

LIGHTING DESIGN RESEARCH IN PUBLIC SPACE: A HOLISTIC APPROACH TO A COMPLEX REALITY

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Abstract

For a period of five weeks, the park around Christinae church in the Swedish town Alingsås functioned as a full scale laboratory. This was a design research project examining how light distribution in a public space is experienced, with particular focus on light direction, light patterns and luminary height. User experience was collected through questionnaires, video recorded interviews and focus group discussions.

The informants agree about the effect of depth and broadness to a great extent when they compare the different illuminated façade fields on the church. In this spatial context street luminaries at a height of 4.5 metres contribute more to creating a pleasant, delimited and legible spatial experience that gives a feeling of safety than luminaries at a height of 6 metres. The informants judged illuminated trees to have higher impact of the feeling of being safe than traditional street- and park luminaries.

Keywords: Lighting design research, Spatial experience, User experience, Public space, Spatial complexity.

1 Introduction

Lighting designers frequently use test lighting as a working tool but seldom have the opportunity to test the effect of a complete lighting design proposal in a complex real public space. Furthermore, project evaluation is often neglected in the project budget. To summarise, there is not only a need for studies on the relation between the lighting designer's intentions and user experience but also for discussions on the designer's specialist knowledge and toolbox.

This research is inspired by and based on John Flynn's research on the preference of lit walls and how light can affect atmosphere experience (Flynn, 1973). It is also influenced by Sven Hesselgren's studies on the experience of light in an enclosed space (Hesselgren, 1969, 1975).

2 The Experimental set-up and methodological approach

This research project is conducted as a temporal light installation (from September 24 to October 31) in collaboration with '*Lights in Alingsås 2010*,' an annual light event and an international workshop arranged by PLDA (Professional Lighting Designers Association), and Alingsås City Council.

The lighting installation is designed by the researcher according to hypotheses from earlier studies (Wänström Lindh, 2006). This temporal installation consists of more than 90 luminaries that light several objects. The study setup, which is a conscious design choice, enables several parameters and questions at a time to embrace the complex public space holistically; a mixed methodological design that can even be called quasi-experimental is used (Groat, 2002). No real space can be seen as isolated from other phenomena such as connected spaces, connected functions and cultural context. Concerning visual appearance in real environments the methods used in this study are linked to a colour research tradition (Fridell Anter, Billger, 2010); (Fridell Anter, 2000); (Billger, 1999); (Hårleman, 2007); (Hårleman, Werner, Billger, 2007).

The street lighting has varying height. The research question not only addresses the relations between luminary height and how spatial size, shape and delimitation are experienced but also the consequences this has for our experience of a safe atmosphere. The LED light facilitates the use of light control. Every fifth minute, the luminary height shifts between a level of 6 metres and a level of 4.5 metres.



Figure 1. Street light at 6 metres height.



Figure 2. Street light at 4.5 metres height.

The Christinae church is primarily illuminated as a back wall in the public space. The lighting changes every third minute between five, three and two lit facade fields, in order to study how they relate in size and mutual distance affects how width, depth and coherence of the public space are experienced.



Figure 3. Five lit fields.



Figure 4. Three lit fields.



Figure 5. Two lit fields.

The white pilasters on the town hall are periodically illuminated from beneath, the light changes at an interval of 15 minutes in order to study how light directed upwards reinforces how the height and size of the building is visually perceived.



Figure 6. Façade and tree trunks with uplight.



Figure 7. Façade and trees without uplight

The tree trunks surrounding the park are illuminated, every 15 minutes, with the aim of studying spatial delimitation.



Figure 8. Tree trunks and benches.



Figure 9. Path with light directed inwards.

The path is illuminated with low bollards. Their light is directed either in an outward direction from the path or on its gravel surface, in order to see if this has any effect on the experience of feeling safe.

For a **holistic spatial approach**, the laboratory lighting is supplemented by light that emphasises interesting and characteristic details in this space, like the old red electrical cabinet. In the park, two prominent graves are made visible. The magnificent trees that give the park its identity are illuminated as volumes exposing a ceiling of leaves. Benches have also been illuminated by placing a light underneath them.

3 Empirical collection

During the five weeks this temporal installation took place, 222 questionnaires were collected. The eleven questions on each questionnaire were formulated so as to focus on one object at the time. The answers, cannot be completely isolated from other nearby parameters; therefore as a complement, a qualitative approach has been chosen, where video recorded interviews, about how and why the informants have answered in a certain way are used as a means to support the analysis (Kvale, 1996). The questionnaire has been constructed in a way that it can be answered quickly on the spot by people passing by.

Just as important as the questionnaire results are the 27 interviews with 39 interviewees that were carried through and video recorded on site, a film material of 4 hours. These interviews were rather loosely structured with questions about people's spontaneous impression about the lit park and the spatial atmosphere. The purpose was to complement the questionnaire and to receive insight in how people had answered the questionnaire and understand the concepts. The amount of answering architects/designers showed to be relatively high (33 %) and the distribution of answering male/female tend to be rather equal (54 % women). Furthermore, discussions with three focus groups consisted of architect students and light- and colour researchers were included in the empiric collection.

The empirical collection was also complemented by participatory observation made by the researcher.

4 A reflective interpreting analysis

To develop the qualitative analysis of the interviews further, a reflexive approach was used (Alvesson, Sköldberg, 2009). Reflective interpretation is a method combining several theoretical and methodological schools in order to make a view of the material from many aspects available. This approach consists hereby of an analysis of the interviews through eight metaphors comprising social scene and dynamics, identity work, impression management, application of cultural script, political interest and other motives for talk, language construction work and powers of discourse (Alvesson, 2011). In this case the interpretation includes phenomenology, hermeneutics, poststructuralist and critical theory aspects.

By combining this qualitative approach with a quantitative empiric collection through the statistic gained from the questionnaire with a high number of answering persons, a clear and broad overview is received that should decrease the number of misinterpretations depending on whether the informants have misunderstood the questions. This gives a good picture of how representative the interviewees are in

relation to the questionnaire informants.

5 Results

5.1 Light topography - The street light scale

The initial hypothesis that the luminary height affects the experienced size of the public space was confirmed by the informants. 69 % (154 persons out of 222) answered that luminaries at a 6 metres height made the space higher, while 9 % answered lower. By considering that the high placement can have the effect that the buildings in relation to that tend to look lower makes the minority answer more understandable. 19 % of the informants either did not answer the question or answered “no difference”. Similarly, the experienced space followed the luminary height so that it was mainly considered as lower, by 50 % (111 persons), when the luminary height changed to 4.5 metres. However, there were more informants that answered contrastingly to the lower luminary position, 27 % of them said the room looked larger. The results regarding the question of the relation between luminary height and the perception of spatial height were clearer than the question about luminary position and spatial size. This difference could be explained as a consequence that it is easier for the informants to understand what was meant by spatial height than by spatial size. The question of depth of the park space may also have been difficult to understand for the informants. The judgments about depth are quite equally distributed, yet with a slight overweight for the opinion that a higher luminary position of 6 metres makes the whole space feeling deeper. (People may have selected more than one checkbox, so the percentages may add up to more than 100 %).

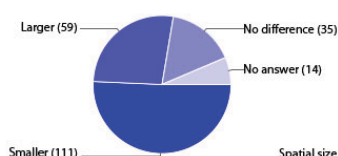


Figure 10. Estimation of the size of the whole public space with street luminaries at 4m height compared to 6m, smaller, larger or no difference.

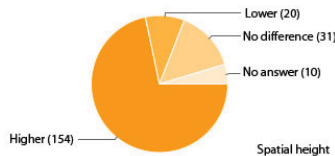


Figure 11. Estimation of the height of the whole public space with street luminaries at 6m height compared to 4m, higher, lower or no difference.

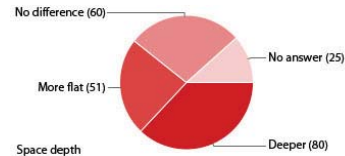


Figure 12. Estimation of the depth of the whole public space with street luminaries at 6m height compared to 4m, deeper, more flat or no difference.

Interestingly, most people (62 %, 138 persons) says that a luminary height of 4 metres contribute more to the feeling of being safe than luminaries at 6 metres. This tendency was also clear among the interview answers.

A 70 year old, male, local politician (M) is interviewed by the researcher (I):

M: If I should choose one type of street lighting, I would choose the low height. It gives a more secure impression.

I: Yes, in what way do you mean secure?

M: It comes closer to us that walk on the street level. Then one can receive a feeling that is somewhat more secure than by a general lighting. This is a lighting design that touches us that are here. In that case, that it is illuminating the walls more than the higher one, it also feels a little safer."

There might be a relation between spatial delimitation and the experience of feeling safe in the street space. The answers about which luminary height that make the space most delimited have the same distribution like the question of the experience of feeling safe. 61 % (135 persons) find that a luminary height at 4 metres reinforces the spatial limitations most. 24 % answered 6 metres height and 9 % said it was no difference.

The scale of light needs to be seen in relation to the local context, Alingsås is a small scaled, picturesque historic wooden town. The building height is two to three floors (6 m - 8 m), which is rather low for a town. But the result should probably be comparable for another (Swedish) similar streetscape around a park of similar size, also with light pastel coloured facades, of comparable height, street width (7,5 m - 9,5 m) and distance between the luminary poles. A luminary height of six metres is probably more noticeable in Alingsås than in another town. Many Swedish towns have this height for this street category, a residence street. Four metres is commonly seen as very low and something that is mostly used in parks and on

squares. These streets that surround the park do not really seem to be included in the park space. The original luminary height on the streets surrounding the park varies irrationally between 4 m – 5,5 m.

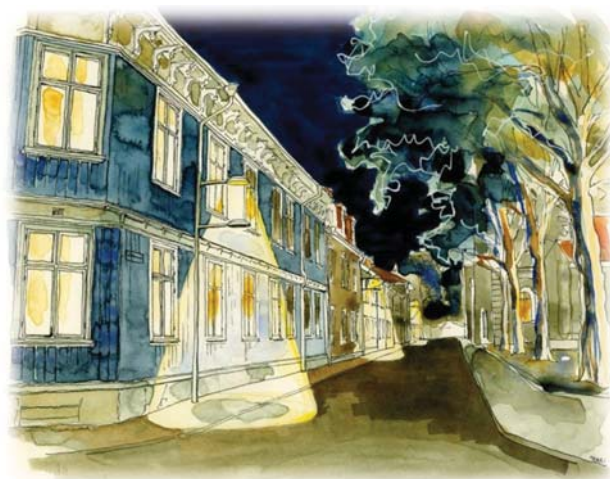


Figure 13. The experimental street lighting had two luminaries at the same lamp pole.



Figure 14. A plan sketch of the park.

A middle-aged male engineer explains why he experiences the lower light position as more positive than the higher:

"The ceiling becomes lower. It becomes cosier. That changes the spatial experience because if it was pitch-dark there had been no room here. When luminaries are lit it defines the dimensions of the space, one could say. That is similar to walking in to a hall with a high ceiling. That is not comfortable. You then feel vulnerable. The lower ceiling level, the more significance you self have, in this big volume. One becomes a larger percentage part of the whole space. The case is similar when you lower the ceiling, when you decrease the luminary height."

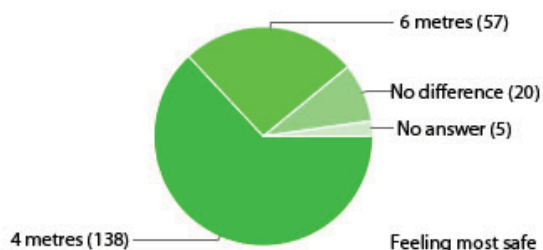


Figure 15. The luminary height that felt most safe, 4m., 6m. or no difference.

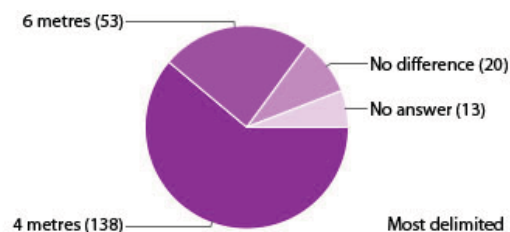


Figure 16. The luminary height that delimited the space most, 4m., 6m. or no difference.

5.2 The church facade seen as a back wall

5.2.1 Experience of distance, depth and width

Surprisingly, the changes of perceived shape of the church facade seemed to be the question that caught most interest from the informants and what they made their quickest decision about, even though it was one of the most difficult answers to predict in advance. A continuous lit façade was judged as larger and broader. With only the corners lit, it was still considered as rather broad, but not that large as with five lit fields. The façade with three lit fields, with a rhythmic play between lightness and shadow was seen as narrower and higher. 53 %, 118 persons of 222 informants estimated the church facade as most broad with five lit fields. Some people, 27 %, answered that they perceived the façade with two lit fields, only the corners, as most broad. Only a few people, 9 %, considered three fields, to be broadest.

A middle-age woman explains why she experienced that the building looks smaller with three lit fields

compared to two and five fields:

"Because of the field in the centre catches the gaze, the church wall and its length looks shorter. But when it was only two lights, one at each corner, you see a longer church façade."

Most people answered that the façade with two fields was perceived as deepest (49 %) and that the façade with five fields comes closer than the other scenarios (only 17 % estimated this as deep). 23 % estimated the scenario with three fields as deepest. The more evenly distributed results on this question can be related to the difficulty to properly understand the question. The question about which of these three scenarios that had most impact on the perception of spatial depth were easier to understand if the interview question was put in another way, to instead ask about which scenario the informant felt come closer respectively which one they felt as more distant. An important distinction is if the informants thought about the depth as a phenomenon about the whole space from their position to the façade, or if they sensed the surface itself as more flat or deep. Several interviewees judged the façade itself as more flat with five lit fields and deeper with three lit fields, i.e. when every second field is dark so a play between dark and shadow is constructed.

5.2.2 Spatial coherence

The spatial context as a whole was experienced as splintered when only the corners were lit, but seemed according to the interviewees work just as well with three lit fields as five lit fields.

Two designers, one of them a researcher, in front of the church:

"M: I liked the facade with three lit fields best.

W: I like five, when it is completely illuminated. It becomes very strange with just two light fields, at the corners. Then you break a shape."

5.2.3 A shape changing phenomenon

Several interview persons observed a phenomenon of the building shape when the church façade was lit with only two fields, just the corners. Those who detect this difference said the façade seemed to be bowed in a concave shape so that the darkest middle part seemed more distant than the bright corners.

A middle age man observes the church façade:

"M: Yes exactly, now it is just the corners that are lit.

I: Precisely, how do you experience that difference?

M: At one hand it becomes less bright, but I think it seem to feel as more distant. It is strikingly darker.

I: Yes, yesterday I met an interviewee here that said something happened with the shape itself, that some of these illuminated fields...

M: Accordingly, I think it feels a little convex towards me. Just as if the middle part comes towards me while the others make a bow."

There were other interviewees that also experienced a shape changing phenomenon at the church façade. However, this middle-age woman with her husband saw the bow shape as a concave shape instead:

"W: One almost experience that it is shaped a little in this way (she shows a concave half circle with her hands).

I: That it becomes vaulted in some way?

W: Yes, precisely.

I: In which way then, there are more persons that have said this?

W: Well, that the sides comes closer, and that it goes like this.

I: So it is more far away in the centre?

W: Yes, precisely.

M: But it is not strange that you experience it in this way since it is dark in the middle, it can be anything."

5.3 A façade lit from beneath

Light directed from beneath may contribute to an emphasised power impression. The façade is then seen from a worm's-eye view there one has to look up; the building is stretched up, prolonged and reinforced. The pilasters illuminated from beneath would probably have given another impression at a larger stone building than at this cute pink wooden house. This illumination gives the City council building a more official touch. Columns are traditionally rich of symbols and metaphors, like to support the building, carry a weight, show status and richness and connect to a tradition of an official style with

antique roots. Actually, these half columns are the only visible architectonic element of this building that shows its official function.

According to the initial hypothesis, the upright on the City council building's pilasters made the building to be regarded as higher. This can of course be related to both the light direction and the fact that it was thin vertical elements that were emphasized. However, some informants judge the building with upright as lower, a fact that can be seen in relation to if they felt the lit pilasters stood out from the background, the building. Then the building might be regarded as smaller in comparing to the pilasters that tend to look higher. 66 % of the informants judged the building with added upright as higher while 15 % judged it as lower.

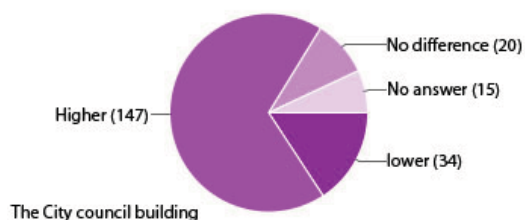


Figure 17. The building with upright becomes: higher, lower or no difference.

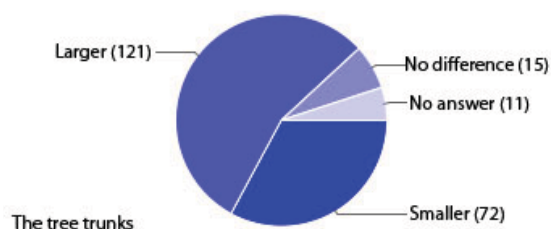


Figure 18. The park with lit tree trunks becomes: larger, smaller or no difference.

5.4 Illuminated trees and the effect of spatial size and distance

That the tree trunks surrounding the park were illuminated had obviously a remarkable effect on the perception of spatial size. Most people, 55 %, experienced that the space becomes larger while 32 % of them contrastingly said the room size diminished. Only few did not leave an answer or answered that it was no difference. In order to understand this result it is important to listen to how the informants approached the issue.

A married couple in their 70s:

M: It was gloomy and dead before the trees were lit.

I: Do you experience any difference in room size now?

W: Yes, the light makes it larger.

M: I think quite the reverse. Yes, but before, these trees there were far away. Now it is, now you see.

W: Yes, but then there is a wall that one do not really now the limitations of. Here you can see the limitation.

M: Well, I think it encloses and comes closer, now when it is lit up. Yes, that is what I think.

W: I sense this form of the park much more when it is light all around, and I think that the distance have increased while we moved ourselves a bit, when you watch the tree trunks. Additionally, this red electricity cabinet glows like a spot over there and I think it also draws the attention there”.

This quotation above captures most of the issue from two angles. The man says the space becomes smaller while the woman says it becomes larger. Yet, they have the same point of departure for their statements. Both address the rooms more legible delimitation as an argument. The conclusion is that the tree trunks, illuminated from below, at one hand decrease the space according to the distinct delimitation, so one sees where the space ends. On the other hand, the fact that the spatial limits are defined can also be experienced as an enlarging effect, which most people answered.

From the participatory observation made by the researcher during several evenings, this size phenomenon developed into a new insight. From the researcher's point of view the illuminated tree trunks increased the space in most situations. However, when one self were positioned close nearby a couple of the trees, these lit trees tend to come further. So the distance from the observer to the lit object may have relevance. That the trees mostly were considered given a larger space is a contradictory to the general hypothesis that light comes closer while darkness remote. Still the hypothesis is confirmed by the closest trees. That the tree trunks by most of the informants were perceived as enlarging the space does not mean that the effect was very large, i.e. that the room size become much larger.

5.5 The direction of light on the pathway according to the feeling of being safe

The same pathway was lit with in-directed light at one part and out-directed light on another part. The

initial hypothesis was that it is more important to light the dark surroundings there someone can hide than to expose the pathway and the pedestrian self. However, there were more people, 53 %, that judged the illumination inwards as contributing more to the feeling of being safe than those who choose the out-directed illumination as safe (37 %).

A 60 year old married couple shows both standpoints:

W: Well, I thought that when it was shining inwards, it felt delimited and safe. You walked on the path that felt like a space by itself, in a sort of way. So you did not have to bother about that there was something outside.

I: And you had another opinion?

M: Yes, because when it is shining out from me, I walk in the unlit part and feel safer; otherwise it is like having spotlights exposing me. I wish rather to see the surrounding and prefer therefore that the light is directed out from me. It is like I had been walking around with a torch; it is not that I am walking around illuminating myself. I send light away from me in order to see the surrounding. It gives me, if we are talking about feeling safe, it feels considerable safer."

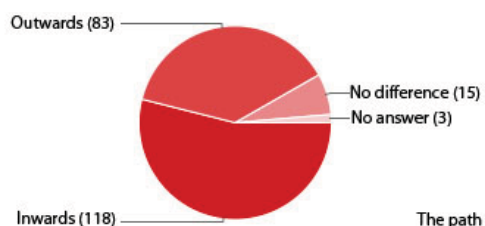


Figure 19. The light direction at the path that was judged as most contribution to the feeling of being safe.

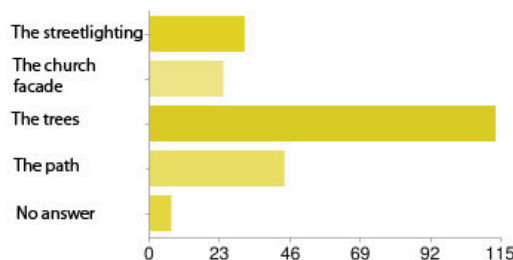


Figure 20. The object that ontributed most to the feeling of being safe.

It is important for the results if the informants have considered this issue from a general or a local point of view. The path light shows that the generalization of this question is delimited. In this case the hypothesis, with light outwards as safer, was not strong enough since the luminary position was so low, 20 cm over ground and that the park lacked bushes. The hypothesis will probably be more relevant in another context, with higher luminaries and more dark vegetation. However, this way of illuminate will probably need some kind of general lighting on the pathway itself, for example as indirect reflecting foliage. In the end of the experimental period, the leaves reflection quality had diminished according to the autumn season. The informants' preference for a beautiful light may also have interfered with their judgment of safeness. The light that was directed inwards fell with a low angle at the gravel and emphasized its texture that can be regarded as more beautiful than the texture of the grass, illuminated from the outwards directed low wattage halogen spotlights. Since path lighting traditionally often lights up the path itself and not the surrounding, it might be harder to appreciate something you are not used to.

5.6 Spatial coherence and the feeling of being safe

By creating a legible space through utilizing vertical elements such as surrounding facades, tree trunks and bushes, this have effect of the experience of feeling safe as well as to facilitate spatial orientation and comfort. The distinct spatial enclosedness of this lit park, with an outer shield of wall oriented streetlights, an inner semi-open space demarked by lit tree trunks and the emphasized ceiling of leave crowns were highly appreciated by the informants.

A female municipal architect in Alingsås states that this temporal illumination makes a big difference for the park especially regarding spatiality and she explains what she means with the concept of spatial enclosedness:

W: Well, I have the focus on the ground, with this illumination on the grass and the pathway, so we have the ground. And then we get the walls up, especially by the tree trunks, but also through the original street luminary poles that are so closed related to the surrounding facades, the light falls also on them, which make the spatial walls legible. Now when the City council building also is illuminated or stronger illuminated, it constitute a more distinct wall. Yes, very much focus here, also together with the ceiling of tree crowns."

Many interviewees talked about the larger volume they experienced in the park, but also about that the park had received a ceiling of leaves. A 60 years old male engineer:

"M: It feels like the crowns constitute a ceiling in some way; or the tree crowns contribute to an experience of being partly indoors, you get an indoor feeling. It is obvious that you feel taken care of since it is a ceiling. You are protected in a way."

There were clear consensus on the atmosphere of the park being holistically created so as to be experienced as a calm, peaceful, relaxing, inviting, warm and safe place. During the interviews, the informants have explained that their judgements are based on their experience of the spaciousness created by the illuminated trees in combination with the mixed colour temperatures and the low scale light on the paths and underneath the benches.

The informants were finally asked which one of the following objects that contributed most to the feeling of being safe: the street lighting, the path lighting, the church facade or the tree illumination. Most informants, 51 %, claimed that the trees contributed most to the feeling of being safe. The trees were followed by the path which 20 % answered. The street lighting, 14 % and the church facade, 11 %, received fewer votes. However, the informants may have made their judgements from the centre of the park where the street is in the periphery.

6 Conclusion and discussion

When it comes to experience of light and space, most is relatively, contextual and contrast dependent. Still it is possible to draw conclusions that are possible to generalize to some extent, for example to say that light can invite or exclude people according to some circumstances, but there is no absolute truth. In a study like this in a complex real space it is very important to see the answers from different angles to understand the whole picture of why the informants answered as they did. To be able to generalize, researchers and readers must understand the contextual.

In the Alingsås-study there are several cases when light generally decreases distance, so brighter surfaces tend to come closer while darker parts are perceived as more distant. However, there are also examples of the opposite, that illuminated tree trunks enlarges the space, define the spatial limitations as walls and tree crowns its ceiling so it is perceived as larger and higher. Through the researcher's own phenomenological observations a hypothesis of a distance phenomenon was developed; that the distance from the observer position to the observed object was important. When standing close to illuminated trees the light made them seem to come closer, while the trees further away tend to look even more distant when they were illuminated. In this case the hypothesis was confirmed by the closest trees. The additional hypothesis then becomes that according to a certain distance between the observer and the object, the conditions change so the space instead are enlarged by the light.

It is important to notice that the informants have not been standing on the same spot and the position can affect the answers. Some of them have been moving around more so they could see the park and the light installation from every angle, which was suggested by the researcher. Most of them have entered the park in the same direction, through the pathway the light guiding tour took through the park.

Even though questions about preference were not asked, people often spoke about it. From this study it seems like people's preference, for example about the lit church facade, shifts quite a lot, much more than their judgment of depth and size perception. There were interviewees that prefer two, three or five lit fields, but there was no clear overweight for any of them. Possibly, there were less people that liked two lit fields since several interviewees said it splintered the spatial coherence. The preference of the church facade seemed to be related according to the informants' own relation to the church as an institution. People who do not appreciate a powerful church are less likely to prefer a continuous lit facade.

7 Implication of results

This study points out the importance of vertical lit surfaces for the experience of spatial coherence, legibility and spatial enclosedness. These spatial qualities can all be considered related to the concept of architectural beauty.

Important to the awareness of spatial creation, the placements of luminaries do have a great effect on spatial enclosedness and spatial atmosphere.

It is far from granted that lighting planners in general consider the effect of the experience of spatial

height and size according to the luminary position. Often higher luminary positions than necessary are chosen as a way to decrease costs, since they then can increase the distance between the luminaries and following use fewer luminaries. It is then especially important to know the consequences by this for the spatial enclosedness, a distinct space and for the feeling of being safe.

The result of this study leads to a suggestion that we should more often consider illuminating trees as a way to increase the experience of feeling safe; this might have a larger effect than to add more luminaries at pathways and streets.

References

- ALVESSON, M., SKÖLDBERG, K. 2009. *Reflective Methodology: New Vistas for Qualitative Research*. London: Sage Publication Ltd.
- ALVESSON, M. 2011. *Interpreting Interviews*. London: Sage Publication Ltd.
- BILLGER, M. 1999. *Colour in Enclosed Space Observation of Colour Phenomena and Development of Methods for Identification of Colour Appearance in Rooms*. Gothenburg, Sweden: Chalmers University of Technology.
- FLYNN, JE., SPENCER, T.J., MARTINIUK, O., HENDRICK, C. 1973. Interim Study of Procedures for Investigating the Effect of Light on Impression and Behavior, *Journal of the Illuminating Engineering Society* (3) 87-94.
- FRIDELL ANTER, K., BILLGER, M. 2010. Colour Research with Architectural Relevance: How Can Different Approaches Gain from each Other? *Color Research and Application* **35 (2)** 145-152.
- FRIDELL ANTER, K. 2000. *What colour is the red house? Perceived colour of painted facades*. Stockholm, Sweden: KTH Architecture.
- GROAT, L., WANG, D. 2002. *Architectural Research Methods*. New York, USA: John Wiley & Sons, INC.
- HESELGREN, S. 1969. *The language of architecture*, Lund, Sweden: Studentlitteratur.
- HESELGREN, S. 1975. *Man's perception of man-made environment*, Part I, 365; part II, 281-282. Lund, Sweden: Studentlitteratur.
- HÄRLEMAN, M. 2007. Study of Colour Shifts in Various Daylights: Dominantly Reddish and Greenish Rooms Illuminated by Sunlight and Skylight. *Colour: Design & Creativity* 1(1):8, 1-15.
- HÄRLEMAN, M., WERNER, I.-B., BILLGER, M. 2007. Significance of Colour on Room Character: Study on Dominantly Reddish and Greenish Colours in North- and South-Facing Rooms. *Colour: Design & Creativity* 1(1):9, 1-15.
- KVALE, S. 1996. *Interviews: An Introduction to Qualitative Research Interviewing*. Thousand Oaks: Sage.
- WÄNSTRÖM, LINDH, U. 2006. Observations of Spatial Atmosphere in Relation to Light Distribution. *Proceedings from the 5th Conference on Design and Emotion 2006*, Department of Product and Production development, Division design, Chalmers University of Technology, Gothenburg, Sweden.

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