Responsive City Lighting: Perspectives From Architecture & the Public Lighting Industry

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Abstract

This paper presents and discusses perspectives extracted from two interviews conducted during the experiments Urban Responsive Lighting. The two experts embody two different fields related to city lighting: architecture & public lighting industry. The representatives were invited to the test-site, where 15 LED RGB Park lamps, controlled driven by a wind sensor, mobile phone applications or by thermal camera tracking. According to the specialists are the social and aesthetical dimensions more interesting than the energy use cases and efficiency. This motivates an interdisciplinary discussion on applied technologies and responsive light design in the contemporary cities.

Author Keywords

Responsive Lighting, Interview, Experiment, Energy, Social.

ACM Classification Keywords

Documentation, design, human factors, security, experiment.

Introduction

Within the last decade mobile and sensor technologies has become ubiquitous [6]. Technologies has been pushed into the build environment, within a wide range of scientific fields. The research is often very technical [8,12] or very artistic and expressive [1,3,4,7,10]. Often the technical innovations end as features in new products and the artistic installations as temporary setups. However there is a need for a deeper understanding, and critical approach, to how the lighting can react in relation to everyday life situations and the improvement of life qualities in cities. During the last years we, have conducted a series of full-scale experiments within the research cluster of Urban Responsive Lighting [9]. We acknowledge that rethinking the paradigm of public lighting; into one of sensitivity and response demand an interdisciplinary and inclusive engagement from leading expects in the field. This motivates the article to ask leading Danish specialist in architecture and lighting: How do you see the future potentials and pitfalls for Responsive Urban Lighting?

Interview

The two experts are Lars Kjær, product manger in Swarco Nordic and Peder Baltzer Nielsen city architect in Aalborg. Peder Baltzer Nielsen is educated from The Danish Royal Academy of Art and Architecture in Copenhagen in 1980. In his daily work he represents the architectural responsibility as city architect and set out new visions for future city development of architecture and lighting. His primary job is to secure a well-functioning and elegant development of architecture and to create good public spaces that afford a vivid city life.

Lars Kjær has been working in the lighting business since 1993 and has been taking the role as Pioneer in the development of LED luminaires. Because new technologies allow sensors to be distributed into the lamps, the capacity to enforce a better adapting light solution is immediately evident. However there is still no product on the market, which fully presents the technologies for a situation specific to public lighting, this challenge is to be taken by the market leaders together with architects and technologies, he says.

Perspective: Public Lighting Industry
This year over 150.000 outdoor-lamps have to be replaced by new LED light fixture, specified by Danish municipalities. In traffic, parks and on squares new LED lamps are the first choice due to the good energy performance and lifetime. The LED technology presents a huge potential for power saving, not only in the more effective light source, but also in the adaptive capacities of the control and regulation of the lighting.

Often energy efficiency is a selling point for LED technology, and experiments such as [9] present energy savings up to 92 %, which are not to be overseen in the big picture. Innovations in the field of regulation and control, goes hand-in-hand with new light technologies and this new potentials are for researchers to investigate before it is unleashed into everyday life situations. Nevertheless new LED technologies are already very efficient. Lars Kjær takes us though a simple example to visualize, his point: if you have a luminaire using 25 Watt at 100%, if you then introduce a midnight dimming on 50% in 6 hours you save 50%, the average energy consumption will then about 16-17 Watt. Seen from a financial point of view, the luminaires are already doing a good energy

performance. If we use the average energy consumption of 17 W pr lamp and add sensors and control hardware to light control system we are able to save 50 % more. This make an average energy consumption of 8,5 Watt. If we summarize over 4000 hours a year, it would make an average consumption on 34 KWh. In Denmark the price for 1 kWh is: 1,89 kr./KWh, this make 64,3 dkr. in energy savings a year, which equal 8.6 € a year. Only if we can develop standalone light fixtures that can save costs to establishment and maintenance we can find an economical argument in this perspective, Lars point out.

This notion indicates that energy consumption should not be the central driving force in the development of responsive lighting solutions. Advanced control systems and distributed sensing networks needs other qualities, such as, better performing lighting that are able to present situation specific lighting dependent on time, weather, season, air quality, occupancy patterns etc. Lars Kjær reports: "We are testing how radars, microphones, new control software and traffic loggers can help us classify activity on the street. Today we can see how the weather are, the conditions of the lamps, the energy consumption and due to this information the system are able to present 15% more light in rainy conditions, enabling a faster traffic flow on the roads, which again limit the cue of cars" - We utilize the information to make better performing light solutions for the city, Lars Kjær says.

One of the greatest challenges for future responsive lighting will be to share and communicate data between different systems. Hence new information technology infrastructures will need to be developed. Lars describe

how most data already are digitalized and available in today's systems like Omnia [11], which are already installed in many cities. "It is now only a question of sharing a couple of values forth and back between the software applications often located on the same server." Says Lars Kjær. According to Lars is the technological infrastructure very soon available, but it is the visionary politicians and innovative developers that need to take the lead of a new beautiful, safe and efficient responsive urban lighting.

Perspective: Architecture
Within the last years we have experienced the emergence of mediated architecture. Media facades have become omnipresent in contemporary public spaces and the control of pixels has become trivial in contemporary public spaces. It is time for engineers and architects to develop a critical approach to the qualities of media architecture. Responsive light strategies could be one of the solutions that make future public lighting sensitive, beautiful, elegant, efficient, novel, safe and at the same time functional. All values, which are well known in the traditional Nordic architectural design tradition. City Architect Peder Baltzer Nielsen describe: "response design open up an additional design dimension in the process of making creative, attractive and enjoyable public spaces. I can see a new type of intimacy, which occurs on a square. It attracts me and maybe these new interactive light strategies can extend some of the good city qualities, we design in daytime, into the night?"

The new technology raises new potentials for the lighting to be adaptive. This notion challenge our existing norms and light regulations, because, the city lighting will be able to change intensity in relation to

the city life and adapt to the situation. Peder Baltzer Nielsen describes this new approach: "I think there is a balance in the normative approach. Thinking responsive solutions challenge this notion: because we are now able to detect the situations and adjust the lighting, such that you can have interesting experiences when traveling through or visiting the city, and still light when needed."

These new responsive solutions challenges the traditionally role of the architect; as being the one who design the square, to be the one, who engage in a continual dialogue with the life on the street. Architects now also design behaviors, when is the light behaving best? Architects have to contribute to the creation of new adaptive and creative design solutions to improve the creative, cultural and social dimensions within the debate about the Smart Cities [5]. Architects also need to master new skills and technologies, which are often presented from the user's premise for design. This sensitive design approach is new and need to be developed and discussed.

Peder Baltzer Nielsen describes the new role of the light architect/light designer, as: "The light designer who have the insight in the technology (and that they must have) will understand how to place these activities, so it ads an extra design dimension, beyond the fact that citizens can activate. We have to remember that the square should be beautiful in day-time too. There is challenge for the architect in combining these interventions so the square is living around the clock. I think, this is an exiting new challenge for architects, and we need to explore how we can address these issues of meaningful response design. I think it will trigger many people across ages and social groups,

because there is the element of surprise, which is always interesting."

Discussion

It seems like perspectives from the field of architecture can enrich and broaden the discussion on responsive urban design strategies in future cities. According to Peder Baltzer Nielsen does these new tools challenge the existing design techniques and ask architects to enter the debate with new artistic and meaningful response strategies for public lighting. Furthermore does it present new challenges of; how we can develop mood sensitive lighting that generate intimate, calming, engaging feelings, when desired. Furthermore challenge hardware specialists and computer scientists with demands for automatic situation detection. According to the industry many of these data-infrastructures are already established, in different applications, but the analysis and the output lighting are two different applications not liked together. Thus we need to rethink strategies and standards for combining these types of situated data into more beautiful, efficient and safe performing public lighting. As an additional layer, geographers can turn the information into meaningful cartographic outputs, to support new and better planning solutions for the over all city infrastructure.

Another immediate potential is a participatory lighting. The adaptive capacity of responsive lighting, allow people to design the behavior according to certain events. Does this ability of user/citizens controlled in public lighting afford new types of ownerships, creativity and engagement? If so, which tools and methodologies are used to interface these new types of interaction? Maybe will the future strategies for

responsive public lighting not excludes this new type of user involvement, but enable in certain situations allow more user control then others? One thing is for sure: It is only though dialogue with leading advisers, architects and engineers, these questions can be asked and new innovative and responsive solutions can be explored.

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