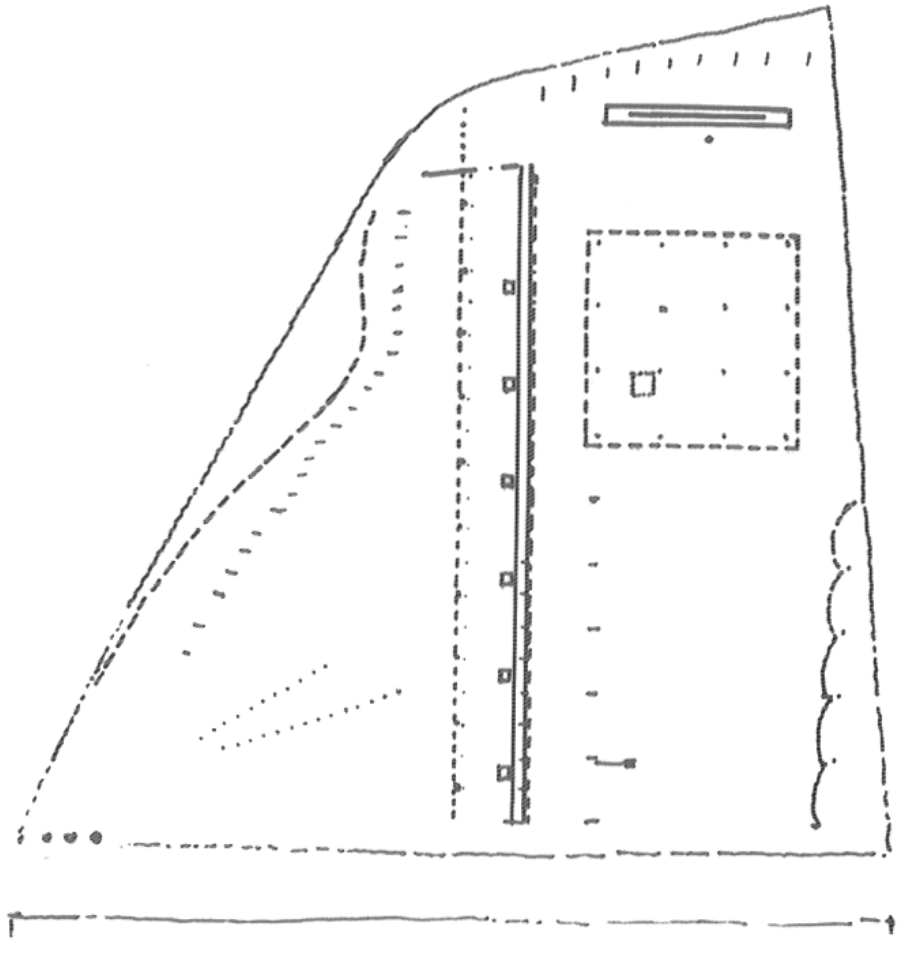

Fig. 2 "Placa dels paisos catalans" -Barcelona (1984-85).

It was not built by long- term using processes, on the contrary: it seems to play with our habits of seeing, it intends to irritate them deeply by design. The perspective view is broken or blocked by installations, bording walls are transparent or pretend sheltered places and so on.

Fig. 3 The former wall of the placa becomes transparent.

As a result the sense of seeing looses its predominance to the other senses - for the time of staying in this place. Users orientate themselves on moving connections, on some benches and specifically on the wandering shadows of the installations.

Fig. 4 Transparent installations pretend to guide into the depth of the place.

Both examples (1 and 2) show that visual perception is the dominant sense for moving and for the design bordering user's spaces - at least in daytimes. The movement is consciously guided by all events in the center of the field of vision, whilst the events in the border zones mostly direct unconsciously. The impressions of the other (four) senses seem to act spontaneously on movement. The outerspace resp. the interspace between buildings can be defined as user's zones for the residents by designing means and in the same time they can leave undefined moving zones for the passing foreigners.

Methodical Aspects

What do we know about using processes and about the user's way of acting in urban spaces?

- **Method 1: Photographic Documentation**

  In documentating several years the acting of different users in the same places regarding the same conditions the development, the fixation and the alteration of the user's places by design can be confirmed. The relationships and the connections of these places can be pointed out.

- **Method 2: Research of Traces**

  User's public or hidden places always can be made out by notation in a defectively way: registrating the traces, the marks and even the wallpaintings which users or usergroups leave at buildings or objects in the outerspace. This method is noticing even the destructions as a form of tackling with the environment. Summing up the results of analysing user's utilization forms of urban spaces, it can be stated that urban space is subdivided in zones corresponding to the built space - according to its different designed borderzones and to the functions in the building. Wideness and dictions depend on the domination of traffic systems:

  - Zonal Type 1 can be described as a narrow zone of distance in front of the building or the constructed object;
  - Zonal Type 2 is appropriated by the resident, differentiated in zones of function and passing through, linked to the entrances and to the openings of the building resp. in places where niches are built or exist, which protect users or even keep the main stream of moving in a distance;
  - Zonal Type 3 represents the stream of "passing foreigners" and much more the running and the parking zones of vehicles produce the moving zone, which dominates the direction and the dimensions of the two other zones and places.

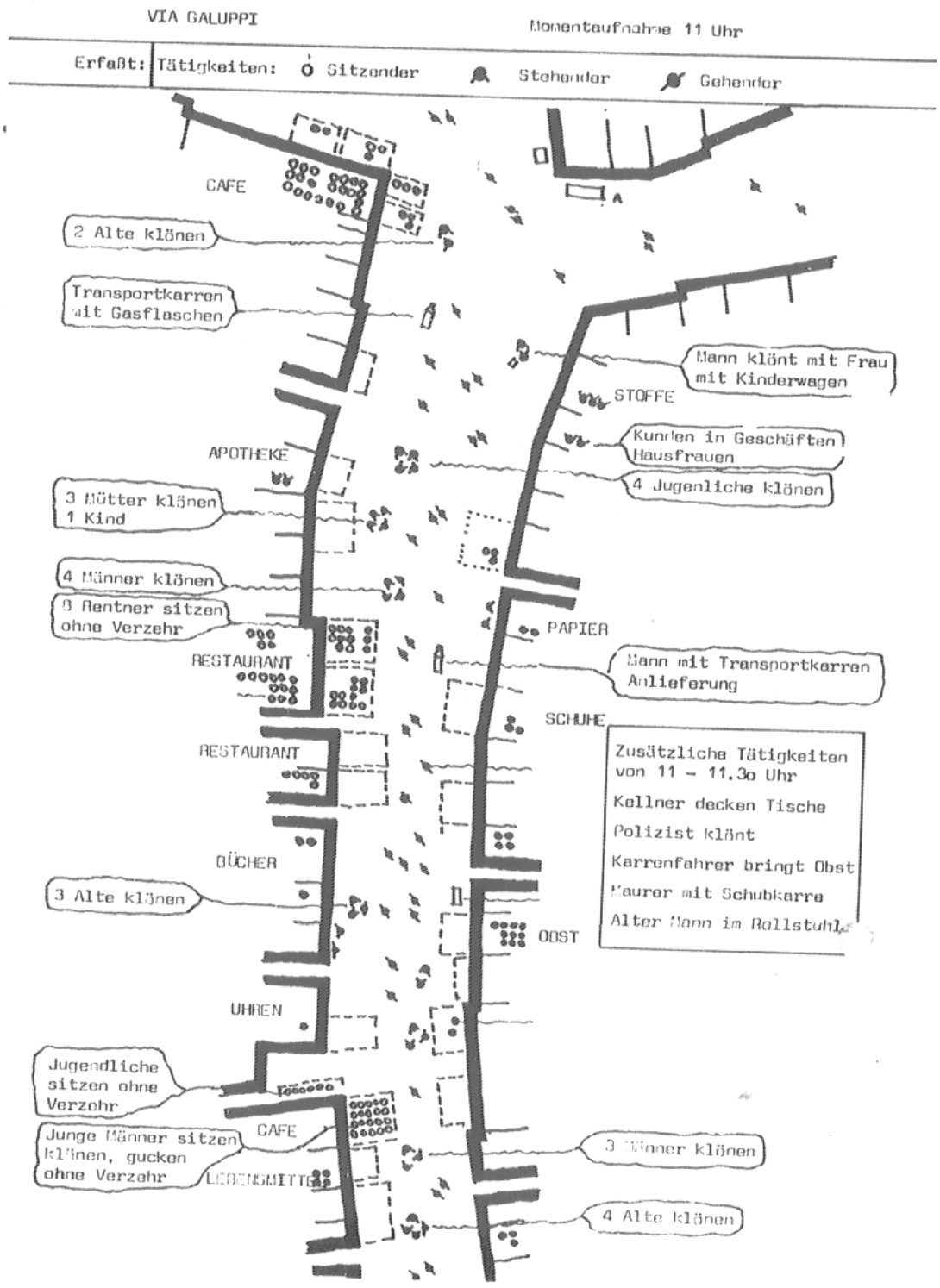

Fig. 5 Example of a method of graphic notation.

- **Method 3: Graphic Notation**

  The graphic notation of movements shows the persistence of preferred localities and the outline of men's moving streams in space, facing other men's presences and opposite to the walls of buildings [2].

- **Method 4: Video Notation transferred into Graphic Notation**

  The notation by video during several hours shows when transferred on the plan: lines of movement, preferred localities and the long-term defined zones containing the same using modes [3].

The User as a Person

User's action produces in cooperation to material design different user zones. In this process users take different roles, which may change in passing or in remaining in a space. We can notice several roles:

- the straight passing foreigner;
- the watching, lingering neighbour;
- the talking or waiting resident;
- the playing child, etc.

Following the roles in the user's areas, we can notice different sequences of moving and special moving lines of each different user type. More precisely analysed we can describe the different ways of influence to the sequence. In its direction the line is roughly determined by the given aim - as far as it is possible to realise it in the certain interspace [4]. The fine shaping of the sequence is due to the more or less distincted "body buffer zone", which each of us owns. It is nearly the reach of our stretched arms [5].

If anybody meets us, he is on the way to penetrate our "body buffer zone". We now have to decide whether we have to get out of her or his way or to communicate. We all have experienced this: If both act to get out of the way in the same direction in the same time, we both practice this funny kind of a slapstick dance together on the pavement. In case we decide to communicate in a group, our buffer zones become part of a new combined and therefore larger buffer zone. The precise run of user's moving line is determined by two influences:

- roughly by the general aim of movement in space;
- the fine shape of the moving line is defined by the forming an the wideness of the "body buffer zone".

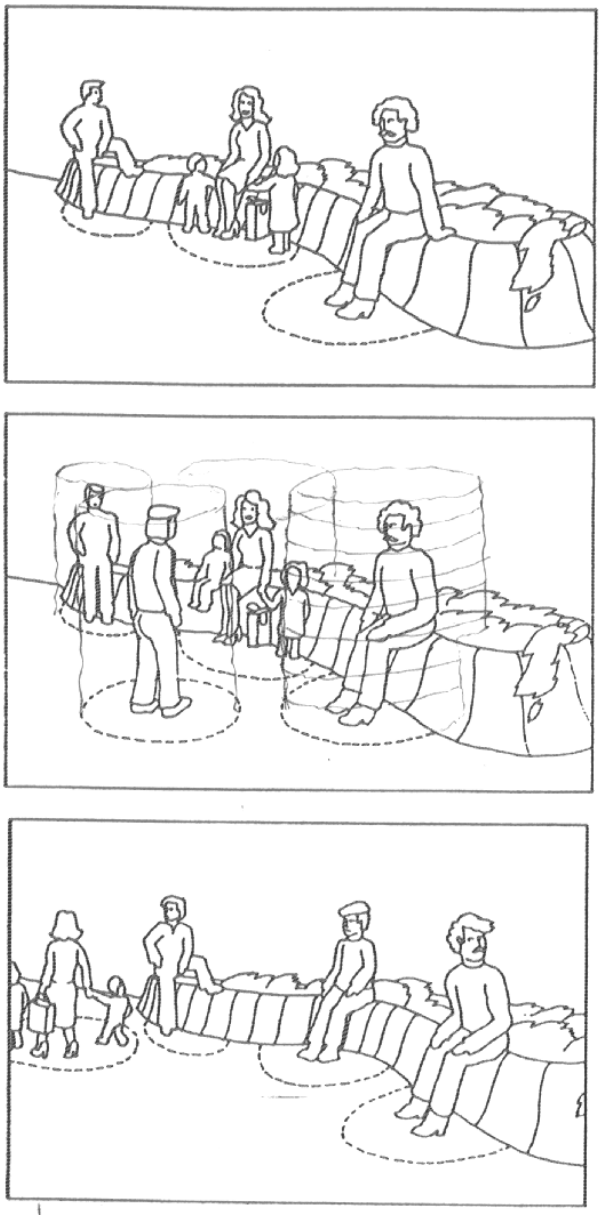

Fig. 6 Body buffer zones.

How can we get user's view into the endoscope with all his senses?

First of all we have to reduce all our sensitive experiences to the sense of seeing. All our senses have to be subordinated to it. The cooperation between senses is not determined by equality [6]. The sense of seeing is dominating the others and our using modes of the endoscope is only one example which is showing this fact. The image of the user's view shown by the endoscope reduces further more. It doesn't distinguish between the events in the center and in the borderzones of view. Generally, they are all equalized by the transformation on the image of the monitor. With regard to the limitations the materialistic settings of the endoscope have to be taken into account. The focus, the vanishing point of the image is in the point of view of the potential or of the

real user. Using the endoscope in regarding a model means more than to avoid lifting the model by hand and to examine it more comfortably. Another possibility is added by means of a *camera rig*, a machine which enables to turn the "head" like a moving person. It is necessary to distinguish between moving direction and visual angle. Depending on the different scales the endoscope can be guided in different spaces: from non- movement to the speed of a car or even more. In this way several roles can be practiced. Inspite of all these possibilities we have to account for the old wisdom: "I only can see what I know" or more precisely and in the same time more optimistic: "I only know what I have experienced". The most advanced way to get parts of the user's view into the endoscope is probably to take the various types of real moving lines as a guiding line for the endoscope and to take the guiding line with corresponding speed into the model as one method among others to improve analyzing, designing and optimizing processes.

In several simulations - computer-aided but also "endo-aided" - the various possible processes of view to urban space are mostly mixing the roles or they operate on the highest level to give a realistic image and in the same time do not regard the reliance between individual and (architectonic) object, for example the moving lines as one of the most import relations. There seem to be three different ways to get a special mode of seeing according to the role of the onlooker. A bird's eye view, which is the mode for the investor to regard the object of investment as a whole like a jewel on the blue velvet pillow. In this way the capacity for the activities of the invested capital can be tested (a). Planners and architects are in most cases following the main axes of space, trying to present the main design ideas, and often to show the object as "exact play of the volume in the light", as Le Corbusier said (b).

Users firstly get in connection with an object by using it. Therefore user's view follows first special moving lines. The real or assumed moving lines of different types of users can help optimizing the design (c).

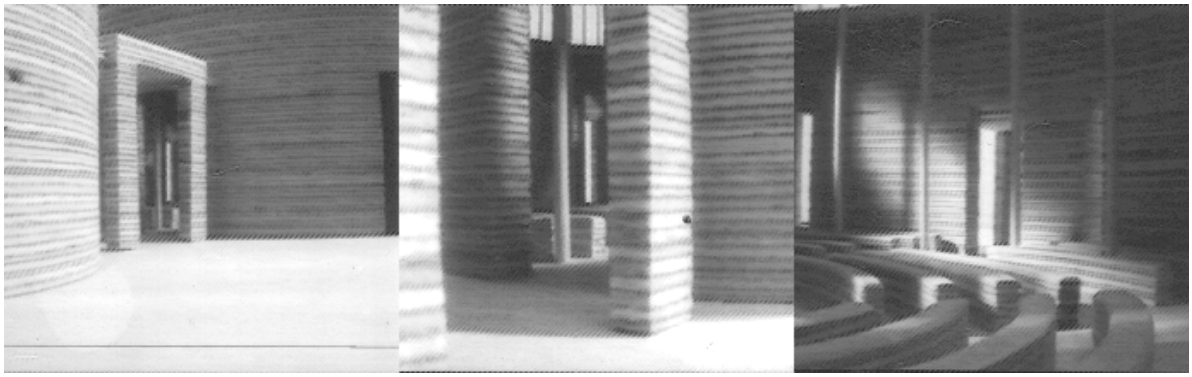

Fig. 7 Examples of the typical view of an architect.

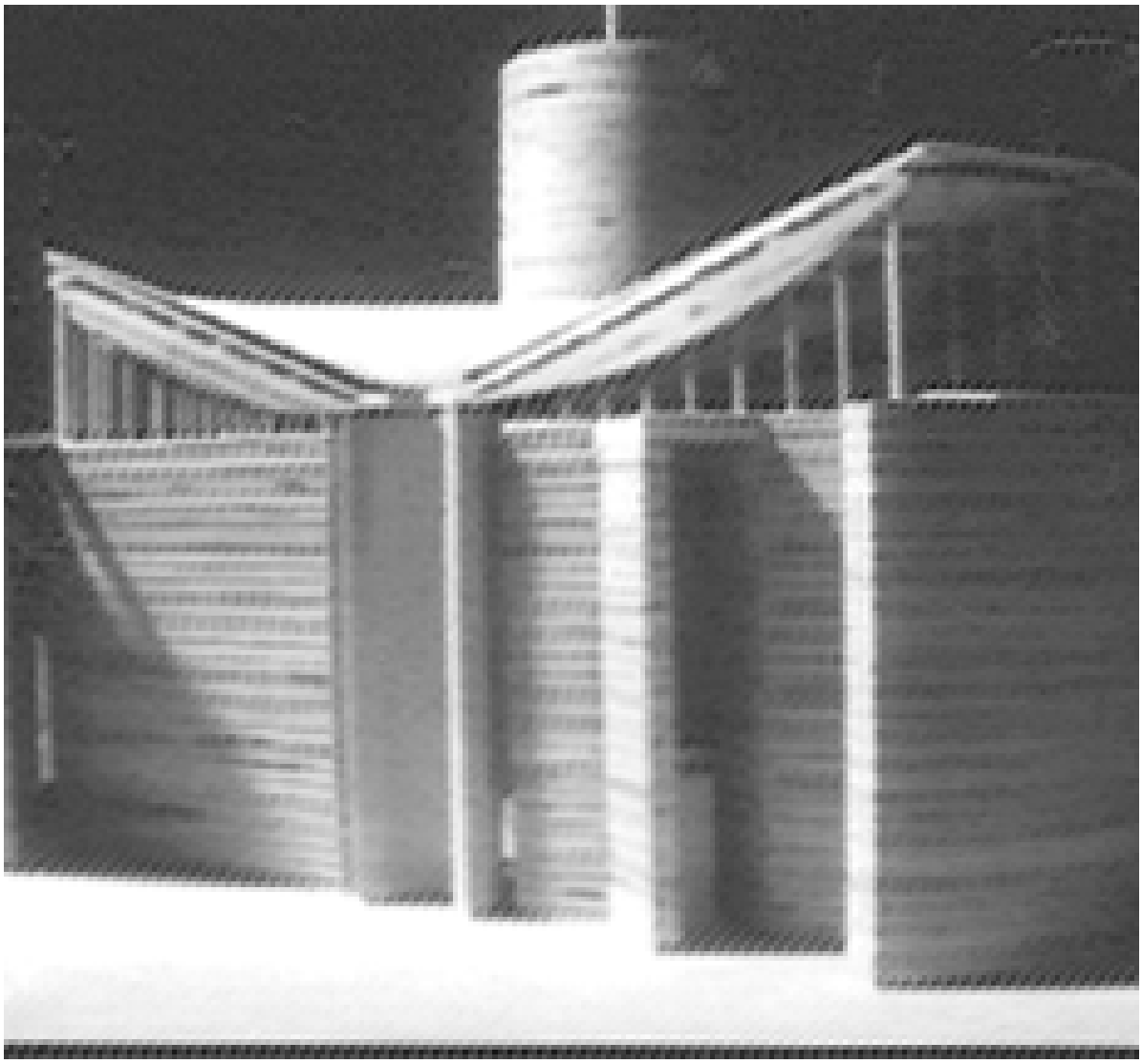

Fig. 8 Users perception following the real moving and using processes.

This means, however, to research much more exactly on actual user's processing in the different cases. It also means to get the user earlier and more deeply involved into the planning process as an expert-user of urban space.

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Management of Sequential Space Experiences

Arne Branzell

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Abstract

In this contribution a way of combining endoscopy with architectural notations will be presented. Endoscopy is regarded as a tool to visualize sequences from a model in order to demonstrate how the environment will look like from the pedestrian's or driver's view. But while using it, its limitations must be considered. The model is mostly too small to present distant landmarks, districts, nodes and edges of importance. And most important, experience of space is not only visual. It is a complex process where many aspects must be taken into consideration. These aspects can be presented with architectural notations on physical drawings of the situation. The resulting "storyboard" is most useful in analyzing the situation and making better solutions possible.

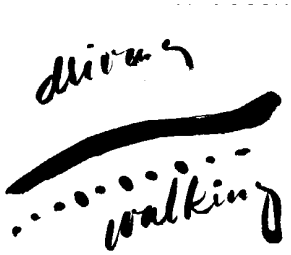
Introduction

Endoscopy is one a tool for visualizing the impact of the future. Nevertheless its limitations must be considered. Actual *space experience* is a very complex feeling where all our senses and our mind cooperate. Looking at an endoscopic video is not the same as actually being there. You sit passively, as a spectator, looking at a two-dimensional screen. Of course, sight and sound can be simulated to some extent, but the active sense of your body while moving is not there and smell, touch and, most important, the spatial experience in all dimensions and in time cannot be simulated. Many aspects of what forms *space experience* in our minds are invisible. For a planner of the future, all these aspects must be taken into consideration. When presenting a future environment, the goal must be to evaluate the situation. In what respect should changes be made? Combining ENDO (endoscopy), which can say something about what will be seen and heard in the future with PAD (pencil aided design) in the form of architectural notations on the projection drawings is a way of making the presentation more informative and achieving a more well-grounded evaluation.

Information about the cause can mostly be found in the projection drawings of the physical objects. The experienced and used effect on man can be described with the help of architectural notations on these drawings, in different colors or on transparent paper placed on top of the drawing. With them, all important aspects concerning the solution can be taken into consideration and be evaluated. Notations are used in all professions, in choreography, music,

film-making, in order to demonstrate man's experience of something presented and dealt with in the future. Why is it so seldom used in architecture? Notations are signs to think with. They are, properly used, a good mental tool which helps the planner to gain an insight into the situation of the future user. They are a partner in the dialogue between planner and project, but can also be used to point out to the authorities and the builder what is most important in the design.

I would like to present a basic set, consisting of only six nonverbal signs which have proved very useful. Being so few, they can easily be remembered and dealt with simultaneously in planning. They should be complemented with verbal notations. And with with one's own signs if necessary. The resulting storyboard can often contain much valuable information. The first five notations are the well-known Kevin Lynch orientational signs [1]: *path landmark*, *node*, *edges* and *district*. They clarify how one mentally utilizes one's perceived surroundings in order to orientate oneself. They can be derived from the *gestalt laws* and can therefore, interestingly enough, be used to describe all spaces perceived by man, not only the city space [2]:



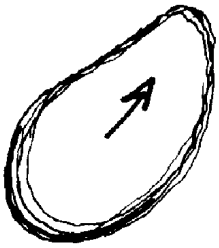
- **Paths**
  Linear elements which are used for man's movement in space; e.g. streets, pavements, biking paths, corridors, etc. They can also be used in a transferred sense (e.g. sightlines).

- **Landmark**
  Single objects which are observed because they differ from the surroundings. They are used as points of support for the movements in space. Size, colour, different shape, meaning can make them be observed. A church, a monument, a blue door can act as a landmark.

- **Nodes**
  Places where paths cross, from which movements start and end.

- **Edges** (Dividers, Barriers)
  Linear elements which you cross, for example the edge of a district, a channel, a road with heavy traffic (if you are driving on the road it is a path).

- **Districts**
  Areas which have one or more elements in common, so that they are experienced as coherent. For example, the object's height, colour or shape.



- **Experienced Spaciousness**
  This symbol is both a mental model and a nonverbal sign for spaciousness experienced. It is of utmost importance, believing that architecture is the art of defining space. The invisible bubble often has a direction, a dynamic character, which in different ways may affect the visitor of the room. This sign for the extension of space in all directions makes for a discussion possible on the dynamics and contents of experienced space.

These six signs help the planner to manage the defining of *experienced space*. In Sweden an environment audit has to be made for each important project (so called *miljökonsekvensbeskrivning*). So far, this mostly refers to what can be described in physical terms, e.g. pollution problems. A *space analysis*, nonverbally noted with architectural notations and verbally described, complemented with an endoscopic demonstration is now being used as one of many audits for this purpose.

Concludingly, the possibility of combining endoscopy with architectural notations has to be regarded as useful. It is an interesting fact, that when two media are combined [3], a third one emerges, having more possibilities than the addition of each one. The future of serious planning has to do with combinations of media, not the single use of one of them. ENDO and PAD is one useful combination; CAD and PAD have also many possibilities. MAD (model aided design), combined with CAD, PAD, and ENDO, will probably be the ultimate design tool of the future.

Notes and References

[1] Lynch, Kevin. *The Image of the City*. Cambridge: MIT Press, 1962.

[2] Dyrssen, Catharina. *Musikens rum : metaforer, ritualer, institutioner*. Gothenburg (Diss. Chalmers University of Technology), 1995. In this Ph.D thesis on Music and Architecture, Kevins symbols where used to analyse the progression in Chopin‘s Fantasie-Impromptu op. 36.

[3] The misuse of the term *multimedia* is depressing, since it is mostly used for 100% CAD presentations.

The Role of Spatial Experience Anticipation in Architectural Education and Urban Design

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Abstract

Space and its matter substance are the main subjects of urban design, in which an architect, by setting in order the functional-operating relationships and the matter-dimensional manifestations of the formed structure, operates with the aim to achieve general harmony, functional and expressive complexity. Demanding a process, which coordinates relationships in all space dimensions, requires flexible openness of the work documentation during the conception period. Experience proved that such requirements are satisfactorily accomplished by the method of space-modeling, where the creative process happens on the working model.

Introduction

At present, when revaluation of relationship between the human society and material values of environment takes place, a man becomes more deeply interested in spiritual dimensions of knowledge and perceives cultural aspects of forming of the material environment more sensitively. He evaluates all manifestations of the matter in the environment more intensively by quality aspects. The basic manifestation of a human settlement is a town spatial structure, which completes the manifold picture of a city by varied capacity and by a continually developed form. Variety of unrepeatable signs as spatial manifestations of town structure elements and their inner balance reflects the quality of the lifestyle and culture of an individual or a town society. According to Kevin Lynch individuality of inhabitants determines the identity of the surroundings in such a way, to make it satisfy the variety of needs and requirements of its inhabitants. This is the main aspect to be regarded by architects and town-planners in the creative process: to complete and transform the structure of the environment continuously and to give it its own identity [1]. The complexity of architectonic and urban design is defined by a whole range of processes, which participate in the value transposition route of the work from an architectonic idea and its elaboration towards a man as a user of the product, its perceiver and evaluator. As an introduction the subject of our reflection requires choosing and recapitulating typical aspects mainly of those processes, which are relevant with respect to architectural education and the aims of urban design.

Perception, Identification and Interaction of Subject in Space

A human being perceives his surroundings by his individual senses - receptors. The mediated information reflects a notion of existence in the space to his mind. The sensory identification of the subject of the perceiver with the real surroundings takes place. Identification in the space is mediated by senses based on double-canal information transfer: the ears - double-canal hearing of the space and the eyes - binocular viewing of the space. The double-canal identification causes the basic experience of 3D real space in the psychical system of a man.

From the space identification point of view, the most important for the process of perception are visual perceptions of iconic manifestations of the spatial structure (nearly 40 % of all sensory information). All techniques of creative and architectonic space representation are based on this fact. Full identification of the perceiving subject and his interaction in dimensions of spatial parameters takes place only within synchronic time dimension, i.e. during a movement. The degree of freedom of the subject, from a viewpoint of choosing the standpoint of perception or movement and alternation of the views, is considered to be, in a certain sense, an interaction movement, a general sequence dynamics. While perceiving a man does not evaluate only objective manifestations of the space, but judges its content and quality from a point of view of previous experience and mainly from a viewpoint of demands of his own activities and his own usage [2].

Model Simulation in Architectural Education

Space and its matter substance are the main subjects of urban design, in which an architect, by setting in order the functional-operating relationships and the matter-dimensional manifestations of the formed structure, operates with aim to achieve general harmony, functional and expressive complexity. Demanding processes, which coordinate relationships in all space dimensions, requires flexible openness of the work documentation during the conception period. Experience proved that such requirements are satisfactorily accomplished by the method of space-modeling, where the creative process happens on the working model.

Such a process is of didactic importance in education of architects, since it enables continual checking of the space topic and conception. Immediate model expression gives rise to creation of varied situations, which further develop new topics. In such a way the quality of the result improves causally [3].

The reality, though diminished in a simplified form, is depicted by working by accessible methods and means on the model. The model simulation of the structure, within which the author is spontaneously aware of the inner spatial aspects of the surroundings formed by the matter, takes place. Through imagination the author performs both the simplified form of the spatial perception anticipation and individual interaction in the designed environment. Primary perception relationship, which accompanies the author and the work during designing with the help of the space modeling, is - despite this - oriented mainly on the object of the modeling, i.e. on the structure [4]. The user, for whom the urban-architectonic solution is designed after the realization, is, however, interested chiefly in the quality of the inner spatial content, its utility and expression value, identity, etc., which can support his identification and acceptance in a positive sense.

Spatial Experience Anticipation

To direct and secure the information communication towards the draft - realization - the user with respect to prerealization searching and consideration of the conception, necessarily has to cross the time disproportion between the draft and the reality. Today there are optical and electronic media available for architects, which help to secure the demands of both the designer and the evaluator and user in this sense. We are acquainted with 3D computer simulations resp. animations of virtual spaces, but also the method of endoscopic sensory simulation, which is able to achieve the imagination of spatial experience on the monitor in advance, i.e in an anticipated way. By adapted periscope the endoscopic method develops the method of spatial modeling in new media dimension and enriches it towards creativeness by enabling the simulated space to be percepted on a traditional artificial model in the natural horizon of a man.

To secure the anticipation by visual simulation of spatial experience on the monitor in a trustworthy manner with respect to “real reality”, according to relevant aspects of the conception, the visual simulation must respect the rules of sensory perception of a man in real environment. From procedure point of view of perception the most significant fact for the psyche is the sequence dynamics of the subject and the movement of the perceiver in the space. This means that in the mind of the subject of the perceiver the most emotionally reflected is the dynamic spatial experience.

Despite the known disadvantages and technical circumstances of model building [2] the method of spatial endoscopy proved itself in didactics, mainly in the approval phase of the aims of urban composition and shaping of an urban space, especially because it enables to carry out the sequence research and

evaluation of the simulated space on the working model by interactive means, directly in the studio or in laboratory conditions with relatively low expenses, and with the possibility of immediate correction and subsequent evaluation of the effect. Similarly, its audiovisually elaborated media outputs may simultaneously complete the identical model presentation within evaluating and approving continuations in professional gremiums or in making the results of urban and architectonic solution popular in the layman public.

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II

THE CHOICE OF APPROPRIATE TECHNOLOGY

A Student's Project: Choices in Media for Communication and Presentation

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Abstract

The Delft Faculty of Architecture is currently working with a new educational method called "Problem Based Learning". After teaching basic principles in free-hand drawing and theory of form in the new block system, the sector *Media* takes also part in the third and fourth year, mostly in the design disciplines. Communication and presentation techniques, so important for the future, that architects and townplanners were organized for further discussions in close cooperation between the three sections of the Media sector**.** It resulted in the creation of a media module.

Introduction

First, I would like to outline the new teaching method, the main subjects and the Department of History, Theory, Media and Information Science at the Faculty of Architecture of the Delft University of Technology. Secondly, I will describe the teaching methods of the Sector Media in the basic principles of studying forms, of freehand drawing, and of presentation techniques. I will also inform you of our contribution to the process of educational innovation, namely, how we developed a media project for the third year course.

Problem-based Learning at the Faculty of Architecture

The Faculty of Architecture provides education and carries out research in the field of building and the built environment. Some characteristics are:

- a five-year curriculum with a basic study of two years, the first of which is a foundation year; in the subsequent three years students opt for a specialization in a renewed course;
- an ample choice in main subjects;
- a renewed research program.

With more than 2,000 students our Faculty is the largest of the Delft University of Technology. For several years now, our student quotas have varied from 450 to 500. Owing to government decisions the Faculty has been obliged to realise its courses with less staff and in a shorter period of time. We are now using a new teaching method, called *problem-based learning*.

The most important objective of the Faculty is the study in design (chosen by 80% of the students), the focal point in the two basic years is the integration of knowledge, insight and skills. Groups consisting of 15 students discuss specifically prepared case studies, they formulate their line of approach on the basis of educational tools available in the study centre of the faculty; they also consult tutors who will help them find solutions to particular problems. In this method of self-tuition each student has to complete a so-called "study block" in seven weeks. Until now there have been 12 study blocks in the two basic years. As it has been decided that the Faculty is to offer a five-year course, we will schedule 10 study blocks in the basic years as from next week.

The Main Subjects

After having completed his basic study and before starting his third year, the student has to choose one of the following five main subjects: Architecture, Building Technology, Real Estate & Project Management, Urban Design, or Public Housing, each of which is organised by the respective Departments. History, Media, Theory and Information Science is the sixth Department of the Faculty and has its own supporting educational and research programs. Each main subject offers a selection of projects. The projects of the third and fourth years are organised within the framework of a module, as we call it. In these projects knowledge, insight and skills are also integrated. Evaluations are necessary, though, for it has turned out that this system can be improved. There are compulsory and optional modules, the latter combining elements from different main subjects. Furthermore, the departments together provide 11 differentiation modules from which students may freely choose. Students have to gain credits for the blocks and modules they attend. All compulsory and optional modules should be completed before students are given the green light to begin their final studies.

Department of History, Theory, Media and Information Science

As to the development of a laboratory in this department I shall confine myself to the main lines. As staff members of the four sectors of this department we discussed and agreed upon the necessity of a structural plan with a number of innovative laboratory facilities, to be used in some cases on a co-operative basis by the two sectors Media and Information Science, which now use a visualization and a CAD laboratory respectively. The sectors History and Theory are planning a laboratory containing prototypes which can be used in combination with the CAD laboratory for the selection of pictures, for viewing, and for copying as well as connecting data files by means of a computer program combined with photographic CD disks.

With these and possibly other combinations we are planning the development of Knowledge, Design and Communication systems in the coming years within the framework of our self-imposed tasks:

- a fundamental, methodological and theoretical task
- a supporting task, including services and facilities.

After the basic study of the first two years, the educational assignments offered by the Sector Media in the higher years are mainly geared to the design disciplines of Architecture, Urban Design, and Building Technology. In my Chair of Architectural Theory of Form and Media Application we do not distinguish a strict division between the components "theory of form", the application of study of forms, lessons in freehand sketching and the application of presentation techniques. The contents of these subjects is most clearly described in our teaching objectives.

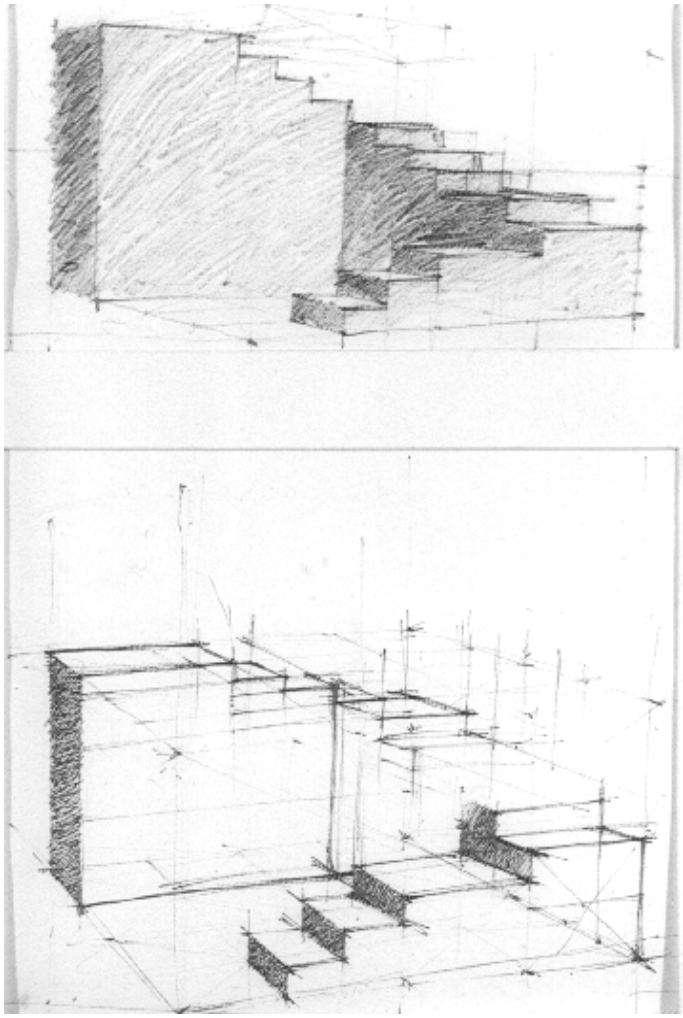

Fig. 1 Student's own observations in bird's eye and eye level perspectives.

Teaching in the Foundation Course

In the foundation course the Section Freehand Drawing emphasizes the development of techniques which will enable a designer to put his ideas across lucidly, observe accurately and then reliably present these observations. The accent is on mastering the basic forms of perspective and tone in set exercises, as well as applying these skills in bird's eye and eye level perspectives, based on the student's own observations and on the ground plan and elevations of a given design. A very important component is acquiring skills at reproducing details of construction (which is especially useful in the study block "Building and Construction" of the first year). This shows that there are points of interest in Problem-based Learning. Not only is the didactic aspect of freehand drawing taken into account in the assignments of the various study blocks, but also the aspect of integrated application of the skills and insight acquired. Students are expected to gain knowledge and skills required to commit their ideas and spatial imagination to paper, and to observe and work in an analytical way. Variety and increasing complexity characterize the series of exercises. Many types of drawing are studied: linework, tone, documentary drawing, perspective construction from documents and by measuring, as well as perspective design.

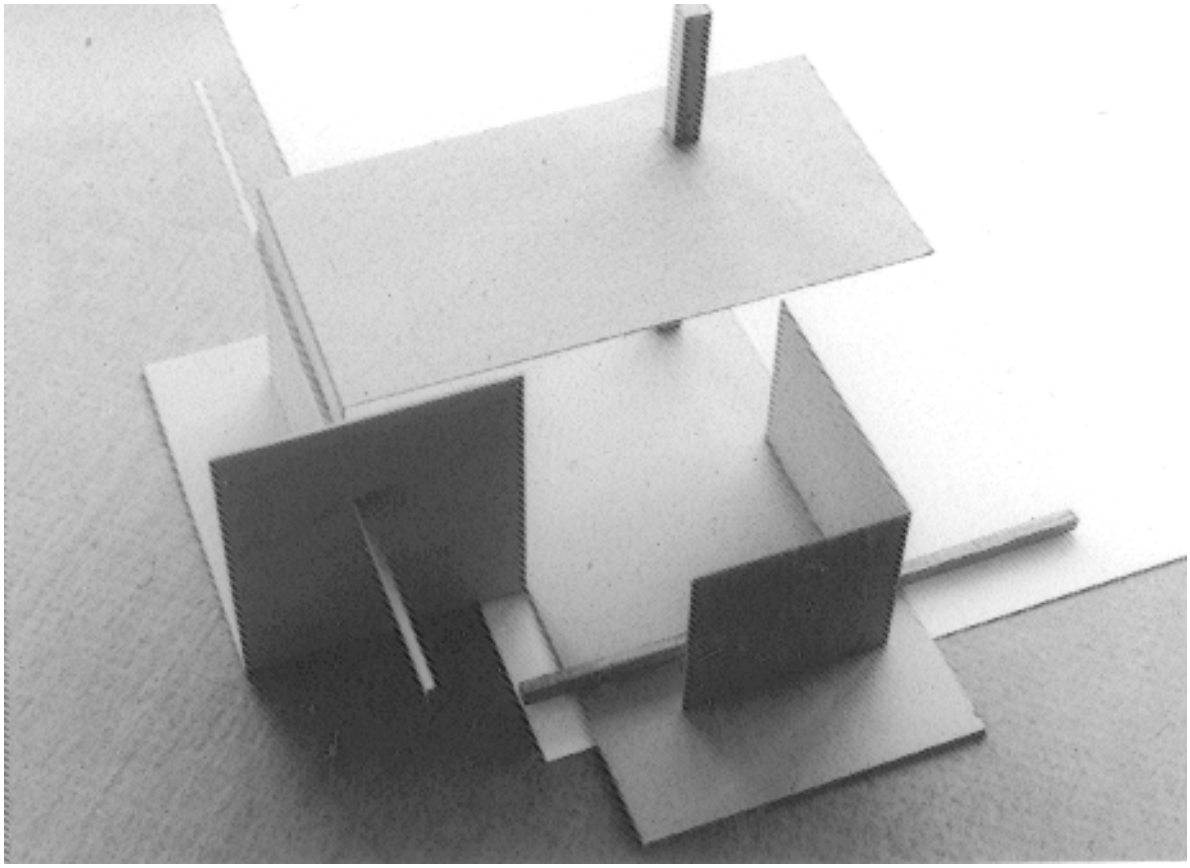

Fig. 2 Practical result during the foundation course in study of forms.

In the first year course the Section Study of Forms focuses on the explanation and development of formal concepts and definitions on the following problems: composition, plasticity, size and scale, texture, color and context. As these exercises deal with the theory of elementary forms, concepts and definitions are investigated as purely independent phenomena. The aim is to equip students with basic skills and spatial insight which will enable them to present their design and architectural projects with greater clarity. Assignments alternate between abstract and concrete. This method of teaching enhances the students' abilities to think in the abstract; insight thus gained can be adapted and applied to suit concrete situations.

Presentation Techniques is the third section of the Sector Media. In the third and fourth years students can choose from various assignments offered by the three Media Sections in different compulsory modules, the majority of which are geared to the design disciplines.

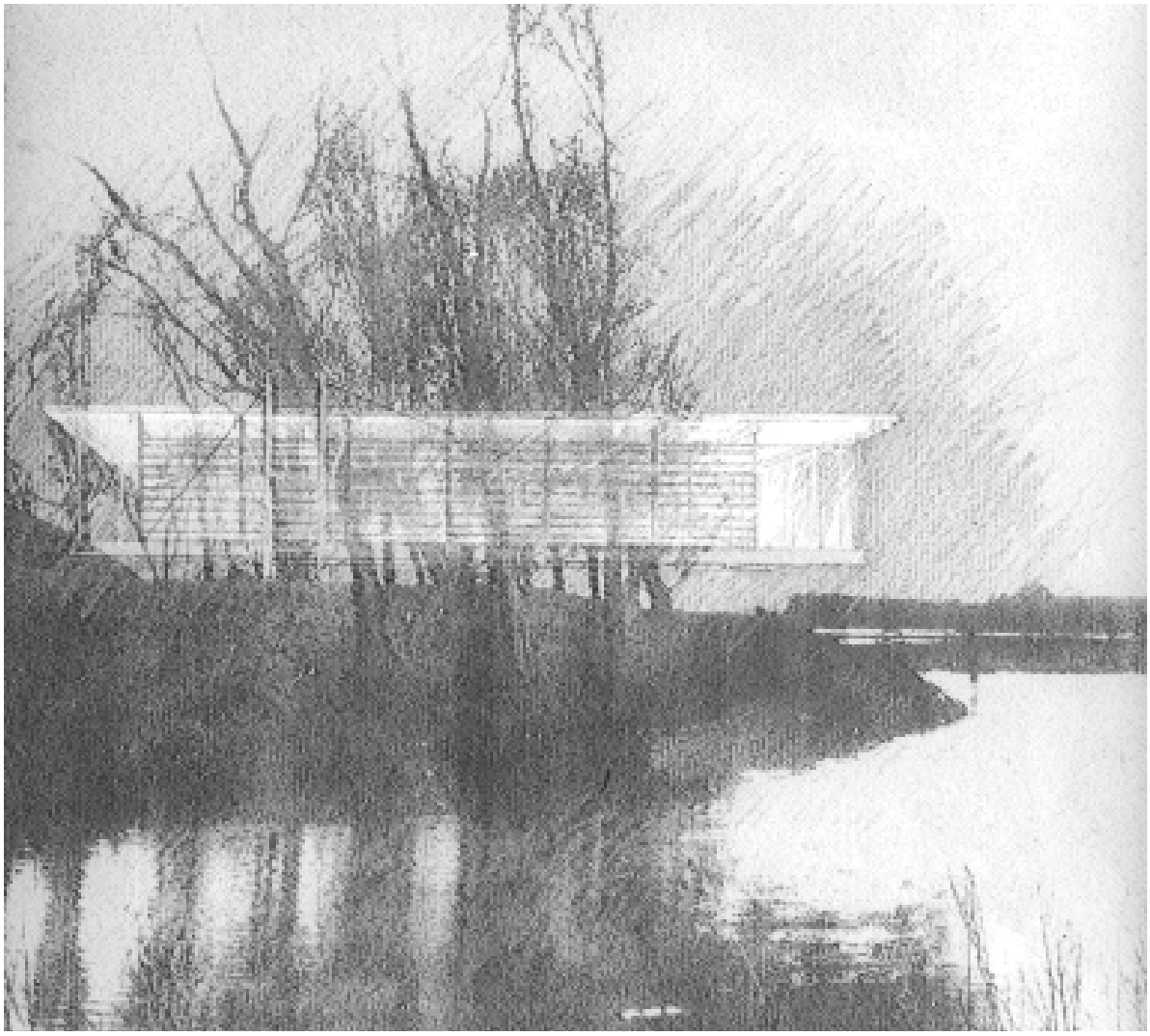

Fig. 3 Media-module: training in presentation techniques.

The Media Module

I have already mentioned that all the departments compose their own modules. Two years ago, when the first cohort of students passed the basic two-year study in line with the new teaching method of Problem-based Learning, the various departments were expected to have available all course elements in the third and fourth years, including the eleven optional differentiation modules. For the Sector Media this created the opportunity of realising a Media Module about communication in which students would learn to transfer their ideas, their designs to others. Future architects or town planners should have various means and methods at their disposal to perceive and clarify their projects. This module was to give students the opportunity of concentrating on the subject of communication for 6 weeks. We had to decide how to structure its contents if we were to offer integrated training in study of forms, in freehand drawing and in presentation techniques.

The Section Freehand Drawing aims at the following learning objectives in this module: increasing skills in spatial drawing, and acquiring skills required for the presentation of a final design. The two learning objectives in assignments set by the Section Study of Forms are: a concept-oriented objective, or creating ideas and images based on a spatial and formal problem, and a materials-oriented objective on the basis of a spatial and material problem. The Section Presentation Techniques was especially interested in the application of integrated media. The use of video may be approached in different ways, for example as a means of recording and presenting designs and the built-up environment. In addition, video has the advantage that it can record and show movement. An endoscope can capture from motion the use of architectural and urban spaces, traffic flows, as well as the perception and experience of the built-up environment.

Fig. 4 Media-module: video registration and editing.

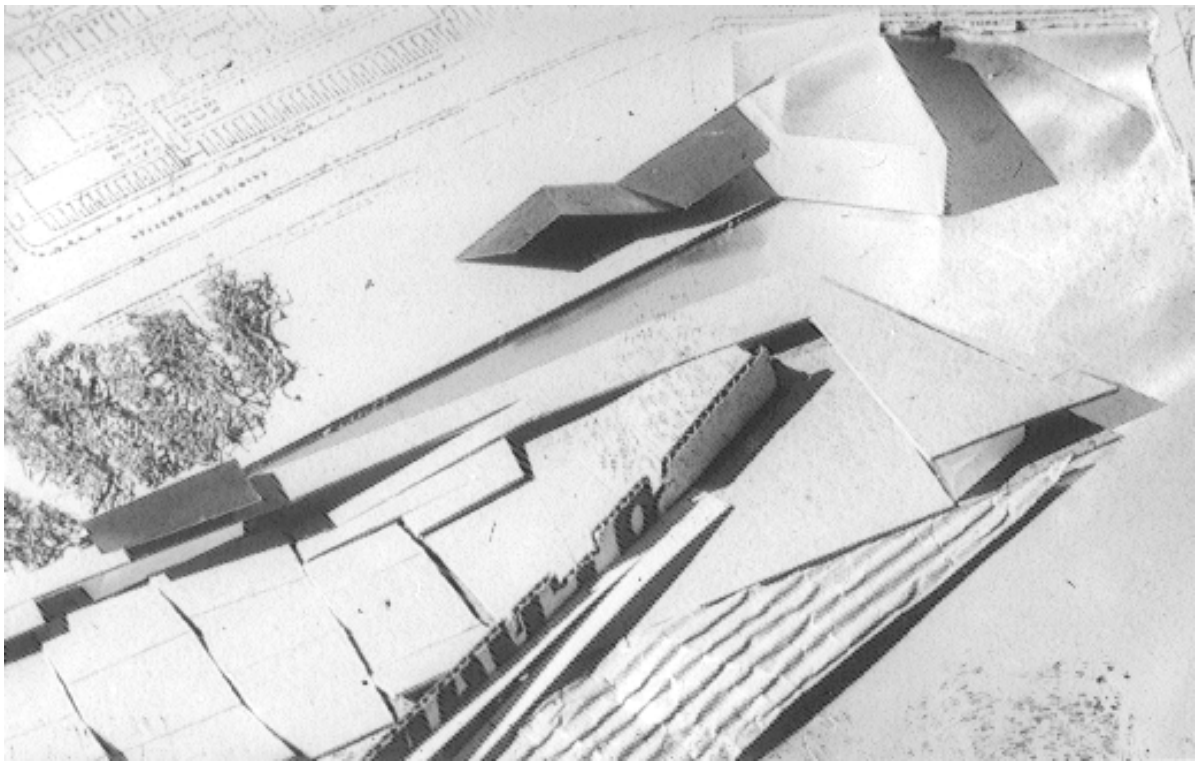

Fig. 6 Media-module: the scale model of the architectural design.

We also had to consider what new developments in communication techniques were to be incorporated in the module; these techniques had been part of appropriate, optional media practicals before the introduction of Problem-based Learning. We have formulated the following learning objectives:

- gaining or enhancing skills in different methods and techniques of transference and presentation;
- optimizing final results through good cooperation, planning as well as an economic selection from and a purposeful use of the means of presentation resp. the strategy of presentation;
- relating plan, target group and presentation, which may involve feed-back from presentation to design;
- gaining information about and acquiring insight into presentations in practice;
- acquiring insight into the possibilities and limitations of various techniques;
- becoming aware of the importance of communication in the Media discipline.

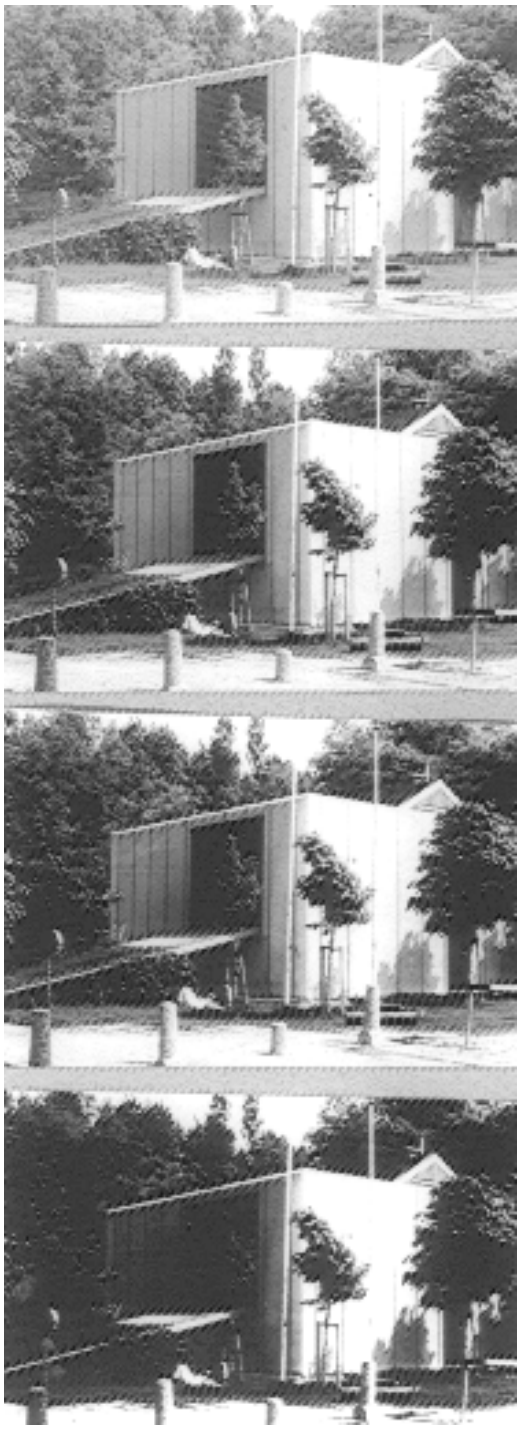

Fig. 5 Photo processing during the practical, scheduled for twelve hours.

Structure of the Media Module

We have composed this module of three parts: staff guidance, practicals, lectures and talks:

- Staff Guidance
  The main theme of this module is that students work out a design of their own, which may be one made in another module, into a final presentation. During staff guidance hours they will be given particular help in deciding their strategy of presentation. There is time to reflect on the experience and knowledge gained during group discussions.

- Practicals
  Compulsory practicals such as presentation drawing, technique of scale modelling, computer visualization, study of form(s), photography, colour, and video. The practical Colour is a general introduction in relation to architecture. In the third week students are to choose from the practicals computer visualization, video or photography. The other practicals are directed towards gaining as much general knowledge of and experience in these techniques as possible.

- Talks and Lectures
  In each Media Module a series of talks has been scheduled in which architects, specialists in presentation and other experts engaged in presentations give their views.

Prescribed learning materials are the module book, the module reader and two syllabuses on photography and on basic techniques of presentation, respectively. Additional learning materials are available in the library.

A Retrospective View

In the past two years the *Media Module* has been offered twice a year, each attended by 45 students divided into groups of 15. In order to participate students have to register in advance. It has turned out that about 25% of the participants are students from abroad and that registration exceeds the available capacity. Although they have to work hard, students are enthusiastic about the module.

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Dynamic Perspective: The Media Research Program

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Abstract

The media research objectives at the Faculty of Architecture for the coming years have been brought together with an overall project: "Dynamic Perspective". The "dynamic" quality may be interpreted both as movement (visual displacement and registration) and as change (the effects of different options). The four projects which together make up this research program deal with perception (understanding) and conception (designing and imaging) of urban space: "the architecture of the city". Specific aspects are the effects of primary and secondary spatial boundaries and the systematic structuring of simulation of visual information. The program will further concentrate on the development and implementation of relevant techniques (besides "traditional" ones such as the drawing and the architectural model, on multimedia techniques such as endoscopy, computer visualization and development of virtual reality systems), both in education and in design practice. By means of analysis, the creation of visual models of choice and the setting up of experiments, the program aims at the furthering of theoretical knowledge and at acquiring better insights into the effects of design decisions at an urban level, both for designers and for other participants in the design process. Further development of existing laboratory facilities towards a comprehensive *Design Simulation Laboratory* is an important aspect of the program.

Introduction

This contribution focuses on the topic of *design simulation* using multimedia techniques, and in particular on the aspects that have to be taken into consideration when attempting to create visual images of architectural or urban concepts. This theme is explored in relation to the Delft Media research program entitled "Dynamic Perspective" and the research goals that have been set for the coming years within this program.

Design

Designing is to a very large extent an act of *composition* taking part simultaneously on different levels, concentrating for instance on functional, structural or aesthetic aspects. It may be viewed as a form of creative organizing. The different parts of a design and the respective solutions devised for these

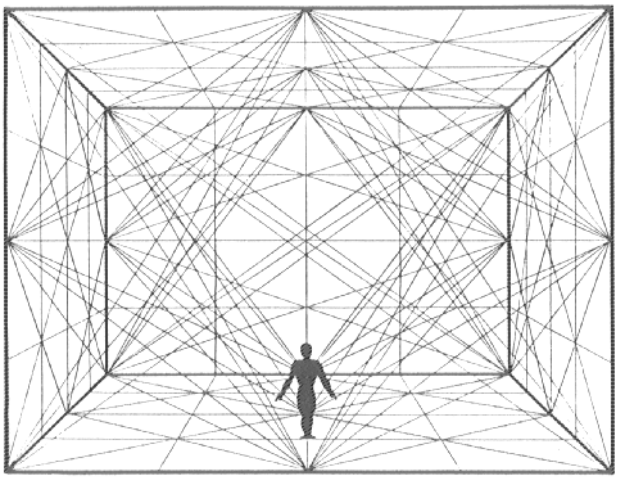

Fig. 1 Oskar Schlemmer: Figur und Raumlineatur (1924).

should not be considered as separate entities. A truly successful design is more than the sum of its parts but forms a synthesis. To quote Leon Battista Alberti paraphrasing Vitruvius [1]:

> "Beauty consists in a rational integration of proportion of all the parts of a building, in such a way that every part has its fixed size and shape, and nothing could be added or taken away without destroying the harmony of the whole."

The myth of design being a form of “devine inspiration” in which everything falls into place as if by magic and the artist only has to put everything on paper does not hold true. Designing is an often painstaking search comparable to hunting (in this case for the proper solution). Design is empirical in that it follows a path of trial and error in which intermediate design results are weighed in order to consider the merits of solutions and determine the further design strategy. Design is, however, not scientific in that there is not one “correct” outcome, but instead there are many possible solutions, each with specific advantages and disadvantages.

The media which are applied within this process of creation and evaluation are principally visual. Zeisel has called this activity *imaging* and has emphasized the iterative quality of the design progression, developing and specifying ideas. A process which he symbolizes as a spiralling line: moments of decisionmaking, reflecting on the results of the previous phase and anticipating the next [2]. I would argue that, when looking for ways to create insights which may benefit design development, it is important to focus on choice in design and composition [3]. Rather than concentrating on the end product of design, it is necessary to find ways of discerning and visualizing different design options, which may be weighed, selected or jettisoned and subsequently, refined step by step towards an integral design. H.P. Berlage, architect and urban designer, stated in 1908 that [4]:

> "The aim of our creations is the art of space, the essence of architecture"

Space in this context is not endless, undefined space, but space which is shaped and defined by boundaries. It may be relevant to consider spatial experience not so much in terms of time and (infinite) space but as the appreciation of place. In the words of Aldo van Eyck: the experience of "place and occasion" [5].

Architectural elements such as floors, walls, roofs (and on an urban scale buildings) and their respective sizes, shapes and relative proportions are primary determining factors shaping our perception of built environments. These primary aspects, however, make up only part of the story as far as the

Fig. 2 Three views of one of Le Corbusiers' designs for the Weissenhofsiedlung,

experience of our surroundings is concerned. There is an immense range of factors which color our visual impressions. Although they may be viewed as secondary from the viewpoint of the designer they are probably experienced more acutely than the underlying primary spatial concept, which organizes the design. Our perception is dynamic (illustrated by the sequence of Le Corbusiers' Weissenhof design) and is also selective in the way in which we absorb spatial impressions. Some elements will stand out more prominently in our mind than others (as everyone knows who has at some point taken a photographic picture which when printed showed visual information which was not noticed at the time).

One could say that the impression of space is primarily influenced by the size, shape and proportions of the elements. This goes for the objects themselves (on an urban scale generally buildings) but also for that which is between: the resulting space. It is obvious that this only a small part of what we perceive. If we attempt to simulate designs for new or altered environments, the dynamic quality of perception and the influence of both primary and secondary spatial factors has to be taken into consideration. A good example of the secondary aspects which influence our appreciation of urban ensembles is the absence or presence of trees and the way in which these can create a spatial *sub-scale* within a larger ensemble, f.i. illustrated by the Place des Vosges, Paris. In the same way in which the *feel* of a place is altered by elements situated within its contours (furniture in an interior, trees and other elements in a cityscape) the make up of the objects themselves influences our experience.

An important factor is the articulation of building façades. A building can take on a completely different appearance when the planes of its basic volume (or the sub-volumes which make up the whole) are articulated in different ways. How an architectural *gestalt* is perceived depends largely on the graphic and plastic treatment of its façades [6]. Façades are compositions in themselves, but should be developed together with the other parts of the built environment with which they interact. The underlying arrangement of façades often consists of a pattern, which may be regular (grids, repetitions of openings, horizontal or vertical bands etc.) or irregular (accentuating specific features or creating compositional tension). The resulting impression of wholeness and contrast, is shaped by the choices made by the designer [7]. Of course, façades and other features which form the characteristic boundaries of designed environments, consist of more than just patterns and lines. Differences in plasticity, in color and texture for instance will alter the visual impact of a building dramatically.

Fig. 3 The influence of trees as secondary elements: the TU Delft in the 1960's and 1990's and Place des Vosges.

Structuring Visual Information

In the same way that perception is selective - certain information getting prominent attention and other information being taken more or less for granted or even ignored until it catches our attention - so the activity of imaging is selective. A designer shifts his or her attention, discerning what is important for the progression of the design and focuses on it. Other actors in the design process generally are not as concerned with specific (problematic) details as the designer, but need to acquire an overall impression of where the design is going. Such non-professional participants expect the visual information to be realistic. The object presented is, however not yet finished, not all is known. How much or how little should be shown to such participants for them to understand the design at its current state? There is a tension between the abstraction in the images used by the designer and the reliability expected by the involved parties. The sketch is an instrument of design reflection, the content can be changed quickly (interactively) while an image for presentation in the design process, though an intermediate result, may seem more definite than it really is, leading to misunderstandings.

Urban concepts are notoriously difficult to communicate. They are essentially frameworks which allow the architects creating the specific buildings in the next step a certain amount of freedom. However, models which offer no information about architectural scale and secondary articulation are insufficient as instruments for interdisciplinary discussion. It may therefore be worthwhile to devise a structure of elementary visual types which can be used in the simulation of urban projects. Although the final image cannot be shown, the intentions of the design and the implications of different design options that are still open might be better understood and debated. Structuring visual information for this aim makes it necessary to classify, using a system of typological characteristics. One of the most effective structuring devices is traditionally the architectural style. The Renaissance fell back on the classic architecture of the Romans and Greeks, leading to a set of stylistic rules. Modern architecture never really produced a *style* in this sense and the *postmodern* movement has not created a renaissance of stylistic clarity, on the contrary. The present design practice is fastmoving and pluriform and recognizes no universally accepted style, no set of rules.

The Media Program

The research program of the Media sector at Delft University of Technology will in the coming years concentrate on urban concepts: “The Architecture of the City” and on the ways in which the consequences of varying design decisions may be understood and simulated. One of the ambitions of this

Fig. 4 Variations on the basis of Ludwig Wittgenstein's house (Vienna, 1929).

program is the development of an interactive expert system which could create better insights into urban design concepts, before the *decision to build* has been made. Dynamism in terms of motion and change - both in perception and in the process of design - is a central, binding theme. In this phase the different projects focus on a number of items such as:

- analysis of the effects of landscaping concepts in modern urban designs, in particular the influence of planned natural elements;
- further understanding of the (spatial) perception of designed, urban surroundings and the relationships between perception, design imaging and simulation;
- developing technologies and possible implementations which may lead to the creation of interactive, virtual environments.

The results of these projects should contribute to the evolvement of an instrument for urban design simulation, either on a technological level or as a contribution to the planned project database. Departing from relatively elementary, basic types the database should, for instance allow the user to interactively select a variety of specific façade patterns and possibly incorporate color, aspects of textural and/or material expression plus certain (meaningful) details. This research is primarily concerned with the interface between architectural and urban design and might in future be of benefit for the design practice and for education in these fields.

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Simulation - How Does it Shape the Message?

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Abstract

Environmental psychologists specializing in architectural psychology offer *user needs' assessments* and *post occupancy evaluations* to facilitate communication between users and experts. To compare the efficiency of building descriptions, building walkthroughs, regular plans, simulation, and direct, long-time exposition, evaluation has to be evaluated. Architectural simulation techniques - CAD, video montage, endoscopy, full-scale or smaller models, stereoscopy, holography etc. - are common visualizations in planning. A subjective theory of planners says "experts are able to distinguish between *pure design* in their heads and visualized design details and contexts like color, texture, material, brightness, eye level or perspective." If this is right, simulation details should be compensated mentally by trained people, but act as distractors to the lay mind. Computer visualizations and virtual realities grow more important, but studies on the effects of simulation techniques upon experts and users are rare. As a contribution to the field of architectural simulation, an expert - user comparison of CAD versus endoscopy/model simulations of a Vienna city project was realized in 1995. The experiment showed that -counter-intuitive to expert opinions- framing and distraction were prominent both for experts and lay people (=general framing hypothesis). A position effect (assessment interaction of CAD and endoscopy) was present with experts and non-experts, too. With empirical evidence for "the medium is the message", a more cautious attitude has to be adopted towards simulation products as powerful framing (i.e. perception- and opinion-shaping) devices.

Architectural Simulation

The term *Simulation Aided Architectural Design* (SAAD) refers to the implementation of spatial simulation techniques in the course of architectural design work. The production of design-accompanying *intermediate products* utilizing the technology as a design-assisting testing device may be regarded as a prominent application field for SAAD. Prototyping and modeling are necessary work stages as far as design activity is concerned making for a means of verification of the reproduction and the operational execution of a building. SAAD is to be taken as a design strategy: design problems are to be realized at an earlier point than with conventional working methods. SAAD is

not to entirely do away with previous working methods but rather acts as an addition also promoting the integration of traditional representation techniques. Thus spatial simulation is of significance for architecture without being a mere end-in-itself. A critical final statement has to be made anyhow. Simulation is to create a representation of reality in line with specified conditions. The possibility of manipulative use of simulation tools, however, is obvious: making believe may mean nothing but hushing up things.

Environmental psychology looking at the built environment utilizes *user needs'assessments* and *post occupancy evaluations* to measure the direct impact of architecture on users by building walkthroughs or long-time exposition [1]. Actual physical exposition is not the only possible way of interacting with a building. Plans and simulation methods offer pre-occupancy cognition, emotion and (imaginary) action about physically non-existent structures [2]. In case of an architectural competition, the decision whether to realize the project or not takes place in this *meta-physical* phase. The worlds of pre- and post-occupancy building evaluation overlap - simulating something is possible because something from the outside world can be handled symbolically by means of its mental representation. A simulated chair is correctly identified as a chair because we all have experienced real chairs. Simulation uses things stored in memory. Architectural simulation is an interaction of newly designed things and spaces with already known, existing examples.

The Selection of Simulation Techniques

The point is to what extent the product of simulation as such may mutate to be the message. How is the message presented? Or: is the wrapping itself regarded as the message? We may be running the risk that the substance is not being conveyed at all and the wrapping as it were is not even opened. Therefore, the intrinsic effects of the simulation techniques implemented are to be dealt with. Following the study "Fields of Application of Simulation Techniques" [3] performed in 1993 a suited selection was made for the present study. It did not come as a surprise at that time that computer-assisted and the endoscopic simulation techniques, resp., were implemented more heavily than e.g. holography and stereoscopy. Furthermore, the evidently great availability of low- and high-end CAD with its major significance in comparison to endoscopy also adds to this effect, simply to be explained:

- computer-aided simulation (CAD-CAAD-CAI-...)
  The virtual-digital model is vested with the ability to "impress" i.e. the reality is in force even without physical matter. The fact that a CAD-model can be at various locations at the same time proves particularly useful.

- endoscopic spatial simulation
  Concerning endoscopic viewing physical models with very differing degrees of detailing seem suited. Apart from insignificant adjustments of models the quick and uncomplicated implementation possibilities without "strings attached" are to be stressed. Thus endoscopy proves meaningful already at an early stage of design.

Computer-aided and endoscopic spatial simulation are the most common visualizations in planning [4]. In a society putting more and more communicative emphasis on computer artefacts and virtual realities [5], one should expect a solid body of knowledge about the effects of simulation in the minds of expert planners, politicians, administrators, and laypeople. However, empirical studies on the individual and social outcomes of simulation techniques are not numerous [6-10].

Selection and Configuration of the Referential Object

A complex urban design concept for the "Altes Flugfeld" (Old airfield) in Aspern (Vienna) acted as the starting point for experience with various perceptive and interpretative approaches. The master project by architect Rüdiger Lainer lent itself extremely well to this purpose being - at first sight - an irregular urban development area for 20.000 people hardly to be matched by any other international project. A digital, Autocad-produced Aspern model was made available. The shadow marking in the computer images indicates the project stage. Based on these digital data a 1:500 city model was produced in block-design. The respective heights of storeys were additionally specified by means of the building-up structure. As it principally was not to be an evaluation of the Aspern project, far-reaching details within the model were not shown (trees, persons, vehicles, façade features, etc.). It is to be stressed that the present manner of project representation in the field of architecture and urban design is to be regarded as representative and intentionally unspectacular (no "CAD-bluff"). Finally, an endoscopic and computer-aided picture of the main street corridor and an accompanying overall view was made.

Empirical study - Material, Method and Hypotheses

An expert - user comparison of CAD versus endoscopy/model simulations of the *Old Airfield Aspern* project was realized in 1995. The Department for Spatial Simulation at the Vienna University of Technology (VUT) provided diaslides of the planned city development at Aspern showing a) CAD and b) endoscopy photos of small scale polystyrene models. In a standard experimental design, the diaslides were presented uncommented as images of "project A" versus "project B" to student groups of architects and non-architects

Experimental design (experimenters and locations in brackets):

Group 1 (Keul/Martens, VUT) n = 30 architecture students a) endoscopy, b) CAD	Group 2 (Martens, VUT) n = 28 architecture students a) CAD, b) endoscopy
Group 3 (Keul, Salzburg Univ.) n = 19 psychology students a) endoscopy, b) CAD	Group 4 (Keul, Salzburg Univ.) n = 18 psychology students a) CAD, b) endoscopy

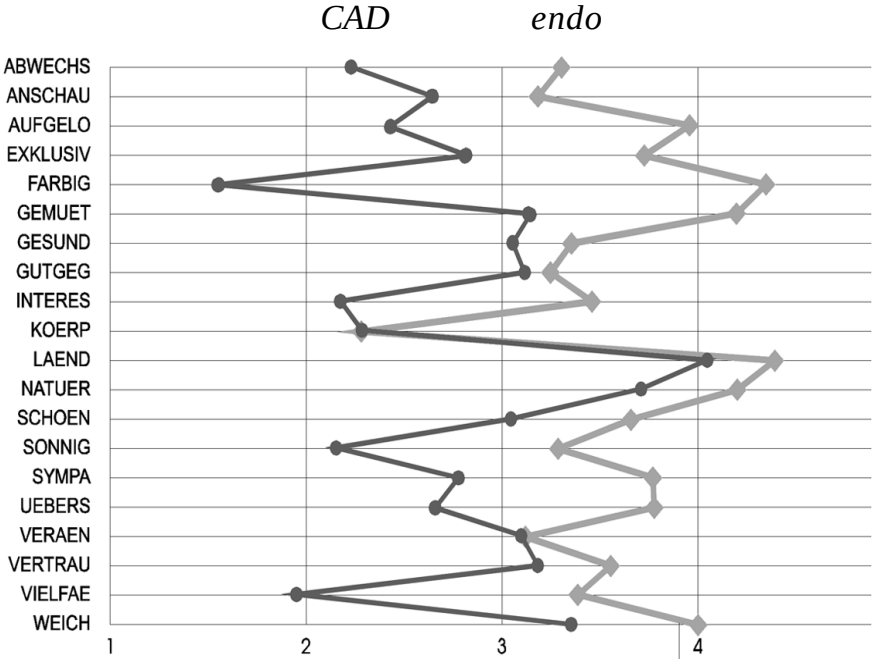

Fig. 1 CAD/endoscopy expert sample.

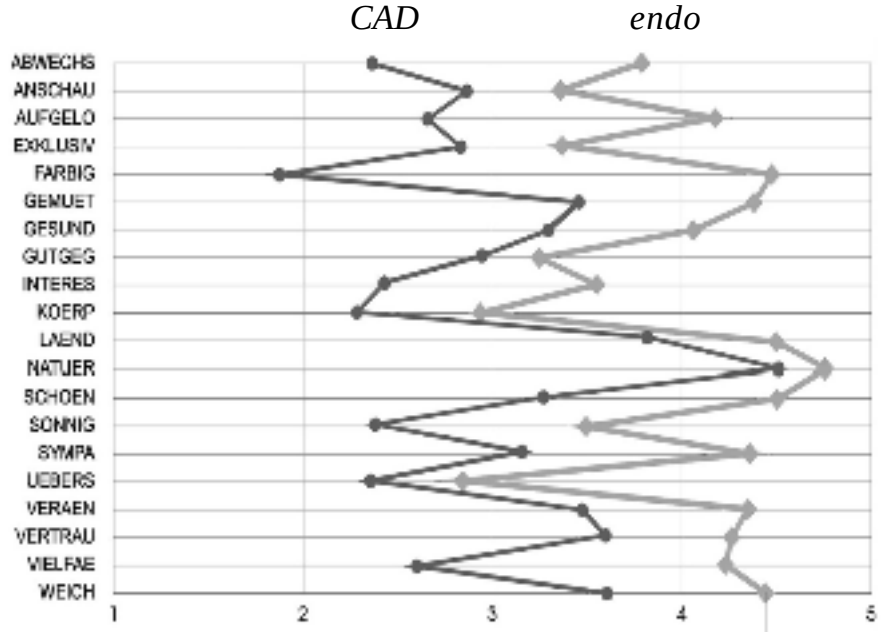

Fig. 2 CAD/endoscopy non-expert sample.

at VUT and Salzburg University (N= 95) and had to be assessed by a semantic differential [11] comprising 20 polar pairs of adjectives (e.g. ugly - beautiful). Two series - CAD and endoscopy - of four slides each were presented with a projection time of 15 seconds per slide. The students had to fill in the instruments twice on separate pages immediately after projection of the fourth slide. The experiment tested two contradictory hypotheses :

1. The selective framing hypothesis (SFH) close to the subjective theory about planners, postulating different judgment effects through selective attention of planners versus material- and context-bound perception of untrained users.
2. The general framing hypothesis (GFH) postulates typical framing and distraction effects of simulation techniques affecting experts as well as non-experts.

Results and Discussion

To present the results in a graphic, understandable way at the EAEA-Conference, only elementary statistics with a significance test was used. First, the similarities and differences of the data sets were examined. Arithmetic means were computed for every polar pair of adjectives [12]. In the graphic display (Fig. 1 and 2), the positive poles are all shwon left, and the negative poles at the right edge. A “totally average“ profile would run at “3“, exactly in the middle. What falls between 2 and 3 is “rather good“, between 1 and 2 means “very good“. Values between 3 and 4 should be read as “rather bad“, between 4 and 5 as “very bad“. It is obvious that both architecture student groups at Vienna found the endoscopic simulation pictures “rather bad“, and that the CAD simulation pictures of the same project were rated between “rather good“ and “average“. Looking at the non-expert psychology student profiles (Fig. 2, Salzburg), it becomes clear that the endoscopy slides were rated “rather“ to “very bad“, whereas the CAD slides got “average“ to “rather bad“. So at first glance there are clearer differences between the endocopic and CAD simulations than between the two user groups.

T-tests for dependent samples were run for the means. They indicate whether the arithmetic differences of the means are significant or not. In Fig. 3, highly significant t-test results [$p \leq 0.01$] are printed bold face. Note that when endoscopy was presented before CAD, 10 of the 20 pairs of adjectives show highly significant differences both of experts and non-experts. When endoscopy was shown after CAD, only two adjectives produced significant differences in both groups. What does the paradox result mean?

T-test significances (SPSS)	*architects E-C*	*non-archi E-C*	*architects C-E*	*non-archi C-E*
diverse	.000	.000	.525	.055
graphic	.016	.070	.907	.090
dispersed	.000	.000	.000	.002
exclusive	.000	.007	1.00	.023
colorful	.000	.000	.000	.000
comfortable	.000	.001	.894	.154
healthy	.048	.003	.852	.332
good area	.646	.056	.824	.312
interesting	.000	.003	.080	.289
bodily	.851	.134	.271	.203
rural	.003	.011	.212	.331
natural	.011	.056	.028	.854
beautiful	.001	.000	.110	.011
sunny	.000	.000	.025	.066
pleasant	.000	.000	.495	.077
clearly arranged	.000	.119	.084	.041
flexible	1.00	.004	.006	.749
familiar	.086	.048	.328	.481
varied	.000	.000	.302	.592
soft	.004	.011	.085	.848

Fig. 3 T-test results.

First, the experiment shows that -counter-intuitive to some expert opinions- framing and distraction were prominent both for experts and lay people (= GFH) in the "endoscopy first-condition". Second, a very strong position effect (assessment interaction of CAD and endoscopy) is present with experts and non-experts, too, overlapping the first effect. Endoscopy presented before CAD of the same project means "bad endoscopy, good CAD", but endoscopy presented after CAD minimizes evaluation differences both for experts and non-experts. The selective framing hypothesis (SFH) postulating the main differences between experts and non-experts is not supported at all by our data. Architectural simulation **does** shape the message, i.e. the plan's contents. With such strong differences, one could even quote McLuhan's "the medium is the message". A more cautious attitude towards simulation should be adopted. One should regard simulation products as powerful framing (i.e. perception- and opinion-shaping) devices. In presentations, simulation up- or downgrades architectonic ideas.

- The scope of our study was limited - no multimedia, no photorealism, no animation were used. As the experimental effect of this two media-study was considerable, strong effects of more advanced techniques on experts and non-experts should be expected. Hirche [9,14] reported that laypeople found model video simulations more useful than model diaslides.

- Smart, colorful CAD simulations are "Zeitgeist" and very popular whereas puristic, black & white endoscopy pictures or films are not that "cool".

Cultural and subcultural value systems are important for the impact of simulation technology on people and should be considered in evaluations.

- Wooley [13] gives an overview of epistemological speculations about virtual realities and cyberspace. Cryptic statements - “psychology is the physics of virtual reality“ or “reality is a cultural artefact“ - are not likely to shed light on interactions of technology, mind and society. One should follow a suggestion of Gregory MacNicol and do interdisciplinary research on new media, perception, cognition and emotion.

- Economically, architectural simulation methods are an innovative product. To develop successful and socially useful marketing strategies, target group-specific user research is necessary. Simulations good for architects could be bad ones for lay-people, and vice versa. Evaluation research tips the scales in that respect.

At the conference, the paper was discussed vividly. Jan van der Does underlined the importance of simulation quality. The realistic model, where the non-specific gets special attention, should be used for the communication designer-user, whereas the non-realistic model is enough for the professional communication designer-designer. Matthias Hirche remarked that the number of visual information could be crucial, so a crossover design with an information-rich endoscopic model and an information-poor CAD model would be necessary to decide. Wolfgang Thomas said that the information difference created a false comparison of apples with pears. Keul replied that simulation differences in the study were small compared to social reality. Glanville criticized that architecture students were probably more close to psychology students than to expert designers. Martens replied that in Austria, architecture studies takes a long time so students grow rather old and usually do practical work beside university. Granville also discussed the language problem sketching an experiment with architectural space vocabulary versus drawings. It was agreed upon that a semantic differential is a first indicator, but no in-depth instrument for a study of architectural perception. Other simulation methods and combinations of methods should be tested. Keul said that apparently, empirical simulation studies since 1973 have had no real impact on what designers and planners do with simulation methods. Therefore, the Keul-Martens project was meant as a constructive provocation.

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[12] In the experiment, subjects were asked to underline 10 adjective pairs "most important" to them. A cumulative analysis of the underlined items showed that for experts, dispersed, interesting, varied, sunny, clearly arranged, flexible, diverse and graphic were most important (underlined by more than half of the subjects), whereas for non-experts, beautiful, dispersed, pleasant, comfortable, colorful, natural, varied and sunny were the chosen items. The overlap experts - non-experts contains three important adjective pairs: dispersed-dense, varied-dull, sunny-dark.

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Applications of Optical and Digital Endoscopy

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Abstract

The Media Research Group at the Faculty of Architecture is currently exploring the opportunities of visualization media such as optical endoscopy and computer aided simulation techniques. The research program focuses on the influence of such media in the design process on an architectural and urban level and on creative applications for the benefit of research and education. The Aspern case-study in the framework of the 2nd EAEA-Conference has been used as a pilot study for emerging applications for design simulation. This contribution compares the possible use of *optical* endoscopes and three types of computer programs which may be viewed as *digital* endoscopes.

Introduction

Endoscopes are essentially tools which allow us to see inside small spaces. An architect can use an endoscope to look into a scale model of a design. Endoscopes provide an insight which may approach an image of reality, with the possibility to look around, to test different proposals and to change design options with relative ease. The endoscope can be used for the presentation of designs, as a design tool and possibly as an instrument in perception research. Optical endoscopes consist of a lenstube providing a virtual image of an object. The place and direction of the endoscope (the point of view) determine what virtual image the endoscope-user perceives. The object of study is generally an existing or designed environment. New and developing techniques bring with them a specific terminology, a technical jargon which in time may, or may not be absorbed into language. Computer jargon has introduced concepts like: *virtual reality*, *artificial environments*, *interaction*, *full immersive worlds* [1], and even *cyberspace*. The boundary between scientific reality and futuristic wishful thinking is not always clear. Steuer [2] defines virtual reality as follows:

> "Virtual reality is a remote or artificially constructed environment in which one feels a sense of presence, as a result of using a communication medium."

Researchers using endoscopes tend traditionally to be more interested in optics and in technical aspects that can be linked to movie-making than in computer technology. However, the optical and digital techniques are more and more frequently used side by side.

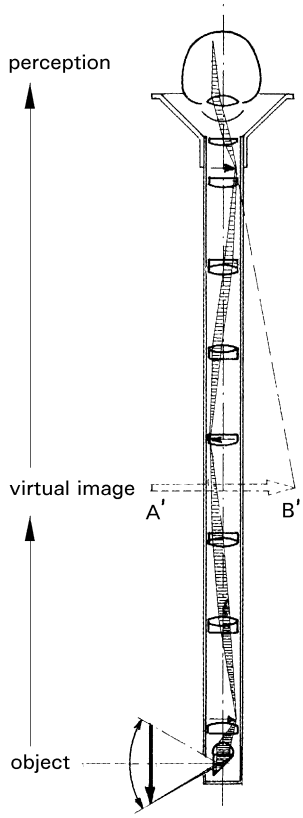

Fig. 1 Example of an optical endoscope.

From the point of view of Steuer's definition, endoscopy may be considered as a kind of *virtual reality*. In fact, endoscopy can give us a good photographic-image of a *virtual world* (a scale model) with *real time* possibilities to look around and to *interact.* In the same way it can be useful to view new spatial software products as *digital* endoscopes. Optical endoscopy and the upcoming computer applications have a number of aspects in common, the techniques of these *optical* and *digital* endoscopes can be compared.

Aspects of Endoscopy Techniques

The following comparative descriptions of four endoscopy techniques cover four aspects which influence their adequacy as instruments for design simulation: (1) the model, (2) the image, (3) navigation and (4) interaction. An endoscope is used to get images from a model at an imaginary eye level.

Making a model is a necessary step in the imaging process. Lighting and background are additional aspects of the model, they influence the final image significantly. The model is a spatial representation of an existing environment or of a design. Models can be relatively realistic or abstract. A scale model (for instance 1:200 for a cityscape model) will always be abstract to a certain

extent. It is impossible to create a completely reliable model of reality. Not all details can be made in the model. Sometimes a relatively high level of abstraction is to be preferred as it gives more adequate insight into the main aspects of a design.

The image is a result delivered by the endoscope. For presentation endoscopy one starts by thinking about the image. What must the image show, what must it look like? What kind of atmosphere or ambience do I want to present? The image for presentation is a product for presenting and explaining a design and it can effect important decisions, for instance, whether or not a design will be built. In contrast with presentation images, the image for research- and design endoscopy is a result of an experimental process. The image is not the final product, it is information for design-decision-making or for research (for instance a test-image for way-finding or perception research). In most cases images for design will be much more abstract than images for presentational use; they are not an end product but images created to test design options.

Navigation through the model gives a *dynamic perspective* of the environment. It can be free and direct or it can be pre-described and computed. Comparison of different models and/or evaluation by different participators can make reproducible and pre-described endoscope movements necessary. Navigation can take place in a flowing motion, but also by series of “stills”. Attention should be paid to the orientation of the participators. It is very easy to lose track of where one is in the model.

Interaction is a word often used for computer applications. Here it means the possibility to influence or manipulate the model or the endoscope movement. In a design process the possibility of interaction is a major aspect. Interaction is a form of communication between the designer and the design. The designer has a general idea which is tested in a model. The model gives information about how the design will work. This visual ‚feedback‘ is important for the designer. The ideas can be tested and the designer can respond to the images of his/her ideas. This cycle of imaging, testing and altering can be repeated a number of times until the designer is satisfied with the result. A model which is abstract and simple, which can easily be changed, is a useful model in a design process; such a model can be used in an interactive way.

Comparison of Endoscopy Techniques

Two main types of endoscopes are to be distinguished: optical endoscopes and digital endoscopes in the form of render-software in computers. Recent developments show three main groups of software for rendering: 3D-animation software, interactive ‚virtual-reality‘ systems based on 3D-vector models and

interactive ‚virtual-reality' systems based on photo-realistic panorama models. In the next paragraphs we will attempt to describe aspects of these types of endoscopes and to discuss the advantages and disadvantages of each, the specific research and visualization tasks they can perform and as far as possible the future possibilities of these media.

Optical Endoscopy

This is a technique for different visualization tasks. Most often the optical endoscope is used for presentations. In previous years the research of the *Media Sector* at Delft University of Technology has focused on the application of endoscopy as a medium for visualization and on comparison with other techniques such as the hand sketch and CAD [3a-b]. The Delft research program now aims to develop methods of use for endoscopy in the initial phase of the design process. The endoscope can be a good tool for *spatial sketching*. One can change a model *interactively*, this means: while you look at the image of the endoscope, you can change the model e.g. by moving blocks or applying *texture-maps*.

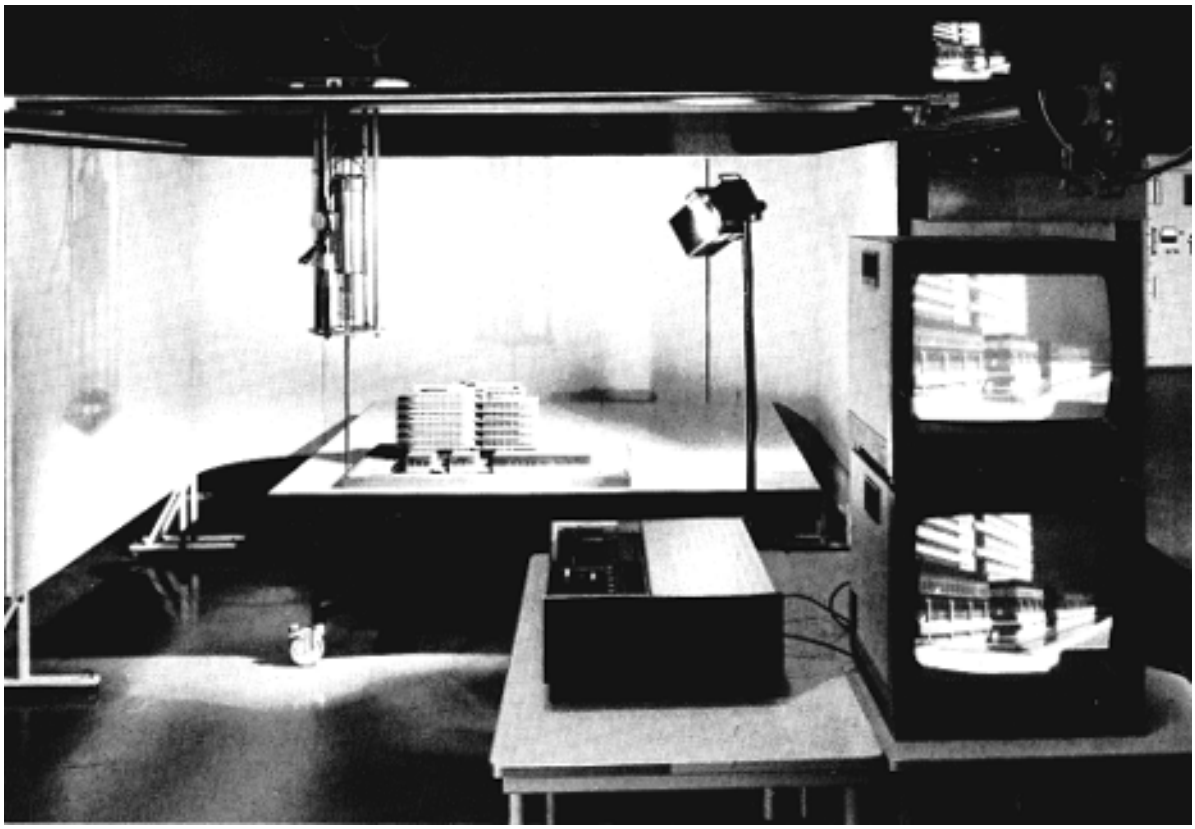

Fig. 2 The endoscope of the Media laboratory (Delft).

In contrast with the digital models used in computer rendering programs, the model for optical endoscopy is physical, it is built with real materials. This *real model* in optical endoscopy has certain advantages and disadvantages. A

good choice of model materials, with respect to colour and texture, can influence the quality and spatial effect of the image. If the model is very detailed, extra attention will have to be paid to lighting. Irrelevant details can distract from the main features of a design. The amount of detail, color and material expression in the model all have to be in balance with each other and in the spirit of the presented ideas. Relatively abstract models can give a clear impression of the primary design aims. On the other hand, details and articulation are necessary for spatial perception. The surfaces of a model need a certain amount of ‚information' (for instance texture and structure) for them to be perceived properly. Gibson saw this phenomenon as one of the *cues* of visual perspective, which he dubbed *texture gradient* [4].

The quality of the final image, delivered by an optical endoscope in conjunction with a video or photo camera, is an important advantage of this technique. With video the image is immediately visible. The images can be easily distributed via slides, photos or videotape. The use of adequate video equipment is important for the quality of the video. The new generation of video cameras have become much smaller. In principle modern mini cameras can be moved directly through a model. Essentially an optical endoscope is a periscope with a lens tube connected to the camera. In recent projects in Delft we have worked without a tube, but with a movable mirror element connected directly to a mini camera, causing less loss of light.

The use of a computer as a pre- or post-production tool can enhance the possibilities of the optical endoscope. The post-production of still pictures with a computer (mixing "real" and produced reality with "paint" programs) can contribute towards a *Renaissance of Endoscopy* [5]. The scanned endoscopic images can be changed with image processing software, for instance to apply a reflection of a building in water. An attempt at pre-production with a computer was made in the Delft contribution for the Aspern-workshop on the occasion of the 2nd EAEA-conference in Vienna. Texture-maps of reduced façade patterns and real façades were applied to the model. Texture-maps were scanned with a computer from photos of buildings. The façade photos were originally in perspective. A computer photo-styler was used to straighten and to multiply the façade images. The façade textures were then printed on scale 1:200, and were glued onto the building blocks of the model. This use of texture maps gives the urban model a more architectural impression. The scale and the distances in the urban design can be judged much better with these textures which are flat but give a suggestion of depth. The use of different patterns, colours, structures and textures can enhance the resulting images.

Fig. 3 Optical endoscopic image for the Aspern workshop. Texture-maps of real façades were applied on the model.

Digital Endoscopy

Digital endoscopy is a technique to look inside a digital spatial model. The term for creating images by computer is *rendering*. A vector-model with spatial information in the form of co-ordinates and additional information of materials, textures and light-sources, can be rendered in order to get a perspective image. The rendering can be performed with differences in quality. Image quality is inversely proportional to render-speed. Some different methods of rendering are *flat shading*, *phong shading* and *ray tracing*. Flat shading is the fastest rendering mode, it shades each facet of the model based on its angle to the light source and the chosen view. Phong shading is used more than any other shading method. Phong shading calculates the correct colour for each pixel in the image. It can render highlights and shades, based on one or more light sources and materials. Ray tracing is the most sophisticated and realistic way of rendering, it takes account of many physical aspects e.g. breaking of light in water and reflection of light in objects. Ray tracing follows rays starting from the viewers‘ eye back through the model, and only image relevant rays are considered. Ray tracing is not a very fast way of rendering; it cannot be used very well for *real-time* rendering on normal desk-

top computers. The ray tracing technique can deliver high quality *still* images, for slide or photo presentations or time consuming, non-interactive computer animations. *Virtual Reality (VR)* is intended to be - by definition - a real-time process: while you navigate through the spatial model, the computer must immediately render the new images. Therefore most VR-programs use fast phong- or flat-shading. Texture maps [6] can be used in VR models, they do not influence the rendering speed significantly and give a better, detailed image. New developments in VR-models use the *radiosity rendering technique*. The radiosity method calculates light distributions starting from the light sources in the scene. With this method the image of light and shade on all surfaces of the spatial model can be pre-rendered. Such pre-rendered images of the light and the shade for each face in the model can be used as texture maps. This trick creates a fast rendering model with a relatively *natural* image of light on different materials. Despite all these ingenious computational rendering tricks, most virtual reality images look unconvincing. Many visual aspects of reality and of human perception are not taken into account. Nevertheless VR-technology can be useful for testing and designing architectural concepts and we may not have to wait a long time; the techniques are developing very fast.

3D-Animation Software

Three dimensional animation software is initially developed for the film industry and for *high-tech* industries like space-, aircraft-, weapons- and medical industries. Architectural use of CAD software started around 1980, use of 3D-animation software started ten years later around 1990. Now many architectural and urban design offices use CAD and 3D-animation software. There are distinct similarities between 3D-animation software and optical endoscopy. The software can produce a detailed rendered preview of the spatial CAD model. The images provided by 3D-animation software depend highly on the quality of the digital model and the set-up of lights. The digital light sources can be spotlights, omni-directional lights and ambient light. The lights can have different colour settings. The model can be prepared for the animation by assigning different material-descriptions to the geometry. These material-descriptions consist of parameters for colour in different lighting conditions (ambient, diffuse and specular) and other aspects like shininess, transparency and different kinds of texture. With these material descriptions virtually any material can be simulated.

To provide a *dynamic perspective* of the spatial model with the lights and different materials, the animation software uses a camera and a time-line. The camera conditions can be described with settings for the focus, and co-ordinates for the point of view and the direction of the view. On the time line the

different movements of the camera, the lights and objects in the model can be described. The whole method of making a 3D-animation consists of pre-description of movements between points in the model space and choosing settings and parameter values for every visual aspect in the final animation.

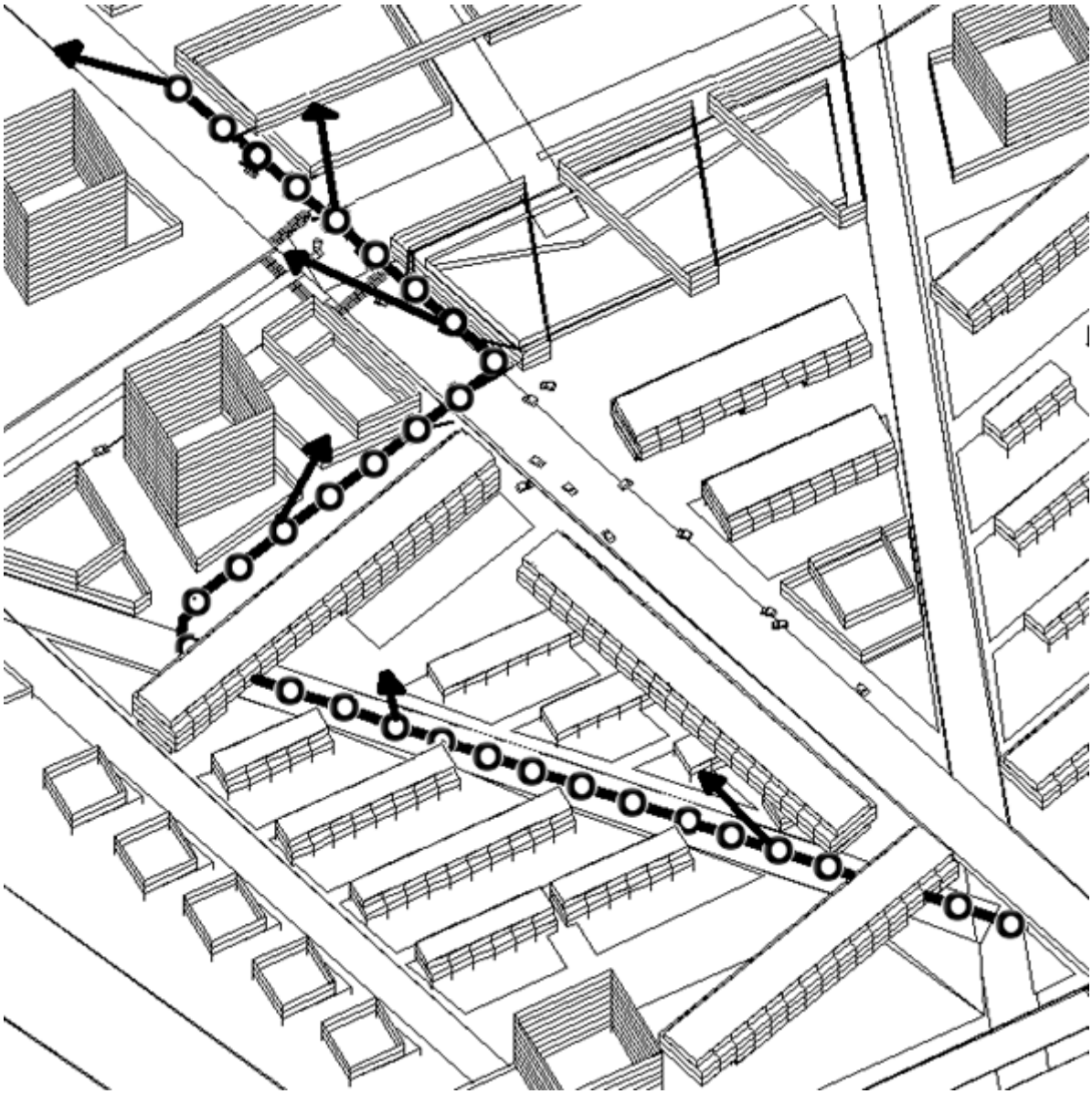

Fig. 4 The pre-described camera path of a computer rendered animation.

3D-animation software is created to produce *final* images and films for presentational or instructive use. Nevertheless this software can also be used as a research tool or as a design tool. Some animation programs can be seen as CAD-modelers extended with animation facilities. These programs provide a good visual interaction between the model and the designer. This extended use of 3D-animation software is only possible if the designer has much initial knowledge of the possibilities of the program and if the program provides

functions for changing the model in an relatively easy way. The perspective preview, provided by most new 3D-animation programs, can also be used as feedback for the designer during the design process. After setting every aspect of the model and the navigation through the model, the final rendering process can start. The computer renders every image and makes an animation of them. Depending upon the type of computer, the amount of images and the image quality, this rendering costs seconds or weeks. After this waiting time, the film can be shown or recorded on videotape.

Interactive VR-Systems based on 3D-Vector Models

These systems can use the same kind of spatial models as CAD-programs and 3D-animation software. However, most CAD and animation models have so much information that they become too slow to be rendered in real-time. The model for virtual reality has to be reduced. The geometry in CAD models uses many faces which do not improve the final image, these faces must be deleted or changed. A lot of geometry in details can be reduced by using texture maps. A whole façade of a building in a model of a city can be represented by a texture-map consisting of a scanned photo or a drawing of the façade. This reduces the geometry-information in the model and speeds up the real-time rendering process. With these *reduced-geometric* models virtual-reality systems can render the perspective images of the model much faster. The user of the software can navigate through the model by either using the mouse pointer, a *joy-stick*, or other spatial pointing devices. The image can be shown on a computer-screen as a flat perspective image, but the computer can also render two images at the same time to display a stereoscopic spatial image. This stereoscopic image can be perceived via ‚head mounted displays' or from a 3D-computerscreen. In this case the screen alternately provides a left-eye-image and a right-eye-image at a frequency of 120 Hertz. A pair of glasses with liquid crystals (which can turn from transparent into black and reverse at a very high speed) separates the left and right eye view at a frequency of 60 Hertz. This stereoscopic 3D-computerscreen in combination with the special glasses gives a very sharp spatial view. The glasses do not weigh as much as the *head-mounted-displays* and they do not separate you from *real-reality*.

Virtual reality applications, both the software and the hardware, are still developing very fast. The question is how we can use this technique for spatial research and design. As an example of an initial attempt of applying virtual reality techniques to urban design we want to mention a preliminary study for the Delft contribution to the Aspern-workshop on the occasion of the 2nd EAEA-conference in Vienna. A digital-3D-model of an urban design for Aspern (a city extension of Vienna) was constructed with similar *faces* of 6x3

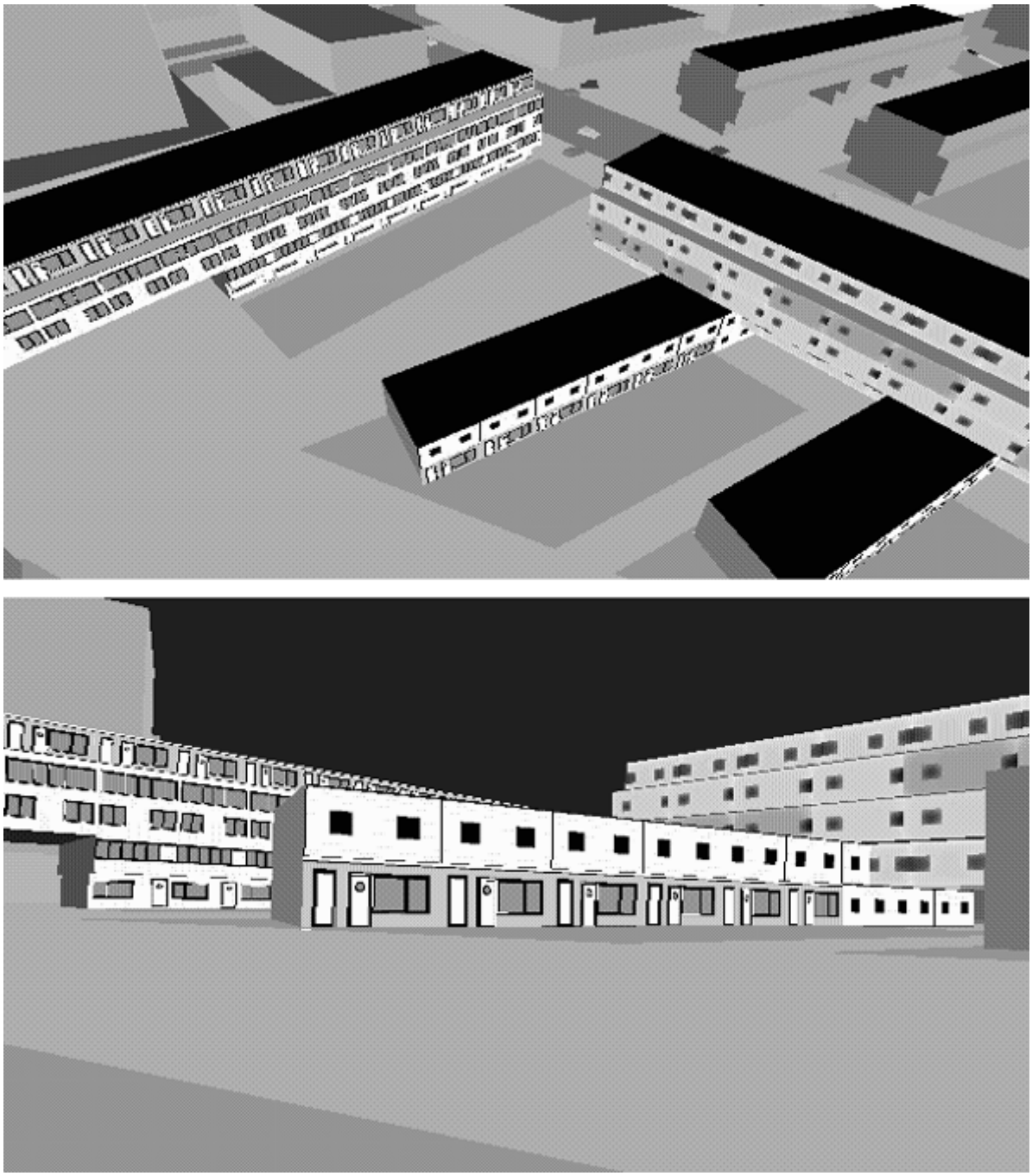

Fig. 5 Digital endoscopic images for the Aspern workshop. Bird's eye view and pedestrian view of the interactive model.

meters representing a front and a backside façade for each house in the urban plan. A small *library* with façade-maps was created. The façade maps are small images of *typical* house façades consisting of 60x30 colour points. Each colour point representing a detail of the façade of 10x10 centimeters. Using a virtual reality program it is then possible to navigate through the model of Aspern. By using the mousebuttons and by pointing to different parts of the perspective screen image, one can in principle look and move

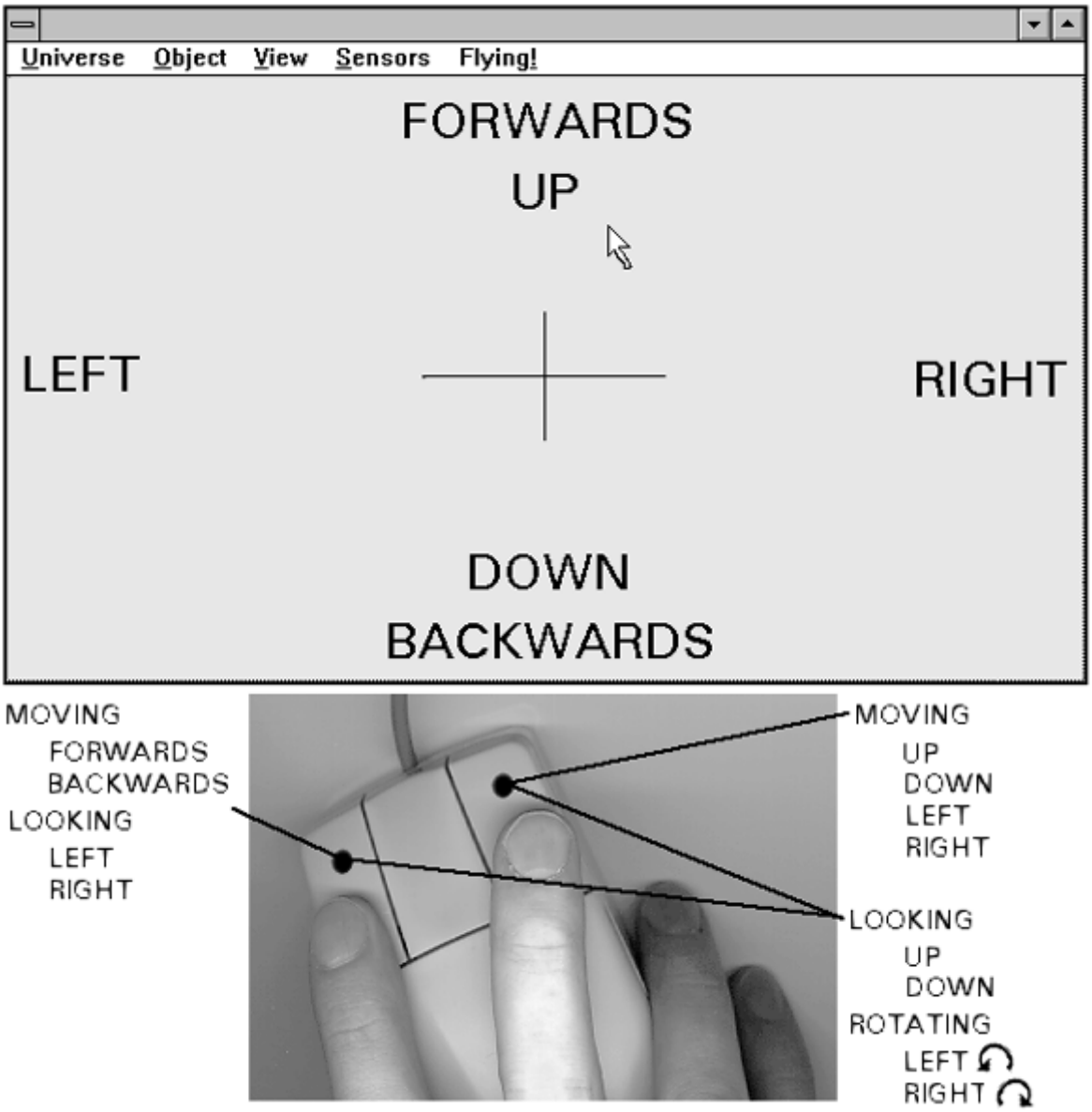

Fig. 6 Method of navigation through a Virtual Reality model by means of different mouse ‚direct' and ‚click' combinations.

anywhere one wants. Using the façade library one can select different façade elements for the house one is looking at. Clicking the mouse changes an element instantly. This is an initial version, a first step toward further development of a possible instrument that may facilitate discussion and decisionmaking concerning urban concepts. This first test gives a fast spatial insight, with different points of view, and with the possibility to change aspects of the model in *real-time* and *interactively*. At this moment the quality and reliability of the images and the perspective projection of the façades is still poor.

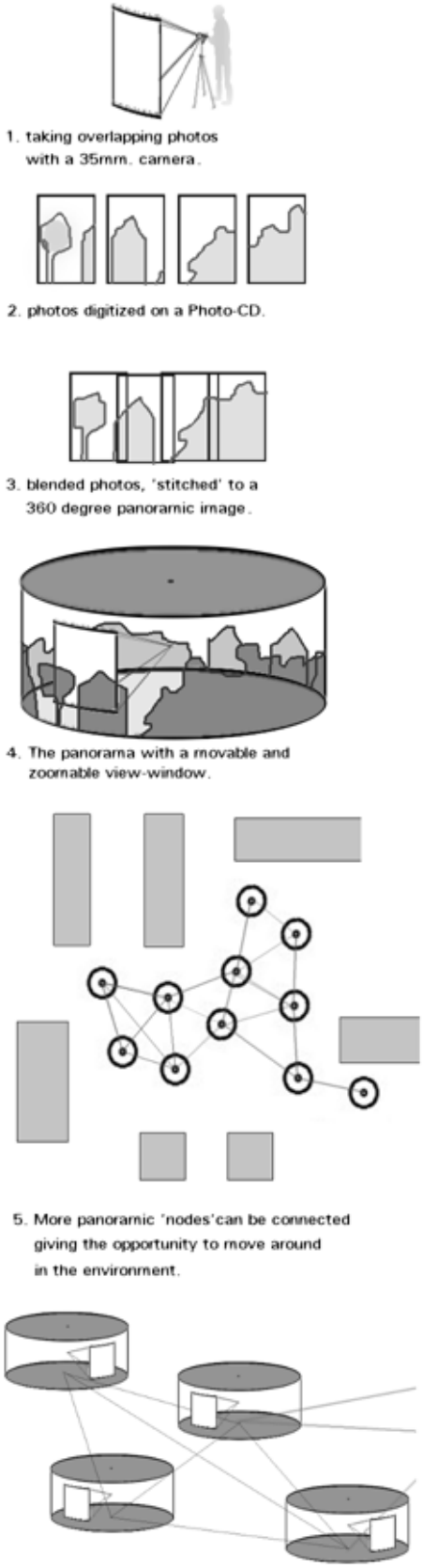

Fig. 7 Method of creating a Virtual Reality model based on photo-realistic panorama models.

Interactive VR-Systems based on Photorealistic Panorama Models

The third *digital endoscope* described in this text has a totally different approach to creating and representing a *virtual world*. Interactive virtual-reality-systems based on photo-realistic panorama models do not use vector geometry as a model. The panorama is like a painting or photograph that surrounds the viewer. The concept of a computer-generated panorama photo viewer is quite new and can be seen in a software product called *QuickTime-VR*. As a design tool this program has limited possibilities as there is little opportunity for interaction. The process of creating a panoramic world consists of four steps:

1. Pictures or computer rendered files of a 360° view are necessary. These pictures can be taken with an ordinary mirror-reflex camera with a 35mm lens on a tripod;
2. The photos are scanned into a computer;
3. A program called the ‚stitcher' connects the pictures and produces a 360° panorama;
4. The panorama can be seen as if one is standing inside, in the middle, and performs like a static endoscope. One can pan and zoom as with a telephoto lens, looking around the panorama from a single spot. By assigning certain places in a virtual environment as so called hot-spots one can jump to another panorama.

Quicktime-VR emphasizes the difference between a non-interactive *image* (in this case a panorama around a fixed point) and a potentially interactive *model* which may be altered and from which different images of design options may be computed. A model may be the subject of design manipulation and experimentation. An image is a result and may be used for presentation and explanation.

Conclusions

The development of endoscopic techniques, both *optical* and *digital* is continuing. The usefulness of endoscopy is likely to increase. On the one hand this is because of specific advancements within the fields of the two types of endoscopy mentioned. For *optical endoscopy* the introduction of digital video systems and optic fibres is likely to increase the existing possibilities. For *digital endoscopy* faster and more efficient rendering techniques in combination with the evolution of real time Virtual Reality can be expected to offer new impulses for design simulation. As we have attempted to illustrate the coupling of these systems, such as for instance the pre-production and post-production enhancement of optical endoscopy, may lead to new approaches

and applications. In the coming time it will be worthwhile to continue exploring further possibilities of the existing techniques and to consider new potentials for architectural and urban endoscopy.

Notes and References

[1] Immersive is a term that refers to the degree to which a virtual environment submerges the perceptual system of the user in computer-generated stimuli. The more the system captivates the senses and blocks out stimuli from the physical world, the more the system is considered immersive.

[2.] Steuer, J., "Defining Virtual Reality: Dimensions Determining Telepresence, in: *Journal of Communication* 42(1992)4, p. 73-93.

[3a] Does, J. van der (et al.), *Overdracht en simulatie, onderzoek naar de waarde en betekenis van mediatoepassing bij architectonische simulaties*. Delft: Delftse Universitaire Pers, 1990.

[3b] Does, J. van der, "Visualization by means of Endoscope, Computer and Hand-drawn Techniques" in: Seppo Aura, *Endoscopy as a Tool in Architecture*. Tampere, 1993, p.167-180.

[4] Gibson, J.J. *The Perception of the Visual World*. Cambridge: The Riverside Press, 1950.

[5] Martens, B. "A Renaissance of Architectural Endoscopy?" in: Seppo Aura, *Endoscopy as a Tool in Architecture*. Tampere, 1993, p. 143-152.

[6] Texture mapping is a powerful technique for adding realism to a computer-generated scene. In its basic form, texture mapping lays an image (the texture) onto an object in a scene. More general forms of texture mapping generalize the image to other information; an ‚image' of altitudes, for instance, can be used to control shading across a surface to achieve such effects as bump-mapping.

[6a] Catmull, Ed. *A Subdivision Algorithm for Computer Display of Curved Surfaces*. University of Utah (PhD Thesis), 1974.

[6b] Heckbert, Paul S. "Survey of Texture Mapping", in: *IEEE Computer Graphics and Applications*, (1986)11, p. 56-67

[7] For this article several internet WWW-pages were consulted to get information about the following programs:
AutoCad, Arcos, Alpha, Allplan, Arc+, Architrion, MicroStation and MiniCad (3D-modellers);
Virtus WalkThrough, Strata Virtual 3D and Avril, (3D-viewers);
World Tool Kit and World-Up (3D-virtual reality programs);
QuickTime-VR (3D panoramic viewer).

[8] Biocca, Frank; Levy, Mark R. (ed.). *Communication in the Age of Virtual Reality*. Hillsdale: Erlbaum, 1995. This book provided information for some recent developments of virtual reality.

Future of Endoscopy, Updated

Petri Siitonen

Tampere University of Technology, Finland

Abstract

This paper covers research based on a case study comparing *CAD* and *Endoscopy* in exploring, generating and illustrating architectural designs. Findings are compared to the former evaluation to study the trend how Endoscopy and CAD stand to each other.

Background

"Future of Endoscopy" [1] is a paper putting down the researcher's own evaluations how he sees the usefulness of architectural endoscopy versus CAD in teaching architectural design. The emphasis was not only to compare the current state of both, Endoscopy and CAD, but to predict the potential of them in the near future. This updated version is based on the experience gathered in the research "Comparing CAD and Endoscopy in Exploring, Generating and Illustrating Architectural Designs" by Ranulph Glanville [2] and Petri Siitonen. The updated version is perhaps somewhat wrong in choice for words, because the issue here is more of testing a theory in practice. Also, the original paper refers to the future endoscope which unfortunately does not yet function as a whole device; it is still under development.

The Comparison

The evaluations for the updated table are gathered from surveying students at work and also from student interviews held at the "Design-by-Modelling-Course" at the Department for Architecture at Tampere University of Tech-

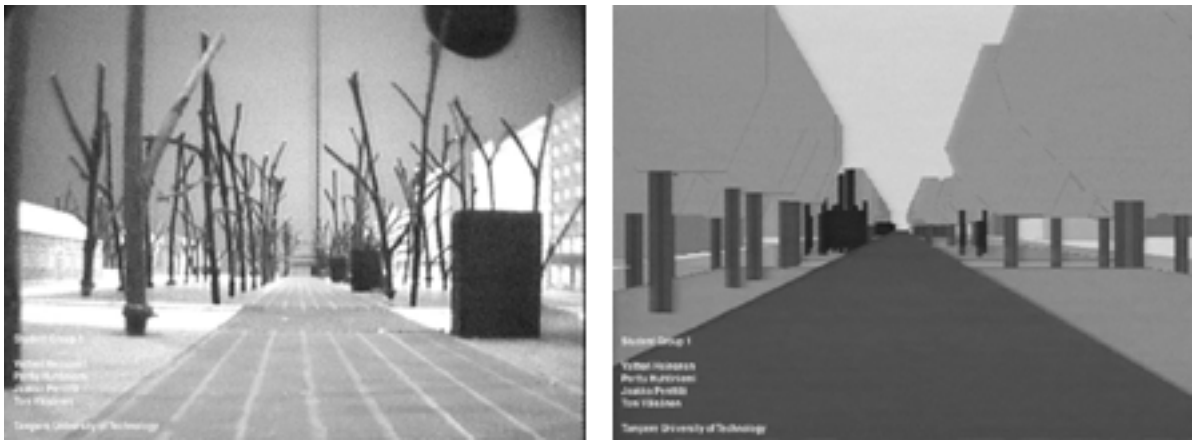

Fig. 1 Results of Group 1.

nology in 1994-95. Students were first and second year architecture students with no or little experience either on CAD nor endoscopy. We felt this was a fair basis for the comparison because once you learn to master one method it is much harder for another approach to gain ground. Students were not directly asked the questions on the table but were interviewed more generally on their experience of using endoscopy and CAD. Students were also observed how they use the equipment provided; they were instructed how to use the Tampere Department of Architecture endoscope and Virtus Walkthrough [3] CAD program but on purpose left alone to approach the design task itself.

Fig. 2 Results of Group 3.

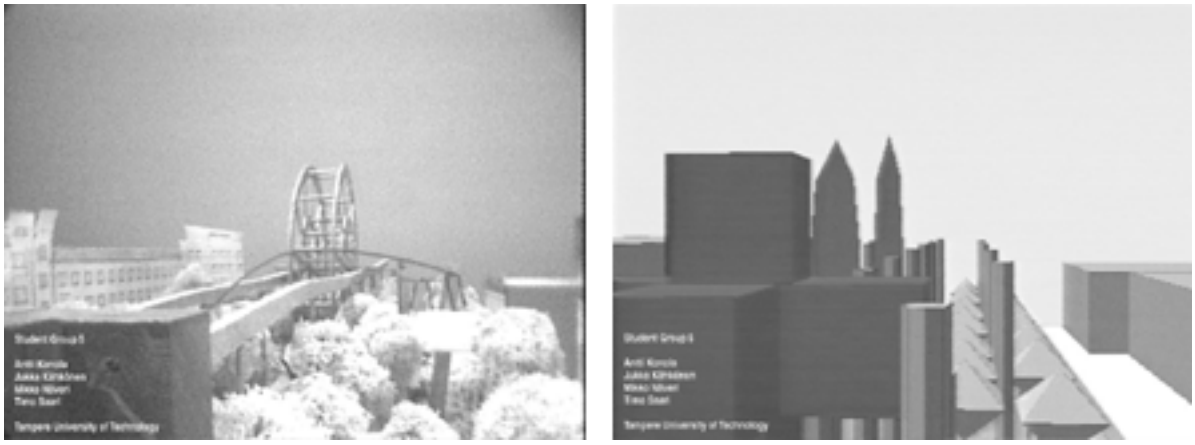

Fig. 3 Results of Group 5.

The Competitors

The Tampere Department for Architecture's endoscopical device is now already more than ten years old. However, it is still working reliably. Basically the endoscope has x,y,z-movements and free rotation, a car-like interface and simultaneous videotape recording capabilities. It is missing tilt-movement, repeatability of the route, computerized light control and collision prevention. It is also somewhat robust on its movements. The *Virtus Walkthrough* was

chosen to represent a CAD equal to the Tampere endoscope. It claims to be made for architectural walkthroughs and visualizations. Virtus Walkthrough differs from the rest of the CAD programs for its ability to produce real-time walkthroughs even with a mediocre computer. It also has simple modeling rules and the interface is quite friendly for a novice. It runs on both *Macintosh* and *Windows* operation systems and the files are interchangeable with each other. The following table summarizes our findings on comparing Endoscopy and CAD.

ENDOSCOPY vs. CAD

MODELLING

• skills needed	%	√	Physical models are present all the time from the beginning of their making. Using CAD one always has to tackle with an operation system first to gain access to modeling. And even if we consider it to be common literacy to know a computer operation system – one still has quite a long way to adopting the computers way of thinking when modeling, even with an "easy CAD" like Virtus Walkthrough. One of our student groups lost their whole model, and for good, because they hadn't backed it up! On the other hand doing a second job with CAD is considerably easier and a lot more rewarding for a student.
• equipment	%	√	In CAD for twenty students you need twenty computers and software lisences!
• accuracy	√	%	In CAD for twenty students you need twenty computers and software lisences!

STAGING

• adding people	√	√	Both way people look dead, you cannot animate humans in real time animation.
• adding trees etc.	%	√	Trees are typically quite problematic for CAD; realism or the number of trees can easily "freeze" any CAD system.
• using backgrounds	%	%	In endoscopy a lot of space is needed and large backgrounds can be tedious to produce. In CAD controlling the backgrounds behaviour with perspective can be difficult.
• using materials	%	%	Endoscopy; hard to make, but easy to use. CAD; flexible, but limitations to vast use and usually quite hard to define.

LIGHTING

•light properties	%	√	Simulating real world lights is typically not possible with CAD programs. Same goes for inter-object illumination that is not possible or very computer intensive to produce. In Endoscopy general lighting is quite easy to create and control but individual miniature light fixtures are difficult to set up.
•number of lights	√	√	In Endoscopy it is quite tedious to have a lot of lights. In CAD adding lights will increase the hardware requirements –to the second degree as a general rule.
•sun simulation	%	%	Can be done in both.

ANIMATING

•moving real time	%	√	CAD typically has limitations.
•control of movement	%	√	This is more the question of interface for both.
•restrictions of moves	√	%	Endoscopy; problem for having (not going through doorways) CAD; problem for not having (going through everything)
•repeatability	%	%	Possible for Endoscopy also.

INTERFACE

•using mouse	√	√	They both need something else.
•using "video-helmet"	%	%	Both possible (not yet tested).
•using 3D-sound	%	%	Both possible (not yet tested).

PICTURE QUALITY

•high res. stills	%	%	Both possible
•VHS-quality	%	%	CAD has problems with 25/30 frames/second
•SVHS- and beyond	%	√	In CAD typically frames have to be precalculated
•Stereo display	√	%	Endoscopy; technically demanding. CAD; easier, but you have to double your investments to retain quality

DISTRIBUTION

•in digital form	%	%	Video to digital -converters are widely and inexpensively available.
•in video form	%	%	And vice versa (see above).

MAKING CHANGES

• while shooting	%	%	Endoscopy is more flexible for sudden changes in lighting and small details. However, major changes are typically easier with CAD without redoing everything.
• editing the route	%	%	Matter of interface, endoscopy needs computer controlled motion.

COSTS AND MAINTENANCE

• cost for real-time	%	%	PC-CAD has evolved rapidly and semi-real-time is nowadays possible quite inexpensively.
• cost for maintenance	%	%	PC-CAD is inexpensive, Unix systems quite costly. For endoscopy one needs specialized personnel.
• cost versus speed	%	√	Speed is not a cost adding feature in endoscopy, where as in CAD one pays dearly for extra speed.

FEEL FOR ARCHITECTURE

• feel for space • feel for materials • feel for reality	% % %	√ √ √	In endoscopy you are dealing with tangible objects. In CAD you are using mathematical representations of objects, points, lines and polygons. This still makes a difference.

SHARING

• sharing in education	%	√	Endoscopy has been proved to be a very social working technique in educational group work. CAD work is typically very lonely. Even CAD networking is targeted for sharing work over great distances, not with the person next to you.
• sharing in presenting	%	%	Endoscopy works naturally in all environments where video technology is present. CAD typically has to be converted technically to be able to be shown for larger audiences.

FINAL SCORE 27/20 Endoscopy is the winner, but CAD is gaining

Notes and References

[1] Siitonen, Petri. “Future of Endoscopy”, in: Seppo Aura (et al.), *Endoscopy as a Tool in Architecture*. Tampere, 1993, p. 181-184

[2] Ranulph Glanville, Centre for Research and Development in New Media University of Portsmouth (UK).

[3] Mac/Windows CAD program by Virtus Corporation Inc., NC (USA).

III

WORKSHOP ASPERN: THE (IN-) VISIBLE CITY

Introduction to Workshop Aspern

Bob Martens

Vienna University of Technology, Austria

Preliminary Remarks

A complex urban-design concept acted as the starting point for experience with various perceptive and interpretative approaches in the course of this workshop. The master project for the "Altes Flugfeld" (Old airfield) in *Aspern* (Vienna) lends itself extremely well to this purpose being - at first sight - an irregular urban development area for 20.000 people hardly to be matched by any other international project. The area Stadlau / Aspern / Eßling / Hirschfeld / Hausfeld / Altes Flugfeld was declared an urban development area according to the guidelines concerning urban development in Vienna of 1991. Reasons for the development of this area are its size and its strategically important location aiming at continuation on the other side of the Danube as well as the cross-linking of the city with this region and an expandable traffic infrastructure. This area represents an extremely valuable potential regarding housing projects and location of industrial facilities and services as well as of development of new urban quarters. What counts is the enhancement of qualities existing within the area while maintaining natural spaces and settlement structures. The project "Altes Flugfeld" - prelude and field office for a major development area - represents a viable and "complete" city quarter as such.

Procedure of the Workshop

Originating with the master project of the Viennese architect *Rüdiger Lainer* careful studies of this urban development took place at different educational centers. Following list of participants was determined on account of the preliminary inquiry (in alphabetical order):

Bialystok (Poland): Jadwiga Zarnowiecka et. al. [CAD]
Delft (The Netherlands): Jack Breen - Martijn Stellingwerff [CAD+ENDO]
Essen (Germany): Wolfgang Thomas [ENDO]
Gothenborg (Sweden):Arne Branzell [ENDO]
Graz (Austria): Annegrete Hohmann-Vogrin / Bob Martens [CAD+ENDO]
Stuttgart (Germany): Arpad Pfeilsticker [ENDO]
Vienna (Austria): Bob Martens [CAD+ENDO]
Zürich (Switzerland): Gerhard Schmitt [CAD]

Furthermore a general preoccupation was provided by Hildebrand Frey from Strathclyde University in Glasgow (UK). Depending on the specific designer the reaction concerning the present master project only issued partial additions and spot-wise details or even diverging measures. In the course of design-supporting work the digital and/or physical model had to be involved. Those participating represented a group of experts individual contributions of which having been entered prior to commencement of conference. Individual projects were to be demonstrated in the course of the conference within the workshop and presented to the general public. Furthermore, this lead to an interesting comparison of various design-approaches accompanied by the simulation techniques used. Based on the findings an analysis of the advantages and shortcomings of the specific simulation procedure put to use could be demonstrated clearly.

The physical urban-design model consisted of two square base plates fastened by means of a frame in between. On putting the square together the rectangle (90x180 cm) matches the separately sent building-up plans. Individual building-up components were fastened by means of magnetic tape to be removed as often as required. This 1:500 model served as a basis subject to individual activities to be performed.

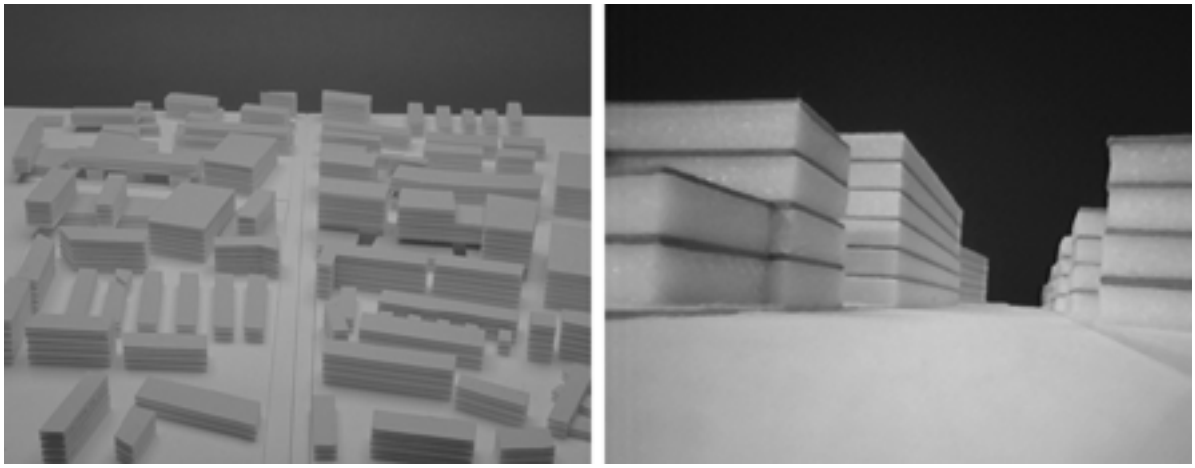

Fig. 1 Overview and detail from physical 1:500-model.

The digital Aspern-model was compiled with *Autocad* and was available in various formats. The digital model served as a basis subject to individual activities to be performed. The digital model could be exhibited at various locations very easily; the 1:500-scale urban-design model had to circulate between several universities throughout spring 1995. The participating universities sent the model to the next location, this allowing both for computer-aided and endoscopic simulations. A film-sequence resp. animation had to document on the achieved result.

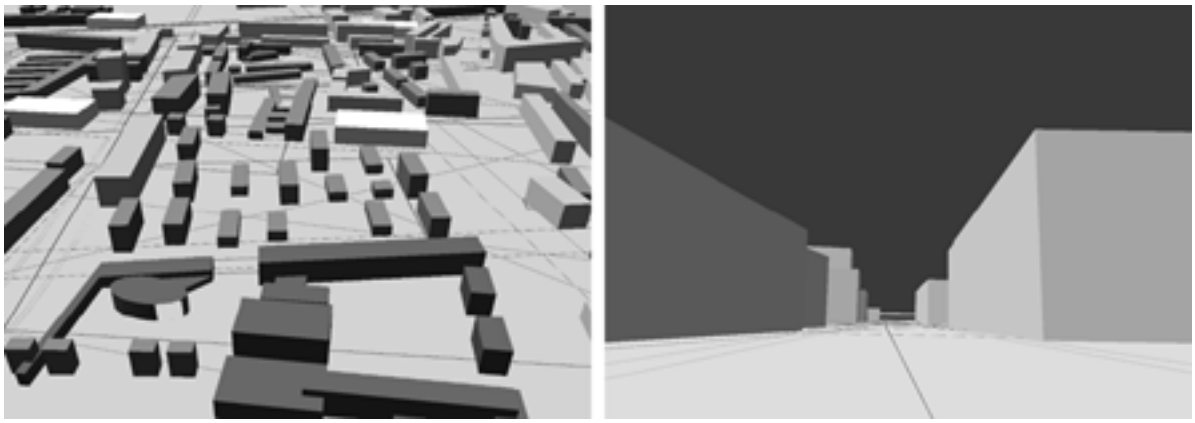

Fig. 2 Overview and detail from digital CAD-Model.

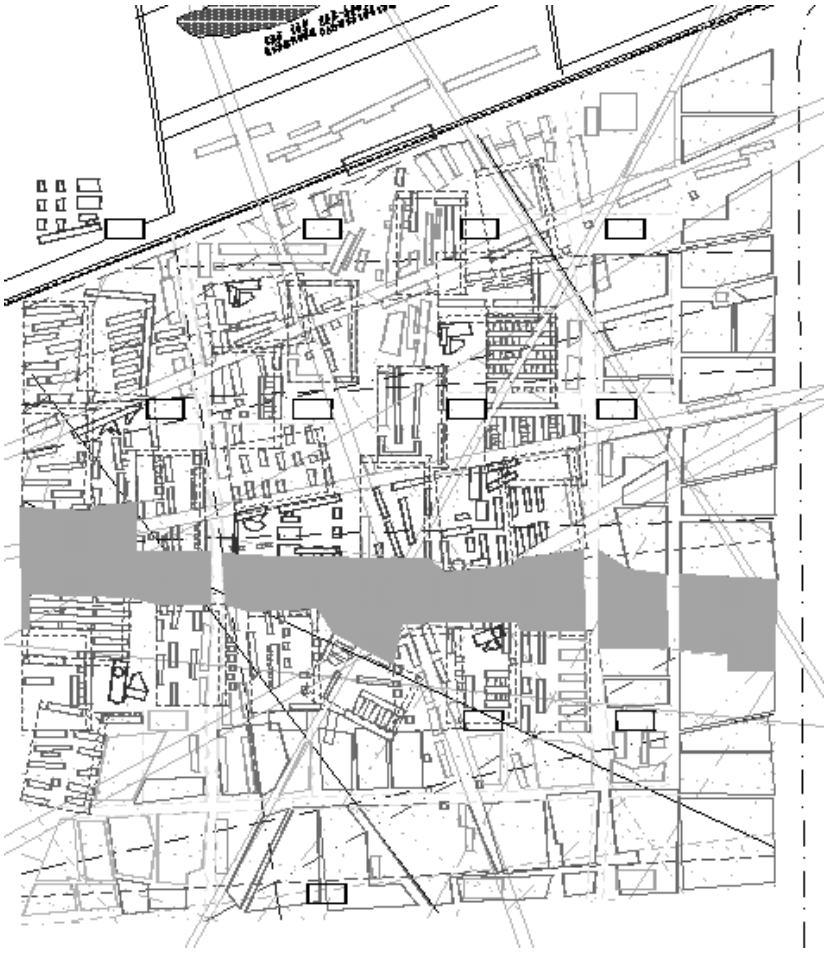

Fig. 3 Masterplan for Vienna Aspern (Architect Rüdiger Lainer)

Notes

[1] By means of FTP the digital model could also be transmitted from the WWW-Server (http://www.archlab.tuwien.ac.at/w2561/model.html).

[2] The EAEA-Workshop was sponsored by a grant of the Cultural Department of the City of Vienna (MA 7).

Workshop Aspern: Strathclyde Approach

Hildebrand Frey

University of Strathclyde, UK

Introduction

Originally I had serious doubts about participating in the Aspern workshop. I had no experience with endoscopes and I hardly ever use our computer facilities in my urban design projects and courses. But above all, as I am not involved in undergraduate design teaching in our department I had no immediate link to the Aspern project. I was nevertheless encouraged to present a short report about our way at the *Urban Design Studies Unit* (UDSU) to approach an urban design project like Aspern.

Unfortunately too much time had already passed, and I had only fragments of the set framework, so it was by far too late to generate an Aspern development project thoroughly. Another problem was that I had only insufficient plan material of Vienna and practically none of the area of and around Aspern. Thanks to our Erasmus student Steve Malone, on exchange in Vienna, I got in the end some of his plans (also inadequate to understand the city context completely). However, there was a kind of Hillier street axes plan of Vienna that would allow me some crude overall view of the structure of Vienna. This dilemma gives a first insight into the precondition for any strategic urban design project I or any of my postgraduate students are involved in: we need to know which part an area like Aspern plays in the city at large before any more detailed planning commences.

What I present in this contribution is first a short introduction into our urban design philosophy at Strathclyde. Then I will try to demonstrate how this philosophy shapes our approach to strategic urban design by making some observations about Vienna and Aspern. My deductions for both the city and this specific district may be rather inaccurate, in parts even false, due to the very limited level of information that was available to me at the time; so the contribution does not attempt to put forward valid strategies but demonstrates our kind of attitude towards Aspern and with it our “Strathclyde approach”.

Some of the important urban design criteria for UDSU

Starting point of any urban design consideration is for me the understanding that many of our contemporary cities may be nice places, at least in parts, but have a rather devastating ecological footprint in the sense that they have become the largest sources of energy wastage, air pollution, waste production,

land contamination, land dereliction, congested roads, long journeys to work and leisure, etc. Some of these problems cannot be dealt with through planning and design but have to do with human behaviour which ought to change from a linear to a cyclic pattern and from a global to a local economy. But there are planning and design measures which can help improving the environmental impact of our cities considerable. These include:

- reducing the use and effects of the private car;
- improving public transport;
- calming traffic in city streets.

All these in turn require:

- more compact mixed use areas;
- reuse of derelict land and buildings;
- new energy-efficient buildings and layouts of settlements and districts;
- locally based combined heat and power provision;
- increased benefits from solar radiation;
- filtering effects of combined tree and shrub planting.

All these measures need to be co-ordinated rather than remain individual attempts. It is of considerable importance that *urban design should generate strategic plans to improve the urban structure and the quality of the city districts and towns*.

Strategic urban design frameworks for cities at large

Many post-industrial cities demonstrate a similar development process: the rather obvious effects of a rich industrial and trade base during the 18th and 19th century that generated a “proud” city but also the slum areas of the working class; the attempts during the 1920s and '30s to solve some of the worst housing problems; new attempts during the 1950s and '60s to provide better housing by demolishing the old slums and replace them with Modern Movement inspired settlements of free-standing high-rise blocks and slabs; the decay of traditional industry and railway that resulted in vast amounts of derelict and contaminated land.

Structural repair of the city

If one studies the figure-ground of such a city it shows all these symptoms of growth and decay, of pride and poverty, of order and chaos. The city has no coherent and continuous structure, it is fragmented into development clusters, often separated by open land. The only exception is usually the central area, frequently the only continuously and densely developed area of the city, sur-

rounded by rings of suburban development which are less and less coherently and less and less densely developed the further away from the centre they are. Such an overall structure of a city is not sustainable in the long term because it is responsible for many of the problems mentioned above that cause the very bad environmental impact of the city on its regional and global environment. The structural characteristics of the city can be dealt with by planning and urban design and are therefore most important when considering any development action:

- the city's overall density is relatively low (though rather high in the centre and sometimes also the inner suburbs);
- large distances from edge to centre increases the need to travel;
- travel from suburbs to centre is predominantly by car due to low peripheral densities and the high concentration of work places in the central area;
- public transport is under-funded and poor and deters many from using it;
- there may be a vast amount of contaminated and derelict land in the central and inner suburban areas which nobody seems to have the funds to decontaminate, and new housing occurs predominantly at the periphery.

To improve the city structure requires some rather dramatic decisions:

- to halt, or even reverse, the sprawl of the suburbs;
- to consolidate the inner ring of suburban development clusters; many of them are fragmented through gap sites and derelict land;
- to get the people to move back into the inner ring of 'towns' and into the city centre;
- next to the densification of the inner towns, they need to have their own cores, workplaces, retail and services, their own identity and urban quality in order to be able to function as real towns; this requires that those uses that are not absolutely vital for the survival of the city centre should be moved out to these towns, thus also making place again for housing in the very heart of the city;
- the urbanized towns should be linked with a network of efficient, fast, comfortable and cheap public transport;
- “green fingers” should be created that link the country right into the city centre; these green spaces can be used for a large variety of functions that do not easily fit into a tight urban structure: recreation and sports facilities, industry, farming and food production, urban forests, vehicular transport etc.;
- vehicular transport should be largely banned from the city centre and the towns; cars should be used from the towns into the country and access to the towns should be via park and ride facilities except for those that live there; in the towns all streets should be traffic calmed.

No doubt, massive efforts are required to make a city more sustainable, more energy efficient, more environment friendly, more people friendly. Interesting enough, the implosion of the city does not require any major restructuring; what is needed is the repair of the existing structure and some design or redesign of the open linear areas as well as the roads and public transport networks. The overall concern of strategic urban design and planning is, at least at Strathclyde and UDSU, the overall improvement of the city structure, and any development project must be guided by a strategic development framework for the entire city and city region. This is the first categorical design principle of the "Strathclyde approach"; and I am sure it is not the approach of Strathclyde only.

Urban Repair of Towns

Having developed a strategy for the city, the next working step is the repair of the city's development clusters. At UDSU a second categorical design principle is applied here: the distinction between the "hard" and "soft" areas in the city, between those "hard" areas that provide a long lasting image of the city, including its skyline, and other "soft" areas that are left to adapt to changing economic conditions and use patterns. A good city cannot be only an open system, it also requires hard areas that change very slowly if at all, except for some of the uses, to guarantee legibility and imageability of the city in Lynchian terms.

Detailed Design of Individual Spaces

After establishing plans for the basic restructuring of the "towns", detailed recommendations for the design of specific streets and squares are generated. The public elements are strictly controlled in design terms, the private elements are only restricted in their volumetric form to prevent them infringing upon the image provided by the public elements. In all this the starting point of design recommendations and frameworks is the existing urban morphology and development pattern.

Any urban project that is carried out at UDSU or by our postgraduate students incorporates the strategic plan for the city (or even city region), the plans for the city's districts or "towns", and the design guidelines for individual spaces within the districts. The result is therefore no new city but an improved city that has imploded, densified in the inner areas and most certainly stopped sprawling. A project like Aspern is not, therefore, acceptable if it remains an isolated event; it must be based on a strategy for the improvement of the structure of the city of Vienna. And for that reason an attempt is made to understand this structure in order to be able to choose the appropriate attitude towards a new town like Aspern.

The Analysis of Vienna

From the explanation of our approach to urban development and regeneration at Strathclyde it should not surprise that I would refuse any involvement in a new development like that of Aspern without knowing a little about the structure and pattern of Vienna. For that reason my preparation to this workshop was really an attempt to develop an understanding of Vienna.

The Figure-ground

This process was painful because I really had insufficient information about the city, and the little I had was of partial and to some extent incorrect nature. None of the maps I could get hold of covered the Greater Vienna area. The only larger plan I had was a kind of Hillier street map, very small and badly readable as river, streets, motorways, canals, and railway lines were all mapped without any differentiation. Nevertheless, this map, with the help of partial maps in more detail, specifically for the inner area of Vienna, seems to me to reveal specific characteristics which many cities share:

- a high-density historical core (inside the Ringstrasse);
- a relatively dense central 17th, 18th and 19th century expansion area around the core;
- an inner ring of suburban development of much lower density overall (though some areas seem to be very dense indeed);
- an outer fragmented ring of very low density suburbs or villages.

The city of Vienna shares accordingly the problems of most cities of that scale and nature: it has a dense core, a much less dense ring of inner suburbs and sprawling outer suburbs. Not a very sustainable form and structure. Following the “Strathclyde approach”, the action to be taken is to densify the inner suburbs many of which seem to have less developed sections, and to give them a clear identity and core on their own. In addition, the ring of inner suburbs is already fragmented at many places by parks; this could become a second restructuring measure that reinforces the linear green spaces to reach the central areas or even penetrate them to some extent.

Any further development of the outer suburbs should be discouraged for Vienna to become a dense, compact city with short distances from the periphery to the centre.

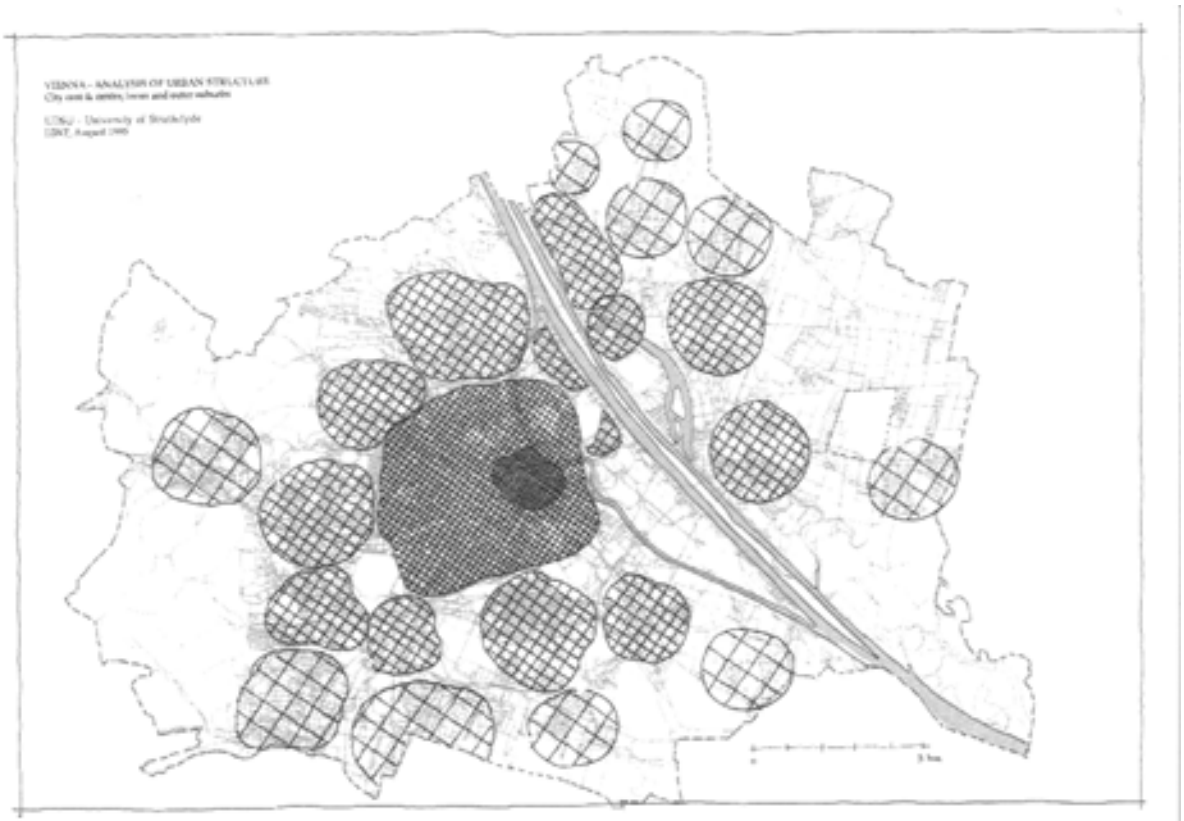

Fig. 1 City core & center, inner and outer suburbs.

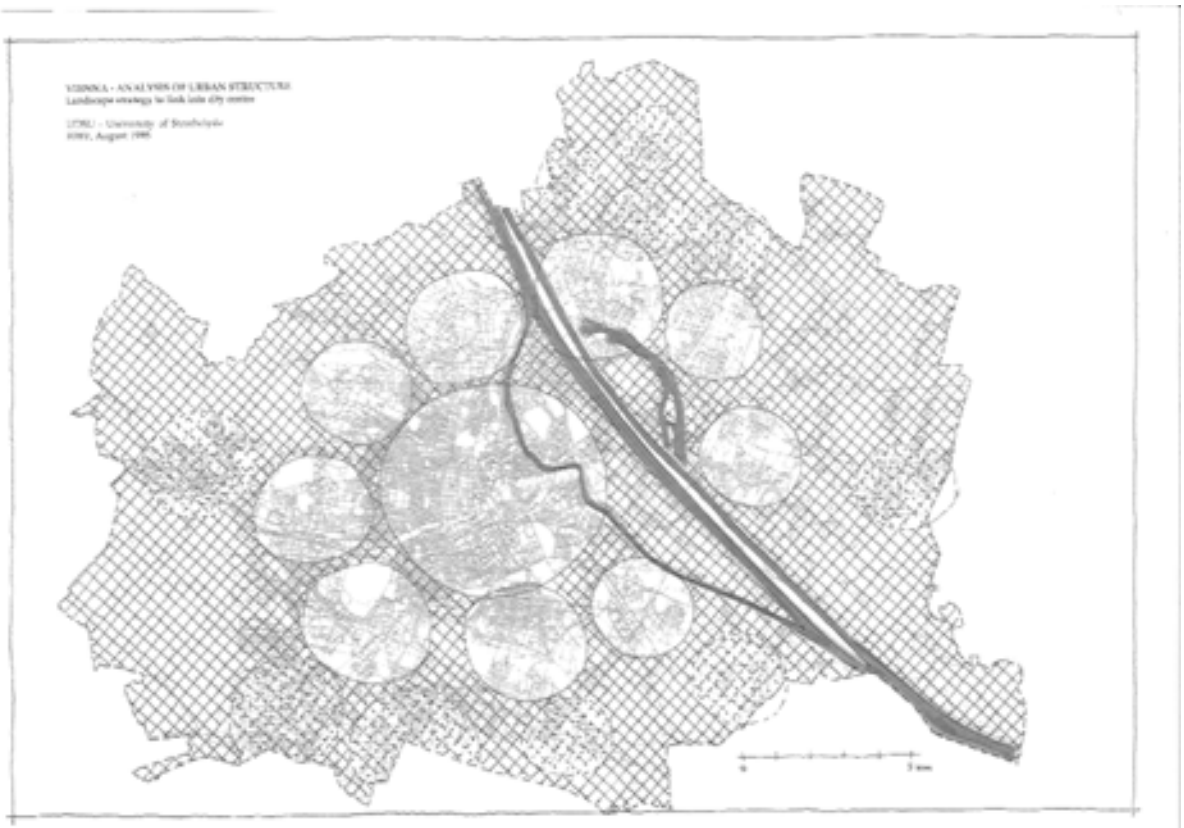

Fig. 2 Landscape strategy to link into city center.

The public and private transport systems

As Vienna has obviously a concentric radial development, it can be assumed that most work places other than those in industries are in the inner core and central area. The public transport pattern shows linear radial and circumferential routes of railway, underground, trams, buses to reach from the centre the inner and outer suburbs and link them with each other. The system seems very well developed and efficient, perhaps with exception of the north-eastern side of the river. The entire area of Vienna north-east of the river seems also much less densely developed overall despite the high density clusters; perhaps that is a reasonable explanation. Considering the existing expressway and motorway system, Vienna seems to be blessed with road engineers similar to those in Glasgow. Why is so much of the network concentrated so far into the central area and so close to the historical core? What difference does it make to bring traffic 2 or 2.5 km further in other than bringing congestion, noise and air pollution close to the heart of the city? One immediate reaction of mine is an attempt to shift all fast road traffic out of the central area all together and locate it between the center and the inner ring of suburbs.

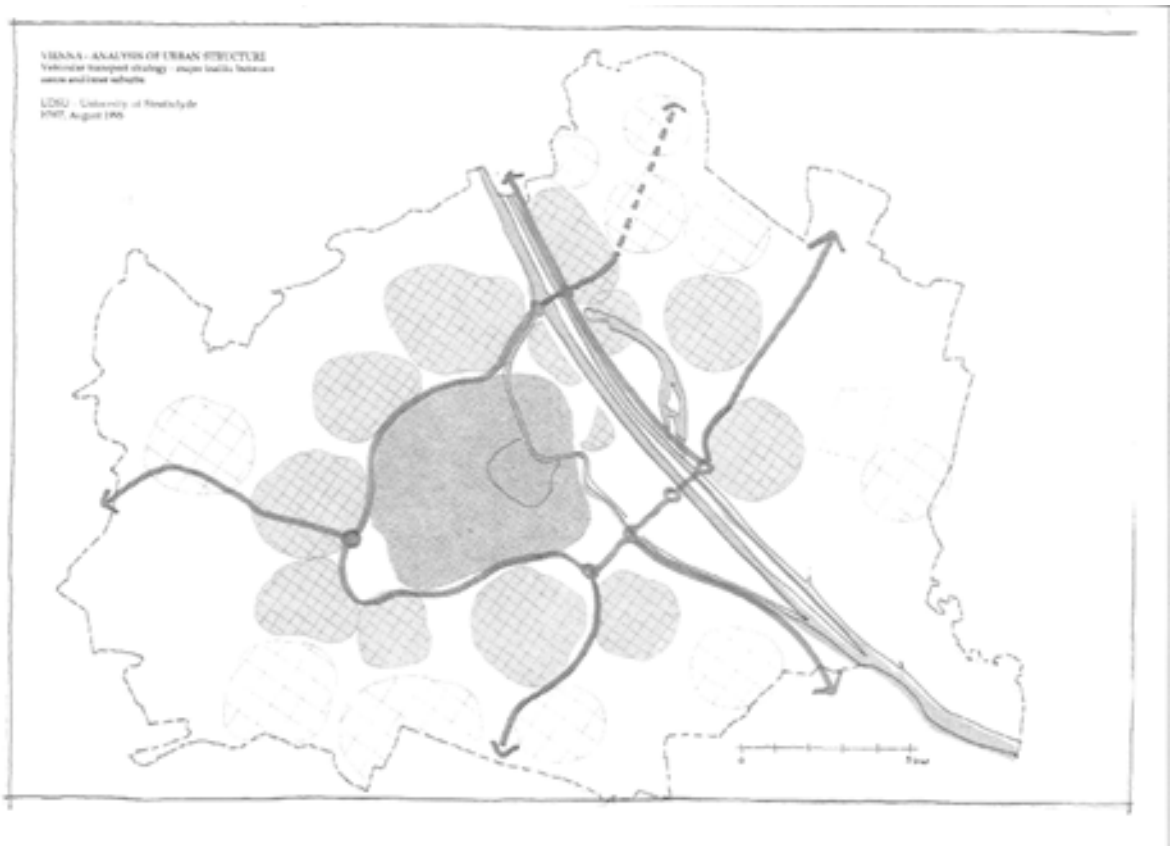

Fig. 3 Vehicular transport strategy - major traffic between center and suburbs.

An even more radical suggestion would be to move the express- and motorway network beyond the ring of inner suburbs, allow access into the towns from outside, and controlled access into central areas. This would necessitate a considerable modification of the existing road traffic pattern, but a more sustainable city has to rely on clean, energy-efficient and fast public transport; the car has to disappear as means of inner-city traffic.

The Aspern project

Having said all this it should not come as a surprise that, after having highlighted the perceived structural strengths and weaknesses of the city and after bringing into play the measures required to achieve a better ecological footprint of the city, the development of outer suburbs is not acceptable to me. Aspern clearly is an outer suburb, and the generation of a new town there would contradict the declared goal of the city's implosion (rather than expansion which should be avoided under any circumstances). Rather than develop Aspern, one should attempt the densification of the inner suburbs on the north-eastern side of the Danube, specifically of the area in and around Kagran and Stadlau. But leaving for this decision aside for the moment and assuming that a new town at Aspern might be thinkable - just for the sake of the demonstration of the next stage of the 'Strathclyde approach' - the potential location of such a new town needs additional investigation.

The location of a hypothetical Aspern New Town

The next step in my attempt to understand the impact of a new town at Aspern is to analyse the potential contribution of a new settlement on the old airfield to the north-eastern area of Vienna. Leaving the question of the outer suburbs aside, of course for the purpose of this demonstration only, one argument for the development of the old airfield is that there is a direct public transport link to the city center via the S-Bahn 80. Ideally the station would form part of the center of a new settlement, in balanced distance to all its areas, reinforced by services, commercial and retail uses as well as high density housing, a center that could be reached from the edges of the settlement in ten minutes walking. The placement of the center of the new Aspern at the S-Bahn station would mean that the settlement would be on either side of the S80 line and not limited to the old airfield. Such a location would, of course, have to integrate the existing settlement of Hirschstetten and would leave old Aspern somewhat isolated as it outside walking distance to the station. Both problems could be avoided by developing a compromise: the new settlement with two poles, one to the north with S-Bahn station, the other to the south with tram or bus stop in the old Aspern.

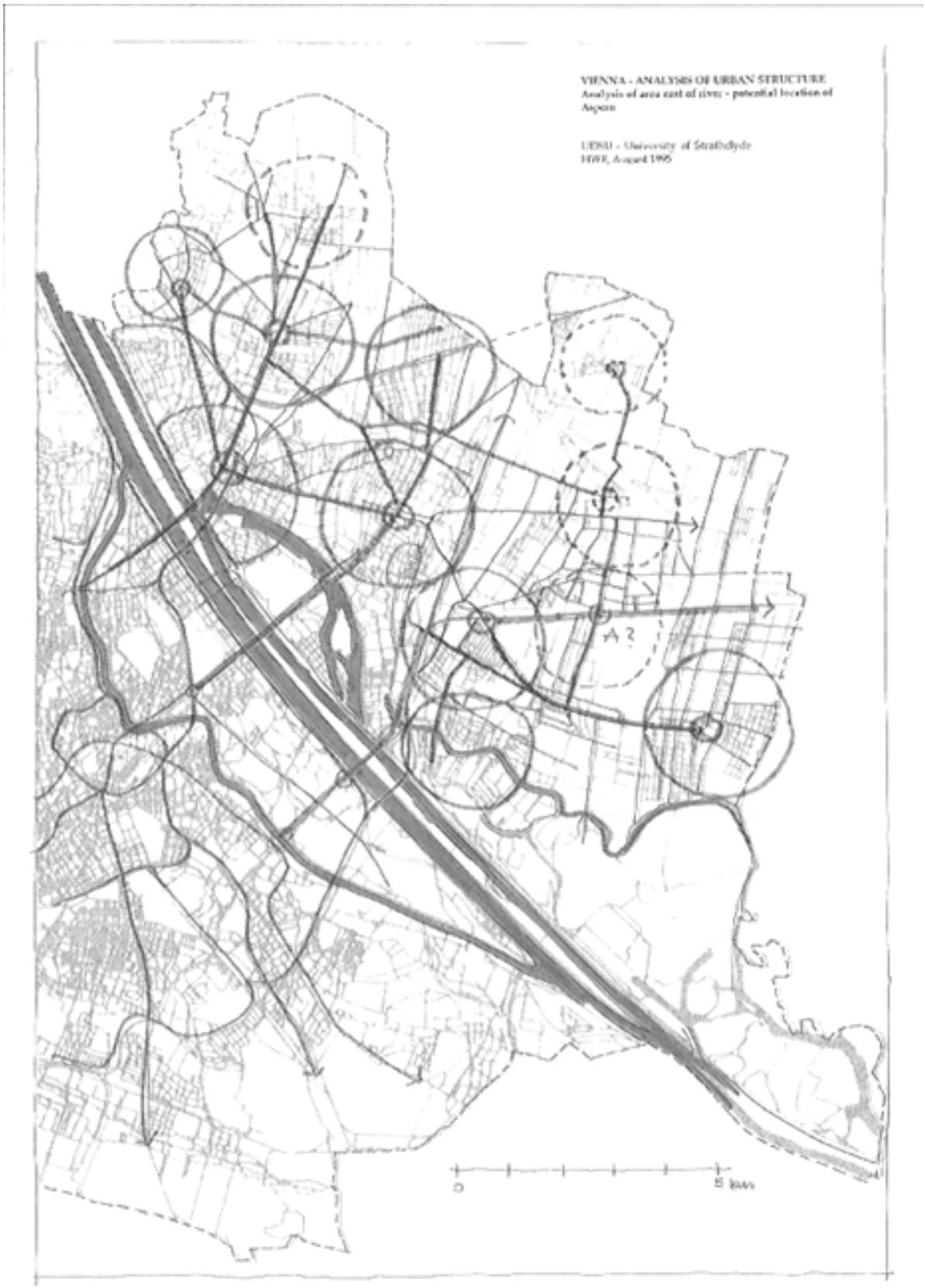

Fig. 4 Analysis of area east of river - potential location of Aspern.

The proposed structure of a hypothetical Aspern

Other important criteria for any further development of the plan, again leaving the question of the development of the outer suburbs aside, would be the physical linkage with the existing settlements and, as far as possible, the adoption of the existing development patterns which is strongly geometrical and linear in north-south direction. Two variations of the provision of central facilities and stations / transport stops are investigated and the strategy that splits the central facilities so that they are located at the available public transport stops north and south of the airfield is preferred. The layout pattern of the new settlement takes on the pattern of existing settlement fragments which require integration more than the new town the visual linkages to far away monuments.

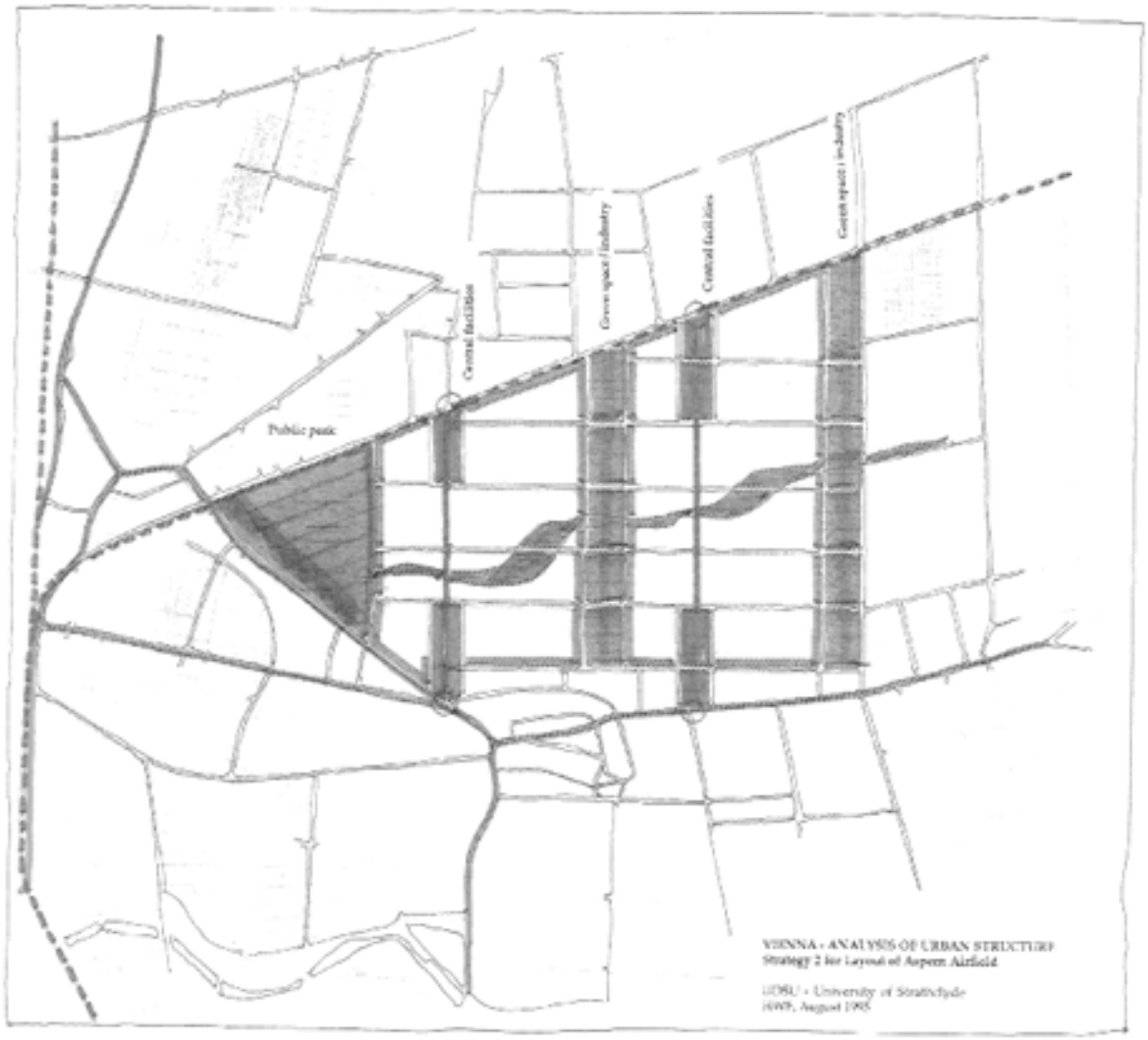

Fig. 5 Strategy 2 for Layout of Aspern Airfield.

What emerges is, therefore, a series of new settlements rather than only one in order to integrate existing fragments of development. A linear east-west green space could link the settlements, and linear north-south green spaces could operate as parks or places for industry which separate the settlements. Over this schematic plan other spatial phenomena may now be superimposed that enable vistas from the settlements to important monuments in the city.

Conclusions

The last investigation regarding location and development pattern of “New Aspern” was undertaken against the premise that no outer suburb should be developed and for the sole reason to find out whether one could agree with some aspects of the structure that was given as framework for more detailed development. This little investigation leads to quite a different pattern: the pre-given structure plan on which all exercises are based ignores all existing development fragments and pretends to be able to exist in total isolation except for the linkage to the S-Bahn and visual linkages to some monuments far away in other parts of Vienna. I don't believe that such isolation is acceptable, because the densification of existing fragments into 'towns' is one of the principle demands of more sustainable urban development. But let me returning to the previous argument whether or not any large-scale development should take place that far away from the city centre. I do not think so, and had I participated earlier in this Aspern project I would have most likely suggested to replace the Aspern plan with a regeneration plan for Kagran instead. I am, of course, fully aware that the idea of the Aspern workshop was not to discuss urban development and design issues but rather to demonstrate the development of parts of a given framework using physical or computer modelling techniques. Though I am personally much more interested in urban design issues rather than in modelling details I sincerely hope that this my contribution to the Aspern workshop is understood as a demonstration of our UDSU approach and our design criteria for a settlement within a city. The principles of strategic design must be ecological, the design of the settlement form must reflect its context. Only thus is a city achievable that has a better ecological footprint, only thus is some form of urban continuity maintained.

(In-) Visible City - In The Mood

Aleksander Asanowicz
Katarzyna Asanowicz
Malgorzata Bartnicka
Jadwiga Zarnowiecka

University of Technology Bialystok, Poland

We decided to get back to the „idea of a street“ and to build our city around that principle. The existing elements and conditions to be considered were: the railway trucks, the railway station in the North, the large green complex in the South, and streets that could basically define splits between the functional zones, and its common relations. We did not interfere within the *Industrial Zone* architectural fabric surrounding our project. We concentrated on the composition and design of an internal part of the city - its character and spirit. The compositional axes of our project flow, sometimes they depart from each other, then join together, sometimes they are even being locked up and accented by architectural elements.

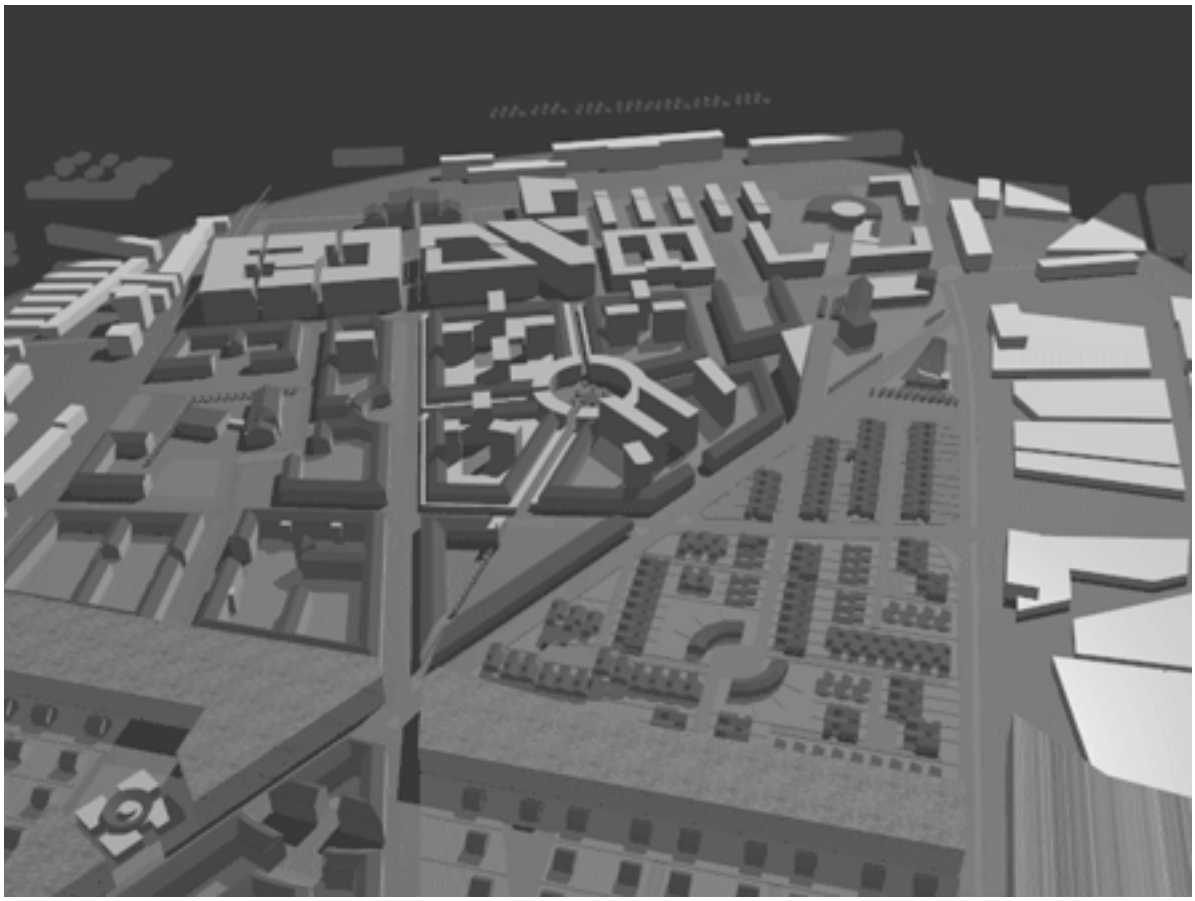

Fig. 1 Overview.

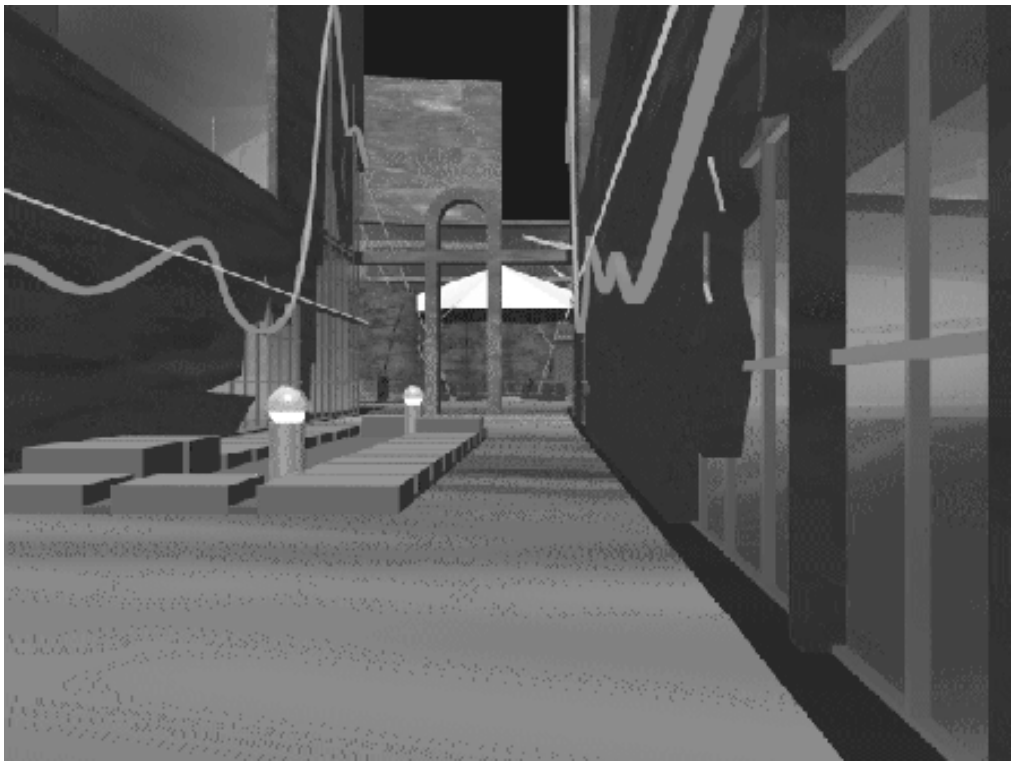

Fig. 2 Pedestrians' view.

The main axis begins at the Railway Station and cuts through a commercial and service tracts all the way up to the Municipal Square - the Market. The other axes depart from the main one providing the communication with residential districts. In localizing variable functional elements we applied as methodological principle the rule of not splitting of the whole project into elements, but assembling it from variable components. Because there in a final effect something more can be found except the simple sum of its components. Thank to such an approach it is possible to gain a new quality. We used the computer model simulation for simplified architectural building forms just showing the scale, building height and cubature relations of an architectural fabric the project consisted of. Full architectural detail can be observed only in the design of the main axis of composition - in the commercial passage, where we intended to show an atmosphere of created architectural interiors.

Note

[1] The 6' animation had been created using the 3D drawing in AutoCAD v. 12. Afterwards all textures and materials were dressed up by using bit maps, providing the source of light and thereafter the consecutive frames of our animation were created. The final effect slightly departed from the result we anticipated to see, although from the other side it unintentionally allowed us for the dynamic check of correctness of undertaken by us main project principles.

Dynamic Perspective: Workshop Aspern

Martijn Stellingwerff
Jack Breen

Delft University of Technology, The Netherlands

The Aspern masterplan was utilized by us to test some of the *dynamic perspective* research ambitions and assumptions. A research team was formed which carried out a number of pilot studies. Among these was an initial attempt to create a dialogue between computer-aided and endoscopical simulation. If one wants to simulate design options, then a model has to be made relatively quickly and this must be flexible in use. This means such a model will be relatively abstract. We asked ourselves how reduced or realistic a model should be. We started with elementary, graphic patterns which were applied as *texture maps* and subsequently, some *sampling techniques* which offered a more realistic image were tried out. The results and findings of this exercise need to be evaluated and developed further. For us the Aspern case study has so far proved to be a useful and stimulating subject for enquiry in this initial phase of the *Dynamic Perspective Research Program*.

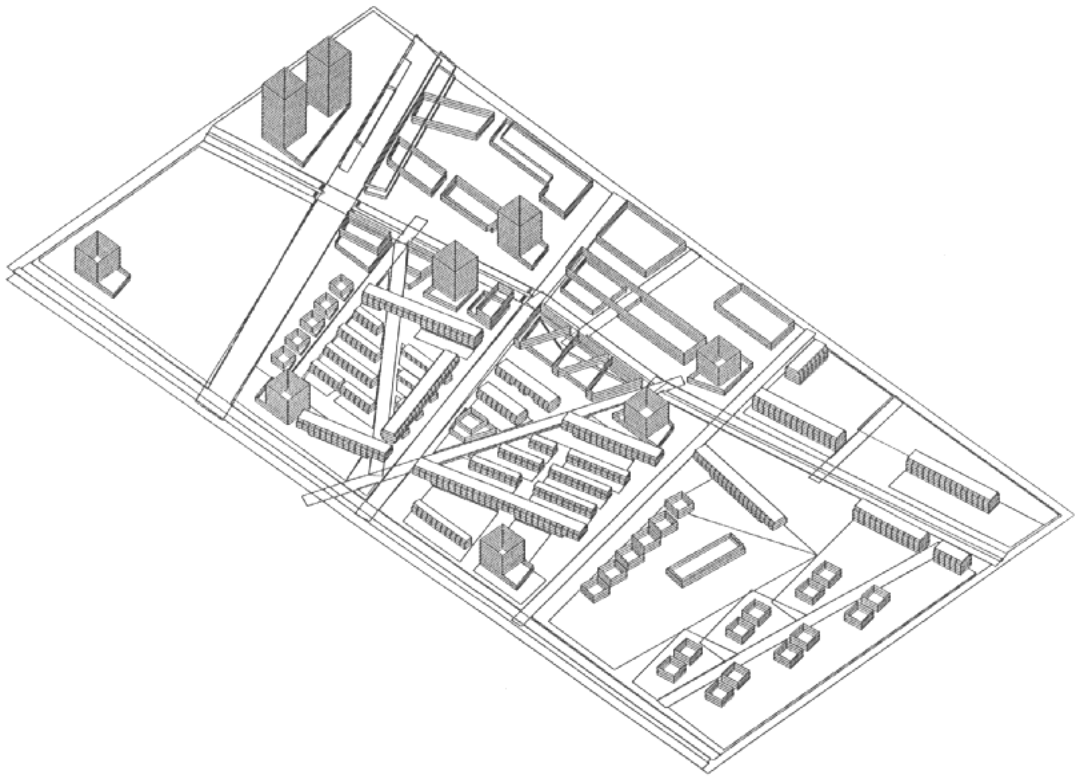

Fig. 1 Computer image of a part of (Delft contribution).

A Didactic Drama

Wolfgang Thomas

University of Essen, Germany

Urban design serves the preservation or creation of *Lebensraum* in the city. It challenges demands which result from the interdependence of living conditions, work and spare time, and this departing from the concrete facts of a planning area. As an ultimate goal, urban design should provide the framework for the native population, so that adequate living conditions may develop. According to one's momentary activity, every inhabitant experiences his or her quarter from a static position or in motion, for example as a pedestrian, as someone looking out of a window or - as has been demonstrated in the beginning - from the top floor of a high rise building. He or she is being moved or moves himself or herself, observes or dreams, may also pursue a specific goal or may simply walk along.

Consciously or more often rather unconsciously he or she experiences the changes of spatial impressions due to external influences: morning and high noon, daylight or artificial light, sun or rain; the seasons; fragrances or odours; noise and peace and quiet, activity and loneliness, heat and cold; a building site as well as the effect of a freshly planted tree. Urban space provides the set for an arbitrary combination of these phenomena. It is not astonishing, then, that the concepts for sometimes huge quarters of a city developed from theoretical considerations could never really satisfy in reality. To the contrary: The *Märkisches Viertel* in Berlin as a laboratory product provides an international example but is by no means an individual case as this example from the *Ruhr* area illustrates.

The search for reasons why this is so, finally aims at the question if or possibly how our capability to experience things multidimensionally can be transferred to the design processes. The fatal error that one is capable to design inner city urban space on paper proves very quickly to be a wide spread illusion. Even the more convincing version according to which a concept of town planning could be set up as a model, or at least be illustrated with the help of a model, does not improve things very much as long as juries from above evaluate and judge its architectural merits. This procedure which is very common today suggests that the town planners and jurors possess the ability to envisage the effects of free space via imagination. Then megalomania is paired with arrogance as countless analyses of built up areas, albeit always after the fact, have proved.

How daring it seems that, after decades of abstinence from big-time ventures of town-planning, an attempt is being made to cut the Gordian knot. This is a rather unique event in central Europe at the moment. The suburban concept of town planning presupposes a rather comprehensive embedding of the planning area and shows this distribution for the envisaged usage. Can such a guideline on the architectural shape of the suburban area, based on the previous assumptions, together with the use of modern video techniques, make plain the basic questions of a functional concept of urban space, that means, to secure a sound town development?

Fig. 1 Simulation of traffic.

This contribution tries to give an answer to this question and turns to the guiding principle which seems to illustrate a new town-planning approach by focussing consequently established principles of urban design:

- corridors of vision to the most important salient points of the wider surroundings;
- existent traffic routes at the northern and southern edge of the planning area.
- the supplementary traffic network with a local grid for the even distribution of parking space for individual car traffic;
- a star-shaped functional grid to secure a network of short foot and bicycle routes which depart from the railway station with its assigned local services;
- a green “backbone“ to provide enough green space.

Fig. 2a-b Comparison before and after (green elements).

All this, in its mutual overlapping, forms a network of guidelines where the architectural substance due to assignment and function of the individual buildings can refer to. Preliminary suggestions to transfer the prospective suburban program indicate that this could be a possibility from the point of town planning. At first sight it transmits features of a grown city. A mass model illustrates a characteristic section. With the help of endoscopic simulation and with the application of simplest means possibilities of an analysis of urban space was demonstrated.

Basically, the satellite perspective allows for modest inferences as regards the spatial experience of the inhabitants. Thus, the different incident of light at different times of the day, demonstrates if or when the public spaces of garden, square or street can be reached by the sun. Any further qualities of space cannot be adequately formulated. Not even important locations or lines of communication can be definitely recognized from this perspective. Our experience of many years in the use of the directed endoscope shows, however, that a reliable labelling of critical positions of observation in the urban space presuppose an utmost careful search process. Its results evade any obligatory imagination of space of the architect: who, for instance, could, if we assume a rather harmless case, describe with certainty which perspective opens up to an observer if he leaves a building below this over-the-roof position? The hermetically sealed visual blockade on both sides bars any incentive to move. We do not believe that this situation will basically change if we leave out this part of the building: an emancipating view encourages curiosity. Urban analysis has become an unrenouncable part of the design process.

Note

[1] A 20’ minute video contribution by means of endoscopy was created.

Visit at Aspern

Gerhard Fast
Ingrid Frisch
Leopold Hörndler
Thomas Mach
Wolfgang Wimmer.

Graz University of Technology, Austria

Basically this concept is aimed at a definite separation of the zones of pedestrians, cyclists, public traffic and motorized individual traffic. Taking into account the requirements of well-structured parking space management and the limitations as to using the motor vehicle in the residential area only in profound exceptions public traffic, cyclists and pedestrians are to enjoy a clear preference. By lowering the access roads a road system totally separated in space and function from the other “vital space” is developed which enables every traffic participant, both cyclist, pedestrian or car driver navigation without disturbances. The lowered traffic routes are accompanied by collector-garages keeping the major part of motor traffic out of the residential areas as well as making for quite equivalent access ways for public traffic thus not being handicapped.

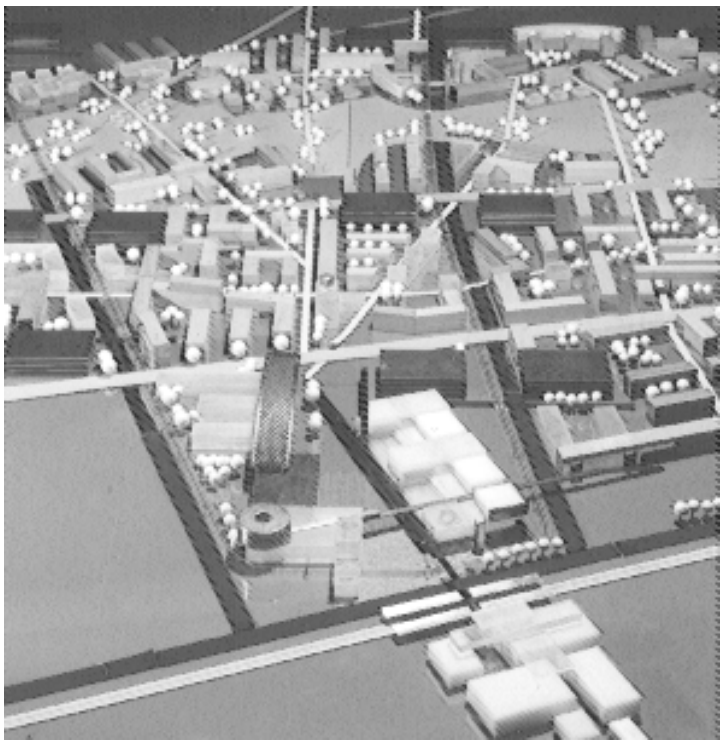

Fig. 1 Overview.

These elevated garages meet the parking requirements of the adjacent residential areas. Visitor´s parking lots are on the ground level of the garages. The size of parking areas in the business and trade zone in the center and in the cultural center is based on the number of utilizers of these facilities. Parking facilities throughout the complete other area are limited to delivery-traffic, short-time parking and no-waiting area. The main object was to create a mixed structure resulting in the confrontation of various social groups. A scenario to the end of a long-term prevention of the tendency of isolation of individuals. Social blending attempting the mere living next to each other at first is to set the stage for encountering and getting to know each other. In the long run we will certainly realize that the future social developments can only be adequately met by creating conditions for living together. A mixed city can only be achieved by the integration of social-minded planning. Differentiated residential building, integrated accommodation for elderly people, living and working with its interactions and temporary accommodation are the main considerations concerning this design.

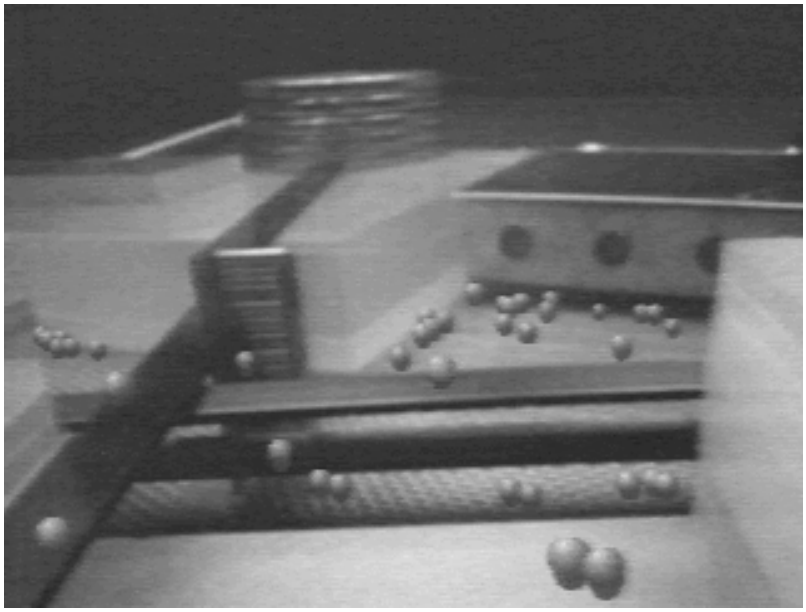

Fig. 2 Superimposed view.

Notes

[1] This 3'-contribution was made in the framework of a design studio directed by Annegrete Hohmann-Vogrin and Bob Martens.

[2] Simulation of picture-scenes were created with Dt-PAINT IV-software (2-dim program had to be changed in a 3-dim effect). Endoscopical exposures were superimposed to computersimulated scenes in the background.

Languages - Final Settlement: Discussion

Wolf-Michael Tschuppik

Vienna University of Technology, Austria

The term city, referring to a city of human beings is inseparably connected to their activities and modes of behavior. City stands for agglomerations and densifications, concentration of requirements and particularities within a relatively limited space. Increasing migration of various races and cultures add to the diversification in regard to forms of lifestyle and beliefs. Thus the city is gradually mutating to the melting pot of the various conceptions of the world, philosophies and religions. The inhabitants of a future city no longer being a culture-historically grown racial group thus no longer will have the want for a characteristic settlement form reflecting their individual nature.

The configuration of a city is to be regarded as a kind of third skin of a generation of people with culture-historical roots of all parts of the world. The question as to significance of form of residence and language of architecture for the individual and its cultural identification cannot be done away with as a mere “intellectual” idea, as the structure of dwelling considerably influences the social life of people and contributes to shaping those noninterchangeable individuals and groupings making in their entirety for the diversity of human mankind.

Fig. 1 View over the Vienna-contribution from above.

The Location

A square of practically unlimited extension, practically nothing there, even less that was there. Without the street corridors enclosing the square the location would be difficult to be spotted, to be defined or to be circumscribed. The projected surfaces, squares and lines demarcate spaces, divide, separate and classify the imaginary density of human creative power. Corridors, the future relicts from times when the location still was not existing pursue that direction only one disposing of the set of instruments of the knowledgeability could have determined.

Player, Square and Figure

Nothing can be relied upon, everything must be invented. Visions and ideas are sought for to be projected into the empty space. Dreamlike and nightmare-like images are cast into a game not familiar with anything like faces, names, smells or colors. Lines are overridden like the wings of Don Quichote`s windmill, are cut or simply passed. They facilitate playing, make for orientation and enable the own positioning. What happens if the detachment from reality of a square hardly to be defined becomes the abstraction of a much smaller square? And what happens if the player becomes contractor, inhabitant and neighbor in one person?

Fig. 2 Combination of Endo with Bluebox technique.

What happens if his projection, the vision as it were of living together in the urban structure would be countered by other possibly diverging, even coun-

tersquaring moves? The continuation of the game can be measured according to the intersections and passes. The indenting and the quality of single transitions. The structure of the game is democratic but the move of the one party can become the offering for the other. Sometimes surrendering of single considerations proves necessary and productive in order to maintain the total structure and to prevent monotony. The question which extent of endurance and self-resignation this city-pulling and -dragging can take is decisive regarding returning to reality.

Abstraction

The player acts as the architect of a world of imaginary inhabitants, demands, preferences and anxieties. As an architect of a world he sees from another perspective. The human kind assumes a dimension he is not able to build, not even with greatest effort. Trees do not show their shadow play. Surfaces and colors, smells and sounds, heat and cold are properties remaining undiscovered to the game world for ever.

Fig. 3 CAD-representation by night.

The question as to the quantity of human imaginative power is to be answered. Can a city be devised by a single person or a small number of people? How much city can be drafted by someone to the best of his belief without

falling back upon already conceived things or without repeating himself over and over again? City as a process, something that comes about, made up of collision, regulations and violations thereof, standards and exceptions, the known and the new. The results of a game with the city thus only can be a station of processual discussion. A discussion with the others and last, but not least, with oneself.

Notes

[1] Two 10'-contributions were created simultaneously, one based on endoscopy, the other on computer-aided space simulation.

[2] This contribution was made in the frame of the design course directed by Bob Martens. Roman Getoff, Alexander Leopold, Robert Mago, Steve Malone, Tibor Nagypal, Bao Phong Phan Quoc, Oliver Pestal, Borislav Petrov, Axel Schmitzberger, Wolf-Michael Tschuppik and Oliver Witzani participated.

Living in (In-) Visible City

Thomas Zwiefelhofer

ETH Zürich, Switzerland

The masterplan for Aspern projects an urban-constructional conception for approx. 20.000 inhabitants within a practically empty space. Its structure results from relations of existing traffic axes, in particular from visual references regarding striking buildings and parts of premises (landmarks) of Greater Vienna. Based on these basic principles the question to what extent these major connections can be experienced in the built detail arises. This project concentrates on the treatment of one of the predefined so-called “fields” being the location of residential dwellings according to the masterplan. The selected field is crossed by a visual axis and is situated directly at the visual corridor reserved for the pedestrians and cyclists.

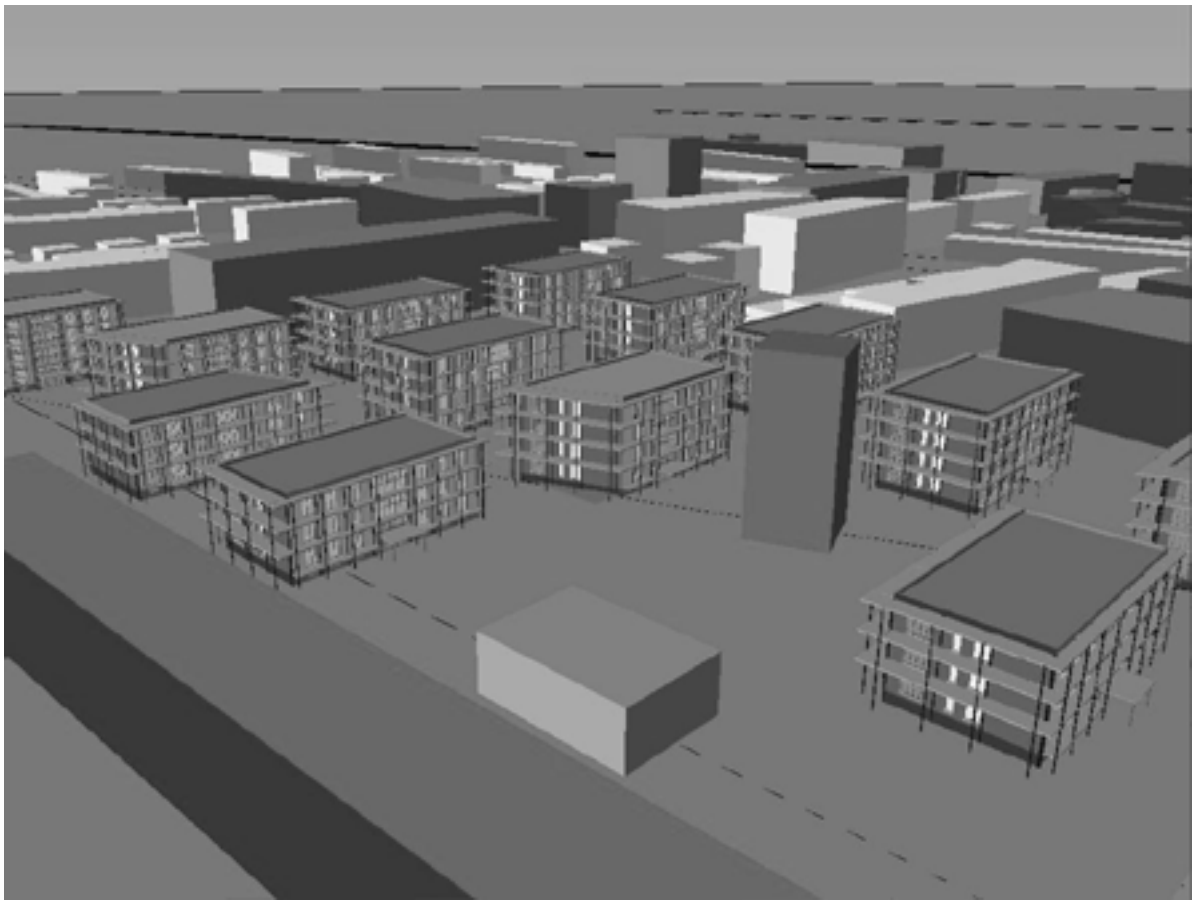

Fig. 1 A bird’s eye view,

The situation is based on these two referential lines. The crossing visual axes act as the line of rupture with regard to the regularities within the settlement. The supporting walls in the longitudinal direction to the residential buildings

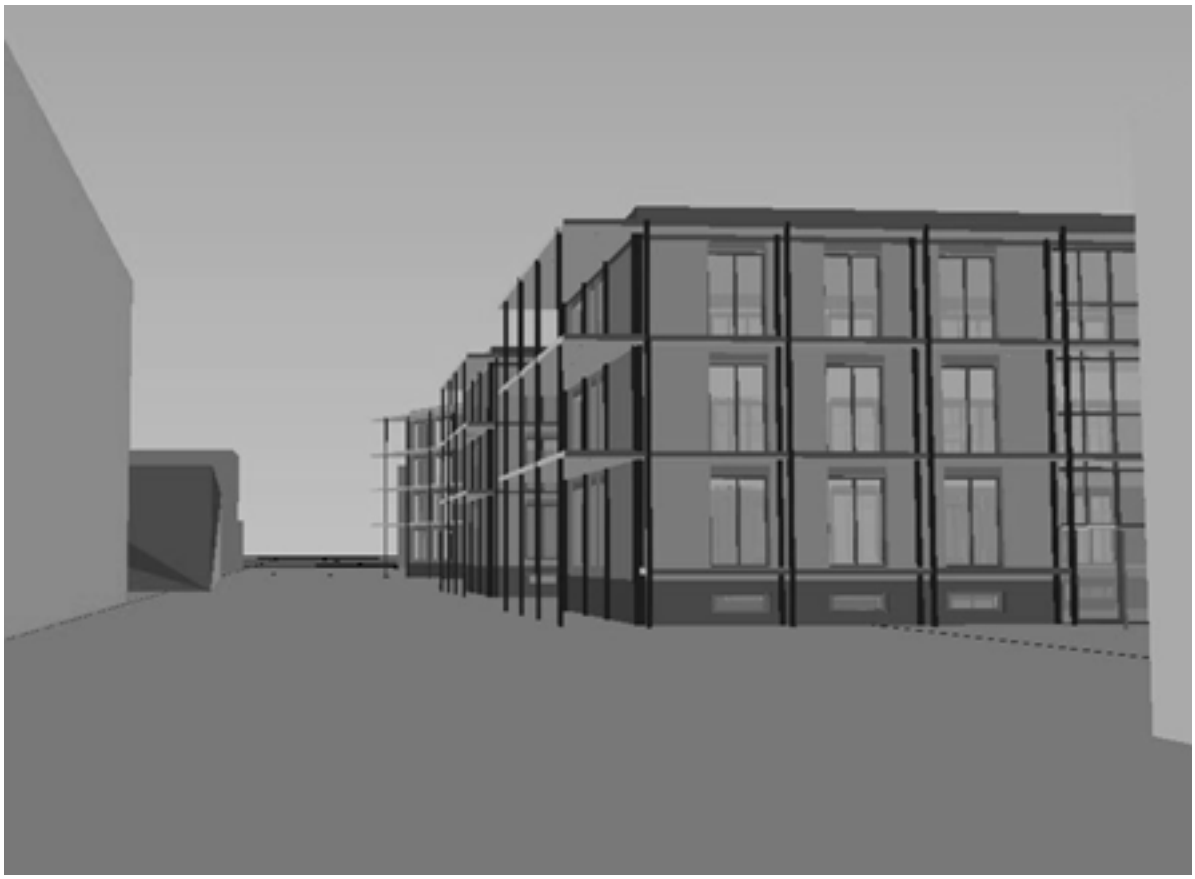

Fig. 2 Empty street.

and the transversal non-supporting flexible parts make for an adjustment of the shape of buildings to the requirements of the situation. The realization of large-scale visual axes and corridors in terms of visual relations to be experienced within the space of the settlement is not only achieved as far as the public and semi-public outdoor space of the settlement is concerned but also continues throughout the balconies accompanying every apartment within the private outdoor space of every living unit.

Note

[1] This contribution was submitted by the CAAD-professorship headed by Gerhard Schmitt.

Pictures of a City: an Attempted Summary

Bob Martens

Vienna University of Technology, Austria

Regarding the various images of a city a term also applying to the contributions of the Aspern urban construction model the question is bound to arise which parameters are of major impact for the image of a city. The exact formation of building structures may be regarded as basis of the city arrangement, the question is, however, which additional information does the skilled and/or the unskilled viewer require? To which extent will the differentiation of facades and the furnishing of the street space help in verifying the accumulation of various volumes as a city? In this respect the contributions throughout the discussion serve as a wide platform for questions only to be answered - if at all - in fragments. Therefore, workshop-contributions are accompanied by a critical-analytical comment in order to be able to give some of these fragmentary answers to the questions arising from endoscopic viewing of physical models as well as from CAD-applications in urban construction. So that the contributions appear in context they are interrelated, i.e. grouped.

The first group comprises the *applicative contributions* referring to those films primarily dealing with the methodics of applying information parameters such as street furnishing, facade mapping or also real- tone sequences into the building volume structure. The basis model is thus enriched to overcome the degree of abstraction for a more realistic viewing. The *Essen* contribution places trees, cars and human models into the model to increase the realistic impression and to simulate in a scholarly way the infrastructural sequences and motion parameter. The viewer is put into various positions (i.e. traffic positions) in order to conceive the perception of the city from a variety of perspectives. Artificial light sources make for experimenting with the position of the sun and its effects on all of the traffic participants. With a certain degree of fuzziness this model qualifies as a simulated small world. Caution is recommended regarding application elements and building structure the scales of which are not accurately matching, unexpectedly town-structures may turn into metropolitan silhouettes as the few scale-determining factors influence the perceived image primarily and particularly persistently. The *Delft* and the *Zurich* contribution chose the possibility of facade detailing (e.g. by mapping). What is to be pointed out is that the street space has to be treated accordingly the more differentiated these surfaces are dealt with in order to maintain the connection between the individual construction volumes. If this rule is not observed the details attract so much that the street space is not represented adequately. Normally the street space with its features is

more striking and the facade is only observed on second sight, explaining the priority of the first information. The *Stuttgart-contribution* takes this into due account demonstrating the importance of the detailed configuration of the street space.

Fig. 1 Night situation (created by A. Pfeilsticker).

Even though the *Graz* film-contribution deals with street features in the proper sense a different, essential issue is treated. The appropriate implementation of real-tone sequences in combination with specifically developed motion sequences helps in overcoming too much abstraction in modeling. The real-tone becomes an associative element making for the creation of worlds in one's head not to be seen nor to be developed by any visual medium. Memory patterns are relied upon more heavily than in the other forms of applicative films. This amounting to the fact that a great degree of reality is achieved at a relatively scarce application effort. The looker-on develops his individual subjective picture of the city. Sound and pictures are transformed to complete experience worlds in one`s mind in the matter of seconds. Rather simple measures, such as children playing, the rotor wings of helicopters or the chirping of birds invoke memory patterns of associative value practically not to be achieved otherwise. The *Viennese* contribution moves to the *non-applicative contributions*, i.e. the conception requiring more or less no additional equipment. The Viennese contribution aims at elaborating a spatial situation specifically characteristic for experiencing urbanity cut into successive sequences. Similar to a trailer of a film the essential volumetrics and the spatial composition of a city are extracted. At a key position the human dimension is introduced by means of endo-stills. The blue-box procedure makes for subsequent

short-term and well-placed definition of the dimensions of a city. Compared to the Viennese CAD-contribution with its videoclip-demonstration of a future world this procedure strikes rather dull. The superabundance of information, in portions furnished as prefabricated data-sets for computer animations of every make, clearly shows the limits to every endo-contribution. What may impress the unskilled eye will, however, have to undergo a critical examination by the experts.

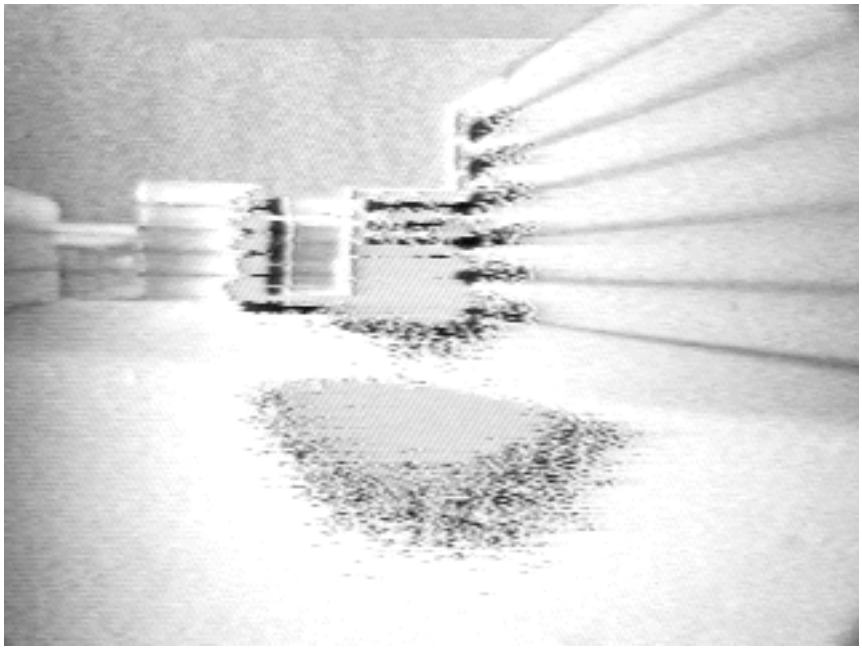

Fig. 2 Videographic drawing (Branzell / Aldenbratt).

The CAD-contribution from *Bialystok* only scarcely embarks upon a discussion pro or contra applying mappings and "computer tricks". It confines itself primarily to flying over the planned area in uniform circles. The city image remains abstract as it is in such an early planning stage. The last and concluding contribution to be commented on is the *Göteborg-contribution*, attempting to visualize the manipulated street space, i.e. the actual invisible volumes, via tone value separating of the image. This being of great interest one will, however, have to look into the effectiveness, i.e. the feelings represented, of this procedure in this context. The applied technique rather quickly turns into a joyful effect fascinating doubtlessly, but only partly meeting the intended goal of making space visible.

Note

[1] This contribution was supported by Wolf-Michael Tschuppik.

IV

THE IMPLEMENTATION OF APPLICATIONS

Street-scape and Way-finding Performance

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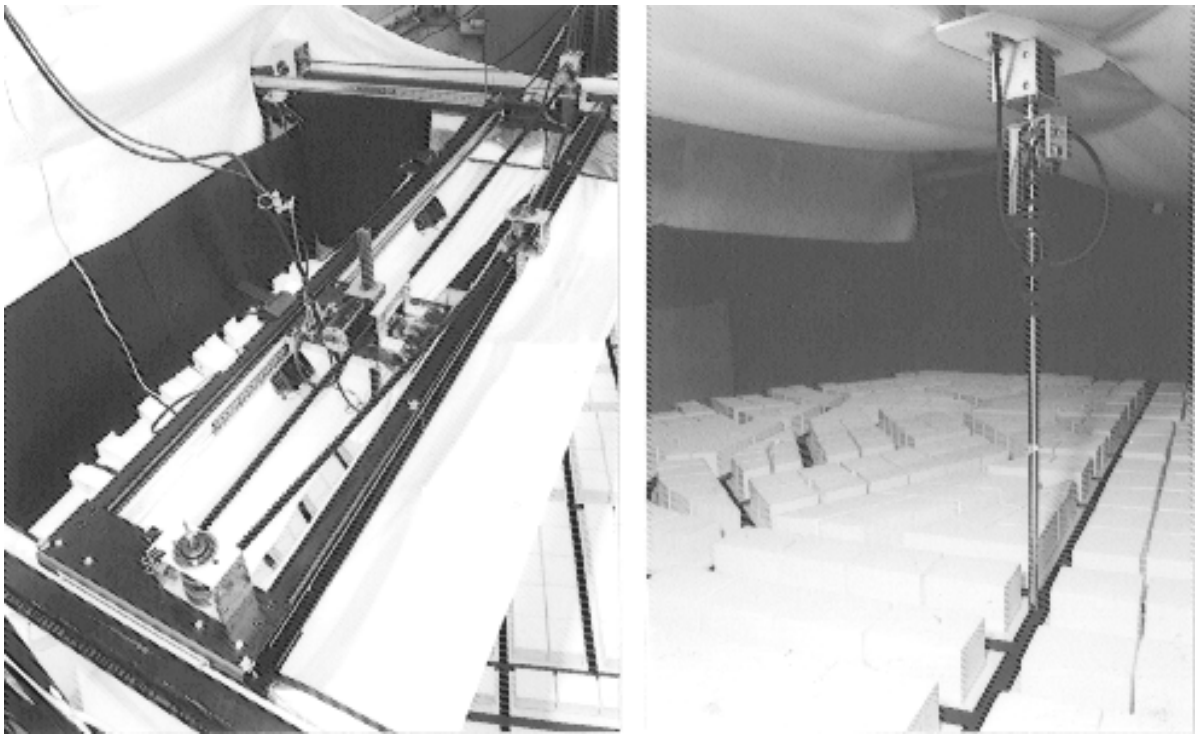
Abstract

The hypothesis that way-finding performance depends on the visual characteristics of the street-scape was investigated by an experiment using a user-controlled space-sequence simulator which was designed to allow a subject to move through a model space and visually experience a travel sequence. Three scale models (1:150) of an identical maze pattern each with a different street-scape were used in the simulator. The three types of street-scapes were: (1) no characteristics, with monotonous surfaces, (2) each corner distinguished with a different building, and (3) streets furnished with trees, columns or fences. Each subject was first asked to memorize the route by viewing a predetermined continuous sequence of model streets, as shown on the screen, then asked to take the instructed route. This procedure was repeated until a subject successfully reached the end of the route. Subjects were allowed to try up to five times. After the experiment, the subjects were asked to draw a cognitive map of the route. Three male and three female subjects were tested in each of three street types. An analysis of the results generally supported the hypothesis that a route in streets with significant visual characteristics was easier to memorize, although there was a large difference in performance between subjects. With an analysis of the cognitive maps drawn by the subjects, it was noted that subjects seemed to rely more on incoming visual information on the changing scene than on structured knowledge of the route, as is emphasized in conventional theory of way-finding.

Introduction

Urban landscapes in modern Japanese cities are notorious for their poor visual environment: they are often chaotic and sometimes monotonous, and people suffer both sensory overload and sensory deprivation. Under these conditions, people need many signs and other aids for orientation and way-finding. These additional visual elements make the situation worse. Are there any more natural and architectural means to guide people's navigation in space? In this study, it was hypothesized that way-finding performance depends on the visual characteristics of the street-scape, i.e., the more visual



(gantry) (endoscope connected to camera)

Fig. 1 The user-controlled space sequence simulator.

information identifying a given place the easier it will be for people to find their way. This relationship was investigated by an experiment using a user-controlled space-sequence simulator and an analysis of the subjects' behavior recorded by the simulation system.

A User-Controlled Space-Sequence Simulator

This simulator was designed to allow a subject to move through a model space and visually experience a travel sequence. With a set of "joy-sticks", the subject controls an endoscope connected to CCD color TV camera supported by a gantry while viewing the model scene as projected on 100-inch CCTV screen (see Fig. 1). The maximum size of the scale model is 2.36m x 2m in horizontal dimensions and 0.5m vertically. The movable area of the CCD camera head is 1.5m x 1.5m. Maximum speed of movement is 30mm/sec, and the angular velocity of rotation is 72 deg./sec. The control system of the simulator records all signals generated by the joy-sticks every 0.01 second, while operating three stepping-motors: two for horizontal movement and one for rotation. The exact position within the model space and the viewing direction at a given moment can be stored in a computer memory, providing data for the analysis of the subject's behavior.

An Experiment

Using the user-controlled space-sequence simulator, an experiment was conducted to examine the influence of the physical characteristics of street-scape on people's performance in way-finding.Eighteen undergraduate students (nine male and nine female non-architectural students) were employed to participate in the experiment. Three scale models (1:150) of an identical maze pattern (300m x 300m; see Fig. 2) each with a different street-scape were used in the simulator. The three types of street-scapes were:

(1) no characteristics, with monotonous surfaces (N-type; see Fig. 3, 4),

(2) each corner distinguished with a different building (C-type; see Fig. 5, 6), and

(3) streets furnished with trees, fences, arcades or columns (S-type; see Fig. 7, 8).

Procedure

Each subject was first asked to memorize the route by viewing a predetermined continuous sequence of model streets, as shown on the screen. While the movement of the endoscope was controlled by the simulator along the programmed route, at walking speed, the viewing direction could be controlled by the subject. Thus the experience of the route was not in a absolutely passive mode, but the subject could voluntarily acquire information. After five minutes of instruction, a subject was asked to take the instructed route. Each trial continued until the subject choose a wrong direction and deviated two blocks from the correct route. This procedure was repeated until a subject

successfully reached the end of the route. Subjects were allowed to try up to five times. After the experiment, the subjects were asked draw a cognitive map of the route. Three male and three female subjects were tested in each of three street types.

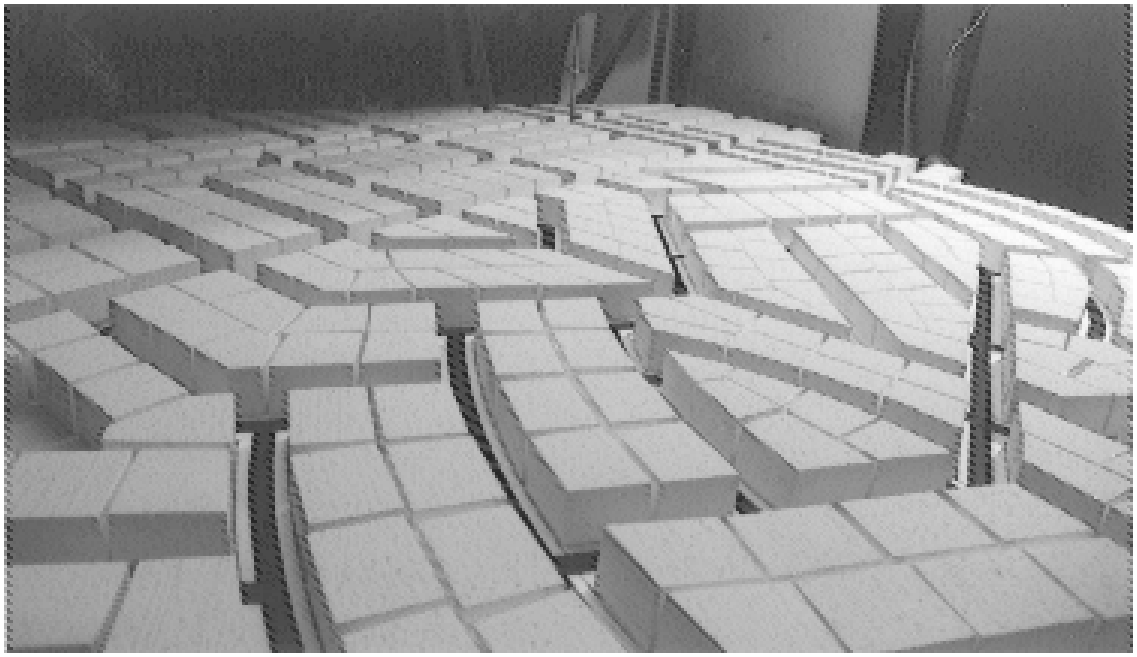


Fig. 2 Overview of the scale-model.

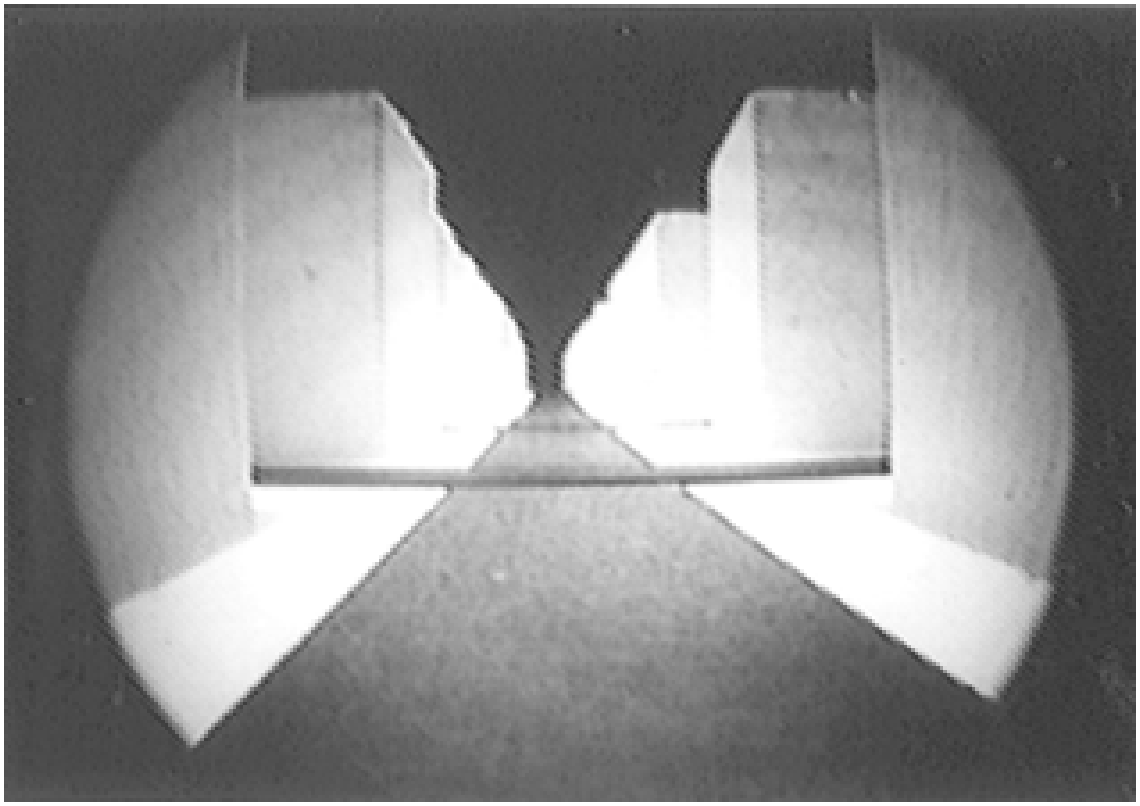


Fig. 3 The N-type street-scape (no characteristics, with monotonous surfaces).

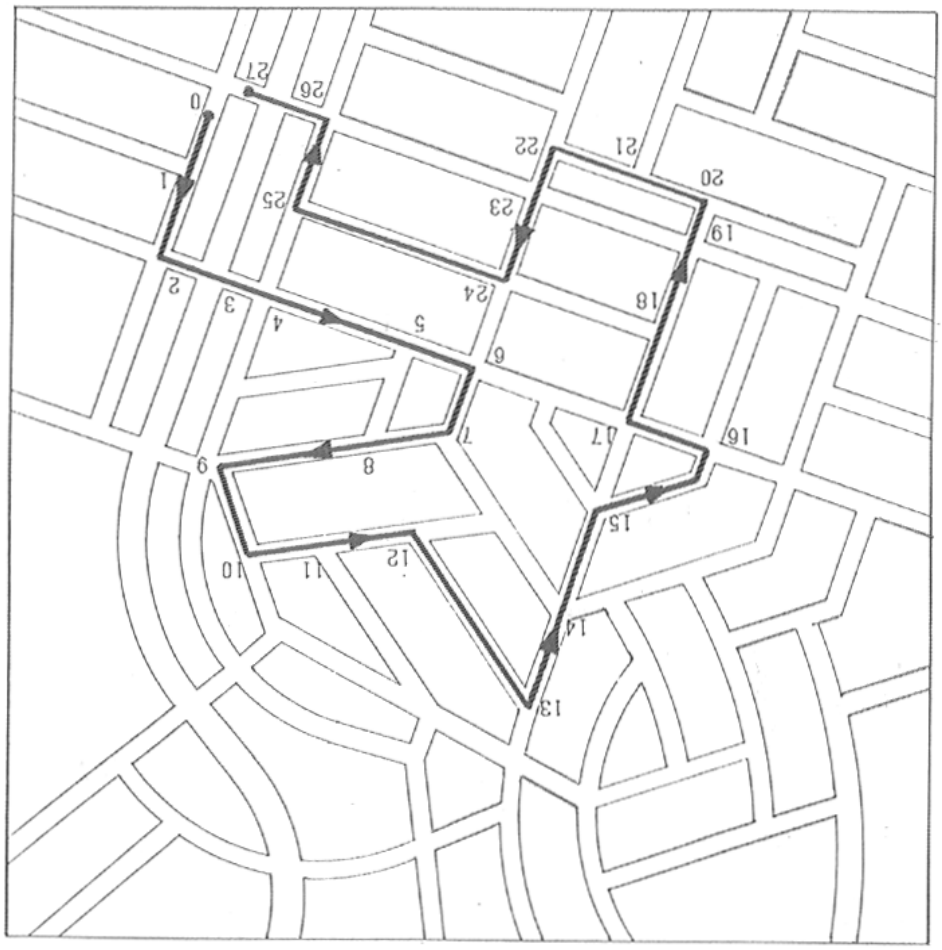


Fig. 4 The predetermined route and numbering of intersections.

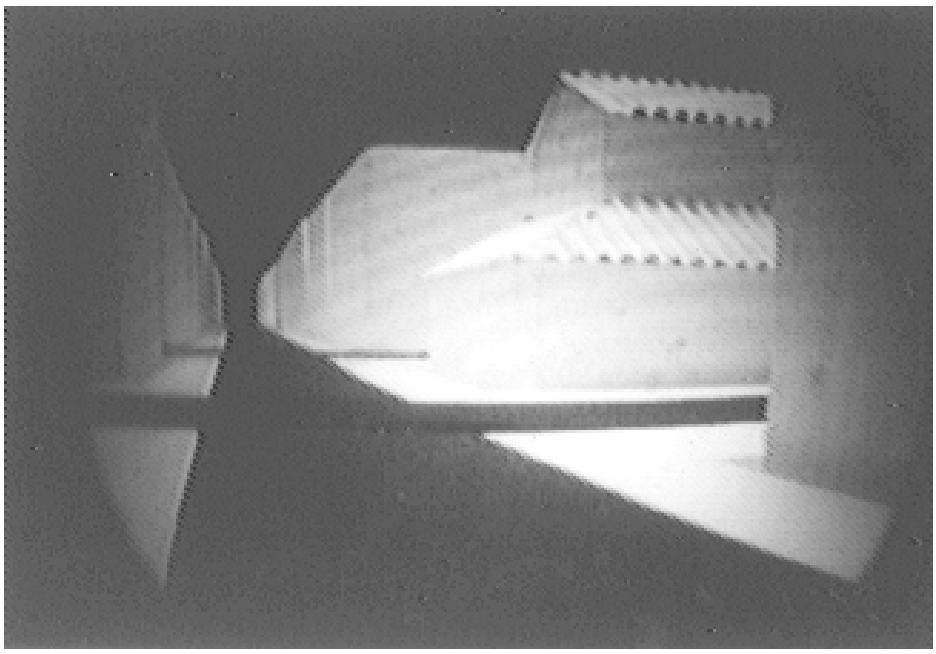


Fig. 5 The C-type street-scape
(each corner distinguished with a different building).

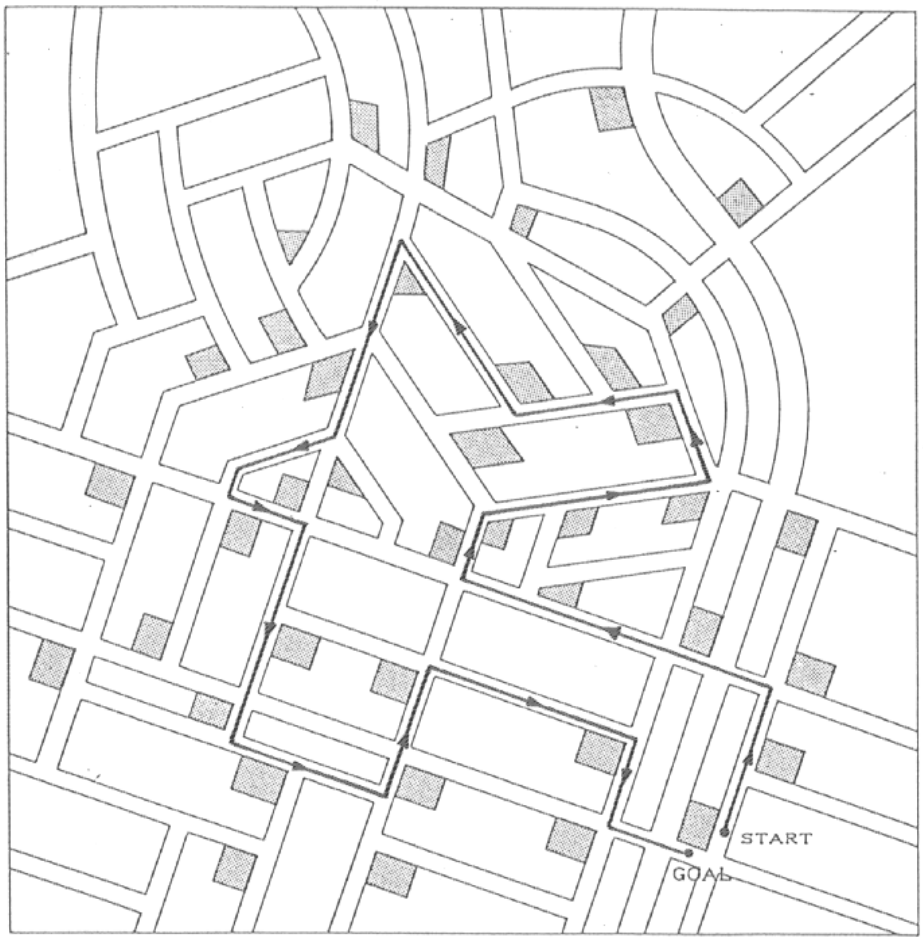


Fig. 6 Layout of buildings of different form in the C-type model.

Fig. 7 The S-type street-scape
(streets furnished with trees, fences, arcades or columns).

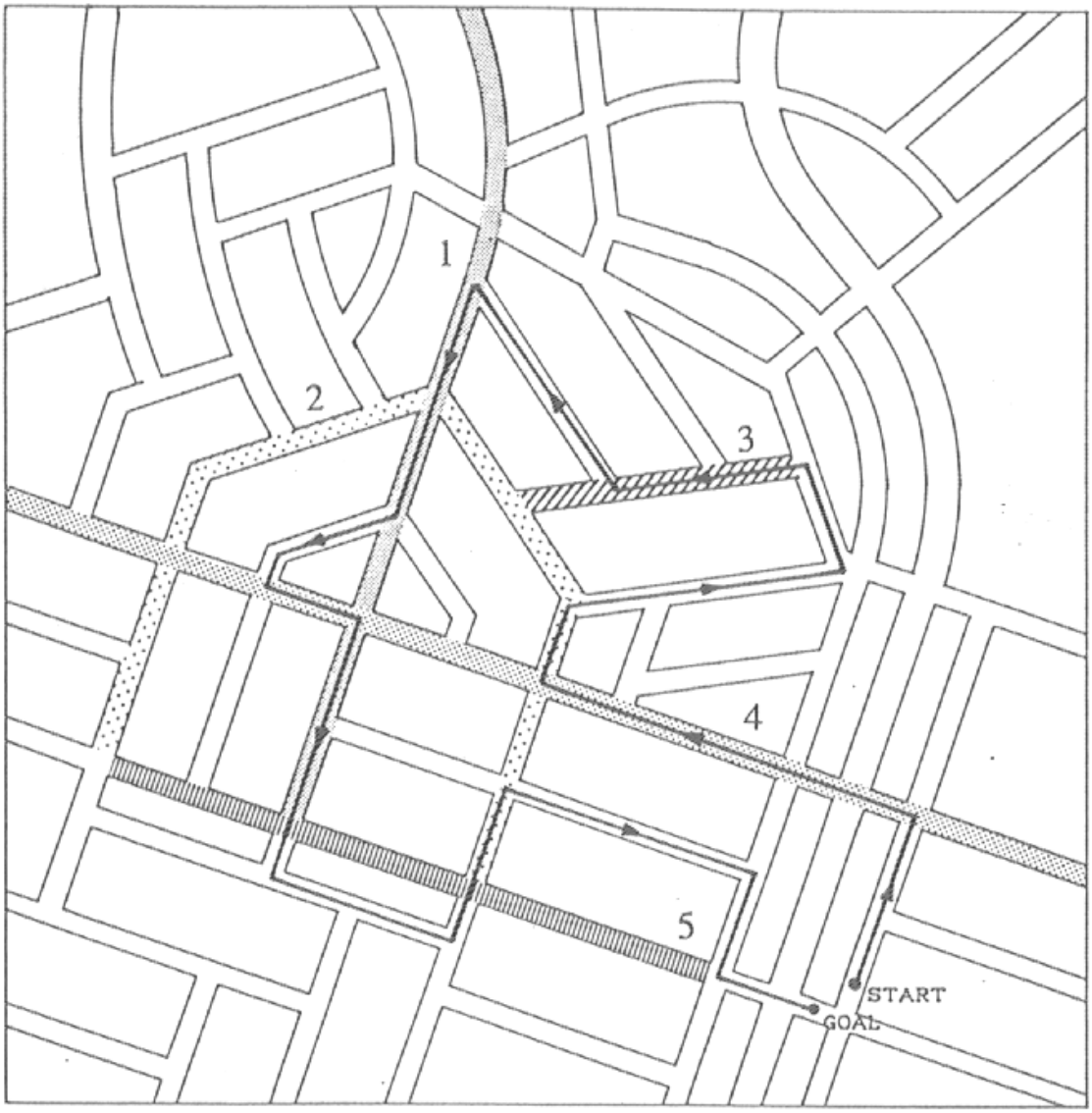


Fig. 8 Layout of streets with different elements in the S-type model
(1: trees of yellow leaves, 2: fences, 3: arcades, 4: trees of green leaves, 5: posts).

Results and Discussions

The trace of movements and viewing directions for each of the eighteen subjects were examined by the printouts of computer display. Figure 9 shows an example of one result. Figure 10 shows the frequency of error occurring at each of twenty-seven intersections along the route. It is noted that at some intersections it seemed more difficult to find the right direction than at others, and the intersections where errors frequently occurred were different between the three street types. At intersection No. 7, for instance, errors occurred frequently in the N-type, but rarely in the other types. In this "Y"-shaped symmetrical intersection, the sense of right/left direction seemed to be enhanced by the characteristics of the street scape. However, since the data is limited, the cause of the results in other cases is not very clear.

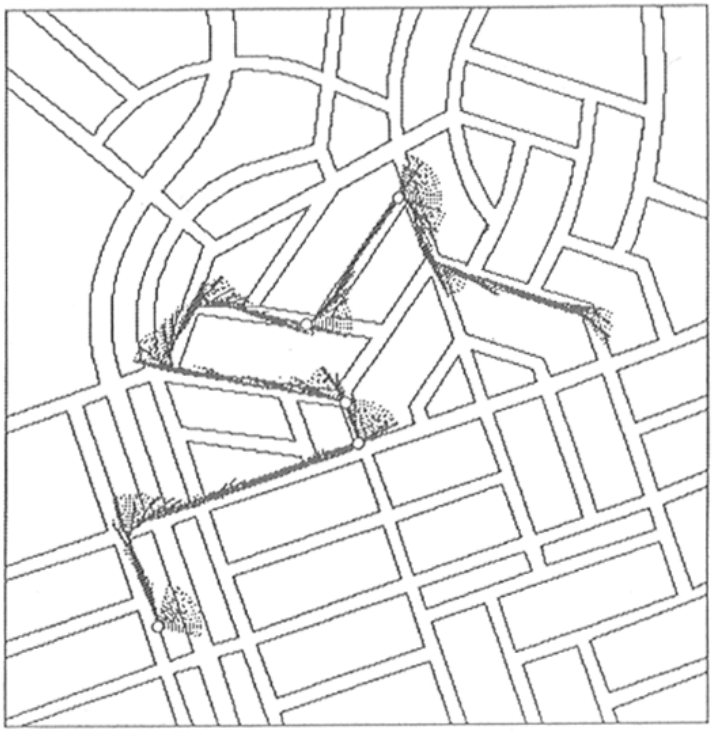


Fig. 9 An example of experimental results
(The trace of movement and viewing directions)

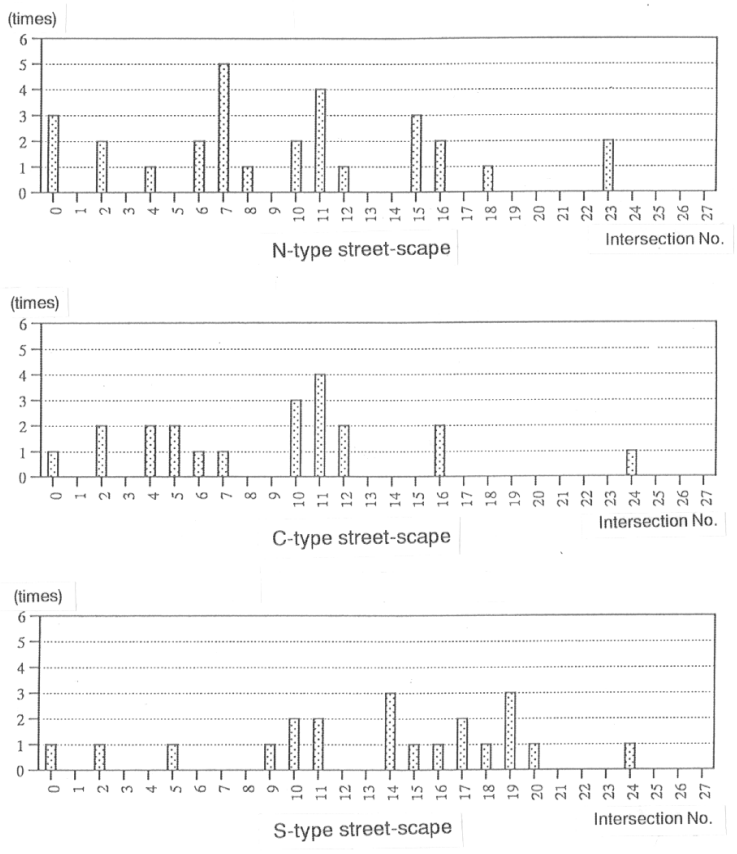


Fig. 10 The total number of errors occurred at each intersections.

Figure 11 shows how many intersections were successfully passed by each subject in each trial. Comparing the results of first and second trials, we noticed as a general tendency that subjects could only go a short distance in the N-type, i.e., it was most difficult to memorize this route. The C-type was easier, and S-type was easiest. After the third trial, personal differences in way-finding performance became evident. Some of the subjects could not reach the goal even in the C-type and S-type, while some could reach the goal in the N-type.

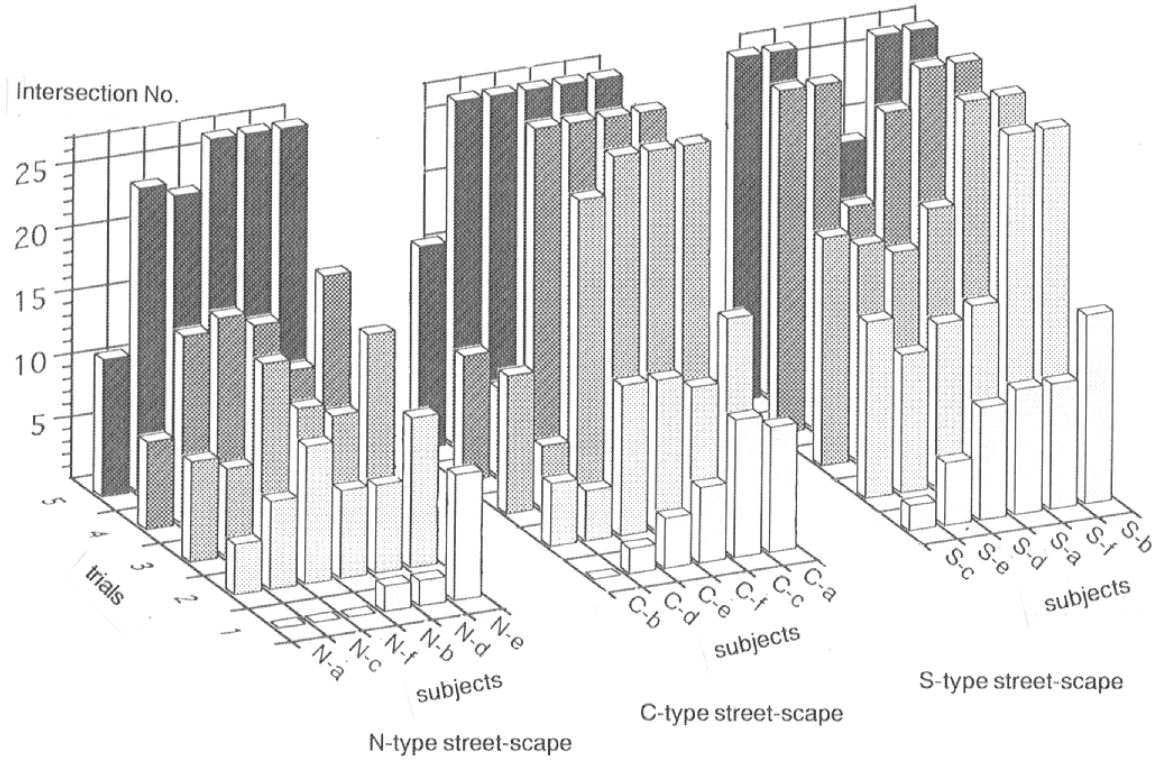


Fig. 11 Number of intersections reached by each object.

The cognitive maps drawn by the subjects who could reach the goal were examined (see Fig. 12). It was found that none of them was geometrically correct, and only five among the fourteen were topologically right with minor errors. This indicates that many of the subjects could find their way without having a map in their mind. This may suggest that we need not have complete knowledge about the route in advance, and that we can choose the right direction based on a sequence of visual scenes as we move along the street. In other words, a part of our knowledge about the place is inherent in the environment, and it is used as necessary in way-finding.

Conclusion

The way-finding experiment using a user-controlled space-sequence simulator generally supported the hypothesis that a route in streets with significant visual characteristics was easier to memorize, although there was a large difference in performance between subjects. With an analysis of the cognitive maps drawn by the subjects, it was also noted that subjects seemed to rely more on incoming visual information on the changing scene than on structured knowledge of the route, i.e., a cognitive map, as is emphasized in conventional theory of way-finding. Although this study deals with an early stage of environmental knowledge, and limited data was extracted from the simulated spaces, it may suggest a dynamic relationship between information inherent in the environment and that in the human mind.

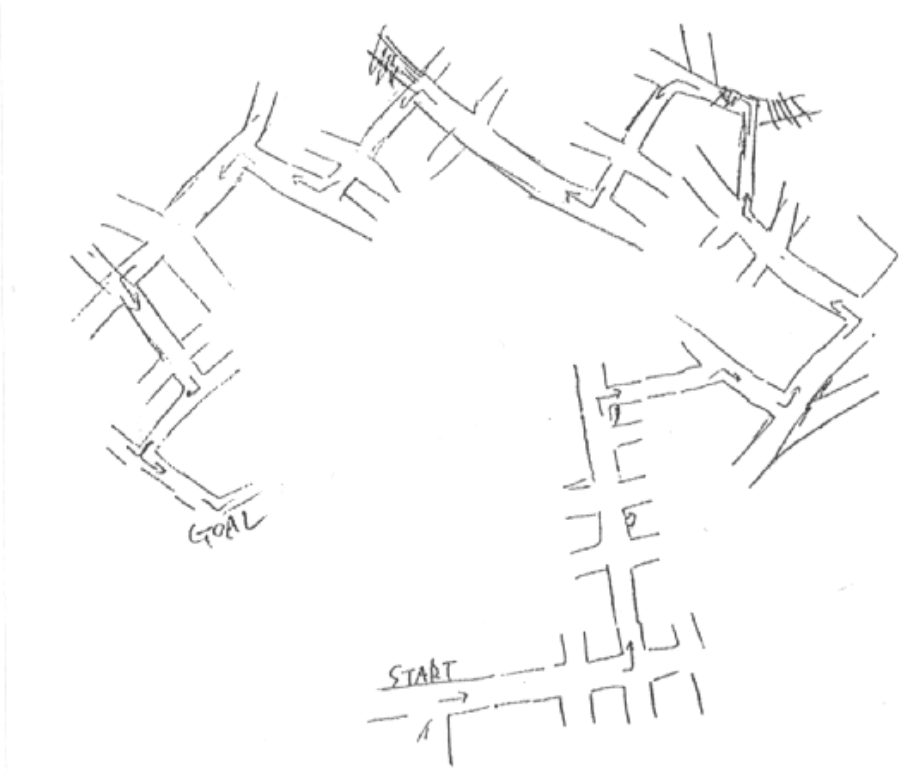


Fig. 12 An example of the cognitive maps drawn by subjects.

Implementation of Endoscopic Model Simulation: Essen-Centre - The main railway station

Wolfgang Thomas

University of Essen, Germany

Assumptions

With approximately 630,000 inhabitants Essen belongs to the six biggest cities in the Federal Republic of Germany. Essen owes its international reputation to a strategically unique position in the centre of one of the biggest economic conurbations on the European continent. Where, historically speaking, the middle of the previous century only documents Essen as an unimportant abbey town, since the turn of the century it developed, particularly in the period between 1930 and 1960, to the industrial capital of central Europe. This important position of Essen has continued well into the nineties despite the sudden collapse of the coal and steel industries. In a process of change, comparable to that of industrialization, the "Ruhr metropolis" has undergone a transition from a centre of industrial production to a centre of service industries; thus, contemporary Essen represents one of the most important centers of commerce in the heart of Europe: distinguished location of fairs and exhibitions, location of headquarters of internationally renowned industrial and commercial companies, centre of seats of energy supply companies, centre of shopping activities and university town. Corresponding to the strategically favorable assumptions, it is in and in the vicinity of Essen that the most important traffic routes of the continent meet. This is true for the railways, the roads, the waterways and for air traffic.

The position of the main railway station of Essen, in the geographic centre of the Ruhr conurbation, symbolizes this unique trait: parallel routes of the regional and supra-regional networks of long distance traffic, that is, railways and motorways, meet directly in the centre of the city; efficient local trains (S-Bahn) provide a first class link with *Düsseldorf International Airport*; finally, the public network of local traffic secures, from a functional point of view, optimal access to all suburbs of and places in the vicinity of Essen by conjoining all the different means of transportation in the railway station itself. Seen from the aspect of town planning those traffic systems mark the focus where the business oriented city and Essen south meet. The southern part of Essen is characterized by urban living, industrial administration, a wide range of shopping outlets, cultural events and spare time facilities.

Unfortunately, the potential, from the point of view of town planning, of the main Essen railway station is extremely disproportionate to the esthetic and atmospheric reality. Instead of providing a meeting point and a centre of supra-suburban communication the main railway station is cut off, by wide traffic routes, from its southern and northern surroundings. Thus, in particular, the car traffic searching for spaces to park causes dangerous situations, noise and exhaust fumes and drastically underline the impression which frightens off pedestrians; riding a bicycle becomes a potentially lethal adventure. The north-south route, which is absolutely dominated by car traffic, immensely aggravates the above mentioned irritating factors: “Trespassing at one’s own risk“. Thus, it is not astonishing that the system of tunnels which is completely cut off from the outside world serves as an important level of distribution for the pedestrians. If one uses this system, however, it becomes a hostile zone which lacks, even for people familiar with the place, any possibility to orientate themselves.

The main railway station of Essen is - and there is no beating about the bush - a psychological barrier which can hardly be bridged. This is valid for the innocent pedestrians of the north-south route on their fenced-in pavements on the main traffic level as well as “underground“ (in Ruhrdeutsch “unter Tage“) as a native of Essen would say. But this is also valid for people who, on five levels altogether, look for different means of transportation (underground, local trains, long distance trains such as Intercities, local buses) and their scattered places of access. Thus, the passage from the Intercity platform, situated on the north side, to the fast-bus stops, situated directly below the Intercity platform, makes excessive demands even on the best guiding system. First-class passengers have to walk - if they do not prefer a taxi out of desperation - about half a kilometer across the underground distribution level. It is even worse for the user of the local trains (S-Bahn) who tries to reach the platform on the same level from *Rellinghauserstraße*. He or she will probably go for a multiple, that is 8 times, crossing of roads, because an “adventurous“ alternative will lead him deep down to the underground level, to the wrong platform, so to speak.

In order to put the rather provincial main railway station of Essen into the middle of a lively communication between the south of Essen and the city involves the dissolution of its isolated position as a traffic island. From the point of view of the town planner it also means to correlate, in terms of space and atmosphere, the station with the buildings of a high identification value situated on the north side. But this does not mean in the least to promote the monotony of anonymous office architecture around the main railway station by a higher density of buildings.

Reinforcing the activities of the *Huyssenallee* would already provide the link with the *Rüttenscheid* shopping mile, the railway station in the centre of an inner city axis parallel to the underground route, from *Rüttenscheid* to the university. Thus, the pedestrian would have within his or her walking distance the whole range of tertiary services: university, city administration, alternative shopping facilities, cultural and leisure time amenities, even the recreational park "Stadtgarten". The concept tries to prove all this in detail and illustrate it with simulated pictures. A student project group at the university of Essen analyzed the inner city situation thoroughly. They focussed on the problems relating to the main railway station, departing from a structural and analytical account of the situation.

Simulation of Urban Space

The analysis of the ongoing conflicts points to the individual car traffic as the core cause of the railway station being noticed more as an obstacle rather than a link between the city and the south of Essen. A preliminary basis of a solution is provided by the recognition that the railway underbridge will have to be closed for car traffic. This is also the position of the town planners of Essen. The same also holds for the square in front of the railway station and part of *Hachestraße*. The southern side of the station should also be relieved of through traffic. This assumption opens up new possibilities of a thorough re-formation of the available space. The underground distribution level, up to now "underground", provides a remarkable potential of a three-dimensional development of the area of the railway station. A vertical section along the underground route between *Saalbau* and *Gildehof* circle points unambiguously to a ground level link with important parts of the city centre. The street space around the hotel "Essener Hof", situated east of the hotel "Handelshof", could merge with the distribution level on the same niveau and thus open up a second zero level. The same is true for the distribution gallery, situated between the main level of the station and the track level on the one hand and the edge of the built-up area of the "Südviertel" on the other hand: both are approximately on the same niveau. The slope between the two intersecting poles comes to about 26 meters.

The video simulation [1] of the situation, from the pedestrian's point of view, illustrates the effects by direct comparison or by using the technique of superimposing reality and model:

> "We enter the main station square at the northern end of the underbridge. The design concept uses the basic possibility to open part of the former street space in a downward direction. The effect, seen from the perspective of urban space, of this procedure for the distribution level

is obvious: the distribution level receives the quality of a lower zero niveau. The three-dimensional experience no doubt also enriches the upper zero niveau. A mutual revaluation cannot be denied. *Hachestraße* will also obtain a new face and becomes part of the three-dimensional development. The view to the west opens up astonishing possibilities. The spatial limitation to the west by a high rise building is rather an abstract hint.

The experience of the design concept, seen from the urban space perspective, departs from where city centre and lower zero level meet on the same niveau: the upper zero level is supposed to facilitate the orientation in the direction of the new entrance situation of the main station: to the right the entrance of the hotel "Handelshof". Now a view of the slightly lowered niveau of the "Handelshof terraces" before we are going to observe the whole project in question from the lower zero level. We enter below our previous location and move slowly in the direction of the station entrance. Above, to the right, we can still recognize the canopy of the "Handelshof terraces". We continue on our way until the view into *Hachestraße* opens up and change again, for the benefit of better orientation, to the upper zero level. When we leave the bridge we are at the old northern entrance of the station. We approach the corner buildings where *McDonalds* still invites us and have a closer look at the now two-floor arcade. From the central position a change to reality. At the same location we have a glimpse of the prospective promenade in front of the main post office and turn towards the south. Here we also superimpose the real picture. Halfway up the stairs another turn in the direction of the promenade in front of the post office, before we return to the lower zero level. Here our walk westwards ends.

From this perspective it becomes clear why there should be no high rise buildings between track level and *Hachestraße*. Because it is only in this way that the traveller can obtain a view of the characteristic buildings of the city. At the niveau of the upper zero level we experience the well-known perspective on to the station square, with the high rise building of the *Bahn AG* as an eastern limitation.

We return via the lower zero level, along the shopping arcade, until we are in sight of the track level of the main railway station; reason enough for a change to this level of communication. The futuristic perspective points to significant changes. This is confirmed even from the perspective of the more remote tracks. Again we return to the op-

posite view position of the lower zero level: from a slightly elevated landing these pictures illustrate a turn of 135 degrees and show a view of the more or less characteristic buildings of the square. We take our position now below the landing where *Hachestraße* and main station square merge: In the northeastern direction we experience "Handelshof" and "Haus der Technik" from the perspective of the former distribution level. Particularly impressive is the two-floor arcade of the "Haus der Technik". It is situated diagonally across the shopping arcade which we have just passed from the west. Going into the same direction we approach the point where our walkabout through the lower zero level started. Now we are below the "Handelshof" and the terrace situated in front of it. In order to mark our way better for the last part of our walkabout we change again to the main entrance of the hotel "Handelshof". The atmospheric changes cannot be missed.

Now we continue our interrupted walk and are at the entrance to the terrace of the "Haus der Technik": Here begins that part of the lower zero level which were to continue the present tunnel system to the east. We enter that part along the row of shops below the terrace zone. Finally, we turn to the eastern ascent to the upper zero level. An illustration of the access to the main station from the east is restricted to the zero level: On the basis of a real picture the alternative possibilities of access. The pictures show clearly that the lower zero level can also be reached via the *Haus der Technik* terrace. A turn to the south opens up a zone which today is absolutely dominated by dormant traffic and is thus not normally noticed by the pedestrian. Finally a survey from the window perspective of the high rise administrative center of the *Bahn AG*. Approximately the same ground-plan position from the perspective of the pedestrian. And, last but not least, the diagonal relation to the prospective main entrance of the station and its square: attractive location and communicative place."

Note

[1] A copy of the video simulation can be obtained at Essen University / FB10 - Städtebau / P.O. Box 103764/ D-45141 Essen (Germany).

Abb. anfordern

Optimal Choice of the Equipment Depending on the Requirements of Educational Projecting

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Abstract

The means of architectural endoscopy play an important role in teaching architects, making it possible to form effectively spatial perception. However, the high price of the up-to-date equipment requires its optimal implementation. On the early stages of training architectural students it is reasonable to use sufficiently simple devices: telemaketoscope connected with a 386DX-computer and printer to get static video series. More complicated educational projects demand studying the object in movement, so a VHS or S-VHS VCR is added to the system. And finally a complex system, comprising minimum 486DX-computer, videostudio and special modernized camcorder is intended for real architectural projects. Such systems make it possible to combine the projected object with the real environment, executing the object itself either in the form of a computer 3D-model or in the form of scale model. The examples of training and real works, illustrate the efficiency of employing proposed system in various fields of architectural designing.

Introduction

During the two last years many great changes have taken place in the work of our laboratory. While earlier we offered architects only endoscopic methods for the use in educational and real projects and envisaged only work with small-size mock-ups (as a rule ranging from 1:50 to 1:5000), now we speak about a single video-computer space, which enables the architect, both perspective and performing real designs, to imagine the designed object in the real situation. We consider “endoscopy” as possibility to analyse the object from the inside, not depending on tools used by us - not only examining mock-ups by periscope devices but also placing images of mock-ups and 3D computer models in the real video-environment. Depending on project technologies, used by the architect, and the specific character of the problems to be designed, we offer video-computer complexes differing in the cost and complexity. In the same way as earlier, depending on the real possibilities of the Institute, we try to choose equipment of minimum cost allowing to get adequate results taking into account the free of charge education. We take into account also traditions of mock-up methods of designing, established in the Institute in the 20’s as well as recommendations of a number of foreign architects and architectural organizations - to retain in the future the individuality

and specific character of methods of architectural education adopted here. The ideas described in this paper are not opposed to the CAAD, we only want to declare, that at the present time and especially in Russia economical conditions for mass employment of computers on all levels of education are absent, but the use by practically all students of technical aids of video-computer modelling based on mock-up designing is quite real. Due to the mock-up the creative conception of the architect gets a visual material expression. The mock-up method develops the ability to visually perceive and evaluate the solution making the conception clear. The architect must be able to see the object being designed and from this point of view a small-scale mock-up is likely to be more preferable, as the computer-made image is seen from an already chosen point and does not allow to check whether the perception of the small-scale model is correct. The mock-up method gets different characters depending on the problem. The preparation of mock-ups for individual objects - three-dimensional and spatial mock-ups of projects of schools, cinemas - helps the search for the external architectural image of the object and develops the three-dimensional image of the structure. Especially important are mock-ups of interiors, which help to understand the interrelation of the exterior and the interior. The town-planning mock-up displays the spatial conception of the development, its connection with environment. The preparation of mock-ups of the object in a particular natural or town-planning environment shows the connection of architecture and landscape, representing an individual building as a part of a more complicated system. However, it is known, that the employment of mock-up methods of designing requires using special periscope devices ensuring real perception. Our many-years-long experience of work made us come to the conclusion that the effectiveness of this technology can be considerably heightened, if the above-mentioned devices begin to play the role of original information transmitters connected with computers. Depending on the specific character and complexity of the problems to be designed it is possible to provide inexpensive video-computer complexes ensuring optimum employment of the equipment. The computers used in the complexes can be used in the spare time for the solution of various problems.

Complex 1

At first students performed their tasks using the available devices. However, as a result of the accumulated experience some changes were made in it. Though it still contains a photocamera, it is not used as a rule. The present-day appearance of the complex is shown in figure 1. The video camera of the telemaketoscope is connected by means of a AVer 2000 PRO card with a computer 386DX. As mock-ups made by students are monochrome as a rule only cheap white-and-black technique is used. The complex makes it possible

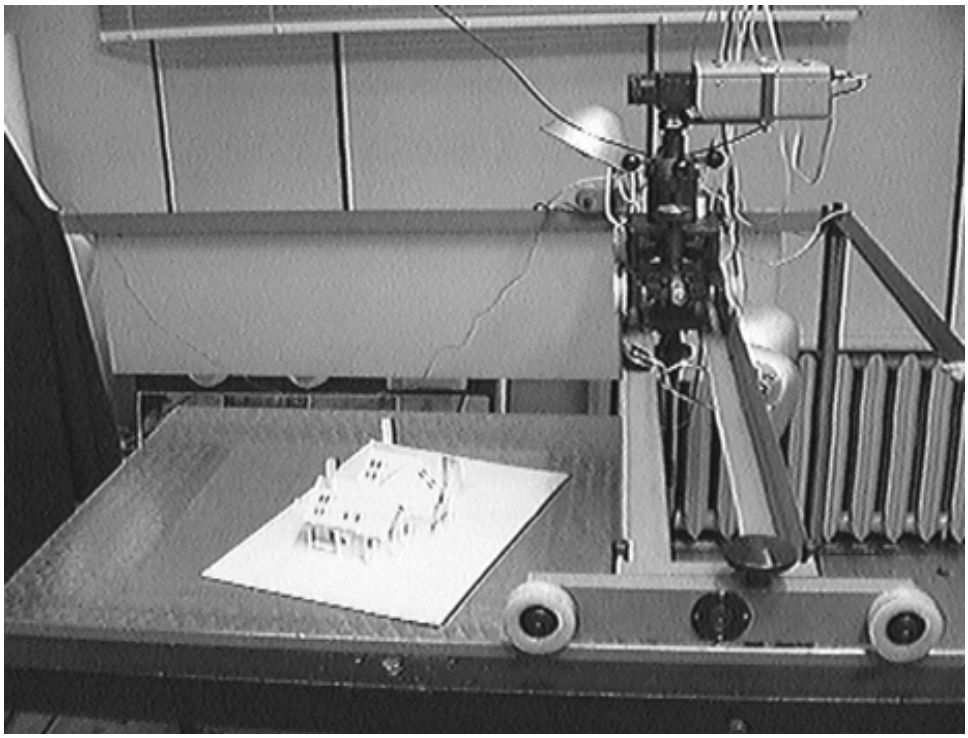

Fig. 1 Telemaketoscope.

to analyse mock-ups from real points and get printer copies of the chosen frames (frame grabbing). It is possible to use later stored files of images and to process the frames depending on the available software. If it is necessary to get and record dynamic video rows, a video recorder is connected to the video camera beside a computer and the images seen at the chosen trajectories of movement are recorded. The complex is to serve students beginning from the second year of studies up to the diploma design. During the work of junior students at the complex the possibility to change the stature of the observer makes it possible to understand the scale of the composition. A positive role during the training is played also by the possibility of simultaneous watching a three-dimensional mock-up and its image on the monitor‘s screen. For example the following experiment took place. The students were told to make some drawings of mock-ups from the point of view of a man corresponding to the mock-up scale. Then the drawings were compared with the images of the monitor‘s screen corresponding to the same points on the telemaketoscope. The work at the images turned out to be very difficult and the results were unexpected by students, displaying the undeveloped spatial ideas of junior students. The possibility of flexible work with light sources gives one more methodological advantage - the student learns to show forms by the light watching results from real points. During the training the employment of the complex for studying the object in movement and the possibility of getting a successive row of images is of importance. Some examples of its employment are shown in figure 2.

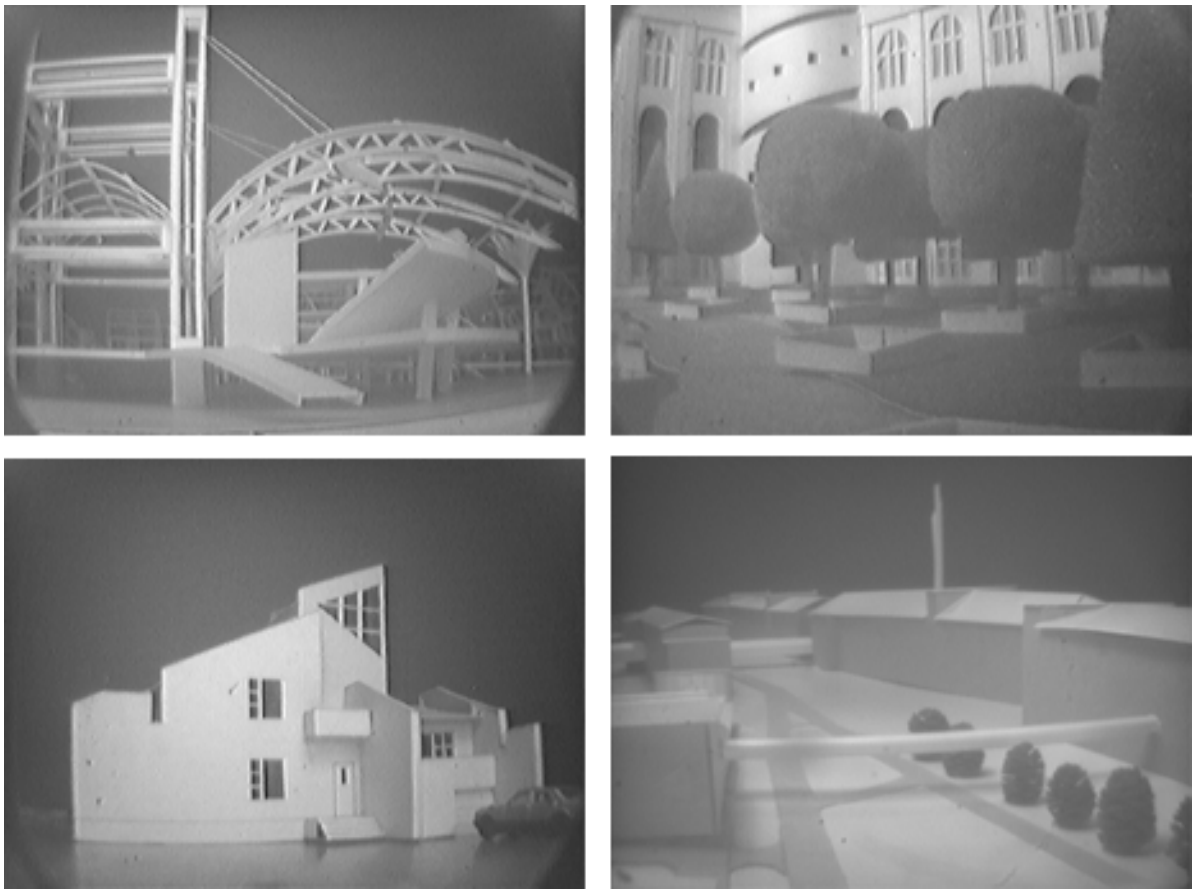

Fig. 2 Some examples of Moscow endoscopy work.

Complex 2

The possibility of operative work and analyses of coloured mock-ups resulted in the appearance of a complex on the base of a portable camcorder with a medical endoscope and an additional optical adapter. The camcorder is placed on a special tripod with a cantilever and can be connected with one of our computers with a video adapter. The small diameter of the endoscope provides for easy work on mock-ups especially when analysing interiors. As coloured mock-ups are executed, as a rule, by senior students or for commissioned works, it defines also chief users. This complex enables us to get both static video rows with colour printer or video printer copies and video fragments recorded on a video tape in VHS format. The general appearance of the device (without a computer) and fragments of some works executed by it are shown in figure 3.

Complex 3

A special place in the laboratory is taken by a complex based on a S-VHS mini video studio with a 486DX2 computer (with video adapters). Its employment makes it possible to solve problems of another level - analysing

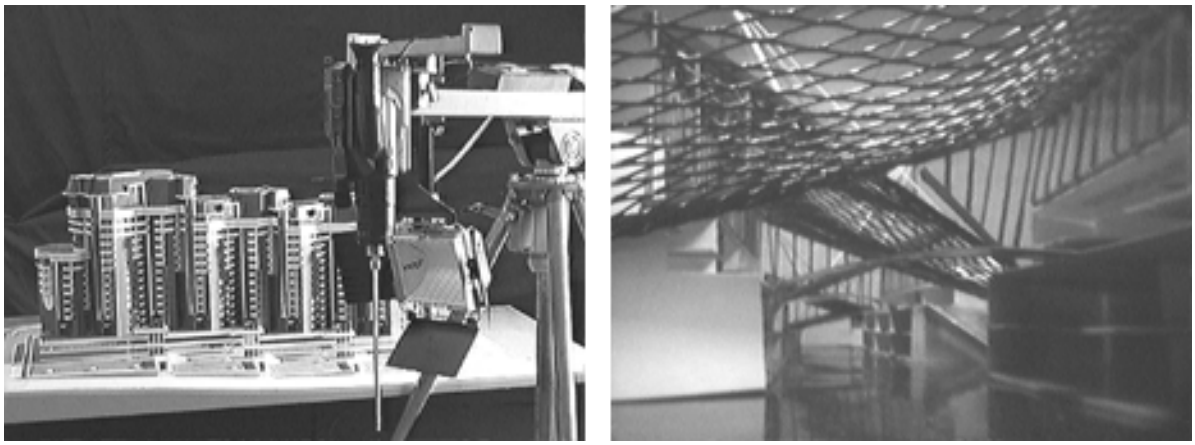

Fig. 3 Complex 1 with example.

designed objects in a real environment. Besides the above-mentioned computer complex contains 2 S-VHS camcorders, 2 S-VHS video recorders, editing controller, digital mixer and monitors. The computer is provided with a Video Commander 2 card resp., an overlay card for the output of computer images with superposition on the exterior video signal. The employment of such equipment makes it possible not only to model the object to be designed executed as a mock-up or three-dimensional computer image in a real environment, but also to create small video materials with the necessary additional information on the design. Three such works were carried out in the laboratory during the last two years. One of them is devoted to the design of an office building in the historic centre of Moscow and was necessary for getting the permission for the construction.

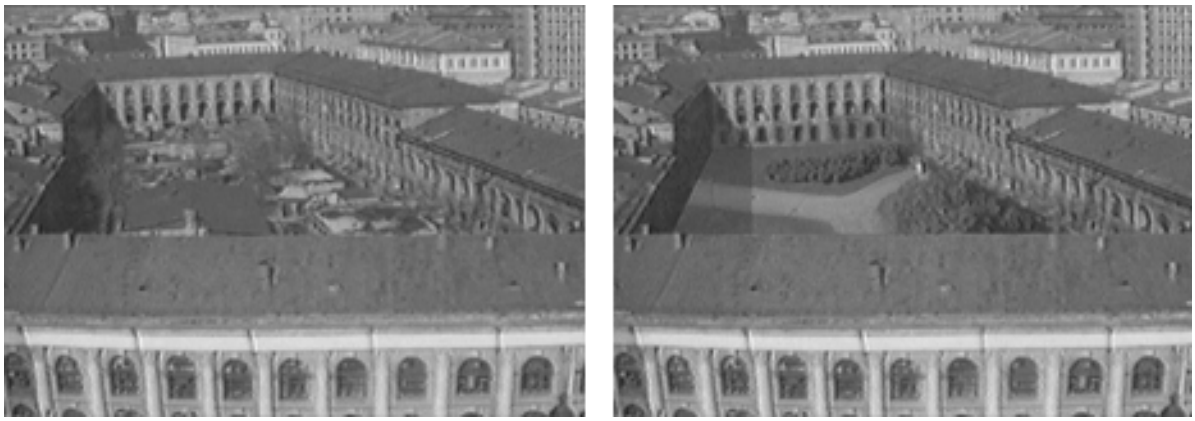

Fig. 4 Reconstruction of Great Gostiny Dvor.

Another is connected with the reconstruction of a historic building - Great Gostiny Dvor near the Kremlin and allows to analyse a variant of a students‘s design of a park and an underground cultural complex in the inner yard (Fig. 4). Here complex 1 was also used. The last work is connected with the reconstruction of one of the central streets of the city of Astrakhan on the Volga.

When working at the project we carried out historical analyses using archive text and photo materials, which was reflected in the video fragment. Project proposals for the reconstruction of the façades of one of the retained buildings, reviving the lost aspect of one of the street sites - all this is shown in real video with the use of mock-ups 1:200. Some frames from the video fragments are shown in Fig. 5.

Fig. 5 Employment of complex 3 in real designing.

The insufficient working out of details of mock-ups on this stage of the project introduces some conventions into the modelled subjects. So the employment of the described complexes enables to execute the following versions of works:

1. Looking at the object being designed from real observation points and if necessary with regard to the real situation in the process of searching for the design solution (it is possible to use photos, video recording and the object itself is executed in the form of a mock-up). This problem is usually solved by video methods (including endoscoping) but for some additional work and documentation we use computers.

2. When depicting the resulting information (final design solution) we carry out searching for the necessary observation points and trajectories of movement, work out a scenario of presenting the design solution and make - besides printer copies - also a video fragment containing a picture of the initial situation and placing there the object being designed. The fullness and complexity of video materials depend on the problem to be solved and the importance of the designed object.

The video-computer complexes employed by us, the corresponding methods and technologies enable us spending only reasonable amounts of material means to ensure the possibility of fuller and more correct perception of designed objects for a great number of students.

Creativity and Media in Architecture

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Abstract

In this paper it is argued that the qualities some of the media architects use may enhance creativity if they are used carefully. Two ways-of-using over which the architect has some control are noted (along with a third, chance/error, over which there is none): the ambiguity typical of the back-of-envelope pencil sketch and the sharing of ideas of a design studio are cited. It is argued that these increase variety in the ideas available to the designer, through a type of conversation. It is also argued that it is possible to become aware of the qualities of even new media through three types of observation, indicating which of these media are likely to be helpful in enhancing creativity in the manner of the back-of-envelope and the design studio.

Media Can Help Us Amplify Our Creativity

Architects have not paid very much attention to the different media that are available to them through which they may explore and illustrate their ideas for designs. It is not that architects do not have media available. It is just that McLuhan's revolution has not led to all that much study of the media available, in architectural circles. This is all the more surprising when it is remembered that architects do use a very wide range of media, and when the recent increases in numbers of media available (with new media appearing seemingly monthly) and the way some of these have been specifically aimed at architects is borne in mind. Yet architects are not unaware, at an intuitive level, of the importance of (their choice of) different media. In architecture schools the conventions about which media should be used and for what task, and of appropriate means of presentation, are instilled in students right from the beginning through the agency of the requirements of the brief (e.g. plans at 1:100) and the counselling of the friendly tutor. Sometimes the advice on choice and use of a particular medium seems bizarre and even contrary. The call, familiar in architecture schools around the world, to think with your pencil can seem amusing and ridiculous: but its validity is shown not only by how architects do work, but the development of this way of acting into a sort of crutch: ask an architect a question at the dinner table, and the chances are that (s)he will pull out a pencil and start doodling on a napkin while explaining! Equally, when presenting a scheme to a client, an architect will often make a model of the proposal on site. But this model is a careful abstraction from what will be built. It is usually made of white card (and very

little else: there might be a little wood). The land is made of layers representing the contours (and is not smoothed out). Trees are of wire, or are twigs, usually painted white. Windows may be shown by outline, or as transparent. But the whole model is a careful abstraction that focuses attention on the building's form rather than its material, color, texture, etc. By abstracting the non-formal qualities (as well as the size and detail), the architect directs the discussion to his primary concern: form, and its complement, space. And white card models are so perfect, so flawless, so clean: so basically attractive. And different media do affect what architects produce. Charles Jencks, in a moment of insight, remarked that the Leicester Engineering Building of James Stirling and James Gowan was inconceivable without the axonometric projection.

In contrast, consider the fact that virtually all media of architectural presentation (excluding briefs and documentation such as bills of quantities) are visual. Our discussion of buildings is in almost purely visual terms. Yet some buildings are not basically or exclusively visually orientated, most obviously churches, concert halls and public lavatories. We have virtually no ways of presenting what we believe will an architectural proposal will be like in non-visual terms (giving a reverberation time is not very sensory). And so we tend to ignore the other senses, or only to handle them with a crudeness we would abhor in the visual [1]. In some ways, however, it is easier to understand the importance of the choice of media in a related field rather than in one's own—just as it is not so easy for a native speaker of a language to come to terms with the grammar of that language. A look at cartography will show the unconvinced just how the choice of projection and of other media profoundly changes the view that is presented in any map (Consider that we all make maps of the world in which our part of the world is in the centre of the page. It is shocking for a European to see a Singaporese map in which the USA is in the far east, and Europe is in the far west: or a Chinese map which may well fracture Asia from Europe, dividing the old communist rival the Soviet Union, as well as the world's cultures, in two!). Thus, it is taken as read that the choices of media significantly modify the presentation of (architectural) ideas, layering interpretations on them and, in effect, helping form them. But this understanding, which is probably straightforwardly recognizable, is only the beginning. Most architects go through a stage which can be recognized in the expressions doodling, and on the back of an envelope. Both suggest an informality and a playful purposelessness, an experimenting. And both are deadly serious. For it is in this activity using this medium that ideas are found: the basic ideas from which design proposals spring. They are, therefore, both central and essential.

What is it about the activity of doodling, the medium of the back of the envelope, that make them so powerful? Is there anything in this medium (for the doodling activity is the how of using the medium and will, henceforth, be subsumed) that we can analyse and that will help us look at other media (most specifically, at computing - in all its various embodiments) to see if they can perform similarly: that is, helping bring to us ideas? [2] It is the belief that there is a major field of study here, so far hardly recognized, the understanding of which may vastly enhance our creative potential, that lies behind this paper. What is it in about the back of the envelope that is so powerful? A formal answer would need interviews and analysis. Many designers have been interviewed about and/or observed during their design process. But the questions they have been asked have been about methods of designing rather than the notion of being given ideas: and ideas do not necessarily come under observational circumstances [3].

However, it is possible to indicate certain qualities of the interaction the designer has with the back of the envelope through doodling by reference to personal experience and by simple enlightened analysis:

- Firstly, in order that the doodle can have a meaning other than we intended (or a meaning at all when none was intended) there must be ambiguity. That is, the doodle on the back of the envelope must be able to mean more than what was intended (or something, when nothing was intended) [4]. It is the ambiguity that makes the re-interpretation possible [5].
- Secondly, we must expect surprise. If we will only look for what we intended, we risk not seeing other possibilities that we did not, intentionally, put there.
- Thirdly, we must “listen” rather than “talk”: that is, we must be willing and able to receive what is on offer (This is a frequent point in therapy, and there are those who would maintain that much of this process of design is a process of therapy.)
- Fourthly, this adds up to design (certainly at the level of the doodle on the back of the envelope) being a conversation, as claimed by the cybernetician and (later) developer of Conversation Theory, Gordon Pask: a conversation held by us with ourselves via the pencil and the back of the envelope [6].

These may lead, in turn, to the insistence that media which we may hope to use to help us in finding ideas, thus enhancing our potential creativity, should exhibit these qualities [7]. We may expect to look for ambiguity, surprise, weak intentionality, “talking back”, and conversation being supported by such media. Thus, we can isolate at least some appropriate qualities of media (These qualities should not surprise those who talk with people commonly re-

garded as highly creative. Many are modest about the ownership of "their" ideas, talk of their amazement at what they come up with, at ideas coming from their doodles, at an exchange between themselves and paper and pencil - or the equivalents in other fields - etc. And many will have personally experienced the way that, for instance, words take over, exhibiting a life of their own. If they appear arrogant, it is probably frequently a protection against the "absurdity" of this experience in a rationally dominated world!).

There is one further, parenthetic concern to be introduced here. One reason for talking seriously about media at the moment is the advent of the computer, and all the assorted technology that goes with computing (Information Technology, the InterNet, MultiMedia, etc) which will be subsumed under the single term. The computer is a medium - or collection of media - of enormous potential and power. In fact, its potential is quite unlike anything we have made before, for it is the first artificial object (made by us) that has the potential to be a partner. In treating it as a slave, as we do at the moment, we deny it the opportunity to contribute to our creativity in any way outside of what we can envisage, with our limited imaginations. To begin to get the benefit of the computer in enhancing our creativity should be one of the great undertakings, but seems not, as yet, to have been begun [8]. The (mutually) beneficial use of computing is a major concern of this paper. In architecture, we do not yet take this possibility, this undertaking, seriously - to our great loss.

Creativity, Variety, Ideas

Let us for a moment consider what might be meant by creativity. There are, of course, many definitions, valid in all sorts of circumstances, so this is no trivial matter. What is meant here is the making of the new. A creative person is one who generates (a lot of) novelty. But this sort of novelty may not appear novel in the so-called objective world. For something which is new for us (even the concept of the "wheel") may not be new to others ("he's reinventing the …"). This does not make it any less novel to us, or any less of a strain or of a challenge successfully confronted. So the very creative person is the person who can generate many such ideas. And, it should be said, is one whose ideas will often appear new also to others, rather than as "wheels reinvented". We know that children create many ideas very rapidly. We know that, for most of us, this ability drops off. We know that, for whatever reason, a few of us retain this child-like ability. Such people form the small band that are usually referred to as creative. This is not to assert that all of creativity is covered by this description, or that it makes all of creativity. It is only to assert that this is a necessary condition, if not in itself sufficient. Thus, to

be creative is to make the new [9]. The more creative are those who create more new, that is, have more "creative", new ideas. But what are the qualities of the new? The first, and the essential one, is that the new is unexpected; it is a surprise. It is not related to anything, it comes from nowhere or from wherever. If it is the result of some logical process (of whatever form of logic), it is not new, but an extension of the old, something inherent in what was. That is not new. However, when the new is seen, it may be possible to account for it by showing a line of "parentage", a way it can be seen as a logical development of what was known already. This is what we normally do, of course. Thus we may (and often do) talk of the emergence of new ideas, which is not logically possible except in hindsight. But it must be understood and kept clearly in mind that the experience of making the new, and the post-rationalization of explaining it, of fitting it into some scheme of what we would probably choose to call knowledge, are entirely different actions. They are not comparable, let alone substitutable. It is so important to keep this in mind just because we have for so long substituted the explanation for the experience that we no longer notice it. Which is very corrupt.

There is a measure, used in cybernetics, called "variety". Without getting unnecessarily technical, this is a measure of how many of the theoretically possible states that some system can be in it actually makes use of. It is a measure similar to information theory's entropy (derived, of course, from physics). The English cybernetician Ross Ashby [10], suggested that it would be possible to amplify intelligence by training the brain to concentrate only on the matter in hand, taking away all the distractions: thus, the brain, most of which seems anyhow not to be used, would be able to use more of its usable part to tackle the problem in question: resulting in an increase in variety, for more of the states that the brain has would be filled by the problem. Ali Irtem extended this notion to happiness amplification (remove those things that make you unhappy: another therapy solution!). It is in this sense that the notion of variety is used here [11]. For it could be argued (as has been done at least for sharing and co-operation) that one way of increasing our design ability is to increase the variety of design ideas available to us: that is, to increase the variety of such ideas. If we have more ideas to choose from, we may make a better, a richer, more startling choice [12], thus increasing the likelihood of appearing more creative. We don't have to know where these ideas came from, and it doesn't matter, for in making an idea that we believe we have got from someone else our own, the idea becomes ours and is not the same idea. I cannot have your idea, any more than my heart can circulate your blood for you, I can smoke your cigarette for you, I can die your death, or I can give birth on your behalf. The ideas we get from others are normally (in the context of this paper) either in response to their understandings and extensions of our original ideas, or are ideas in which we see a link, a relevance, a

potential: thus they become not just any ideas, but ideas that are salient to the matter in hand (our hand). It is, therefore, to the question of how we might increase the variety of the ideas available that the rest of this section is addressed.

There are, it seems, at least two ways that are open to our manipulation in which we can gain ideas (It is not intended, here, to consider any of the more bizarre and mysterious ways that have been proposed by some others.). The first is by looking at things, and then looking, again, differently: the second is by picking things up from others:

- The first case is the case of ambiguity (and, ultimately, the meaninglessness that has been argued to characterize in art [13]. This is, of course, the case with our pencil and paper - our back-of-envelope. Let us recapitulate. We draw and then, looking later, we find that we see things we had not intended to draw, things that are new, unexpected, different. We see what is apparently the same object (the drawing on the back of the envelope) in a different way, we see different things in the drawing: pushed to an extreme, we might have to argue that we see a different drawing. So the image at which we look is ambiguous: it can be seen in different ways and this difference allows us to gain new ideas: "I had no idea that was there", as we say. We are surprised. Often we are delighted. Sometimes the whole direction of our work, the universe of ideas in which we deal, changes. Architects, as much as artists, are heard talking about this way of designing, of the appearance of new ideas in their drawings [14]. From this, it follows that we should look to ways of working that allow such ambiguity to enter in, at least at early stages of designing (the stages often called the "ideas", or "sketch" stages). That we should encourage and actively search out methods that increase the opportunity for us to re-consider what we have done, to see it so that it may "tell" us new things. This involves either us changing how we see things, or constructing things so that they are inherently ambiguous [15]. The more we can construct this ambiguity into what we do and the assorted media in which we do it, the better for us and for our creativity (at the most basic of levels). The variety of ideas (of interpretations) increases [16]. There are two consequent questions that might be asked of media following this assertion. Which media have this quality in abundance? And which media might have this quality increased in them? Although it would be a major undertaking to answer these questions authoritatively, an indication of how progress might be made will be found in the next section.

- The second is through the elicitation of the ideas of others in response to our own. Whereas the first way can be characterized as the holding of a

conversation [17] with oneself through the medium in question, the second involves a more conventional conversation, held with another via whichever medium. It may be that the best example is the design studio - either that to be found in most architecture schools or in the majority of offices. Here, the participants in the studio go round looking at and commenting on the work of others (perhaps by drawing), often under the direction of a tutor or job architect. The others contribute to a continuing conversation in which ideas are continuously developed. Thus, some idea of a particular participant is "commented on" by another, usually making a drawing that extends, modifies, adds a personal insight, or contradicts the original idea. And so on: it's a circular process. So that now there is a greater variety of ideas available to the originator. The fact that the other is not the one, the commentator not the originator is bound to lead to difference and thus the possibility of new insights if they are wanted. This gives us an explanation of the success of the traditional design studio and office. The importance is that they are social environments in which sharing and co-operation take place almost inevitably, thereby increasing the variety available to each designer who wishes to find this. It has been argued that the advent of the computer, with its central and crucial ability to make vastly many copies that are indistinguishable from the original, makes ownership in effect senseless (while raising the value of origination). When ownership is senseless, there is no reason not to share (i.e., to copy). Thus, it may be argued that, while users of computers currently feel alone, lonely and isolated, they should rather be sharing and thus potentially be far from lonely.

And the same two basic consequent questions arise: which media encourage sharing and co-operation (thus increasing variety), and how can the level of sharing encouraged in different media be increased? *A look at the next section and the table in the appendix may suggest to the reader some responses.* There is (at least) one other way in which we can hope to increase the number of ideas available to us, although we have, explicitly, absolutely no control over what these ideas may be: indeed, this is the whole point! This is the way referred to variously as serendipity, accident, bug, error, luck, chance, random, etc. The significance of chance and error in discovery and creativity cannot be overemphasized. There are so many examples - from painters to physicists - that they do not need to be enumerated.

But it is worth pointing out that, at the moment, chance and error are seen as remote from our world: we try to avoid them, and rarely see them as offering positive possibilities. Elsewhere, the value of the abuse of software (and of the underlying concepts that are associated with it) in computers, for instance, have been extolled. The use of something in a way that was not intended by its maker is part of the progress from tool to medium. The use of dis-

turbances and irregularities to induce the unexpected is only a mechanical way of, for instance, arranging and taking part in a conversation: for a conversation must be made up of the creation and re-creation of understandings of participants, who by their very difference must have different understandings and, therefore, introduce what might be thought of as error, variance, difference in interpretation that is (reciprocally) outside the control of each participant and therefore a matter of chance. The acceptance that there may be value in accident (instead of the current fashion of reducing it to causality by the introduction of blame is merely an extreme logical extension of the mechanism of sharing and exchange that makes the conversation so powerful and so creative.

Finally, it should be noted that the condition that we must meet, ourselves, for any of the above to have any chance of success, is that we must keep our minds open, and listen. If we do not, we will not notice that we are being offered anything, nor will we be able to see what this offering is. We will defend our own ideas without giving room for a fair evaluation of other ideas. In short, we will miss all the opportunities we have made for ourselves.

How we may find media qualities

The question no longer concerns whether media can enhance creativity: the previous section has contained demonstrations both that they can, and how (ambiguity, co-operative sharing and chance/error: all tied in with the form of the conversation). The question is how we can discover the qualities of media so that we may enrich our connections with those that are sympathetic to enhancing our creativity. It is interesting to consider, here, the case of the invention of printing. This may be done not through a historian's history, but, nevertheless, through a rough history.

It is clear that Gutenberg [18] invented his process with some reason in mind, and that that reason was to reproduce texts faster. By so doing, the labour of the individual scriptings would be saved. The longer original process of what we came to refer to as composing the type into the page (involving making the type, in the first instance) would lead to a much shorter follow up in production as inked impressions of the many words making up each page were made in one relatively short (if complex) action: inking, pressing the paper on to the inked type, and removing the paper to dry: what we refer to as making an impression. Gutenberg must have known that his process would lead to the making of many copies in a relatively short time, once the (long) time had been spent composing the page. This is to say, he knew what he was doing: he understood that his invention was the speeding up of the process of copying, which would create certain changes. These changes were mainly that

more copies would be available. He probably also realized that the art of the scribe, the illustrating of the illustrated manuscripts, would decline. Here, we see what is involved through a simple process of internalized examination or analysis. That is, we can look at what the process is, and see what its qualities are: speeding up the process of copying, thus making multiple copies; and the reduction of the role of the scribe. If we then look at what happened as many people began to make use of the invention, we discover other qualities. Returning again to Gutenberg, we find:

> The development of different type faces, giving different qualities to the appearance of the printed page as a whole (and to its legibility), that is, the founding of typography, as well as the use of the printing medium in the creation of (non-typographic) images - graphic design and illustration (in its new incarnation). These are the results of many people using the new medium.

This is an analysis based on observed behaviors, and on the social. But there is a third type of development, and that depends on time and is far less predictable, even in hindsight. In the case of printing there were at least two effects that can be seen as qualities of the medium:

- the increase of literacy until it has become a universal basis for the operation of (western) society; for it is easier to learn to read when each letter is more or less the same shape as every other exemplar of it (as we see in how children learn to form letters in kindergarten), when the shape of the letters is specifically designed to be easily recognized and read (thus, the use of serif rather than sans-serif fonts for body text, the development of computer readable fonts for magnetic ink and, recently, for Personal Digital Assistants such as Graffiti for the Newton), and when copies are not fantastically rare, and
- the publification of the ownership of knowledge. This has been of even greater significance than the growth of literacy. The development of the effect of printing from the more efficient making of copies to the liberation of knowledge from the private imperialism of the Catholic Church (the monastic keeping and controlling of all written knowledge) to the libraries of the wealthy and thence to public libraries and, through the paperback, to every home - until the thoughts of even the most recondite are available to all, and the worth of our academics is measured in their ability to persuade their peers to publish their words - is a development that is quite unpredictable no matter how much analytic thought is put into considering the qualities of the medium of printing.

These developments are beyond the behavioral. They are the side-effects of behaviors, and socially they may be the most important qualities of all. But they are not anticipatable, nor can they be found by intelligent introspection.

They need time and independence [19]. And they are also the developments that finally and completely confirm, if such confirmation is needed, that we have a medium rather than just a tool: for in these developments is the confirmation that printing, for example, has a life of its own [20]. From these reflections on how it is possible to develop understandings of printing, we may generalize a form of analysis for (new) media that may will reveal their qualities to us. There are three aspects:

- the analysis of the medium as a phenomenon by simply applying our analytic abilities through reflection (a.).
- the observation of many users, and of how they use the medium (b.).
- waiting a long time, to see the unpredictable qualities that seem to emerge quite unexpectedly (c).

It is possible to combine a) and b) to some extent by asking many to analyse the medium through reflection.

Notes and References

[1] Of course, there are beginning to be computational ways of modeling for our other senses. In particular, it is possible now to create the acoustic of a space, and to hear it as different sounds are made and as we walk through it. Texture (hence touch) is also being synthesized, while smell has been electronically analysable with great accuracy for several years.

[2] There is a problem with wording this concept. It is not clear where ideas come from. Some maintain we make them, others that they emerge (surely a postrationalization), others that they flock to us. My view is that there is a universe in which ideas and concepts live, with which we can have connection. They thus come to us when we allow the gateway between to open, which we do best by not being too wilful or egocentric! The best ideas happen through some sort of “lost” activity in which we, as individuals, vanish: for instance doodling on the back of an envelope.

[3] This is not to dismiss much excellent work, but to indicate a difference in concept and emphasis.

[4] In the extreme, I will argue that they are meaningless: by extension, the greatest art is that with the least “meaning”. Of course, this point depends on how we understand the concept of meaning, and, more particularly, where we believe it to lie. That is outside the scope of this paper, although I follow de Saussure (*Course in General Linguistics* New York: McGraw Hill, 1966.) in asserting that no words (or equivalents) have meaning: meaning is not in the object, nor in the representation: it lies in the (active) observer.

[5] But note that, if there is ambiguity, we don't know what is being re-interpreted. Terrible problems develop here with terminology, but which are, at this stage contained in the development of the argument, and in order to remain attached to a framework of familiar concepts and means of expression, currently inevitable.

[6] We may care to contemplate that design is also the basic psychological act: that is, we design how we see the world (through, for instance, Piaget's accommodation and assimilation). So we make pictures of the world by finding ways of composing together understandings and perceptions/cognitions, which we constantly modify. This explains why it is so hard to change old habits (See Pask, G. *Conversation Theory*. London: Hutchinson, 1975).

[7] It is *not* being claimed that this is the only way towards (greater) creativity.

[8] The computer artist Paul Barker (See "Hype, Hope and Cyberspace - or - Paradigms Lost", in: Maver, T. and Petric, J. *The Virtual Studio* [Proceedings of eCAADe], Glasgow: University of Strathclyde, 1994.) has made a strongly related point: by presenting the computer through the metaphor of the desktop etc that form the content of the GUI, we may entirely miss the possibilities on offer: we restrict it to the familiar, whereas the computer is, in actual fact, far from familiar.

[9] We are all, therefore, creative. This is view of Friedrich Fröbel, who held that we are all creative, but that social pressures eased this quality in us.

[10] Ashby, R. *Introduction to Cybernetics*. London: Chapman, 1956.

[11] But please do not take this too literally. I would not want to claim the brain had a finite or even a measurable number of states: only that this is a way of indicating the sort of effect we might hope for, and that it might work. This, then, is to be taken as a metaphor (See also Irtem, A. "Happiness, amplified Cybernetically", in: Reichardt, J. (ed.). *Cybernetics, Art and Ideas*. London: Studio Vista, 1971).

[12] It goes without saying that it is equally important to throw ideas away. This paper does not try to address this, or similar, concerns, but it certainly recognizes them. Nor does *may* imply *will*: just that there is a better, wider, richer basis from which to come.

[13] The equation of ambiguity and meaninglessness is an extreme. The argument has to do with where meaning resides. As indicated, I am in the camp of de Saussure: meaning is with each of us. Things are meaningless, that is why there is always ambiguity: we apply meaning as we find fit, and no two of these meanings are the same.

[14] The story is told of Kandinsky and the discovery of abstract art. It is said he was in his studio at the Bauhaus, and saw a fascinating image a long

way away at the other end of the studio. Looking, he saw it was a very interesting and beautiful composition. Wondering who had painted it and what it was he walked to the picture and discovered it was one of his that had been placed upside down. Thus he discovered that it was possible to make images and compositions of beauty without them having to be "about" anything at all.

[15] There is a very important philosophical question as to whether there is any significant difference between the two alternatives of us seeing differently and things telling us differently, and, if so, at what level this difference may be taken to exist. My view is that they should not really be differentiated: but to argue this is beyond the scope of this paper and perhaps even of this field.

[16] Although this is not what happens at the moment with computers, the author has argued (See Glanville, R. "CAD Abusing Computing", in: *Proceedings eCAADe 1992*, Barcelona: Polytechnic University of Catalonia, 1992.) that it is possible to use computers in a manner that emphasizes qualities and performance similar to that of back of envelope doodling. It is my position that this is the interesting thing to do with computers in designing, and that we may, thus, learn to treat them as partners rather than slaves, getting much more out of them and thus increasing our creativity.

[17] The term conversation, as used here, is intended in much the sense of normal usage. It can, however, be formalized, as was done by Pask in his evolution of *Conversation Theory* as a formal theory with its own technical language. The formalization makes various extensions and limitations that may make it easier to accept that there might be less intuitive conversations, for instance non-verbal conversations, which can be equally meaningful and productive to the participants.

[18] Of course, there are prior claimants, including the Chinese. However, in our western account, we usually give Gutenberg's work as the starting point.

[19] The need for time would lead to the consideration of how to speed time up so that we can understand these developments much sooner after we discover new media. This is a fascinating topic but is beyond the scope of this paper.

[20] A tool becomes a medium as it is used for things that were not its original intention. As printing spawns its own disciplines such as typography and graphic design, we already know it has gone way beyond the bounds originally intended for it, and must be considered as a medium. When a tool becomes a medium, it gains immeasurably in potency and in its ability to help form our thinking - and thus to take a role as a partner in enhancing our creativity.

European Architectural Endoscopy Association (EAEA)

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1. Founded: 1993

2. What is the Goal of the Endoscopy Association:
To argue for the significance of endoscopy as a unique medium for the exploration and representation of architecture and space. It is a platform for experimentation, research, communication development, user participation and teaching by means of endoscopy and environmental simulation.

3. Field of activity:
Visualization and Application in Architecture and Town-Planning: built environments, road-design, housing areas, urban spaces, interior spaces etc. Implementation of Endoscopy in Design-work. Research on environmental simulation and experience of environment in motion. Observation of technical developments.

4. Aims of the association:
• to promote activities in the field of endoscopy and environmental simulation
• to promote communication and the exchange of experiences
• to promote collaboration in common projects
• to promote the development of the range of applications

5. Official language: English

6. EAEA-Secretariat:
Each member (in turn) for a period of two years (the year before and following a Conference).

7. Newsletter:
Will report the activities carried out by the members, papers about endoscopy and environmental simulation, news about current plans and projects, technical information and reference sources.

8. Conference: To be held every two years.

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