Interactive city lighting: exploration through design

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Introduction

LED based lighting systems have enabled radically new possibilities in the field of artificial lighting. This is due in part to the LED being digitally controllable, which means this efficient light source can be easily integrated with sensors and smart environments. This has opened up a new world of lighting and lighting interaction opportunities that has thus far been applied mostly to indoor lighting concepts. The outdoor lighting domain however has focused mostly on the LED's efficiency and low cost of ownership to save energy and money for local governments. The use of the LED as a potential means for providing interactive city lighting for social good or entertainment is as yet a fairly unexplored area. For example, the interactivity can optimize energy saving schemes where lights can be dimmed when no one is present. Similarly, interactivity can make decorative lighting more dynamic and engaging by allowing people to control aspects of their urban lighting for art or games [1,2,3].

Poulsen et al. [3] investigated how pedestrians' movements can be used for controlling the illumination of a town square. When people walked through the square the general lighting was dimmed slightly and a brighter circle of light would appear and then follow them as they walked. One of the key findings was that many people who crossed the square did not notice any

change of illumination, while those who could see the square from a distance, such as from their apartment, clearly noticed the change in lighting, creating a notion of actors and observers. Another example is the work of Pihlajaniemi et al. [2] who created LightStories. Using the LightStories website, any visitor could create a dynamic lighting design to be presented along a pedestrian street for a whole hour.

Many cities will use light to illuminate a favourite building. Boring et al [1] implemented an interactive façade that enabled people to colour a building by changing the light in each window using a smartphone.

Approach

As a part of the educational program, 3rd year students of "Information and Interaction" of the AVANS University of Applied Science work for four months on the different design cases provided by Philips Research. The cases usually contain an interaction design challenge, a focus on user experience, and sufficient room for creativity. The benefit for the students is that they work on a real case supervised by professionals in industry. The benefit for those in industry is that this is a chance to explore new ideas for domains of interest.

The design case in 2012 ran from the end of August until December. In one of the cases, we asked students to explore concepts around interactive city lighting:

> *With two thirds of the world's population predicted to live in cities by 2050, ensuring that these cities are a nice place to live, work, and relax is challenging. Several initiatives have been taken to create 'livable cities' [4]. However, current initiatives focus mainly on energy and cost saving. In this case, we want you to explore what is beyond this. What can local governments do with light to make their cities more attractive, healthy or safe? We are particularly interested in interactive lighting concepts that strengthen the relationship between the local authorities and the citizens. The lighting should be nicely integrated within the urban landscape. Go out and explore the city! Observe people in the park, the shopping street, the town hall, the square, etc. What can interactive lighting mean in this context? You are free to explore and come up with your own ideas and concepts. Think how to prototype and evaluate your ideas, for example with interactive scale models, projections or video prototyping. In discussion with the coach, you select one concept that you work out in detail and prototype.*

Six students chose this case and in the next section we provide a summary of the topics they explored.

Results

The following topics were explored by the students (figure 1):

Supporting tourists: a large interactive screen located on the floor near the object of interest which tourists could step on and use to obtain information about the city. They could also leave their 'footprint' to mark that they have visited the tourist attraction, which would be visible for future visitors.

Figure 1. Interactive floor by Jaap Geluk; Interactive Picnic table by Anouska de Graaf; Interactive Bus Stop by Mark de Reijer; Safety for Parking by Kevin Mol; Pixelated display for City by Sjoerd Jochems;.

Stimulating social communication: an observation study revealed that many people eat their lunch or relax in the park, yet few seem to talk to those around them. This concept explored the idea of interactive public tables that provided a stimulus for starting conversations through games.

Supporting vehicular parking: as cities become more congested, finding a parking space can be cumbersome. This solution uses the city lighting to highlight free spaces to motorists.

Safety and mobility: as urban spaces become more congested, motorists and pedestrians will have to share the streets safely. This concept uses street lighting to

warn motorists of pedestrians that are near the edge of the road and may cross in front of them.

City beautification: many buildings are being illuminated and this idea suggested an enhanced pixilated display with an app based UI. Settings could be based on the user's mood.

Reducing perceived waiting time: time seems to stand still when waiting for public transport to arrive. The concept, an interactive bus stop including an illuminated dynamic pole, uses specific colours and lighting patterns to provide progress information in an attractive manner and influence the subjective experience of waiting time.

Discussion

During the design case program, the students explored potentially interesting topics for interactive city lighting. The final concepts show a large variety of environments in which interactive lighting can have a positive societal impact, ranging from increasing the attractiveness of cities for tourists or locals to improving customer satisfaction in public transport. However, we also observed that it is not trivial to create convincing interactive lighting concepts that bring benefits to a city and its inhabitants. Furthermore, while there were a great variety of topics explored, a number of similarities were observed. These similarities may be considered to be key interaction design challenges for public environments which will need to be addressed perhaps regardless of the application. They are: supporting multiple users; creating robust and reliable interaction technologies; and enabling immediate usage without the need for learning. This list is unlikely to be complete but it is perhaps the beginning of a set of guidelines that designers can check when implementing an interactive public light installation.

References

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