Perceiving, Orientating and Moving in Urban Spaces during Night-time

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1. Light is a mean of environmental design

Light is one of our essences of living and at the same time it is one of the mediums to perceive our environment, to orientate and to move even in unknown spaces. Above all other senses our guiding sense is the sense of seeing - during daytime. But how do we orientate and move when daylight has gone and when street lights and shop-windows light urban spaces instead of the sun?

In that case the position and the cone of light determines how far the space ahead is visible to us. Does the sense of seeing intensify its guiding function for moving or will one of the other senses step forward when the range of sight becomes smaller?

Gaps, questions and aims of research

We declare that there are no methods of research and not even hints to research in perceiving, orientating and moving during night times. As basics for the planning of cities during night time methods are used - especially in recent master plans of some towns- , which have been designed to analyse urban spaces in daytime, like Kevin Lynch did in 1960.

The necessity to scrutinize perception of urban spaces during night time results out of two reasons:
On the one hand in recent works on psychology of perception it is noticed, that the sense of “seeing” as one of the senses has a special and important position in the system of senses. Whether sight is guiding in all situations is still in research (Guski, 2000, p. 176). For our question it is important, that this guiding function depends on the intensity, on the kind of light and even on the special arrangement of light. In the dawn when the rest of light does not do, hearing, smelling and the other senses will become more and more important. It has to be added that there is no known physiology of the look during night time. On this question Guski points out that there is no physiology and no psychology of sight under light conditions in the night.

On the other hand it is conspicuous that dimension and atmosphere are given to urban spaces by artificial light. The shape of space is produced by the physical structure of the surfaces, the edges, the section of the sky i.e.
in reaction to the lighting. Compared to the situation in daylight, artificial light can define the shape and work out the designed qualities of the space much more clearly: Artificial light is able to underline the profiles and the structures of space, to reduce the visible space or even to let it sink into darkness. It is also able to light away the blanks in the outline of a square or to set off well a singular building.

Hitherto the current Master planning of city lighting is not yet equipped with basic knowledge and planners try to find out a set of acceptable methods in planning. Therefore the planning system of lighted urban spaces is only remodelling the conditions in daylight.

Altogether we remark that we are just at the beginning of our research. Before we can show well checkable results we will define our aims very roughly, pose first questions and formulate first hypotheses.

The aims

Our aim is to find out how we manage to orientate and to move in urban spaces under the conditions of artificial light and to find out which are the criteria of lighting, built environment and their relations to each other - influencing our perception:

- In which way do lighting and built environment operate together and which position gets light in this corresponding system? Are we phototrop beings like Christopher Alexander (1995, p. 698) presumes? In moving do we follow first brightness and do we avoid darker spaces? Does the run of artificial light influence the individual moving in another way than the shape of the same space?

- Is the shape of the town in day-time clearly or even totally distinct of its shape in night-time and what does artificial lighting contribute to its appearance?

- In which way can we imagine the image of a city form in night-time?
Finally we decide to make first conceptional steps, to find out how artificial light is efficient as a medium of designing urban spaces. We know that these steps are not ensured by the results of research thus far.

2. The impact of artificial lighting on perception, on orientation-strategies and on movement, simulation by endoscopy.

**Starting point and carrying-out the experiment**

We try to find out the different impacts of buildings and artificial lighting by simulating a walk through an enlightened mock-up of a town (scale 1: 250).

**Constructing the mock-up**

We refer to the first experiment of simulating light in a mock-up by Pfeilsticker during the first eaea- conference 1993 (Aura, 1993, p.117f). He wanted to achieve best results in simulating lighted urban situations as exact as possible by placing lamps which are normally used to enlight railway mock-ups and by using also the optical fibre. He used the scale of 1: 100 and 1:200, which is habitual to endoscopy. Nowadays there are several working laboratories in Europe testing the products of lighting in real scale and programmes to test the best layout by computer simulation in all scales which might be useful.

In contrast to this, our aim is not to simulate reality perfectly but to test how we perceive and orientate and what our general strategies in orientating and moving are. Therefore we construct a mock-up, which is not overcharged with perfect details even of the furniture in street for example. We try to construct a mock-up in reducing the details of urban space and even lighting. We only wanted to evoke the situation in a street or place in a very concentrated way. We construct a reduced but not simplified mock-up which we improve after the first series of experiments.

The buildings are constructed as cubes, simple and without facades, the moving zones do not differ in pavement and roadway. The mock-up shows all elements of the basic structure in a town during daytime, Kevin Lynch
demands for, except landmarks (Lynch 1965, p. 60f.). It shows a system of urban spaces in a hierarchy of three levels, the edge of town over to the landscape, the residential quarters and the points to concentrate urban identity are the places in the quarters and especially the central place.

To transform the day-light into a mock-up to test the conditions in nighttime the lighting is constructed in three distinct levels as follows:

a - small place in the residential area: small spotlight,
b - space of the streets: the system of the main streets is equipped with a line of light giving a kind of direction.
   It is designed with a drop of brightness in the direction to the edge of town. The light does not guide to the centre in a direct way in “key points” the testing persons have to decide where to go next.
c - central place: lighted surface in a higher brightness than the other urban elements

Figure 2: Mock-up 1 shows a hierarchy of three levels in lighting
The experiment

The task: “You want to meet your friend in her/ his town for the first time. You don’t know the town. In five minutes you want to meet her/ him in the centre. Start and please hurry up!”

In every case this request is directed to a group of four persons. They have to find out what the centre is and where it is. The denominated guiding person tries to reach the centre in following the image on the monitor. A second person tries to make a sketch of the way of searching the aim and the third and fourth watch the searching process and may give advice to find the right way. The searching process is recorded in images given by the endoscope and is also recorded on a tape concerning the discussions on the decisions of orientating. At last we have to point out a methodical restriction by endoscopy while moving in a mock-up of the unknown city”: the piloting should be more direct.

Carrying out the experiment:
First step: In an opening question the representation of “centre of town” is to be described by everyone. How often and in which way brightness is designated?

Second step: The orientation and the moving lines of the testing persons while searching the centre in the unknown town are watched and have to be noted. The only and guiding image is the image produced by the endoscope and shown on the monitor.

Third step: During and after the way of searching we try to find out the searching strategies, the criteria in searching, the idea of the city form - the mental map - by starting to discuss the selected searching line.

Fourth step: After the experiment the persons had to compare the image of the centre of town in night-time they defined with the centre in their own living area. They had to report their experience by an illustration of their own choice.
First results

The searching passages yield the first hints to orientate researching:

1. The orientation of the single movement in the lighted spaces and the resulting strategies of searching follow the installed forms of light. Normally movement is following the brightness of lighting. Light is the more important medium compared to the built environment to conduct the movement.

2. The strategies of searching follow more or less the intensity of light in the given hierarchy to reach the place in the centre of town. All groups, except one, avoid zones of low intensity of light or darkness. This group only composed of women did test darkness in telling that they are curious (concerning this situation). In the other cases absence of light and darkness is understood as the sign of the border of town and of the outskirts. Therefore we introduced darkness or absence of light as the first criterion of four in the hierarchy of lighting in the model.

3. This ascending hierarchy of lighting within the same colour of light is defined as the normal condition of lighting situation in this town. When we give a different colour of light to the centre, as we do in model 1, it is immediately rated as the target - even when it has only low intensity.

4. On the contrary to the distinct guiding function of light the edges and the volumes of the buildings are attracting more the movement than the lighting that illuminates them. Edges and volumes are guiding or assisting to orientate in the second or third place. When in the searching line perceives only two of the three levels of hierarchy, the space which is the brighter one will be declared “centre”. The material shape of space is subordinated in most cases.

Only if the searching process is performed by a mental map of space, this map can bring lighting in the second position. One group out of twenty seven strictly practised this strategy.

These hints are confirmed in the passages of the second series. Keeping the space structure of the first mock-up we improve the second one in some points:
In contrast to the lighted surface of the “centre” in the first mock-up the second was illuminated by the facades, which were a light surface themselves. The light lines of the main streets now were placed on the upper edge of the cubes - lighting is coming from above.

The small spotlights in the small places were not visible directly anymore, now they light the place indirectly by lighting the facades.

Altogether we turned the direction of light from up-light to down-light, so that it is referable more to day-light conditions.

Figure 3: Mock-up 2, which is improved by transposing the lamps and by changing the layout of the central place. The hierarchy of spaces and lighting are kept like in mock-up 1
To conclude the simulation in a mock-up we want to mention some observations:

80% of 82 test persons in 22 groups designate “Light” as one of the criteria to characterize the centre of town. In the second set covering five groups who tested the improved mock-up the criterion “darkness” is added in the meaning of absence of light marking the outskirts of the town.

Light is an important medium to design urban spaces
We can determine that light is a strong medium for orientation and design in the production of urban spaces. It can be more effective to define a space during night-time than the materialistic elements that produce space. This quality may be worked out carefully by the intensity and colour of light in connection to the identity of the chosen space. In this context we have to observe that the time of using urban spaces is widely extended into night-times. This is caused for example by flexible times of working and of shopping.

The designed appearance of a town at night-time (Nachtgestalt) is very different compared to that in day-time (Taggestalt). The used methods of analysing the design of urban spaces do not yet mention the difference in the appearance or atmosphere during night-times. Our experiments point out the very strong effects of lighting for orientation and atmosphere. We ask, if the analysing methods of urban spaces have not to be completed by methods and instruments that analyse the design qualities of a town in night-time in connection to the using processes.

3. From Lab to Plan - the workshop “StadtAngstLoch”

The simulation in the lab gives sense to recognise lighting as a medium of urban design. In a workshop to improve a big subway which passes under the railway in the north of Dortmund some participants, who took part in our experiments could use their experiences in developing a design proposal. We made a workshop with the citizens office in the “Harbour Quarter” inviting the inhabitants to improve the dark junction between City and housing areas beyond the railways.
The general aims are to design the subways as a connection and to improve the usage and to make the passage endurable especially for pedestrians. The gloomy and noisy “Angstloch” (hole of fear) should be dismantled in its impression as a barrier and in the same time constructed as an element connecting the two separated quarters of the inner town.

The planning groups were not asked which medium of designing they want to introduce. But obviously these places require light in any form and so lighting is important in all proposals. The winning group took light as the most important medium in a new way: The northern edge of the hugh is changed into a connecting and passable rampart. The subway Schützenstrasse gets two entrances, one on the city side, the other on the northern square. Trees - artificially constructed and lit- continue the avenue from the north to the city. Thus two well defined and separate passage ways for pedestrians only, besides the cars way, were produced in the underpass - completed by “the gallery” - as a wall out of lights. At the same time the artificial trees mark the subway in the sky above the railway line.
4. Questions and next aims of research

In the literature on planning, urban design under the conditions of artificial lighting is not yet available as a guiding idea or as theme on methodical aspects. Not even when the atmosphere of town - one of the most important impacts of light - is on the agenda (f.e. Laage, 2000). Designing with light is also not yet mentioned when event is the matter (f.e. Bittner, 2001). On the other hand the number of national and international master plans “Light” in towns like Bremen, Düsseldorf, Frankfurt/M., Köln, Winterthur and Zürich is increasing fast. Other communities are planning them or are even preparing the framework. But they are planning without analysing their existing and very complex situations in lighting and mostly planning without referring to it. In most examples the system of urban spaces under daylight is switched on to that of artificial lighting during night-time. It is switched as if the basic structure after Kevin Lynch is not an instrument but only to be illustrated. Because the practice is changing very fast, the image of towns at night-times demands a methodical approach to hold together the town as a whole, or even to hold the identity in several areas or to the elements of town. A first step was made by Dennis Köhler in 2005. He analysed the lighting situations of urban spaces in a whole town to get basic information to design a concept.

We think we have shown artificial light as a very strong medium of designing spaces, in a different way than sun and the shadows normally do in daytime. We hope that we could show how important lighting yet is and how the spatial image and therefore the structural identity in night-times could be constructed. The dynamics of lighting towns are on their way simply because of the conserving energy and costs.

Altogether the question is posed, whether we dispose of sufficient knowledge on the methodical analysis of urban design under the conditions of artificial (and even natural!) lighting. In simulating and in analysing realities we notice differences in perception, orientation and movement in the town during night-times. On these subjects the locations, places of various target groups, on their perceptions and on their moving customs, on their localisation and forms of using places we know nearly nothing. These questions need immediately some chargeable results gained by research.
This situation demands the development of methods and analytic instruments to analyse, to gain more experience in conceiving, to analyse and to evaluate the results by well designed criteria. Thus could be the way to settle lighting design of towns as a good contribution to urban design.

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